Device Enforcement

Program Manual

Incorporating the Examination Procedures Outline for Commercial Weighing and Measuring Devices

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DEVICE ENFORCEMENT MANUAL

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INTRODUCTION

The following Device Enforcement Program Manual (incorporates the Examination Procedures Outline for Commercial Weighing and Measures Devices) has been prepared as a guide for determining if devices are correct and suitable for commercial service. Each outline describes what is considered a minimum examination, preceding official action.

References to sections of the California Business and Professions Code (B&P Code) or the California Code of Regulations (CCR) - Field Reference Manual have been included for easier location of specific wording. The CCR Section 4000 adopts the National Institute of Standards and Technology (NIST) Handbook 44 (HB 44) with exceptions. The section suffix numbers in brackets [1.10, 2.20, 3.30, etc.] direct you to the specific portion of the CCR or HB 44. Exceptions to HB 44 in the CCR are numbered in the 4002 series and are shaded, bordered, and show the page number where found. Sections in the CCR that apply to devices that are not included in HB 44 (e.g., electric watt-hour meters) still maintain the old numbering series.

Enforcement action (Notice of Violations, Administrative Actions and Citations) should include the appropriate Business and Professions Code authority section or sections and include the following:

Examples:

1. From HB 44 without exceptions -
   B&P Code 12107; CCR 4000; NIST HB 44, 1.10, G-UR.4.1

2. Exceptions might look like -
   B&P Code 12107; CCR 2.20, 4002.2, d

3. Not in HB 44 -
   B&P Code 12107; CCR 4027, N.4

References pertaining to DMS Policy Letters and Notices aid in clarification and are found in the back of the manual prior to the EPO references.

"Safety Guidelines" are included for your reference, as well as specific safety reminders throughout the outline on individual subjects.

Periodic changes to the procedures will be made to accommodate code changes and new developments in device technology.

Suggestions for improving this manual are welcome at any time.

BASIC CONSIDERATIONS ASSOCIATED WITH THE ENFORCEMENT OF DEVICE CODE REGULATIONS

Uniformity of Requirements - Discussion

Acceptance and Maintenance Tolerances: Tolerances for commercial equipment are the limits of inaccuracy officially permissible. Tolerances are established, therefore, to fix the range of inaccuracy within which equipment will be officially tested and sealed.

- Acceptance Tolerances are applied to new equipment (prior to its first commercial use) and equipment undergoing type approval. These tolerances are smaller than (usually one-half of) maintenance tolerances.

- Maintenance Tolerances thus provide an additional range of inaccuracy within which equipment will be accepted on subsequent tests, permitting a limited amount of deterioration before the equipment will be officially rejected for inaccuracy and before reconditioning will officially be required.

Theory of Tolerances: Tolerance values are so fixed that the permissible errors are sufficiently small that there is no serious injury to either the buyer or the seller of commodities, yet not so small as to make manufacturing or maintenance costs of equipment disproportionately high. Obviously, the manufacturer must know what tolerances his equipment is required to meet so that he can manufacture economically. His equipment must be good enough to satisfy commercial needs, but should not be subject to such stringent tolerance values as to make it unreasonably costly, complicated, or delicate.

Tolerances and Adjustments: Tolerances are primarily accuracy criteria for use by the regulatory official. However, when equipment is being adjusted for accuracy, either initially or following repair, it must be adjusted as close as is practical to zero error (CCR 4000; HB 44, 1.10, G-UR.4.3). Equipment found to be in error, predominately in the favor of the owner/ user, is not acceptable (CCR 4000; HB 44, 1.10, G-UR.4.1.).

Inspection of Commercial Devices

Inspection Versus Testing: Although the term "inspection" is frequently used to include everything that the weights and measures official has to do in connection with commercial equipment, it is useful to limit the scope of that term primarily to examinations made to determine compliance with design, maintenance, and user requirements. Testing then obviously becomes those operations carried out to determine the accuracy of value or performance of equipment under examination.

Necessity for Inspection

It is not enough merely to determine that the errors of equipment do not exceed the appropriate tolerances. Specifications and user requirements are as important as tolerance requirements and should be enforced. Inspection is particularly important and should be carried out with unusual thoroughness whenever new equipment is being brought into service for the first time. Many times at a given device location, it is beneficial to bring along appropriate copy(s) of type approval(s) for:

1. Specific test considerations.

2. Specific equipment compatibility/interface considerations (e.g., approved only with a certain scale, certain software applications, RAM, specific load cells, etc.).

3. Provision for sealing - methods vary from physical seals to audit trail information. See "Methods of Sealing" below.

Devices initially inspected/tested, and then retested a year later, may have had nonapproved equipment, computer software, or alterations made which would make them nonapproved and could facilitate the perpetration of fraud. These conditions are often found during the pre-test inspection of a device prior to the actual test.

Methods of Sealing

In years past, a security seal involved placing a lead and wire or pressure sensitive seal over the access plate to the calibration and/or parameter adjustments (many devices are still sealed in the same manner). However, with the advent of computers and remote configuration capability through a modem or access lines, the above mentioned functions that affect the metrological aspects of a device must be secured through audit trail methods.

The need to seal some features depends upon the ease with which the feature or the selection of the feature can be used to facilitate fraud and the likelihood that the use of the feature will result in fraud not being detected.

<u>Examples of an audit trail method of a seal:</u>

1. A water dispenser where deliveries are controlled by a rotary flow mechanism equipped with a magnetic pickup which sends pulses to an internal computer that regulates the deliveries by pulse counts. Sealing of this programmable count is achieved by a non-erasable audit trail which maintains the date, real clock time, calibration factor, and number of entries into the calibration mode.

2. A batching controller (PC computer and application software) consisting of compatible, certified indicating and load receiving elements, water meters, monitor, keyboard, process logic controller (PLC), and one or more slave printers. Sealing of the video display (primary indicator) uses *Category 3* audit trail and is viewable in the "Scale Audit Report" on the CRT video display. A printed copy must be made available. (See Table S.1.11. in Section 2.20. Scales Code.)

Table S.1.11. separates devices into categories as to metrological parameter access and outlines the method of sealing.

Table S.1.11. Categories of Device and Methods of Sealing	
Categories of Device	*Method of Sealing*
Category 1: No remote configuration capability.	*Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.*
Category 2: Remote configuration capability, but access is controlled by physical hardware. *Device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.*	*The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one or calibration parameters and one for configuration parameters.*
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).	*An event logger is required in the device; it must 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 through the device or through another on-site device. The event logger shall have a capacity to retain records equal to ten 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.)***

[Nonretroactive and enforceable as of January 1, 1995.]
(Table added 1993)

(For Liquid Measuring Devices see Table S.2.2. in Section 3.30. LMD Code.)

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WEIGHING AND MEASURING DEVICES INTERFACED TO COMPUTER SYSTEMS

Discussion

An increasing number of commercial weighing and measuring devices are being interfaced with computers. An interface links external devices (weighing and measuring systems, indicator's printer or ECRs) to the computer system hardware. This linking is what establishes weights and measures jurisdiction for commercial weighing and measuring devices. Often the computer performs many of the significant metrological functions typically performed by a self-contained weighing or measuring device. In such cases, the software has become an accessory connected with the weighing or measuring instrument that may affect the metrological or audit trail aspects of a transaction and therefore must be type evaluated (type evaluation is based on all equipment that affects the measurement process or validity of a transaction). Evaluation and inspections should include all equipment to the point of the first indication or recorded representation of the final quantity on which the transaction will be based (possibly a receipt or printed ticket). Additionally, weights and measures jurisdiction may include remote, wireless or modem applications.

A system may have a weighing and measuring component of the system changed (Example: a scale indicator, console, controller, or CPU). If these changes are not compatible with the computer software's ability to translate data to a correctly printed ticket, the system may then facilitate the perpetration of fraud. Many of the manipulations that are done by computer software have no affect on the weights and measures functions.

The system verification tests below are designed to help determine type evaluation compliance. In all cases, it is recommended that the equipment operator handle the system - the inspector should just request them to access and display the information or to attempt to perform the operations. Always have a copy of the type approval available. This allows the inspector to determine whether components are compatible as approved, what are the sealable parameters, if a physical seal or audit trail is used, and how to access same. In multiple devices, at least one complete system should be inspected. This may include one dispenser and the controller and POS system or scale controller and POS system.

Many of these tests are the same that have been historically applied to any electronic weighing or measuring system interfaced only with a printer and no computer.

Weighing and Measuring Devices Interfaced to Computer Systems

System Verification Tests

NOTE: Item numbers 1 through 5 apply to both weighing and measuring devices. Numbers 6 and 7 are specific to weighing devices; while numbers 9 and 10 apply to measuring devices.

1. Identification. The identification (ID) tag may be on the back room computer server and could be viewed on an identification screen on the computer monitor. The ID information may be displayed on a menu or identification screen. Though currently discouraged, some systems may be designed so the system must be shut down and reset to view the ID information. **G-S.1 (1.10)**

    1.1. Manufacturer.

    1.2. Model designation.

2. Provisions for sealing. **G-S.8 [1.10]; S.1.11 [2.20]; S.2.2 [3.30]**

    2.1. Verify sealing category of device (refer to Certificate of Approval for that system).

    2.2. Verify compliance with certificate.

3. Units of measure.

    3.1. A computer and printer interfaced to a digital indicator shall print all metrological values, intended to be the same, identically. **G-S.5.2.2(a); G-S.5.1 [1.10]**

    3.2. The unit of measure, such as lb, kg, oz, gal, qts, liters, or whatever is used, must agree.

4. Operational controls, indications and features (buttons and switches). Verify that application criteria and performance criteria are met (refer to Certificate of Approval).

    4.1. Any indication, operation, function or condition must not be represented in a manner that interferes with the interpretation of the indicated or printed values.

5. Indications and displays.

    5.1. Attempt to print a ticket. The recorded information must be accurate or the software must not process and print a ticket with erroneous data interpreted as a measured amount.

Weighing and Measuring Devices Interfaced to Computer Systems

Weighing Devices

6. Motion detection.

   6.1. For railway track, livestock, and vehicle scales apply or remove a test load of at least 15d while simultaneously operating a print button, push-button tare or push-button zero. A good way to do this is to try to print a ticket while pulling the weight truck or another vehicle onto the scale. Recorded values shall not differ from the static display by more than 3d. Perform the test at 10%, 50% and 100% of the maximum applied test load. **S.2.5.1(a) [2.20]; EPO NO. 2-3, 2.4**

   6.2. For all other scales, apply or remove at least 5d. Printed weight values must agree with the static weight within 1d and must exactly agree with other indications. **S.2.5.4(b) [2.20]; EPO NO. 2-3, 2.4**

7. Behind zero indication.

   7.1 Apply a load in excess of the automatic zero setting mechanism (AZSM) and zero the scale. **S.2.1.3 [2.20]; EPO NO. 2-3, 2.4, 2.5.2**

   Example: On a vehicle scale have someone stand on the scale, then zero them off (AZSM is 3d). Remove the weight (person) and note the behind zero display (usually a minus weight value) or error condition.

   7.2. Attempt to print a ticket. With a behind zero condition, (manually or mechanically operated) a negative number must not be printed as a positive value.

8. Over capacity.

   8.1. Manually enter a gross weight if permissible or apply a test load in excess of 105% of the scale's capacity. **S.1.7 [2.20]; S.1.12, UR.3.9 [2.20]**

   8.2. Attempt to print a weight ticket. A system must not print a ticket if the manually entered weight or load exceeds 105% of the scale capacity.

Weighing and Measuring Devices Interfaced to Computer Systems

Measuring Devices

10. Motion detection.

    10.1. Initiate flow through the measuring element. Attempt to print a ticket while the product is flowing through the measuring chamber. The device must not print while the indication is not stable. **S.2.4.1. (3.30)**

11. Over capacity.

    11.1. Attempt to print a ticket in excess of the indicated capacity. A system must not print a ticket if the device is manually or mechanically operated in excess of the indicated value**.**

    NOTE: Be aware of error codes on the indicator which may be interrupted as measured values.

DIRECTORY OF DMS POLICY LETTERS, NOTICES AND EPO REFERENCES PERTAINING TO WEIGHING AND MEASURING DEVICES

Service Agent Authority and Responsibilities	D-00-13	10-00
Vapor Recovery System Repairs	D-86-2	7-86
Rebuilt and Repaired Vapor Recovery Nozzles	D-94-1	1-94
Type Approval Requirements of One-of-a-Kind or of Modified Devices	DMS-10	7-86
Static Electricity Safety Hazards	G-91-4	10-91
Clarification of Business and Professions Code Section 12014	EPO REF-A	7-86
Checkstand Scales	EPO REF-B	1-95
Electronic Cash Registers and Point-of-Sale Systems	EPO REF-C	1-95
Three-Wheel Registers	EPO REF-D	1-95
Electricity - Static	EPO REF-E	5-87
LPG Reciprocal Agreement	EPO REF-F	7-86
Sampling Procedure for Vapor Meters	EPO REF-H	1-95
Sampling Procedures for Testing Electric Meters	EPO REF-I	5-87
B and K Rebuilt Electric Meters	EPO REF-J	7-86
Obsolete and Unsafe Electric Watt-hour Meters	EPO REF-K	5-94
Rebuilt Electric Watt-hour Meters	EPO REF-L	7-86
Field Testing of Electric Meters	EPO REF-M	9-86
Sampling Procedure for Domestic Water Meters	EPO REF-N	5-87
Electric Submeter Review	EPO REF-O	1-95
Gravimetric Testing of Liquid Meters	EPO REF-P	4-90
Load Cells	EPO REF-Q	1-95
Testing of Vehicle Tank and Wholesale Liquid Meters	EPO REF-S	1-95
Utility Meter Billing Complaints	EPO REF-T	3-99
Parking Meters	EPO REF-U	9-99
Vapor Meter Test Laboratory	EPO REF-V	1-02

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NEWLY INSTALLED WEIGHING DEVICES

The following information may be used as a suggested checklist to obtain compliance for problems most commonly found on newly installed devices. The most logical time to obtain such compliance is during the first examination by a weights and measures official.

1. Identification.

1.1. Each weighing device shall have a minimum of one permanent and conspicuous identification marking with the following information. It may be located under a platter or cover, as long as it is accessible without the removal of a part requiring the use of any means separate from the device. The exception is a load receiving element not permanently attached to an indicating element, installed so only the weighing surface is visible (i.e., vehicle scale installed in a pit) which may require the use of a tool provided the information is easily accessible.
G-S.1 [1.10]; G-UR.2.1.1 [1.10]; S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]

1.1.1. Manufacturer's or distributor's name, initial or trademark. **G-S.1 [1.10]**

1.1.2. Model number. **G-S.1 [1.10]**

1.1.3. Nonrepetitive serial number. On scales installed after January 1, 1986, the number must be prefaced by words or symbol that clearly identifies the number as the required serial number. **G-S.1 [1.10]**

1.1.4. Capacity. **S.6.1 [2.20]; S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]**

1.1.5. Value of the scale division or verification scale division "e" when different from "d". **S.6.3 [2.20]; Tables S.6.3(a),S.6.3(b) [2.20]**

1.1.6. If the device was manufactured after January 1, 1986, it must be marked with an accuracy Class (I, II, III, III L, or IIII). **S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]**

1.2. For weighing devices which have separable major components such as a load receiving element, indicator and printer, all information should be on each component except for the capacity on a printer unless it is being used as a primary indicator.
S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]

1.2.1. Weighing elements not permanently attached to an indicating element such as a vehicle scale attached by a cable to a remote read out, must also be marked with the accuracy class, the maximum number of scale divisions and the minimum verification scale division (nonretroactive as of January 1, 1988).
S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]

1.3. Concentrated load capacity (CLC). A vehicle, axle-load or livestock scale shall be marked with the concentrated load capacity on or adjacent to the identification plate on the indicating element and on the load receiving element (nonretroactive as of January 1, 1989).
S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]

NOTE: The marked nominal capacity shall not exceed the CLC times the quantity of the number of sections in the scale minus 0.5, or

Nominal capacity $\leq$ CLC x (N-0.5)

Where N = the number of sections in the scale

On scales manufactured before January 1, 1989, the section capacity may be used. Upon modification, the concentrated load capacity shall be added to the load receiving element of a previously unmarked scale. The CLC shall not be larger than the section capacity listed on the approval.

1.4. Indicating elements not permanently attached to a weighing element shall be clearly and permanently marked with the appropriate accuracy class and the maximum number of scale divisions, n. Indicating elements that qualify for use in both Class III and Class III L may be marked III/III L and shall be marked with the maximum number of scale divisions for each accuracy class. **S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]**

1.5. Load cells must be marked with a serial number (nonretroactive as of January 1, 1988). They must also be marked with, or have, an accompanying document with accuracy class, maximum number of scale divisions (n_{max}), an S or M for single or multiple cell applications, direction of loading if not obvious, the name and address of the manufacturer or his trademark, model, minimum dead load, maximum capacity, safe load limit, and load cell verification interval (v_{min}). The serial number must also be on the document if the manufacturer uses a document.
S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]

2. Type approval. **B&P 12500.5; DMS 10 (7-1-86) following EPO 51-2**

2.1. Devices intended for commercial use shall be type approved and a weights and measures “seal” shall be applied only on correct, type approved devices. Provision has been made for the commercial use of devices undergoing type approval reliability evaluation. (Temporary use permit.)

2.1.1. For a weighing device that received a Certificate of Approval based on type evaluation of its components, verify that the major components in the device (i.e., load cell, indicator, software, scale base) have a Certificate of Approval. Often certificates of approval will simply state “with compatible approved component”. However, sometimes certificates of approval specify specific “named” components. If this is the case then that system must have all of those listed “named” components to be approved. If software is included in a system, then the scale and software are looked at together and tested as a “system”. See page 5 for a discussion on computer interface.

2.1.2. For load cells in electronic scales and weighing elements greater than 2,000 lbs. or installed in levertronic scales that have had load cells tested separately, verify type approval. **EPO-REF-Q**

2.2. Verify that the device and its major components are marked with the class and number of divisions.

2.3. Verify that the load cells and indicators are used within their n_{max} ratings and minimum verification interval limits (v_{min} for load cells and d_{min} for indicators).

2.4. If a new device needs a special temperature range other than 14°F to 104°F, it will be marked on the device and on the type approval.

2.5. Unapproved devices are not to be sealed, "red-tagged", or "blue-tagged" by weights and measures officials. Yellow "unapproved device" tags are to be applied. **B&P 12500.10**

3. Suitability of equipment.

3.1. Commercial equipment shall be suitable for the service in which it is used...including weighing capacity...number of scale divisions, value of d or verification scale division, minimum capacity and computing capacity. **G-UR.1.1 [1.10]; UR.1 [2.20]**

3.2. Suitability should be considered on the basis of customer readability, device sensitivity, and recommended minimum load (see Abbreviated Table 8 below). To be suitable for its application, a scale shall have a division value such that the requirements of Table 8 are satisfied. The use of a scale to weigh relatively light loads is likely to result in large errors. **UR.3.1 [2.20]; Table 8 [2.20]**

Table 8. (Abbreviated) Recommended Minimum load

Class	Value of Scale Division (d or e*)	Recommended Minimum Load (d or e*)
III	All**	20
III L	All	50

* For Class III devices, the value of "e" is specified by the manufacturer as marked on the device; "e" must be less than or equal to "d".

** A minimum load of 10d is recommended for a weight classifier marked in accordance with a statement identifying its use for special applications.

3.2.1. Minimum load, vehicle scales.

Except for weighments of ferrous metals, cardboard, paper, rags or plastic, and the weighing of vehicles for registration purposes, a vehicle scale shall not be used for weighing net loads less than the value of 20 scale divisions.

4002.2 [2.20] (b.) Page D2-25

3.2.2. Minimum load, Class III, Class III L and UNMARKED scales used for recycling.

Except for weighments of ferrous metals, cardboard, paper, rags or plastic, scales used in recycling shall not be used for weighing net loads less than the value of 20 scale divisions. **4002.2 [2.20] (c.) Page D2-25**

3.3. Discrimination requirements - MARKED automatic indicating scales only. This is the ability of the scale, with a given test load on the receiving element, to produce a specified minimum change on the indicating element. If you suspect a problem in the scale performance, such as erratic readings, refer to EPO NO. 2-8, 3.6 for the method of testing discrimination. **N.1.5 [2.20]**

3.4. Load cell installation.

3.4.1. Full electronic scales (load cells in lieu of lever system). **S.5.4 [2.20]**

Total number of scale divisions, n, must be ≤ the n_{max} rating of either the indicator or load cells, whichever is less. **EPO-REF-Q**

Verification scale division, v_{min}, for the load cells must be less than or equal to the scale division, d, divided by the square root of the number of load cells, N, used in the scale:

$$v_{min} \leq \frac{d}{\sqrt{N}}$$

(Nonretroactive as of January 1, 1994.)

NOTE: The v_{min} value marked on the load cell must be less than or equal to the v_{min} value in the table based upon the d and N for the scale.

Maximum Values of v_{min} for Multiple Load Cell Scales (Table values are in pounds)							
Load Cells	Scale Divisions						
	1 lb	2 lb	5 lb	10 lb	20 lb	50 lb	100 lb
2	0.71	1.41	3.54	7.07	14.1	35	70
4	0.50	1.00	2.50	5.00	10.0	25	50
6	0.41	0.82	2.04	4.08	8.2	20.4	41
8	0.35	0.71	1.77	3.54	7.1	17.7	35
10	0.32	0.63	1.58	3.16	6.3	15.8	32
12	0.29	0.58	1.44	2.89	5.8	14.4	29
14	0.27	0.53	1.34	2.67	5.4	13.4	27

3.4.2. Levertronic scales (scales employing a combination of both levers and load cells). In the formula, "d" is the value of the scale division and $\sqrt{N}$ represents the square root of the number of load cells. **S.5.4 [2.20]**

$$v_{min} \leq \frac{d}{\sqrt{N} \text{ x (scale multiple)}}$$

(Nonretroactive as of January 1, 1994.)

NOTE: When the value of the scale division "d" is different than the verification scale division "e" for the scale, the value of "e" must be used in both formulas above.

3.4.3. Example problems (load cell installation).

Number 1. Full Electronic (multiple load cells)

For a livestock scale with two sections (four load cells) and a displayed scale division of 5 lb., the maximum value permitted for each load cell is 2.5 lb. The calculation is shown below. If the value marked on the cell is less than or equal to the value computed for the v_{min}, then the load cell is considered to comply with T.N.8. [2.20].

$$v_{min} \leq \frac{d}{\sqrt{N}} = \frac{5 \text{ lb}}{\sqrt{4}} = \frac{5 \text{ lb}}{2} = 2.5 \text{ lb}$$

Number 2. Levertronic (both levers and load cells) **S.5.4 [2.20]**

For a livestock scale with levers that has been retrofitted with a load cell in the steelyard rod, calculate the multiple of the lever system from the ratios marked on the levers. Suppose the multiple for a livestock scale is 400:1 and that the scale has a scale division of 5 lb., then the maximum value of the v_{min} of the load cell is 0.0125 lb. The calculation is shown below. If the load cell is marked with a v_{min} less than or equal to the calculated value, then the load cell is considered to comply with T.N.8. [2.20].

$$v_{min} \leq \frac{d}{\sqrt{N} \text{ x (scale multiple)}} = \frac{5 \text{ lb}}{\sqrt{1} \text{x (400)}} = 0.0125 \text{ lb}$$

NOTE: A simple way of determining the scale multiple (ratio) is to place a one pound weight on the steelyard rod - with the beam balanced at zero. Whatever the beam/indicator reads is the scale multiple.

Example: If by placing a one pound weight on the steelyard, the indicator reads 400 pounds, the scale multiple would be 400:1.

4. For primary indicators separated from their weighing elements.

    4.1. "... there shall be a convenient and permanently installed means for direct communication, oral or visual, between an individual located at a primary indicating or recording element and an individual located at the weighing or measuring element."

5. Installation requirements for heavy capacity scales.

    5.1. "The foundation and supports of any scale installed in a fixed location shall...provide strength, rigidity and permanence...and clearance shall be provided around all live parts..." The need for strength and rigidity is especially important on initial inspections of monorails and meat beams **UR.2.4 [2.20]**

    5.2. "Adequate provision shall be made for ready access to the working mechanisms of a vehicle, livestock, or animal scale for purposes of inspection and maintenance." **UR.2.5 [2.20]**

6. Accessibility for testing purposes. **G-UR.2.3 [1.10]**

    6.1. Some scales, such as hoppers and large dormants, are so installed that suitable test weights cannot be put on or brought to the load bearing element. The owner or operator is required to provide facilities and necessary labor for tests. The inspector should consider not making initial tests until he or she is satisfied with the facilities for an adequate test.

    6.2. Due to the design of scales and weighing elements, it may be difficult to have the load cell identification readily observable. It may also be necessary for the owner, or an agent of the owner, to remove parts of the scale to verify load cell information. This should be done before the scale is tested because an unsuitable load cell violates the scale approval.

7. Installation and positioning of retail (direct sale) equipment.

    7.1. A device used in retail trade shall be placed so the indications and weighing operations may be seen from a reasonable "customer" and "operator" position. **B&P 12510(a)6; G-UR.3.3 [1.10]**

    7.2. Installation characteristics should not affect device performance. For example, an initial examination may be the best time to require a computing scale on a meat counter, deli counter, or checkstand to be on a stable base capable of maintaining a level position and clearance around the moving parts. **G-UR.2.1 [1.10]**

8. Recommended minimum test weights and test loads for device certification (Table 4).

    4002.2 [2.20] (a.) Page D2-14

TABLE 4

Minimums
(in terms of device capacity)

Device Capacity (Pounds)	Test Weights (greater of)	Test Loads	Recommended (Where Practicable)
0 to 100	105%		
101 to 1,000	50% or 100 lb	105%	
1,001 to 40,000	25% or 500 lb	50%	Test weights to dial face capacity, 1,000d, or test load to used capacity if greater than minimum specified
40,001 +	12.5% or 10,000 lb	25%	

The term "test load" means the sum of the combination of certified field test standards and any other applied load used in the conduct of a test using substitution or build-up test methods.

4002.2 [2.20] (a.) Table 4, Page D2-14

INDICATORS - AUTOMATIC AND NONAUTOMATIC

Devices currently used for commercial weighing are equipped with a variety of indicators. The following inspections and tests for the various indicators commonly found are listed in this EPO to avoid repetition throughout the procedures for all weighing devices. References to this EPO will be made in those instances where it seems appropriate.

The indicators are:

1. Dial Weight Indicators.
2. Digital Weight Indicators (DWI).
3. Weighbeam Indicators.

1. Dial weight indicators.

1.1. Dials are commonly used as follows:

1.1.1. With dial chart capacity only (mechanical and electronic).

1.1.2. With unit weights (mechanical and electronic).

1.1.3. With tare bars (beams).

1.1.4. As mechanical indicators with shaft-mounted potentiometers which, in turn, operate digital indicators.

1.1.5. As part of a dial or digital weight indicator (DWI) combination on an electromechanical weighing system.

1.2. The following comments apply to dial indicators in the order listed above.

1.2.1. Mechanical and electronic dials using chart capacity only.

1.2.1.1. All mechanical dial indicators should be tested at 1/4, 1/2, 3/4, and full chart capacity in addition to the no-load repeatability tests common to all weighing device indicators.

1.2.1.2. Tests are made at these quarter positions to determine the linearity and accuracy of adjustment of the dial mechanisms. In those instances where it is not feasible to apply test weights for all quarters, such as on some hopper scales, a dial test kit may be used to check the dial accuracy.

1.2.1.3. Electronic dials need not be tested at all quarters as the indicators are driven by motors responding to electrical signals.

1.3. Mechanical and electronic dials with unit weights.

1.3.1. Mechanical dials with unit weights.

1.3.1.1. With test loads on the load bearing element equal to dial chart capacity, the unit weight (first unit weight) should be activated and the dial indicator should return to a no-load indication. Additional unit weights should be tested to the extent that test loads are available.

1.3.2. Electronic dials with unit weights.

1.3.2.1. Normally, electronic dial unit weight indications occur automatically in response to the test loads on the load bearing element.

1.4. Dials with tare bars.

1.4.1. Tare bars may be graduated or ungraduated. The accuracy of a graduated tare bar, similar to that of a weighbeam, depends on the position of notches or graduations and the calibration of the movable weight. Tare bars should be tested at a minimum of two points, half and full capacity. Reductions in dial weight indication must be equivalent to the values selected on tare bars.

1.5. Mechanical dials with shaft mounted potentiometers.

1.5.1. These units are used to operate automated batching equipment and remote DWI's.

1.5.1.1. Tests of a remote indicating system must include a test of the DWI's ability to track the dial accurately. A dial test kit may be used effectively to test DWI response throughout the dial range.

1.5.1.2. **<u>CAUTION</u>**. Initial calibration of the DWI establishes the zero relationship between the dial and digital indicators. Any subsequent "zero" adjustments made during operations must be made with the mechanical mechanisms provided and not with an independent electronic "zero" control.

1.6. Combination - dial and digital weight indicator. **T.N.4.1 [2.20]**

1.6.1. Both indicators must respond together or independently within tolerance to test loads on the load bearing element.

1.6.2. Normal operation of the DWI in such a system may be more stable with the dial in a locked out position.

2. Digital weight indicators (DWI).

2.1. Electromagnetic interference tests.

2.2. Maximum capacity with test weights.

2.2.1. Indicator shall not indicate or record values exceeding 105 percent of nominal capacity. **S.1.7(a) [2.20]**

2.2.2. Computing and point-of-sale scales manufactured after January 1, 1993 shall not indicate or record values exceeding labeled scale capacity plus 9 scale divisions (excluding weight classifiers and postal scales). **S.1.7(b) [2.20]**

2.3. Provision for sealing. **S.1.11 [2.20]**

2.3.1. Provision shall be made to seal access to adjustments.

2.4. Test for motion detection for scales with a printer. **S.2.5.1(a) [2.20]**

2.4.1. For scales with a capacity greater than 5,000 lb. placed in service prior to January 1, 1981, and hopper (other than grain hopper) scales with a capacity exceeding 50,000 lbs., apply or remove a load of at least 15d while simultaneously operating a print button, push-button tare or push-button zero. Recorded values shall not differ from the static display by more than 3d. Perform the test at 10%, 50%, and 100% of the maximum applied test load.

2.4.2. For all axle-load, railway track, livestock and vehicle scales, use the test above. **S.2.5.1(a) [2.20]**

2.4.3. For all other scales, apply or remove a test load of at least 5d while simultaneously operating a print button, push-button tare or push-button zero. Recorded values shall not differ from the static display by more than ld. Perform the test at 10%, 50%, and 100% of the maximum applied test load. **S.2.5.1(b) [2.20]**

2.5. Zero load adjustment.

2.5.1. Hand-operated, push-button zero shall only be operable when the indication is stable within:

2.5.1.1. ± 3 scale divisions for scales of more than 5,000 lb. in service prior to January 1, 1981 and all axle-load, railway track, and vehicle scales (see test for motion detection). **S.2.1.2(a) [2.20]**

2.5.1.2. ± 1 scale division for all other scales (see test for motion detection). **S.2.1.2(b) [2.20]**

2.5.2. Automatic zero load maintenance (AZM). (Nonretroactive as of January 1, 1981.) Not all electronic indicators use this feature. To verify this, place test load of one scale division (ld) in 1/4d steps. If the scale remains in a balanced condition (zero indication), AZM is present, continue to 2.5.2.1. **S.2.1.3 [2.20]**

2.5.2.1. Test for automatic zero maintenance (AZM window) on digital scales.

The test to determine compliance consists of placing enough weight on the scale as a unit to equal the width of the AZM window plus the zone of uncertainty (see below). The scale complies in the positive direction if it displays the appropriate weight for the load applied and does not automatically return to zero. With the weight still on the scale, manually re-zero the scale and remove the weight as a unit. The scale complies in the negative direction if it indicates a negative scale condition and holds it. This may be negative numbers, blanking, complement weight values, or a meaningless symbol like EEEE. It must not automatically return to zero.

2.5.2.2. For bench, counter and livestock scales, ±0.6 minimum (d) scale division and 0.3d zone of uncertainty for a total of 0.9 scale division. **S.2.1.3(a) [2.20]**

EXAMPLE: Test of automatic zero maintenance for computing scales with a "d" of 0.01 pound.

With the scale on zero, add 0.009 lb. to the platter. The scale should indicate 0.01 lb. at the end of 10 seconds. It should not automatically return to zero with the load on the platter. Manually, re-zero the scale with the 0.009 lb. still on the scale. Remove the weight as a unit; the scale should show a negative scale condition. It should not return to zero.

2.5.2.3. For axle-load, railway track and vehicle scales, ±3.0d and 0.3d zone of uncertainty for a total of 3.3d. **S.2.1.3(b) [2.20]**

EXAMPLE: Test of AZM for digital combination railway track and vehicle scale with a capacity of 200,000 lb. and a "d" of 20 lb.

With the scale on zero, add 75 lb. as a unit to the deck. The scale should indicate 80 lb. at the end of 10 seconds. It should not automatically return to zero with the load on the deck.

With the 75 lb. still on the deck, manually re-zero the scale, then remove the test load as a unit. The scale should indicate a negative scale condition. It should not automatically return to zero.

2.5.2.4. For all other scales, + l.0d and 0.3d zone of uncertainty, for a total of 1.3d. **S.2.1.3(c) [2.20]**

EXAMPLE: Test of automatic zero maintenance for digital platform scale with a capacity of 1,000 lb. and a "d" of 1.0 lb.

With the scale on zero, add 1.3 lb., as a unit to the platform; the scale should indicate 1.0 lb. at the end of 10 seconds. It should not automatically return to zero with the load on the deck.

With the 1.3 lbs. still on the deck, manually re-zero the scale then remove the test load as a unit. The scale should indicate a negative scale condition (-1.0 lb., blank, rrrr, etc.). It should not automatically return to zero.

2.6. Printer operation with an indicator.

2.6.1. A printer (or recorder) used with digital indicator shall print all numbers identically (no tolerance). **G-S.5.2.2(a) [1.10]**

2.7. Zero indication. **S.1.1 [2.20]**

2.7.1. On a scale equipped with indicating or recording elements, provision shall be made to either indicate or record a zero-balance condition.

2.7.2. On an automatic-indicating scale or balance indicator, provision shall be made to indicate or record an out-of-balance condition on both sides of zero.

2.7.3. A zero-balance condition may be indicated by other then a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a weighing operation or to return to a continuous digital indication when the scale is in an out-of-balance condition.

2.8. Digital indicating elements. **S.1.1.1 [2.20]**

2.8.1. A digital zero indication shall represent a balance condition that is within ±1/2 the value of the scale division.

2.8.2. A digital indicating device shall either automatically maintain a "center-of-zero" condition to ±1/4 scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ±1/4 of a scale division or less. (Nonretroactive as of January 1, 1993.)

3. Weighbeam indicators.

3.1. Pre-test inspection items for weighbeam equipped scales should include the following:

3.1.1. Balance ball - shall not itself be rotatable on scales used in direct sales unless tool operable or enclosed in a cabinet. **S.2.1.2 [2.20]**

3.1.2. Poise stop - a shoulder or stop shall be provided on each weighbeam bar to prevent a poise from traveling and remaining back of the zero graduation. **S.1.5.6 [2.20]**

3.1.3. No part of a poise shall be readily detachable except on a steelyard with no zero graduation. **S.1.6.1 [2.20]**

3.1.4. Poise pawl - a poise, other than a hanging poise, on a notched weighbeam shall have a pawl that will seat the poise in a definite and correct position in any notch. **S.1.6.3 [2.20]**

3.2. Error weights.

3.2.1. Error weights should be balanced on the load bearing element of a weighbeam equipped scale prior to beginning tests. The smallest weight should equal the minimum tolerance value applicable. The total value of error weights should equal the tolerance value for the maximum test load to be applied.

3.3. SR requirements for weighbeam equipped scales NOT MARKED with an accuracy class.

3.3.1. Application - the sensitivity requirement (SR) applicable to the scale is the same regardless of whether acceptance or maintenance tolerances apply. **T.2.1 [2.20]**

3.3.2. General - except for equipment specified in T.2.3 [2.20] through T.2.8 [2.20], the SR on a nonautomatic-indicating scale shall be twice the value of d on the weighbeam, 0.2 percent of the nominal capacity of the scale, 2d, or 40 lbs., whichever is less. **T.2.2 [2.20]**

3.3.3. Prescription scales, use 0.1 grain (6 milligrams). **T.2.3 [2.20]**

3.3.4. Jewelers scales, capacity 1/2 ounce or less, use 0.1 grain (6 milligrams); capacity more than 1/2 ounce, use 1d or 0.05% capacity, whichever is less. **T.2.4.1[2.20]; T.2.4.2 [2.20]**

3.3.5. Butterfat test scales, use 0.5 grain (32 milligrams). **T.2.5.1 [2.20]**

3.3.6. Moisture test scales, use 0.3 grain (19 milligrams). **T.2.5.2 [2.20]**

3.3.7. Grain test scales, use the value of ld at zero and 2d at maximum test load. **T.2.6 [2.20]; T.N.6.1(b) [2.20]**

3.3.8. Livestock without balance indicator, 10 lb. **4002.2 [2.20]; (d.) Page D2-18**

3.3.9. Vehicle, axle-load, and animal without balance indicator shall be twice the value of d or 0.2% of nominal capacity, whichever is less. **T.2.7.2 [2.20]**

3.3.10. Vehicle, axle-load, livestock, and animal equipped with balance indicator shall be the value of d on weighbeam. **T.2.7.1 [2.20]**

3.3.11. Railway track scales, use 100 lb. or three times the value of d, whichever is less. **T.2.8 [2.20]**

3.4. Sensitivity tests.

The minimum change in equilibrium with test loads equal to the values specified in 3.3 (scales NOT MARKED). **T.3 [2.20]**

3.4.1. Sensitivity tests shall be made at zero load and at the maximum test load applied by increasing or decreasing test weight load on load bearing element. The response shall be as follows: **N.1.4 [2.20]**

3.4.1.1. Trig loop without balance indicator - position of rest of weighbeam shall change from center to top or bottom of trig loop (against the top or bottom). **T.3(a) [2.20]**

3.4.1.2. Single balance indicator - nominal capacity of less than 500 lb. - position of rest of a single indicator shall change at least 0.04 inch or at least one division on the graduated scale, whichever is greater. **T.3(b) [2.20]**

3.4.1.3. Single balance indicator - nominal capacity of 500 lb. or greater - position of rest of a single indicator shall change at least 1/4 inch, one division on the graduated scale, or width of the central target area, whichever is greater. (For batching scale, 1/8 inch or one division on the graduated scale, whichever is greater.) **T.3(c) [2.20]**

3.4.1.4. Two opposite-moving balance indicators. The position of rest of the two indicators shall change 0.04 inch, with respect to each other. **T.3(d) [2.20]**

3.4.1.5. Scale with neither a trig loop nor a balance indicator. The position of rest of the weighbeam or lever system shall change from the horizontal or midway between limiting stops, to either limit of motion. **T.3(e) [2.20]**

3.5. Sensitivity test for weighbeam equipped scales MARKED with an accuracy class. **T.N.6 [2.20]**

The test load for sensitivity for nonautomatic indicating vehicle, axle-load, livestock and animal scales shall be ld for scales equipped with balance indicators; and 2d or 0.2 percent of the scale capacity, whichever is less, for scales not equipped with balance indicators. For all other nonautomatic-indicating, the test load for sensitivity shall be ld at zero and 2d at maximum test load. **T.N.6.1(a) [2.20]; T.N.6.1(b) [2.20]**

3.5.1. Scale with a trig loop but without a balance indicator. The position of rest of the weighbeam shall change from center to top or bottom of trig loop (against the top or bottom). **T.N.6.2(a) [2.20]**

3.5.2. Scale with a balance indicator. The position of the indicator shall change one division on the graduated scale, the width of the central target area or the value as follows, whichever is greater. **T.N.6.2(b) [2.20]**

Scale of Class I or II: 0.04 inch.

Scale of Class III or IIII with a maximum capacity of 70 lb. or less: 0.08 inch.

Scale of Class III, III L or IIII with maximum capacity of more than 70 lb.: 0.20 inch.

3.5.3. Scale without a trig loop or balance indicator. The position of rest of the weighbeam or lever system shall change from the horizontal or midway between limiting stops to either limit of motion. **T.N.6.2(c) [2.20]**

3.6. Discrimination test - Only conducted on MARKED automatic-indicating scales. If you suspect a problem in the scale performance as described below, conduct this test.
G-UR.1.2 [1.10); N.1.5 [2.20]

NOTE: It is important to be aware, that the discrimination test must be conducted under controlled conditions. The test will not be successful for example, if the scale is not shielded from the effects of the wind, free from vibration, or if automatic zero maintenance (AZM) is present. (See EPO NO. 2-3, 2.5.2 to determine its presence.) If it is, bypass it or have it disconnected, then proceed.

3.6.1. The purpose of this test is:

On mechanical analog automatic indicating scales, to assure that the scale is sensitive to small changes in load and provide repeatable weighings within tolerance values.

On electronic indicating scales, to verify that the zone of uncertainty is less than or equal to 0.3d.

3.6.2. Discrimination test requirements.

2.6.2.1. Analog automatic indicating (i.e., dial, drum, fan, etc.) - A test load equivalent to 1.4d shall cause a change in indication of at least 1.0d.
T.N.7.1. [2.20]

2.6.2.2. Digital automatic indicating - A test load equivalent to 1.4d shall cause a change in the indicated or recorded value of at least 2.0d. This requires the zone of uncertainty to be not greater than 0.3 times the value of the scale division. **T.N.7.2. [2.20]**

3.6.3. The method of testing discrimination.

3.6.3.1. Analog automatic-indicating scales - Test for discrimination at least at no load and scale capacity. Apply a test load of 1.4d.

EXAMPLE: Where d = lb, apply 1.4 lb. The scale must indicate at least 1.0 l.

A scale fails to meet the requirements of the discrimination test if it does not change the indication by at least 1d under those conditions - it will not provide repeatable weighings within tolerance values.

3.6.3.2. Digital automatic-indicating scales - The zone of uncertainty is the area between adjacent increments on a digital device in which the value of either of the adjacent increments may be displayed; on a mechanical scale, the scale operator decides if the pointer is closer to one graduation than the other and decides which value it is indicating. However, on a digital scale, the indicator must, in effect, make those tough calls. If it prints weights to 1 lb.; and for example, the load weighs somewhere between 817 lb. and 818 lb., somehow the digital indicator must "decide" which value to display. That "grey area" or portion of the zone halfway between scale divisions is known as the zone of uncertainty. The width of the zone of uncertainty must not exceed 0.3d.

For the scale with 1 lb. scale divisions, the weight values over a range of 0.3 lb. (halfway between scale divisions) may display different values when the same weight is placed on the scale.

Discrimination and Zone of Uncertainty, N.1.5, T.N.7 [2.20]

The test procedure for proper discrimination (i.e., acceptable width of the zone of uncertainty) is:

1. At zero load (or just above the zero tracking range of the device if it is so equipped), add weights in steps of 0.1d until you just reach the zone of uncertainty. The zone of uncertainty is detected by an occasional flickering of the display from the initial weight value to the next higher weight value with no change in weight on the scale. Then remove 0.1d of weight to cause the reading to become stable just below the edge of the zone of uncertainty.

2. Then add a test load of 1.4d. (Example: On a scale with d = 1 lb., apply 1.4 lb.)

3. That amount of load must cause the indicated value to change by 2d.

   Failure of the indication to change 2d under those conditions is a failure of the scale for discrimination.

Repeat the same test at the maximum test load. In that case:

1. At the maximum test load value, remove weights in steps of 0.1d until you just reach the zone of uncertainty. The zone of uncertainty is detected by an occasional flickering of the display from the initial weight value to the next lower weight value with no change in

weight on the scale. Then add 0.1d weight to cause the reading to become stable just above the edge of the zone of uncertainty.

2. Then remove a test load of 1.4d. (Example: On a scale with d = l lb., remove 1.4 lb.)

3. That amount of load must cause the indicated value to change by 2d.

Failure of the indication to change 2d under those conditions is a failure of the scale for discrimination.

3.7. Weighbeam equipped scales employing counterpoise weights.

3.7.1. The slotted or "hanger" counterpoise weights should be individually tested (with beam poises in the zero balance position) by placing standards on the load receiving element. Basic maintenance or acceptance tolerances apply as appropriate.
N.1.7 [2.20]

3.7.2. Ratio tests are then performed by substituting known weight (field standards) on the counterpoise hanger to duplicate the nominal values of the counterpoise weights. Place known standards on the load receiving element. UNMARKED SCALES and MARKED scales receive 3/4 basic applicable tolerance values.
Table T.1.1 [2.20];T.N.2.5 [2.20]

3.8. Increasing load tests.

3.8.1. A minimum test of at least two points on each weighbeam bar should be made with three points preferable to establish linearity of beam and accuracy of poises.

3.8.2. Excerpts from the increasing load test for livestock and animal scales recommended by the Packers and Stockyards Administration of the USDA are as follows:

3.8.2.1. Center test. The fractional bar of the weighbeam should be tested successively at one-half capacity and at full capacity. The fractional poise is then restored to its zero position and the intermediate bar, usually graduated to 900 lb. capacity by 100 lb. intervals, should next be tested at each notch to its capacity. If the weighbeam is not equipped with an intermediate bar, each 100 lb. notch should be tested on the weighbeam up to 1,000 lb.

3.8.2.2. Distributed-load test. The test should then continue with the main poise set at either successive or alternate 1,000 lb. notches and with test loads of corresponding value applied to the platform in a reasonable uniform distribution pattern. At each load, the amount of balance weights should be decreased or increased as required to produce a correct balance of the weighbeam or indicator.

Any difference between the value of balance weights at zero-load and the load at a given notch will represent the error value.

TOLERANCES – USE OF TABLES T.1.1 and 6

Discussion

Weighing devices are divided into accuracy classes and shall be designated as I, II, III, III L, or IIII (nonretroactive as of January 1, 1986). Those devices manufactured after January 1, 1986 must be so MARKED. **S.5.1 [2.20]**; **S.6.3 [2.20]; Tables S.6.3(a), S.6.3(b) [2.20]**

1. Tolerances applicable to devices NOT MARKED I, II, III, III L, IIII. **T.1 [2.20]**

Table T.1.1. Tolerances for Unmarked Scales

Type of Device	Subcategory	Min. Tol.	Accept. Tol.	Maint. Tol.	Decreasing Load Multiplier'
Vehicle, axle-load, livestock, railway track (weighing statically), crane, and hopper (other than grain hopper)		Class III L (Table 6)			1.0
Grain test scales	n ≤ 10,000 n >10,000	Class III (Table 6) Class II (Table 6)			1.0
Customer-operated bulk-weighing systems for recycled materials		± 5% of applied material test load. Average error 10 or more test loads ≤ 2.5%			1.0
Wheel-load weighers and portable axle-load scales	Tested individually or in pairs[2]	0.5 d or 50 lb, whichever is greater	1% of test load	2% of test load	1.5[3]
Prescription scales		0.1 grain (6 mg)	0.1% of test load	0.1% of test load	1.5
Jewelers' scales	Graduated	0.5d	0.05% of test load	0.05% of test load	1.5
	Ungraduated	Sensitivity or Smallest weight, whichever is less			
Dairy-product-test scale	Loads < 18 g 18 g load	0.2 grain 0.2 grain	0.2 grain 0.3 grain	0.2 grain 0.5 grain	1.5
Postal and parcel post Scales designed/used to weigh loads < 2 lb	Loads < 2 lb	15 grain, 1 g, 1/32 oz, 0.03 oz or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz or 0.002 lb	1.5
	Loads ≥ 2 lb	Table 5	Table 5	Table 5	
Other postal and Parcel post scales		Table 5	Table 5	Table 5	1.5
All other scales	n > 5,000	0.5 d or 0.05 % of scale capacity, whichever is less	0.05 % of test load	0.1% of test load	1.5
	n ≤ 5,000	Class III, Table 6			1.0

[1] The decreasing load test applies only to automatic indicating scales.
[2] If marked and tested as a pair, the tolerance shall be applied to the sum of the indication.
[3] The decreasing load test does not apply to portable wheel load weighers.

2. Table 6 tolerance values **T.N.3.1 [2.20]**

Table 6. Maintenance Tolerances (All values in this table are in scale divisions)				
Tolerance in Scale Divisions				
Class	1d	2d	3d	5d
	Test Load			
I	0 - 50,000	50,001 - 200,000	200,001 +	
II	0 - 5,000	5,001 - 20,000	20,001 +	
III	0 - 500	501 - 2,000	2,001 – 4,000	4,001 +
IIII	0 - 50	51 - 200	201 - 400	401 +
III L	0 - 500	501 - 1,000	(Add 1d for each additional 500 d or fraction thereof)	

Acceptance tolerance values shall be one-half the maintenance tolerance values. **T.N.3.2 [2.20]**

This tolerance is only applied to new equipment placed into service for the first time. **G.T.1(a) [1.10]**

EXAMPLES: Scales that use Table 6.

CLASS III*

Test Load in Divisions	Tolerances in Divisions	
	Acceptance	Maintenance
0 - 500	1/2d	1d
501 - 2,000	1d	2d
2,001 - 4,000	1 1/2d	3d
4,001 - 10,000	2 1/2d	5d

* See Tolerance Tables (Digital and Analog Values).

Digital

d = 0.005 lb. for Deli, Candy Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (b)
0.000 - 2.500	0.005
2.505 - 10.000	0.010
10.005 - 20.000	0.015
20.005 - 50.000	0.025

CLASS III - Table 6 (Continued)

Digital:

d = 0.01 lb. for Retail Food, Bench, Counter Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0.00 - 5.00	0.01
5.01 - 20.00	0.02
20.01 - 40.00	0.03
40.01 - 100.00	0.05

d = 0.02 lb. for Bench, Floor, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0.00 - 10.00	0.02
10.02 - 40.00	0.04
40.02 - 80.00	0.06
80.02 - 200.00	0.10

d = 0.05 lb. for Bench, Floor, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0.00 - 25.00	0.05
25.05 - 100.00	0.10
100.05 - 200.00	0.15
200.05 - 500.00	0.25

d = 0.1 lb. for Bench, Floor, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 50.0	0.1
50.1 - 200.0	0.2
200.1 - 400.0	0.3
400.1 - 1,000.0	0.5

d = 0.2 lb. for Bench, Floor, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 100.0	0.2
100.2 - 400.0	0.4
400.2 - 800.0	0.6
800.2 - 2,000.0	1.0

CLASS III - Table 6 (Continued)

d = 0.5 lb. for Bench, Floor, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0.0 - 250.0	0.5
250.5 - 1,000.0	1.0
1,000.5 - 2,000.0	1.5
2,000.5 - 5,000.0	2.5

Analog:

d = 1/4 oz. for Retail, Computing, Spring Scales, Etc.

Test Load (oz)	d	Maintenance Tolerance ± (oz)
0 - 7 lb 13 oz	500	1/4
7 lb 13-1/4 oz - 31 lb 4 oz	2000	1/2

d = 1/2 oz. for Retail, Computing, Spring Scales, Etc.

Test Load (oz)	d	Maintenance tolerance ± (oz)
0 – 15 lb 10 oz	500	1/2
15 lb 10-1/2 oz - 62 lb 8 oz	2000	1

Digital/Analog:

d = 1.0 lb. for Bench, Floor, Platform, Animal Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 500.0	1
501 - 2,000.0	2
2,001 - 4,000.0	3
4,001 - 10,000.0	5

d = 2 lb. for Floor, Dormant, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 1,000	2
1,002 - 4,000	4
4,002 - 8,000	6
8,002 - 20,000	10

d = 5 lb. for Floor, Dormant, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 2,500	5
2,005 - 10,000	10
10,005 - 20,000	15
20,005 - 50,000	25

CLASS III - Table 6 (Continued)

d = 10 lb. for Floor, Dormant, Built-In, Platform, Grain Hopper Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 5,000	10
5,010 - 20,000	20
20,010 - 40,000	30
40,010 - 100,000	50

d = 20 lbs. for Floor, Dormant, Platform, Grain Hopper Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 10,000	20
10,020 - 40,000	40
40,020 - 80,000	60
80,020 - 200,000	100

d = 50 lbs. for Floor, Dormant, Built-In, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 25,000	50
25,050 - 100,000	100
100,050 - 200,000	150
200,050 - 500,000	250

d = 100 lbs. for Floor, Dormant, Built-In, Platform Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 50,000	100
50,100 - 200,000	200
200,100 - 400,000	300
400,100 - 1,000,000	500

CLASS III L - Table 6

Test Load in Divisions	Tolerances in Divisions	
	Acceptance	Maintenance
0 - 500	1/2d	1d
501 - 1,000	1d	2d
For each additional 500d of test load, or fraction thereof	Add 1/2d	Add 1d

CLASS III L - Table 6 (Continued)

d = 5 lbs. for Livestock, Hopper (other than grain hopper) Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 2,500	5
2,505 - 5,000	10
5,005 - 7,500	15
7,505 - 10,000	20
10,005 - 12,500	25
12,505 - 15,000	30
15,005 - 17,500	35
17,505 - 20,000	40
20,005 - 22,500	45
22,505 - 25,000	50
25,005 - 27,500	55
27,505 - 30,000	60
30,005 - 32,500	65
32,505 - 35,000	70
35,005 - 37,500	75
37,505 - 40,000	80
40,005 - 42,500	85
42,505 - 45,000	90
45,005 - 47,500	95
47,505 - 50,000	100

d = 10 lbs. for Vehicle, Axle-Load, Hopper (other than grain hopper) Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 5,000	10
5,010 - 10,000	20
10,010 - 15,000	30
15,010 - 20,000	40
20,010 - 25,000	50
25,010 - 30,000	60
30,010 - 35,000	70
35,010 - 40,000	80
40,010 - 45,000	90
45,010 - 50,000	100
50,010 - 55,000	110
55,010 - 60,000	120
60,010 - 65,000	130
65,010 - 70,000	140
70,010 - 75,000	150
75,010 - 80,000	160
80,010 - 85,000	170
85,010 - 90,000	180
90,010 - 95,000	190
95,010 - 100,000	200

CLASS III L - TABLE 6 (Continued)

d = 20 lbs. for Vehicle, Axle-Load Railway Track (static), Hopper (other than grain hopper) Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 10,000	20
10,020 - 20,000	40
20,020 - 30,000	60
30,020 - 40,000	80
40,020 - 50,000	100
50,020 - 60,000	120
60,020 - 70,000	140
70,020 - 80,000	160
80,020 - 90,000	180
90,020 - 100,000	200
100,020 - 110,000	220
110,020 - 120,000	240
120,020 - 130,000	260
130,020 - 140,000	280
140,020 - 150,000	300
150,020 - 160,000	320
160,020 - 170,000	340
170,020 - 180,000	360
180,020 - 190,000	380
190,020 - 200,000	400

d = 50 lbs. for Vehicle, Axle-Load, Railway Track (static), Hopper (other than grain hopper) Scales, Etc.

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 25,000	50
25,050 - 50,000	100
50,050 - 75,000	150
75,050 - 100,000	200
100,050 - 125,000	250
125,050 - 150,000	300
150,050 - 175,000	350
175,050 - 200,000	400
200,050 - 225,000	450
225,050 - 250,000	500
250,050 - 275,000	550
275,050 - 300,000	600
300,050 - 325,000	650
325,050 - 350,000	700
350,050 - 375,000	750
375,050 - 400,000	800
400,050 - 425,000	850
425,050 - 450,000	900
450,050 - 475,000	950
475,050 - 500,000	1,000

CLASS III L - Table 6 (Continued)

d = 100 lbs. for Railway Track Scales (static)

Test Load (lb)	Maintenance Tolerance ± (lb)
0 - 50,000	100
50,100 - 100,000	200
100,100 - 150,000	300
150,100 - 200,000	400
200,100 - 250,000	500
250,100 - 300,000	600
300,100 - 350,000	700
350,100 - 400,000	800
400,100 - 450,000	900
450,100 - 500,000	1,000
500,100 - 550,000	1,100
550,100 - 600,000	1,200
600,100 - 650,000	1,300
650,100 - 700,000	1,400
700,100 - 750,000	1,500
750,100 - 800,000	1,600
800,100 - 850,000	1,700
850,100 - 900,000	1,800
900,100 - 950,000	1,900
950,100 - 1,000,000	2,000

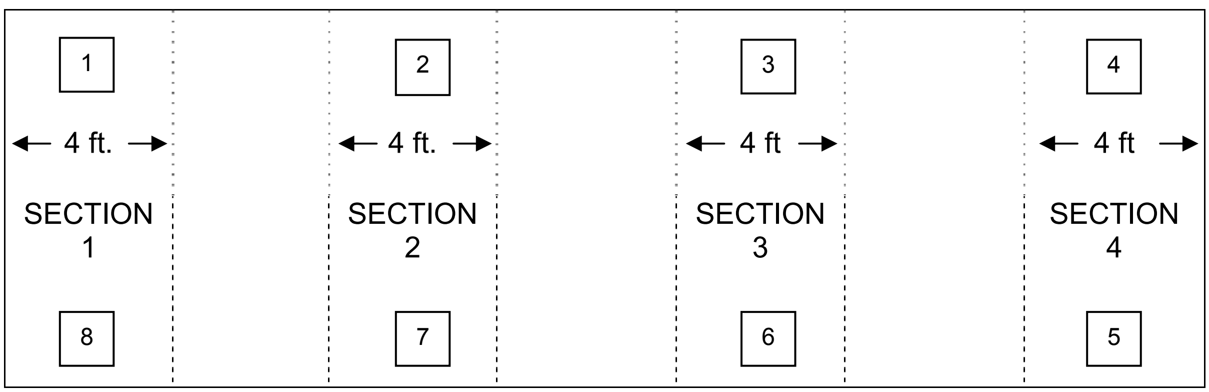
SCALE TEST WEIGHT POSITIONS - SHIFT TEST

All positions are numbered as though the scale were being viewed from the indicator location.

SHIFT TEST - VEHICLE, LIVESTOCK, AND AXLE-LOAD SCALES. Shall be conducted with a test load successively distributed anywhere on the scale using a test pattern at least 4 feet long and as wide as the scale. **N.1.3.4 [2.20]; N.1.3.8 [2.20]**

NOTE: As a recommended testing pattern, place the test load successively distributed between the two load bearing elements that support each section.

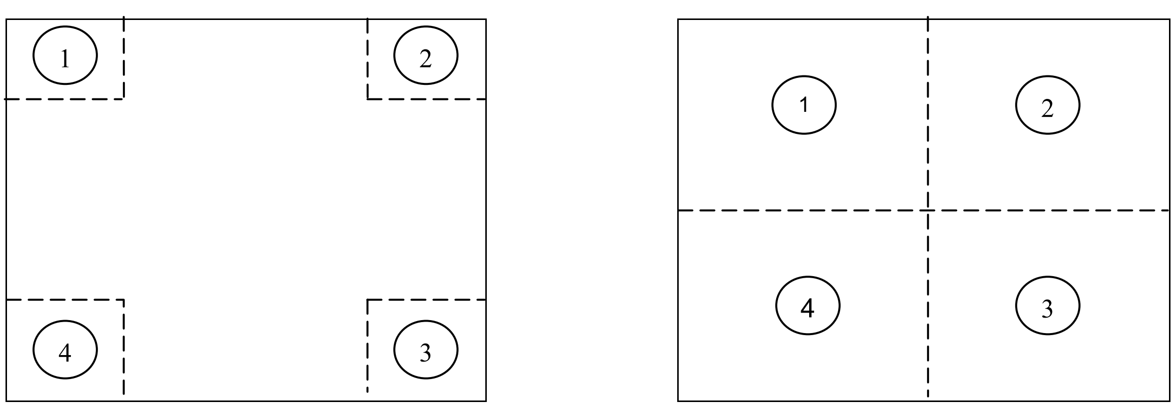
EXAMPLE OF SECTION AND LOAD BEARING NUMBERS – 4 SECTION SCALE



Load Bearing Elements INDICATOR

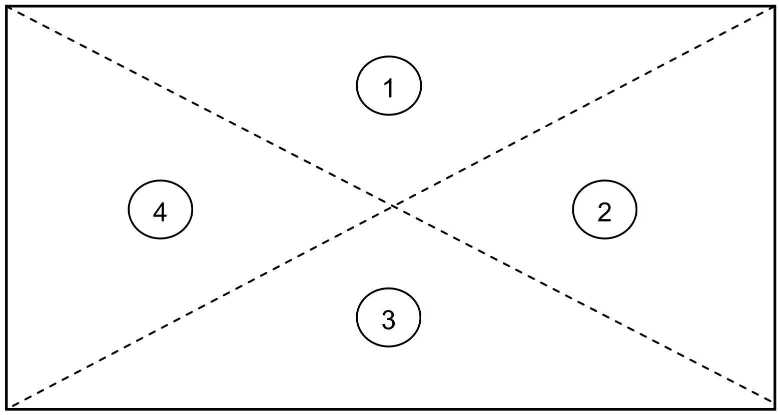
Maximum Loading – One side of the test patter shall not exceed 25% of the CLC until the other side is

SHIFT TEST – PORTABLE PLATFORM AND DORMANT SCALES



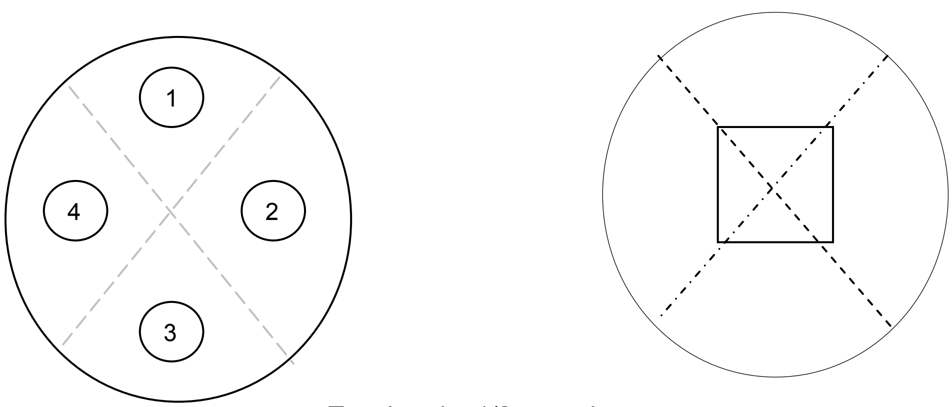
Test Load – 1/4 Capacity and / or Test Load – 1/2 capacity

SHIFT TEST – BENCH OR COUNTER SCALE



Test Load – 1/2 capacity

SHIFT TEST – EQUAL ARM SCALES



Test Load – 1/2 capacity
Test each pan independently
In four places as shown

SUBSTITUTION/STRAIN-LOAD TESTS

In the test of a large capacity scale where the amount of known weight available is less than the "use" or nominal capacity of a scale, it is necessary for the inspector to resort to the substitution method of testing or the strain-load test method. The primary differences between the two test methods are outlined as follows:

1. In the substitution method of testing, the known test weight is applied to a given scale in the manner outlined in the appropriate EPO and tolerances are applied. Then, by means of small weights and/or the movement of a poise, if necessary, the scale indicator is brought to a readily reproducible condition of balance - as the beam tip coming to rest in the center of the trig loop, or with a balance indicator exactly on a graduation (depending on how the scale is equipped). Caution - do not move the balance ball or in any way change the balance condition of the scale during these test procedures, because at the conclusion of testing the "zero" balance condition will be checked against minimum tolerance values. Then, the known test weight is removed from the scale and any material available is added (leaving room for a test vehicle if a vehicle scale) in an amount which will cause the scale to repeat the exact indication previously displayed by the appliance of known weight. This material is then left on the scale and the known weight is placed back on the scale. Tolerances are then applied to the entire amount represented on the scale. This method can be repeated as often as necessary up to the "use" or nominal capacity of the scale.

2. In the strain-load method of testing, both known weight and unknown weight are utilized in order to stress the scale parts as they are normally stressed under ordinary operating conditions. Under this method, the known weight is first applied to the scale using procedures outlined in the EPO; tolerances are applied. Then, the known weight is removed from the scale and some unknown load is placed on the scale, as a loaded vehicle or grain in a hopper, preferably in an amount equal to or less than the known test weight previously applied. The unknown load is then balanced out by any convenient means, but preferably not by utilizing the regular balancing means, because at the conclusion of testing we will test the "zero-load" balance condition of the scale. The test weight is again added to the scale and tolerances are applied, but only to the amount of known test weight added. If at this point the scale has not yet been "stressed" to its "use" or nominal capacity, we would again repeat the procedure previously outlined: that is, remove the known test weight, apply additional unknown weight, which is balanced out, then reapply the known test weight to which tolerances are applied.

This application of tolerances only to the known test weight added is the basic difference between "strain-load" testing and the "substitution" method. The "strain-load" method is dependent on the addition of unknown weight only to stress, or load up the scale as it would normally be used. In the "substitution" method, this material is added in an amount exactly equaling the known test load and thereby becomes a known amount.

ELECTROMAGNETIC INTERFERENCE - ELECTRONIC DEVICES

The following steps may be combined with routine device tests or conducted separately.

Pre-Test Inspection

1. Identification requirements. **G-S.1 [1.10]**

2. Type approval. **B&P 12500.5**

3. Establish no load balance condition for weighing device, or zero starting position for measuring device.

Tests

1. Apply test load, draft or material as appropriate for device being tested. **G.N.2 [1.10]**

2. Operate all available electrical or electronic equipment in adjacent area in its normal and customary operating location. Examples are:

    2.1. Electrical office equipment, fans, and fluorescent lighting fixtures.

    2.2. Electrical industrial equipment, such as welders, air compressors, overhead cranes, drills, motors and power saws.

    2.3. Public address systems, intercoms, walkie-talkies, base station and vehicle-mounted radio transmitters.

    2.4. When a vehicle scale will be weighing vehicles equipped with radio transmitters, test should be performed using vehicles normally weighed on the scale with the vehicle situated on the scale platform and the radio equipment in the transmit mode. Other vehicles equipped with radio transmitters but not normally weighed on the scale may be used for this test, providing this vehicle is not located directly on the scale platform. **T.N.2.3 [2.20]; T.N.9 [2.20]; G.N.2**

    2.5. When testing a taximeter, have the radio operated in both the receiving and transmitting modes. **G-N.2 [1.10]**

    2.6. When testing in an environment where security personnel use walkie-talkies, request the radio to be operated in the transmit mode 1 meter from the electronic equipment (scale indicator, remote console, pump pulser, etc.). For retail bench and counter scales, the test distance shall be 2 meters. **G-N.2 [1.10]**

3. Apply required tolerances for the test being conducted when equipment in Step 2 is in operation.
   EPO Page 13

   An indication which exceeds the required tolerance and is steady enough to use as a measurement value for the device under test shall be cause for rejection or an "out-of-order" marking. **G-N.2 [1.10]**

   The following scale indicator responses shall be deemed in compliance: **T.N.9 [2.20]**

   (a) "Blanking out".

   (b) "Error" message.

   (c) Indication so unstable that it could not be interpreted, transmitted into memory, or transmitted to a recording element as a correct measurement value.

WEIGHT TRUCK CALIBRATION GUIDELINES

Pre-Test Determinations

Scale selection is of primary importance in a weight truck calibration. First choice, if available, should be a mechanical weighbeam equipped vehicle scale with scale divisions of 10 pounds or less and excellent sensitivity. If a suitable mechanical scale is not available, a digital scale will suffice with careful weight application. Pay attention to the weather. Depending on local conditions you may have to start the calibration early in the day to beat prevailing winds (deadly on sensitivity, repeatability and discrimination testing). Scale platform must be clean and have clearance around its perimeter

NOTE: *If you do not know the approximate axle weights of the unloaded truck, go ahead and two-spot (first pull front axle only on scale platform and determine its weight, then repeat with rear axle).*

Scale sensitivity for mechanical/weighbeam equipped scale - At both zero balance and maximum applied load, the scale sensitivity should be such that the weighbeam will meet sensitivity requirements. For calibration purposes, this is equal to one scale division.

Procedure

1. Zero Balance

   1.1. Establish a repeatable zero balance. If the scale has not been used recently, run the weight truck over the scale platform several times rechecking zero each time.

   1.2. Digital scale - Check the width of the zone of uncertainty to establish a definite zero starting point. Add error weights equal to 0.1d to the scale platform until the indicator just starts to flash to the next weight division. If the discrimination is proper for the scale, this will occur at 0.3d or 0.4d (just on the edge of the zone of uncertainty). Remove a 0.1d error weight to get a solid weight display. This is your zero starting point.

   Note the weight of error weights used.

   NOTE: *If using a digital scale, place 100 lb of 50 lb error weights simultaneously on the scale platform to override the automatic zero-setting mechanism (AZSM). These weights are to remain on the scale platform throughout the entire weight truck calibration.*

2. Scale Test

   2.1. Test the scale, particularly for sensitivity or discrimination and repeatability. Record the section errors on the back of the test form.

3. Placing of Field Standards

   3.1. After a successful test, place an amount of known weight (field standards) on the scale equivalent to (preferably slightly greater than) the anticipated tare weight of the weight truck.

3.2. Place the standards on the scale in the best position to represent the anticipated weight distribution on the truck axles and in an area of least error found during the test of the scale.

NOTE: *On vehicle scales with more than two (2) sections, use the two that are "closest" to each other.*

Best results will be obtained by moving field standards on and off the scale platform without driving truck on the platform.

4. Set Scale Indication for Comparison

4.1 Mechanical/weighbeam equipped scale - Place the weighbeam poises to balance the field standards on the scale platform and mark the position of the beam tip on the trig loop or the balance indicator. Record the weight of field standards used.

NOTE: *The weighbeam indication may or may not exactly match the amount of field standards on the platform (the scale may have a slight error - not to worry).*

4.1.1. Lock the beam and without disturbing beam poises or balance arrangements, carefully remove the field standards from the scale platform.

4.2 Digital scale - Add error weights equal to 0.1d to the scale platform until the indicator just starts to flash to the next weight division. Remove a 0.1d error weight to get a solid weight display.

NOTE: *The digital indication may or may not exactly match the amount of field standards on the platform (the scale may have a slight error - not to worry).*

4.2.1. Record the digital indication and the weight of field standards used. Carefully remove the field standards from the scale platform, leaving behind the error weights used in step 1.2. to obtain a steady weight display.

5. Prepare Weight Truck

5.1. The weight truck fuel tank should be topped off; coolant, engine oil, and hydraulic oil reservoirs should be full or at a predetermined marked level. Spare fuel cans, clothing, and equipment not normally a part of the truck tare weight must be removed (refer to the weight truck inventory list, see step 8).

5.2. Drive the weight truck slowly onto the scale platform to the same position previously occupied by the field standards.

For mechanical/weighbeam equipment scales take care not to alter weighbeam balance arrangements.

6. Determine Tare Weight of Weight Truck

    6.1. Mechanical/weighbeam equipped scale - With weight truck in position, unlock weighbeam. Add or subtract ballast weight to weight truck until weighbeam comes to the original balance position.

    6.2. Digital scales - With weight truck in position, add an error weight equal to 0.1d to scale platform (this is in addition to the error weights used in step 4.2). Add or subtract ballast weight to the weight truck to match the digital indication noted in step 4.2.

        6.2.1. If ballast weight is added, add sufficient ballast weight for the indication to just flash, remove 0.1d error weight. Indication should be solid. If not, remove ballast weight until a solid indication is obtained.

        6.2.2. If ballast weight is removed, remove sufficient ballast weight for the indication to become solid. Add ballast weight for indication to just flash, remove 0.1d error weight. Indication should be solid. If not, remove ballast weight until a solid indication is obtained.

    NOTE: *The weight added to the truck to balance the beam or achieve a predetermined digital indication becomes part of the truck tare weight (some counties substitute scrap metal into a tare box to adjust their truck tare weight).*

    6.3. The tare weight of the weight truck now equals the weight of the field standards documented in step 4.1. or 4.2.1.

    6.4. Do not remove or replace the ballast weight adjustment in 6.1 or 6.2.

7. Recheck Zero Balance

    7.1. Remove the weight truck from scale platform and recheck zero balance (see step 1).

    NOTE: *The established tare weight of the test truck plus the field standards gives you a known gross load.*

8. Inventory Weight Truck

    8.1. Inventory the equipment that was on the weight truck during calibration to assure that calibration conditions can be duplicated. Amend the inventory list if necessary and keep it on the weight truck at all times.

Be aware that the weight of your weight truck will change due to tire wear/changes or equipment modification. Maintain cleanliness with routine washing/touch-up paint of weights and truck bed. Recalibrate your weight truck as often as its use dictates. Your weight truck is being used as a “field standard” and needs to be maintained as such. If a scale’s accuracy is questionable using the weight truck, do not hesitate to off-load and use field standards to confirm your findings.

WEIGHT TRUCK CALIBRATION WORKSHEET

Electronic

County #

Date:	Vehicle Identification:		Trailer:
Vehicle Odometer Reading:		Start Time:	End Time:
Remarks/reason for calibration:			
Scale Location:			
Wind and Weather Conditions:			
Type of Scale: Full Electronic ☐ Levertronic ☐			
Scale Dimensions:		Scale Manufacturer:	
Scale Capacity:		Minimum Division:	
1.2 Establish a repeatable zero balance.			
2.0 Discrimination test @ zero load, refer to **EPO 2-8**. Error weights used for 0 balance:			
Repeats Zero? Yes ☐ No ☐		Variation:	
Perform two section tests. Note the results/repeatability/variation on a drawing of the scale on back of this form.			
Perform discrimination at full load:			
Check Zero:			
3.0 Place test weights onto scale.		Amount Used:	
Show positions of field standards on the scale on a drawing on the back of this form.			
		Digital indication:	
4.2 Set indicator to standards with error weights.		Error Weights:	
Remove field standards from scale.			
5.0 Top off all liquid levels to a predetermined marked level.			
Remove all equipment, clothing, coolers, tec., from vehicle that are not normally part of the tare (operating) weight.			
NOTE: Check Inventory List to ensure all equipment and gear is accounted for.			
Correct? Yes ☐ NO ☐	Remarks/Changes:________________________________		
6.2. Place vehicle onto scale in approximately the same position as test weights.			
Add or subtract ballast weights to vehicle to duplicate the conditions in (4.2).			
6.3 This is the tare weight of the vehicle.		Tare Weight:	
7.0 Remove vehicle from scale.			
Recheck zero (as originally zeroed).			
Add weight in (3.0) to (6.2) = gross weight of vehicle.			
Corrected calibrated weight of vehicle:			
Test Truck Calibration Performed By:	Inspector (Print) ____________________	Inspector (Print) ____________________	

Send a copy of this completed form to the Division of Measurement Standards.

A.

WEIGHT TRUCK CALIBRATION WORKSHEET

Mechanical/Weighbeam

County #

Date:	Vehicle Identification:		Trailer:
Vehicle Odometer Reading:		Start Time:	End Time:
Remarks/reason for calibration:			
Scale Location:			
Wind and Weather Conditions:			
Type of Scale:	Mechanical Beam ☐ →	Over/Under Indicator	☐ Yes ☐ No
Scale Dimensions:		Scale Manufacturer:	
Scale Capacity:		Minimum Division	
1.1 Establish a repeatable zero balance.			
2.0 SR @ Zero Load:	Repeats Zero? ☐ Yes ☐ NO	Variation:	
Perform two section tests. Note the results/repeatability/variation on a drawing of the scale on back of this form.			
		SR at Full Load:	
		Check Zero:	
3.0 Place Test Weights onto scale.		Amount Used:	
Show positions of field standards on the scale on a drawing on the back of this form.			
4.1 Position weighbeam poises to balance field standards, mark position of beam.			
Lock weighbeam, then remove field standards from scale. **NOTE:** Do not disturb beam poises.			
Top off all liquid levels to a predetermined market level.			
Remove all equipment, clothing, coolers, etc., from test truck that are not normally part of the tare (operating) weight.			
Check Inventory List to ensure all equipment and gear is accounted for.			
Correct? Yes ☐ NO ☐	Remarks/Changes:____		
6.1 Place test truck onto scale in approximately the same position as field standards.			
Unlock weighbeam.			
6.1 Add or subtract ballast weight to test truck until weighbeam comes to rest at the original balance position (Item f).			
The "amount used" in (3.0) is the tare weight of the test truck.		Tare Weight:	
7.0 Remove test truck from scale.			
Recheck zero (as originally zeroed).			
Add weight in (3.0) to (6.1) = gross weight of vehicle.			
Corrected calibrated weight of vehicle:			
Test Truck Calibration Performed By:	Inspector (Print) ______________________________	Inspector (Print) ______________________________	

Send a copy of this completed form to the Division of Measurement Standards.

A.

A.

B.

C.

D.

Comments:

COMPUTING SCALES - ELECTRONIC AND MECHANICAL

Computing scales are those that indicate money values for an amount of product weighed at predetermined unit prices throughout all or part of the weighing range of the scale. Examples are drum type analog, fan and electronic computing.

The Examination Procedures Outline for computing scales is divided into two categories. Inspection and test procedures common to all are detailed in the procedure for computing scales. Additional information for point-of-sale systems and digital price calculations can be found as listed below.

8-A. Computing Scales (Basic Scale)
8-B. Point-of-Sale Systems

Basic Computing Scale

<u>Pre-Test Inspection</u>

1. Identification. **EPO NO. 1-1; EPO REF-B**

2. Type approval. **B&P 12500.5; EPO NO. 1-2**

3. Scale position.

   3.1. Readability from "customer" position. If shown on operator's side with digital indications, such as net weight, price per pound or total price, it shall be similarly displayed on customer's side. **B&P 12510(a)6; G-UR.3.3 [1.10]**

   Unit price displays visible to the customer shall be in terms of whole units of weight and not in common or decimal fractions. (Nonretroactive as of May 9, 1996.)

   4002.2 (2.20); (e.), Page D2-4

   3.2. The scale platter or weighing element shall be so positioned that the weighing or measuring operation may be observed from some reasonable "customer" and "operator" position. This distance and position determination must be made on a case-by-case basis. The size and character of the indicating element should be taken into account.
   B&P 12510(a)6; G-UR.3.3 [1.10]

4. Balance condition. **UR.4.1 [2.20]**

   4.1. This user/maintenance regulation requires that a scale shall be maintained in balance. Appropriate enforcement action should be taken for scales found with the zero balance improperly maintained.

5. Level condition. If a scale is equipped with a level indicating means, the scale shall be maintained in level. **UR.4.2 [2.20]**

6. Check the following items (pan or tray may be moved with hands).

    6.1. Pan or tray clearance. Must have clearance empty throughout weighing usage. **UR.2.4 [2.20]**

    6.2. Indicator return to starting point within minimum tolerance (observe each time load is removed). **N.1.9 [2.20]**

    6.3. Oscillations. Automatic indicating scales and balance indicators shall be effectively dampened to bring indicators quickly to rest. **S.2.5 [2.20]**

    6.4. Motion detection. Electronic scales equipped with printers shall record values only when the indication is stable within plus or minus one scale division. Printed indications shall be within applicable tolerance for applied test load. **S.2.5.1(b) [2.20]**

    6.5. Indicator visibility (dirt, lights, brightness of display). **G-UR.4.1 [1.10]**

<u>Pre-Test Determinations</u>

1. Basic tolerances (acceptance or maintenance). **T.N. [2.20]**

    1.1. Scale is MARKED with an accuracy class, use Table 6. **EPO NO. 3-2; T.N. [2.20]; T.N.3.1 [2.20]**

    1.2. Scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale, use Table T.1.1. **EPO NO. 3-1**

<u>**EXAMPLE:**</u> $$\text{n (number of divisions)} = \frac{\text{capacity of scale}}{\text{value of minimum division}}$$

$$n = \frac{12\ \text{lb}}{.01\ \text{lb}} = 1{,}200$$

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

    2.1. On UNMARKED scales where n > 5000 divisions, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 "d", whichever is less. **T.1.1 [2.20]**

    2.2. On scales that are MARKED with an accuracy class or on UNMARKED scales where n ≤ 5000 divisions, use Table 6. (The minimum maintenance tolerance is 1d. Acceptance tolerance is one half of maintenance tolerance.) **T.N.3.1 [2.20]; EPO NO. 3-2**

Tests

1. Maximum capacity with test weights.

   1.1. Computing and point-of-sale scales shall not indicate or record values exceeding: **S.1.7 [2.20]**

      1.1.1. Scale capacity plus 9 scale divisions for electronic scales (excluding postal scales and weight classifiers). (Nonretroactive as of January 1, 1993.)

         NOTE: This does not prohibit such scales from weighing gross loads of up to 105% of the scale capacity. For example, a 30 lb x .01 scale could weigh a gross load of 105% (or 31.5 lb) as long as 1.41 lb of this amount was tare; then the scale could indicate up to 30.09 lb (or +9 scale divisions).

      1.1.2. 105% of the capacity of the system for all other scales.

2. Decreasing-load test.

   2.1. On UNMARKED automatic indicating scales, the decreasing-load test shall be conducted with a test load equal to one-half the maximum load applied in the increasing-load test. **N.1.2.2 [2.20]; T.1.1 [2.20]**

      2.1.1. Where n > 5000 divisions, the tolerance is 1-1/2 times the basic tolerance.

      2.1.2. Where n ≤ 5000 divisions, the tolerance is the same as basic tolerance (Table 6). **EPO NO. 3-2**

   2.2. On scales MARKED with an accuracy class and with n ≥ 1000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance breakpoint. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

   2.3. On scales MARKED with an accuracy class and n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3. Shift test - Conduct this test at 1/2 capacity. (See EPO NO. 4-1 for test positions.) **N.1.3.1 [2.20]**

   3.1. On MARKED scales, any two results obtained during the shift test must be within absolute value of maintenance tolerance for that load (even when acceptance tolerance applies to the scale). **T.N.3.1 [2.20]; T.N.4.4 [2.20]; EPO NO. 3-2**

   3.2. On UNMARKED scales, tolerance is the basic maintenance tolerance determined under pre-test determinations 1.2. **T.1.1 [2.20]; Table T.1.1 [2.20]; EPO NO. 3-1**

Example: On a 30 lb. x .01 lb. scale, the allowable maintenance tolerance at 15 pounds test load is ±.02 lb. As shown in the following example, the scale is within +.02 lb.; however, the error between position 1 and positions 2 and 4 is in excess of .02 lb. absolute. **T.N.5 [2.20]**

Test load 15 lb.:

Position	Weight Indication	Error
1	14.98	-.02
2	15.01	+.01
3	15.00	0
4	15.01	+.01

4. Check analog price charts for accuracy and alignment. **G-S.2 [1.10]**

5. Digital price indications - Check weight times price calculations for proper rounding up and down. Tape printers should be checked at selected weights to determine accuracy. **EPO NO. 8-B-4, 1-4, 1-5**

6. Recheck no-load indication after removal of any test load. Zero balance should not change by more than the minimum tolerance applicable. **N.1.9 [2.20]**

7. Increasing load test. **N.1.1 [2.20]**

   7.1. Add test weights in 1 oz. increments from no-load to 1 lb. For electronic digital scales, add test weights in .01 lb. increments from no-load to 0.1 lb. and by 0.1 lb. to 1 lb. If the value of d is less than 0.01 lb., use appropriate test weights to verify indications.

   7.2. Add test weights from 1 lb. to capacity in 1 lb. increments, deleting those values previously tested. (This is considered a minimum test.)

   NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in the scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6. for the method of testing discrimination.) **N.1.5 [2.20]**

8. Test electronic tare capability.

   8.1. The tare mechanism shall have sufficient capacity to equal the heaviest tare container used. **B&P 12024**

   8.2. Test for tare auto clear (nonretroactive 1-1-83). **S.2.3 [2.20]**

   8.2.1. Enter tare value.

8.2.2. Remove container from the scale and check to see if the tare value is retained.

8.2.3. Replace the tare item and add 25d net weight.

8.2.4. Without entering a unit price, remove all the weight from the scale. The tare value should be kept.

8.2.5. Repeat Step 8.2.3 and enter a unit price. The scale should display a correct total price.

8.2.6. When the load is removed from the platter, the scale may clear the tare and unit price.

9. Motion detection (see EPO NO. 8-B-4, 2.1, 2.2). **S.2.5.1 [2.20]**

10. Price look-up (if the computing scale has that capability).

11. Tare program. **EPO NO. 8-B-3, 1.2**

When the scale PLU has a predetermined or programmed tare, verify that it performs the weighing correctly.

When the scale has PLU, check to see if it will correctly weigh with a manually entered tare.
EPO NO. 8-B-3,1.2

NOTE: If a PLU tare cannot be overridden, there must be a separate PLU for each tare of the same product. **G-S.2 [1.10]**

POINT-OF-SALE SYSTEMS

Contact Store Manager for Assistance

The point-of-sale (POS) systems must be in a training, manager's or test mode before making scale tests or entries. A keyboard selectable void or error key that allows cancellation of transactions during the testing procedures is acceptable. **G-UR.4.4 [1.10]**

In some cases, the manager will have to remove the cash drawer.

Pre-Test Inspection

1. Identification. **EPO NO. 1-1; EPO REF-C; B&P 12500.5**

2. Type approval status of scale and ECR.

3. Weight indication and zero balance information must be visible at all times from a normal customer's and operator's position. When registers are interfaced to electronic scales, the customer must be provided with a continuous zero balance information. This can be accomplished in either of the following ways: **G-UR.3.3 [1.10]; B&P 12510(a)6**

   3.1. The register may have an integral weight indicator that is part of the terminal. However, the weight indicator must be entirely separate from the price transaction portion of the customer display.

   3.2. The register may have a remote customer's weight indicator mounted on or adjacent to the terminal or weighing element.

   NOTE: If a permanent, non-rotatable customer's weight indicator is provided, it must be visible at all times from a normal customer position. The zero balance condition may be indicated by words such as "scale ready" or annunciator. When scale is out of balance, weighing is inhibited. **S.1.1(c) [2.20]**

4. Balance condition. **UR.4.1 [2.20]**

   4.1. This user/maintenance regulation requires that a scale shall be maintained in balance.

   4.2. The operator of the scale must be able to see the zero balance indication.

5. Level condition. **UR.4.2 [2.20]**

   5.1. If a scale is equipped with a level indicating means, the scale shall be maintained in level.

6. Check the following items:

   6.1. Pan or tray clearance. Must have clearance empty throughout weighing usage. **UR.2.4 [2.20]**

   6.2. Zero condition after each time a load is removed (repeatability of indications shall be within the minimum tolerance applicable for that device). **N.1.9 [2.20]**

   6.3. Indicator visibility (dirt, burned-out lamp segments, brightness, etc.). **G-UR.4.1 [1.10]**

Pre-Test Determinations

1. Basic tolerance (acceptance or maintenance).

   1.1. If the scale is MARKED with an accuracy class, use Table 6. **EPO NO. 3-2; T.N.3.1 [2.20]**

   1.2. If the scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale.

$$\text{number of divisions} = \frac{\text{capacity of scale}}{\text{minimum division}}$$

      1.2.1. If n > 5000 divisions, use Table T.1.1. **T.1.1 [2.20]; EPO NO. 3-1**

      1.2.2. If n ≤ 5000 divisions, use Table 6, Class III designation. **T.1.1 [2.20]; EPO NO. 3-2**

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale

   2.1. On scales that are MARKED with an accuracy class or UNMARKED scales where n ≤ 5000 divisions, use Table 6. The minimum maintenance tolerance is 1d. (Acceptance tolerance is one-half of maintenance tolerance.) **T.N.3.1 [2.20]; T.1.1 [2.20]; EPO NO. 3-2**

   2.2. On scales which are UNMARKED where n > 5000 divisions, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 "d", whichever is less. **T.1.1 [2.20]; EPO NO. 3-1**

Tests

1. The following tests should be evaluated using point-of-sale receipts.

   NOTE: The following information is required on the printed customer receipt. **S.1.8.4 [2.20]**

   (a) Product class (PR, Proc) or on price look-up systems, product name or code number.

(b) Net weight.

(c) Weight quantity abbreviation or symbol. (Must be "pound", "lb" or the symbol "#".)

(d) Unit price.

(e) Total price.

Number each receipt with tests 1.1 through 1.5 listed below:

1.1. Tests - Follow basic computing scale test procedures as outlined in EPO NO. 8-A-4, 7, Increasing Load Test, using a unit price of $1.00 for randomly selected entries.

1.2. Price look-up - For terminals equipped with PLU capabilities, verify accuracy and correctness of transactions based on look-up program. Look at a current newspaper advertisement for that location, or prior to starting POS testing take a walk through the produce and bulk food sections of the store noting the price on various items. Then using the product code listing (usually adjacent to the register) enter or have the store clerk enter the PLU's for those chosen scale items into the register with a one (1) pound weight on the scale.

NOTE: For systems combining tare and PLUs refer to 1.4.

1.3. Tare program - Verify operation and accuracy of all net weight transactions using tare program. The tare mechanism must have sufficient capacity to equal the heaviest tare container used. Use EPO NO. 8-A-4, 8.2 to test for tare auto clear. **B&P 12023, 12024**

1.3.1. Tare capability may be achieved in one of the following methods: **S.2.3 [2.20]**

1.3.1.1. A standard tare may be programmed into the register if a single tare function is adequate for proper operation. Provision to override tare is acceptable if the standard tare is not to be used for a particular transaction.

1.3.1.2. Keyboard tare is acceptable. This tare normally functions when the operator enters a number prior to pressing the scale key.

EXAMPLE: With 1.00 lb. placed on the scale, operator enters "2" before activating "scale" key and ECR prints 0.98 lb. net weight on the customer receipt.

NOTE: It is preferable that the most commonly used tare be programmed to automatically occur as in 1.3.1.1. above with provision to override tare by special keystroke.

1.4. Combined tare/price look-up program - Using the same procedure outlined in 1.2, check those bulk items in the store that are in a bag or tray that would require a tare to be taken (such as produce, bulk coffee, bulk candy, bulk health food items, soup and salad bar - if sold by the pound). Verify that the correct tare is applied by observing the net weight value on the printed receipt.

Example: Entering the PLU for fresh mushrooms, place a 1 lb test weight on the scale and print a receipt. If the tare for a plastic bag and tie is 0.01 lb you should see a printed net of 0.99 lb. If the PLU is for freshly ground coffee, you may see a different net weight of say 0.94 lb. (check the tare against the type of bag used).

NOTE: This procedure may be used on any computing scale with PLU capability, such as service delis, fish markets, meat markets, and specialty stores.

1.5. Mathematical agreement - Verify correct computation of money values for both manually entered and price look-up transactions using the following table: **G-S.5.5 [1.10]**

Net Weight Indication	X	Unit Price Entered	=	Total Price Recorded	Correctly Rounded
0.10 lb.		$.15		$ .0150	$ .01 or $.02
0.32 lb.		$.83		$ .2656	$ .27
0.32 lb.		$.89		$ .2848	$ .28
2.54 lb.		$.79		$ 2.0066	$ 2.01
2.54 lb.		$.86		$ 2.1844	$ 2.18
20.67 lb.		$.59		$12.1953	$12.20

NOTE: Allow for POS with pre-programmed tares with extra test weight; i.e., indicated amounts will show actual weight applied to the platter while printed amounts may differ by 1d (add this amount to your test weight to make the printed weight values match table split-price amounts).

2. Motion detection - Depending upon the manufacturer, the ECR will usually print the weight indication when either the “scale” (“weight”) or department keys are depressed. **S.2.5.1 [2.20]**

2.1. Place a 1.0 lb. test weight on the scale while simultaneously depressing the print key. The ECR will either print a stabilized weight or give an error indication.

2.2. To the 1.0 lb. test load, add 0.1 lb. to the scale while depressing the print key. The ECR will either print 1.0 lb. or 1.1 lb. (± 0.01 lb.), or give an error indication.

2.3. Repeat Steps 2.1 and 2.2 above using a 5 lb. test weight.

3. Zero Indication.

    3.1. Electronic cash registers must indicate or record a zero or below zero reference (example: customer indicator = -0.01 lb. or the words "scale ready"). **S.1.1 [2.20]**

4. Maximum capacity with test weights.

    4.1. Computing and point-of-sale scales shall not indicate or record values exceeding: **S.1.7 [2.20]**

        4.1.1. Scale capacity plus 9 scale divisions for electronic computing scales (excluding postal scales and weight classifiers). (Nonretroactive as of January 1, 1993.)

        NOTE: This does not prohibit such scales from weighing <u>gross</u> loads of up to 105% of scale capacity or for example, a 30 lb x .01 scale could weigh a gross load of 105% (or 31.5 lb) as long as 1.41 lb of this amount was tare and then the scale could indicate up to 30.09 lb. (or +9 scale divisions).

        4.1.2. 105% of nominal capacity for all other scales.

5. Manual weight entries.

    5.1. For electronic cash registers interfaced to point-of-sale scales, manual entry of weight information is <u>prohibited</u> unless the following conditions are met: **G-S.2 [1.10]**

        5.1.1. The terminal is in a key selected credit mode.

            5.1.1.1. The customer's receipt records previously voided weight entries.

            5.1.1.2. The words "Manual Weight", "Manual Wt." or "MAN.WT" must be automatically printed on the customer receipt. Multiple manual weight entries can be represented by a symbol provided that the symbol is defined on the same page and is automatically printed on the receipt. (Nonretroactive as of January 1, 1993.) **S.1.12 [2.20]**

6. Scanner equipped systems and non-weight PLU may be checked for comparison of computer prices with shelf prices. (These operations must be cleared with store manager prior to tests.)

CRANE SCALES

Definition

One with a nominal capacity of 5,000 lb. or more designed to weigh loads while they are suspended freely from an overhead, track mounted crane.

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

2. Type approval. **B&P 12500.5**

3. Minimum increment of indication. **UR.1.1 [2.20]**

   3.1. On an UNMARKED scale, the value of the minimum division shall be not greater than 0.2% of the nominal capacity of the scale.

4. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

Pre-Test Determinations

1. Basic tolerances (acceptance or maintenance). **T.N.3.4 [2.20]**

   1.1. Scale is MARKED or UNMARKED with an accuracy class, use Table 6, Class III L. **T.N.3.1 [2.20]; EPO NO. 3-2**

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale. **T.1.1 [2.20]**

   2.1. Scales which are MARKED or UNMARKED with an accuracy class, use Table 6. (The minimum maintenance tolerance is 1d.) **T.1.1 [2.20]; EPO NO. 3-2**

   Acceptance tolerance is never less than ld or 0.1% of scale capacity, whichever is less. **T.N.3.4 [2.20]**

Tests

1. Increasing test load.

   As with most high capacity scales, difficulties can be encountered in applying sufficient test weights to properly test a crane scale. **G-UR.2.3 [1.10]; EPO NO. 1-6, 6.1**

   1.1. The most satisfactory method thus far is the use of a beam-type dead weight tester located at some manufacturing facilities; it is appropriate for the owner or supplier to make arrangements.

1.2. Another method for scales with relatively low capacities is to have the owner or supplier provide a platform for loading test weights and the means to hoist the platform.

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in the scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

2. Maximum capacity with test weights.

2.1. Automatic indicating scales shall not indicate or record values exceeding 105% of capacity. **S.1.7 [2.20]**

3. Decreasing load test.

3.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.2 [2.20]; T.1.1 [2.20]; T.N.3 [2.20]; EPO NO. 3-2**

3.2. On scales MARKED with an accuracy class and with $n \geq 1{,}000$, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance level. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3.3. On scales MARKED with an accuracy class and $n < 1{,}000$, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerances are shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

4. Return to the no-load indicated value within minimum tolerance applicable for that device. **N.1.9 [2.20]**

EQUAL-ARM SCALES - AUTOMATIC INDICATING AND NONAUTOMATIC INDICATING

Equal-arm (or even balance) scales are those having a single lever with equal arms (this is with a multiple of 1) equipped with two similar or dissimilar load receiving elements (pan, plate, scoop, etc.), one intended to receive materials being weighed and the other intended to receive weights. (Weighbeams are optional.)

Scale Indicators

1. Automatic indicating.

   1.1. Equipped with graduated over and under (o/u) chart.

   1.2. Also, one with chart that begins at zero and is graduated to a design capacity.

2. Nonautomatic indicating.

   2.1. Equipped with an ungraduated balance indicator.

   NOTE: Equal-arm scales may be designed with center tower indicators, end tower indicators or towers with intermediate positions. May be with or without weighbeams.

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

2. Type approval. **B&P 12500.5**

3. Scale position. **G-UR.3.3 [1.10]; B&P 12510(f)**

   3.1. Readability from "customer position."

4. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

   4.1. Check customer indications for agreement with operator's indicator during inspection and tests.

5. Level condition. If a scale is equipped with level indicating means, it shall be maintained in level. **UR.4.2 [2.20]; S.2.4 [2.20]**

Pre-Test Determination

1. Basic tolerance (acceptance or maintenance).

1.1. Scale is MARKED with an accuracy class, use Table 6. **T.N.3.1 [2.20]; EPO NO. 3.2**

1.2. Scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale, use Table T.1.1. **EPO NO. 3-1**

$$\text{(number of scale divisions)} = \frac{\text{capacity of scale}}{\text{value of minimum divisions}}$$

EXAMPLE: $n = \frac{5\text{ lb}}{1/16\text{ oz}} = 1{,}280$

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

    2.1. On scales that are MARKED with an accuracy class or UNMARKED scales where n $\leq$ 5000 divisions, use Table 6. (The minimum maintenance tolerance is 1d.) **T.N.3.1 [2.20]; T.1.1 [2.20]; EPO NO. 3-2**

    2.2. On scales UNMARKED where n > 5000 divisions, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 "d", whichever is less. **T.1.1 [2.20]; EPO NO. 3-1**

3. Minimum travel of pans of nonautomatic indicating equal-arm scale without balance indicator. **S.3.1 [2.20]**

<u>Tests</u>

(Use <u>test</u> weights for the following tests.)

1. SR test (nonautomatic indicating) NOT MARKED with an accuracy class (see EPO NO. 2-6, 3.3; 2-7, 3.4). Sensitivity (nonautomatic indicating) MARKED with accuracy class (see EPO NO. 2-7, 3.5). **N.1.4 [2.20]**

    1.1. Check SR at zero and at maximum applied load for both pans. **T.2 [2.20]; T.3 [2.20]; T.N.6.1 [2.20]**

    1.2. Recheck no-load indication (zero load balance) each time test load is removed. **N.1.9 [2.20]**

        1.2.1. Record balance changes.

        1.2.2. Tolerance is equal to minimum tolerance applicable. **N.1.9 [2.20]**

2. At maximum and 1/2 capacities.

    2.1. Check with test weights and weighbeam if so equipped.

3. Shift test. Perform at 1/2 capacity for each pan using test weights. (See EPO NO. 4-2 for test positions.) **N.1.3.3 [2.20]**

   3.1. On UNMARKED scales, the results obtained must be within maintenance tolerance for that load as determined under pre-test determinations 1.2. **T.1.1 [2.20]**

   3.2. On MARKED scales, the maximum allowable difference between any two results must be within absolute value of maintenance tolerance for that load (even when acceptance tolerance applies to the scale). (See EPO NO. 8-A-4 for example of application of absolute tolerance value.) **T.1.1 [2.20]; T.N.3.1 [2.20]; T.N.4.4 [2.20]**

4. The above tests are considered a minimum. For scales with automatic indicators and weighbeams, sufficient intermediate positions should be checked to assure weighbeam linearity and accuracy of chart graduations.

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in the scale performance such as erratic readings. (See EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

5. Weights supplied with scale may be checked by comparing with certified test weights. Incorrect weights shall be marked "out-of-order." (See EPO NO. 22.)

HANGING SCALES

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

2. Type approval. (Approvals have been revoked on most non-temperature compensated scales.)

   2.1. Unless noted on the Certificate of Approval, electronic hanging scales are tested for influence factors as a weighing system.

3. Scale position. **G-UR.3.3 [1.10]**

   3.1. Readability from "customer position." **B&P 12510(f)**

4. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

   4.1. Check customer indications for agreement with operator's indicator during inspection and tests if scale is so equipped. (Analog device indicators should agree within one-half "d".) **T.N.4.3 [2.20]**

5. Minimum graduated interval. **UR.1.1 [2.20]; Table 7b [2.20]**

   5.1. Shall not be greater than 1 oz. on scale with capacity of 50 lb. or less used for retail food sales.

6. Drainage. **S.3.2 [2.20]**

   6.1. Shall be provided for on scale used for weighing wet commodities. **UR.3.6 [2.20]**

Pre-Test Determinations

1. Basic tolerance (acceptance or maintenance). **T.N [2.20]**

   1.1. Scale is MARKED with an accuracy class, use Table 6. **EPO NO. 3-2; T.N.3.1 [2.20]**

   1.2. Scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale.

   EXAMPLE: $$\text{(number of scale divisions)} = \frac{\text{capacity of scale}}{\text{value of minimum divisions}}$$

   $$n = \frac{20\,\text{lb}}{1/1\,\text{oz}} = 640$$

   1.2.1. Where n > 5000 divisions, use Table T.1.1. **T.1.1 [2.20]; EPO NO. 3-1**

   1.2.2. Where n ≤ 5000 divisions, use Table 6, Class III designation. **T.1.1 [2.20]; EPO NO. 3-2**

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

2.1. On scales that are MARKED with an accuracy class or UNMARKED scales where n ≤ 5000 divisions, use Table 6. (The minimum maintenance tolerance is 1d.)
T.N.3 [2.20]; T.1.1 [2.20]; EPO NO. 3-2

2.2. On UNMARKED scales where n > 5000 divisions, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 "d", whichever is less. **T.1.1 [2.20]**

Tests

1. Maximum capacity with test weights.

   1.1. Automatic indicating shall not indicate or record values exceeding 105% of capacity.
   S.1.7 [2.20]

2. Decreasing-load test (automatic indicating scales).

   2.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half the maximum load applied in the increasing-load test.
   N.1.2.2 [2.20]; T.1.1 [2.20]; EPO NO. 3-1

   2.1.1. Where n > 5000 divisions, the tolerance is 1-1/2 times the basic tolerance.

   2.1.2. Where n ≤ 5000 divisions, the tolerance is the same as basic tolerance (Table 6).
   EPO NO. 3-2

   2.2. On scales MARKED with an accuracy class and with n ≥ 1000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance break point. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

   2.3. On scales MARKED with an accuracy class and n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6, Class III. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3. Recheck no-load indication after removal of any test load. Zero-load balance should not change by more than the minimum tolerance applicable. **N.1.9 [2.20]**

4. Increasing-load test. **N.1.1 [2.20]**

   4.1. On UNMARKED scales, test at several points throughout the devices range. Also, test dial indicators at 1/4, 1/2, 3/4 and full capacity.

   4.2. On MARKED scales, the increasing-load test shall be conducted as outlined above making sure to include test loads equal to the maximum test load at each tolerance break point.

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in the scale performance, such as erratic readings. (See EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

HOPPER SCALES - STATIONARY

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

2. Type approval. **B&P 12500.5; EPO NO. 1-2**

   2.1. Full electronic and levertronic hopper scale weighing elements require load cells that have been separately tested and approved.

3. Primary indicators separated from their weighing elements. **G-UR.2.2 [1.10]; EPO NO.1-6, 4.1**

4. Adequate facilities and assistance for applying weights.
   G-UR.2.3 [1.10]; EPO NO. 1-6, 6.1; EPO NO. 4-A-1

5. Balance conditions of indicators. (See EPO NO. 2 for additional information on type of indicators installed.) **UR.4.1 [2.20]**

6. Electronic digital weight indicators shall not have automatic zero maintenance (AZM) capability.
   G.S.2 [1.10]

7. Minimum division of indication. **UR.1.1 [2.20]**

   7.1. On grain hopper scales - UNMARKED. **Table 7b [2.20]**

      7.1.1. Capacity up to and including 50,000 lb to 10 lb (but not greater than 0.05% of capacity).

      7.1.2. Capacity over 50,000 lb to 20 lb.

   7.2. On all other UNMARKED hopper scales, the maximum size of the minimum division is 0.1% of capacity (but not greater than 50 lb). **Table 7b [2.20]**

8. A MARKED Class III grain hopper must have a minimum of 2,000 divisions. **UR.1.2 [2.20]**

Pre-Test Determination

1. Tolerances (acceptance or maintenance and minimum).

   1.1. Grain hopper scales UNMARKED with an accuracy class ("All other scales" category).
   T.1.1 [2.20]; EPO NO. 3-1

1.1.1. Where n > 5000 divisions, use Table T.1.1 values.

1.1.2. Where n ≤ 5000 divisions, use Table 6 tolerances (Class III). **T.N.3.1 [2.20]; EPO NO. 3-2**

1.2. Grain hopper scales MARKED with an accuracy class, use Table 6 (Class III) for maintenance and acceptance tolerance. **T.N.3.1 [2.20]; EPO NO. 3-2**

1.3. All other hopper scales MARKED or UNMARKED, use Class III L tolerances from Table 6 for maintenance tolerance. Acceptance tolerance is one-half maintenance tolerance. **T.1.1 [2.20]; T.N.3.1 [2.20]; T.N.3.2 [2.20]; EPO NO. 3-2**

1.3.1. MARKED construction hopper scales have a minimum tolerance of ld or 0.1% of capacity, whichever is less. **T.N.3.4 [2.20]**

2. Suitability of load cells. **EPO NO. 1-1**

Tests

1. Attach chains or hooks as necessary to accommodate weights for tests.

2. Tare off weight of added hardware. (Re-zero indicators or note "no-load" indications.)

3. Add test weights as required.

3.1. For hoppers with a capacity exceeding available certified test weights, perform substitution test using the maximum amount of known test weights that can be applied. **EPO NO. 4-A-1**

3.1.1. Note/record indicator reading.

3.1.2. Remove certified test weights, request an operator to load material into the hopper until indicator reading of known test load is reached and reapply test weights.

3.1.3. Apply basic tolerances to the total amount of weight that has been applied.

3.1.4. This procedure should be used to load hopper to 1/2, 3/4 or use capacity depending on hopper size and equipment available.

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (See EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

3.2. As an alternative to the substitution test, a strain test may be performed. If, during Step 3.1.2 extra material is inadvertently added, a strain test has been initiated. **EPO NO. 4-A-1**

3.2.1. Tolerances shall be applied only to errors resulting from the addition of test weights during strain tests. **EPO NO. 4-A-1**

4. Decreasing-load test. (Automatic indicating scales only.) **N.1.2 [2.20]**

4.1. On UNMARKED scales and scales MARKED CLASS III L, a decreasing-load test shall be performed at one-half the applied test load. The tolerance is in Table 6. **N.1.2.2 [2.20]; T.1.1 [2.20]; EPO NO. 3-2**

4.2. On scales MARKED CLASS III with n $\geq$ 1,000, the decreasing-load test shall be conducted with test load equal to the maximum test load at each tolerance level. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

4.3. On scales MARKED CLASS III with n < 1,000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

5. Operate printer during above tests if so equipped.

6. Observe operation of automatic batching controls if so equipped.

7. Perform checkweighing or "end result" tests as delivered by automated consoles if a checkweighing scale is reasonably available. (See EPO NO. 13 for procedure for using a checkweighing scale.)

HOPPER SCALES - VEHICLE MOUNTED ELECTRONIC

The test procedure outlined below is basically an end result or comparison between the amounts delivered by the vehicle operator and the net weight shown by a checkweighing scale. A conventional static test for initial calibration or trouble-shooting should be the responsibility of the owner or a device repairman.

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

   The indicator, a printer if separate, and the hopper should all have the manufacturer's name, a model number, and a serial number. The indicator and hopper identification should also include the capacity. **S.6.3 [2.20]; EPO NO. 1-1**

2. Type approval. **B&P 12500.5**

   Includes indicating elements, optional recording element, hopper weighing element, and load cells if the scale is manufactured or converted after January 1, 1986.

Pre-Test Determinations

1. Test checkweighing scale.

   1.1. Refer to EPO NO. 20 for vehicle scale test procedures.

   1.2. Test weights should be as near as possible to expected gross and tare weights of the vehicle to determine linearity of error.

   1.3. It is important that the vehicle be positioned at the same place on the checkweigh scale for both tare and gross weight. Checkweigh scales should be rechecked after completion of tests.

   1.4. Zero balance of checkweighing scale should be checked prior to each use.

   1.5. Example for correction of checkweighing scale error can be found in EPO NO. 13-3.

2. The electronic hopper scale system should warm up for at least one hour prior to tests.

3. Make arrangements for a weights and measures official to accompany vehicle operator during deliveries to observe and record test data.

4. Make arrangements to fill vehicle fuel tank prior to each checkweighing unless travel and unloading times are very short.

5. Suitability of load cells.

Tests

1. Load hopper. Record hopper pre-delivery net weight and vehicle gross weight on checkweighing scale. (Hopper weight readings should be stable.) Oscillation of analog type indicators of one-half increment or more shall be cause to discontinue tests.

2. Proceed to first delivery point. There are two important areas of concern which have the greatest effect on the accuracy of the first delivery for products such as cattle feed.

   2.1. Depending on distance, wind and speed of the vehicle, considerable loss can occur during transport (consider use of covers).

   2.2. Moisture absorption and loss in humid or dry areas, particularly if there is a time delay between checkweighing and delivery, can cause an appreciable weight error.

3. Net weights for individual deliveries may be totaled prior to returning to the checkweighing scale, or an individual delivery may be checked. In either case, before returning to the checkweighing scale for an empty or tare weight, consider need for refueling.

4. Calculate net weight of delivery by subtracting tare weight of vehicle from original gross weight of vehicle on checkweighing scale. Correct for checkweighing scale error if necessary.

5. Calculate weight difference between net weight from checkweighing scale and net weight delivered according to hopper indicator or printer.

6. Calculate percentage of error.

$$\text{percent error} = \frac{\text{weight difference}}{\text{checkweighing scale net weight}} \times 100$$

7. Apply tolerance of ±0.3%.

8. Two or three complete deliveries should be made to check repeatability of vehicle hopper scale. The maximum error spread between tests shall be 0.3%.

9. Vehicle mounted hopper scales approved in recent years are required to have level detection systems. With hoppers so equipped, the level detection system must be operative and so adjusted that out-of-level conditions, which would cause an out-of-tolerance weight indication, must also inhibit printer operation.

EXAMPLE OF CORRECTION FOR ERROR ON CHECKWEIGHING SCALE

NOTE: Checkweighing scale should be tested at expected vehicle gross and tare weights to determine linearity of error.

Test Load	Vehicle Scale Ind.	Error
40,000 lb	40,020 lb.	+ 20 lb
20,000 lb	20,010 lb.	+ 10 lb

Error = + 10 lb.
(Weight range 10,000 to 20,000 lb.)

Error = + 10 lb.
(Weight range 20,000 to 40,000 lb.)

Vehicle Scale Ind.		Actual Weight	Feed Wagon Scale	
Gross	39,060-20 lb.	= 39,040	Loaded	20,020
Tare	19,050-10 lb.	= 19,040	After Delivery	30
Net	20,010	20,000	Total Delivery	19,990

Actual Net Weight	20,000
Total Delivery Tickets	19,990
Difference	-10 lb.

To calculate percent of error:

$$\%\ \text{error} = \frac{-10\ \text{lb}}{20{,}000\ \text{lb}} \times 100 = -0.0005 \times 100 = -0.55\%$$

LIVESTOCK AND ANIMAL SCALES

Pre-Test Inspection

1. Identification. (Refer to Newly Installed Weighing Devices, EPO NO. 1 for those devices manufactured after January 1, 1986.) **B&P 12500.5; EPO NO. 1-1**

2. Type approval.

   2.1. Electronic or levertronic scales (includes indicating element, weighing element, load cells, and recording element).

3. Indicator.

   3.1. Value of minimum increment. Animal scale - not greater than one pound. **UR.1.1 [2.20]; Table 7b [2.20]**

   3.2. Minimum load on livestock scale with divisions greater than 5 pound. **UR.3.8 [2.20]**

   EXAMPLES:

Divisions	Minimum Load
10 lb	5,000 lb
20 lb	10,000 lb

   3.3. Customer readability required if weighing will be done in full view of the interested parties. **B&P 12516**

4. Cleanliness - platform should be cleaned prior to any tests.

5. Installation.

   5.1. Foundation and supports. **UR.2.4 [2.20]**

   5.2. Clearance. **UR.2.4 [2.20]**

      5.2.1. Clearance shall be provided around all live parts to the extent that no contacts may result when the load-receiving element is empty and throughout the weighing range of the scale.

      5.2.2. Clearance between load-receiving elements and the coping at the bottom edge of the platform shall be greater than at the top edge of the platform. (Nonretroactive as of January 1, 1973.) **UR.2.4 [2.20]**

5.3. Stock racks.

5.3.1. Racks with gates shall be securely mounted on platform with adequate clearance. **UR.2.7 [2.20]**

<u>Pre-Test Determinations</u>

1. Refer to EPO NO. 2 for test information on type of indicator being used.

1.1. Suitability of load cells. **EPO NO. 1-2, 1.5**

2. Basic tolerances (acceptance or maintenance). **EPO NO. 3-2, 2**

2.1. <u>Livestock</u> scales. Applicable tolerances whether MARKED or UNMARKED use Table 6, Class III L. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

2.2. <u>Animal</u> scales.

2.2.1. Applicable tolerances for UNMARKED single head or animal scales are:

$$(\text{number of scale divisions}) = \frac{\text{capacity of scale}}{\text{value of minimum divisions}}$$

2.2.1.1. Where n $\leq$ 5,000, use Table 6, Class III. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

2.2.1.2. Where n > 5,000, use Table T.1.1. **T.1.1 [2.20]; EPO NO. 3-1**

Maintenance tolerance is 0.1% of test load. Acceptance tolerance is 0.05% of test load.

2.2.2. Applicable tolerances for MARKED animal scales, use Table 6, Class III. **T.N.3.1 [2.20]; EPO NO. 3-2**

3. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

3.1. <u>Livestock</u> scales which are MARKED or UNMARKED use Table 6. (The minimum maintenance tolerance is 1d. Acceptance tolerance is one-half of maintenance tolerance.) **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3.2. <u>Animal</u> scales which are MARKED use Table 6, Class III Tolerances. (The minimum maintenance tolerance is 1d. Acceptance tolerance is one-half of maintenance tolerance.) **EPO NO. 3-2**

3.3. Animal scales which are UNMARKED where n > 5,000, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2d, whichever is less. **T.1.1 [2.20]; EPO NO. 3-1**

3.4. Animal scales which are UNMARKED where n ≤ 5,000 or MARKED, use Table 6, Class III tolerance. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

4. Maximum error on individual section.

4.1. Livestock scales MARKED or UNMARKED Class III L. Any two results obtained during the shift test must be within absolute value of the maintenance tolerance of that load and be within applicable tolerances (whether or not acceptance tolerance is being applied). See EPO NO. 8-A-4 for example of application of absolute tolerance value.
T.1.1 [2.20]; T.N.4.4 [2.20]; T.N.5 [2.20]

4.2. Animal scales

4.2.1. On MARKED scales - same as 4.1 (livestock scales) above.

4.2.2. On UNMARKED animal scales - Results obtained during the shift test must be within maintenance tolerance values for that load. (Absolute tolerances do not apply.)
T.1.1 [2.20]; EPO NO. 3-1

5. Determine livestock scale use capacity to determine amount of test weights. **NIST HB 112**

Platform area in feet (L x W) x 110 lb. for cattle
Platform area in feet (L x W) x 70 lb. for calves and hogs
Platform area in feet (L x W) x 50 lb. for sheep

6. Refer to USDA, Packers and Stockyards Administration Instructions for Testing Livestock and Animal Scales, for further information and specific instructions for filling out livestock scale test reports.

Tests

1. Sensitivity test.

On weighbeam equipped scales, check SR at zero load and at maximum applied load.

1.1. UNMARKED scales.

1.1.1. For livestock scales UNMARKED with an accuracy class, balance in 10 lb. of small test weights. The SR shall be 10 lb. if not equipped with balance indicator.

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1.1.2. For <u>animal</u> scales UNMARKED with an accuracy class. SR is 2d or 0.2% of capacity, whichever is less for nonautomatic indicating scales not equipped with a balance indicator. SR is one division if equipped with a balance indicator.
T.2.7.2 [2.20]; T.2.7.1 [2.20]

1.2. For MARKED nonautomatic indicating livestock and animal scales. SR is 2d or 0.2% of capacity, whichever is less for nonautomatic indicating scales not equipped with a balance indicator. SR is one division if equipped with a balance indicator. **T.N.6.1 [2.20]**

1.3. Equilibrium change required. The minimum change in equilibrium with test loads, as listed above shall be as outlined in EPO NO. 2, 8, 9, 10, 11, 12 and 13. **T.3.1 [2.20]; T.N.6.2 [2.20]**

2. Shift test. **P & S Instructions**

2.1. Scale with 2 sections - conduct corner tests with test weights equal to 1/4 scale's use capacity centered successively as near as possible over each main load bearing. **N.1.3.4 [2.20]**

2.2. Scale with more than 2 sections - at least one-half of use capacity test load successively concentrated on each section of the scale (refer to Pre-Test Determinations, EPO NO. 14-3, 4).
N.1.9 [2.20]

3. No-load test - Each time loads are removed from platform, scale shall be capable of repeated no-load indications within the minimum tolerance applicable for that device.

3.1. Obtain new zero-load balance, or

3.2. Use the no-load balance change as the basis on which errors at succeeding stages of the test will be computed.

4. Increasing load test.

4.1. Test fractional bar of weighbeam at one-half capacity and full capacity (if so equipped) and at notches that appear to be worn or damaged. **N.1.1 [2.20]**

4.2. Test intermediate weighbeam bar or weighbeam at each 100 lb. notch up to 1,000 lb. (if so equipped).

4.3. Ratio tests shall be made on all scales designed to use counterpoise weights.
N.1.7 [2.20]; T.N.2.5 [2.20]; EPO NO. 2-10, 3.7

NOTE: <u>Discrimination</u> requirements. On MARKED automatic indicating scales <u>only</u>. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.)
N.1.5 [2.20]

4.4. Distribute test weights in uniform pattern on platform observing errors at successive or alternate 1,000 lb. amounts until capacity is reached. ("Use" capacity for livestock scales.) Keep in mind use of error weights to determine errors for weighbeams and certain printer equipped dials - also test dial/unit weight combinations at 1/4, 1/2, 3/4, and full capacity.

4.5. Scales equipped with combination indicators. **T.N.4.1 [2.20]; T.N.4.2 [2.20]; T.N.4.3 [2.20]**

4.5.1. Observe and record separately performance of each unit.

5. Decreasing-load test - Automatic indicating scales only.

5.1. <u>Livestock scales</u> MARKED or UNMARKED CLASS III L, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied on the increasing-load test. Tolerance is as shown in Table 6. **N.1.2.2 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

5.2. <u>Animal scales</u> UNMARKED, the decreasing-load test shall be conducted with a test load equal to one-half the maximum load applied on the increasing-load test.
N.1.2.2 [2.20]; T.1.1 [2.20]; EPO NO. 3-1

5.2.1. Where n > 5000, the tolerance is 1-1/2 times the basic tolerance.

5.2.2. Where n $\leq$ 5000, the tolerance is the same as the basic tolerance (Table 6).
EPO NO. 3-2

5.3. <u>Animal scales</u> MARKED CLASS III and with n $\geq$ 1000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance level. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]**

5.4. <u>Animal scales</u> MARKED CLASS III and with n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6.
N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2

6. No-load indications (zero load balance).

6.1. Record balance changes.

6.2. Tolerance is equal to minimum tolerance applicable. **N.1.9 [2.20]**

MONORAIL SCALES

Pre-Test Inspection

1. Identification. **EPO NO. 1-1, 1-3**

2. Type approval. **B&P 12500.5**

    2.1. Electronic or levertronic scales [includes indicating element, weighing element, load cells (if tested separately), and optional recording element].

3. Balance condition. (A scale shall be maintained in balance.) **UR.4.1 [2.20]**

4. Installation. **UR.2.4 [2.20]**

    See EPO NO. 1 "Newly Installed Weighing Devices". Installation details and provisions for communication between load-bearing element and a remote readout or printer. **G-UR.2.2 [1.10]**

5. Assistance in testing operations. **G-UR.4.4 [1.10]**

    There are several important considerations for the successful operation of a monorail scale. The best time to obtain compliance is during the initial inspection and test of a new system. Compliance with the following considerations will provide better end results and less deterioration in system accuracy.

    5.1. Initial solid installation and support of load bearing elements (live rails) as well as adjacent tracks are essential to prevent deterioration of system after initial testing. **UR.2.4 [2.20]**

    5.2. On "in-motion" scales, controlled operating speed as established by testing or device type approval must be maintained to prevent excessive load swinging and the accompanying random errors.

    5.3. A statistical sample or 100% preliminary test of trolley tares (hook and wheel combinations) must be made to determine weight uniformity.

    5.4. The owner or operator of the monorail scale should be encouraged to set up a quality control program for maintenance of the trolleys and have provisions for verifying them at certain intervals. **G-UR.4.1 [1.10]**

    5.5. Provisions should be made by the owner/user of the scale to provide trees or baskets for the accommodation of weights for testing. Owners should be encouraged to acquire or provide their own checkweighing equipment for periodic testing to become aware of problems or accuracy deterioration. **G-UR.2.3 [1.10]**

Pre-Test Determinations

1. See EPO NO. 2 for the type of indicator installed. **EPO NO. 2-1**

   1.1. Suitability of load cells.

2. Basic tolerances (acceptance or maintenance).

   2.1. Scale is MARKED with an accuracy class, use Table 6, Class III. **T.N.3.1 [2.20]; EPO NO. 3-2**

   2.2. Scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale.

$$\text{(number of scale divisions)} = \frac{\text{capacity of scale}}{\text{value of minimum divisions}}$$

      2.2.1. If $n > 5000$, use Table T.1.1. **EPO NO. 3-1; T.1.1 [2.20]**

      2.2.2. Where $n \leq 5000$, use Table 6, Class III. **T.N.3.1 [2.20]; EPO NO. 3-2**

3. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

   3.1. Scales which are MARKED with an accuracy class or UNMARKED and with $n \leq 5000$, use Table 6. The minimum maintenance tolerance is 1d. (Acceptance tolerance is one-half of maintenance tolerance.) **T.N. [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

   3.2. For UNMARKED scales where $n > 5000$, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 d, whichever is less. **T.1.1 [2.20]; EPO NO. 3-1**

4. Determine that adequate trees or weight hangers are available.

Tests

1. Attach equipment needed to accommodate test weights to load bearing element (trolley, tree, chains or basket).

2. For scales equipped with weighbeam indicators, add error weights to above equipment and balance in (tare off) error weights and other equipment before beginning actual weight tests. Error weights should consist of a total value equal to the tolerance for the maximum test load to be used. One of the error weights should have a value equal to the minimum tolerance applicable to the scale being tested. **EPO NO. 2-6, 3-2**

3. For additional tests applicable to a particular type of indicator such as SR, ratio, “four point” test of dials, and decreasing load (see EPO NO. 2).

4. Increasing load test. **N.1.1 [2.20]**

   4.1. If a single tree or basket will accommodate test weights, it should hang from the center of the load bearing element. If two trees are used, for example, they should be placed close to the center of the load bearing element.

   4.2. Test weights should be applied up to scale capacity with indications being observed as weights are added.

   NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

5. Shift test should be made with a test load equal to the largest load that can be anticipated, but not less than one-half capacity with load successively placed on the right end, left end, and the center of the live rail. **N.1.3.6 [2.20]**

   5.1. On UNMARKED scales - Tolerance is the basic tolerance determined under Pre-Test Determinations 2.2. **T.1.1 [2.20]; EPO NO. 3-1**

   5.2. On MARKED scales - The maximum allowable difference between any two test positions must be within absolute value of maintenance tolerance for that load (even if acceptance tolerances apply). See EPO NO. 8-A-4 for example of absolute tolerance application. **T.N.3.1 [2.20]; T.N.4.4 [2.20]; T.N.5 [2.20]; EPO NO. 3-2**

6. Decreasing-load test (automatic indicating scales).

   6.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. **N.1.2.2 [2.20]; T.1.1 [2.20]**

      6.1.1. Where n > 5000, the tolerance is 1-1/2 times the basic tolerance. **EPO NO. 3-1**

      6.1.2 Where n ≤ 5000, the tolerance is the same as the basic tolerance (Table 6). **EPO NO. 3-2**

   6.2. On scales MARKED with an accuracy class and with n ≥ 1000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance level break point. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

   6.3. On scales MARKED with an accuracy class and n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6, Class III. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

7. No-load indications shall be within minimum tolerance values at completion of tests or at any time all test weights are removed. **N.1.9 [2.20]**

PLATFORM SCALES

This Examination Procedures Outline covers a broad category of platform scales which fall in between computing scales and those scales designed for weighing livestock and heavy vehicle loads.

Examples are:

Bench or counter portable platform scales.

Portable platform scales (floor models which may or may not have wheels).

Permanently installed dormant scales (may be installed above ground or in a pit).

Load cell approval requirements on electronic platform scales manufactured or converted after January 1, 1986 will vary depending on the capacity and size of the scale. Electronic platform scales and weighing elements greater than 2000 lb. require load cells that have been tested and approved separately. Electronic scales and weighing elements 2000 lb. and smaller have been tested for compliance with influence factor requirements. Load cells in the smaller capacity device are not required to be type approved unless a replacement cell is not the same as the load cell the scale was type approved with.

<u>Pre-Test Inspection</u>

1. Identification.

   1.1. Electronic or levertronic scales (includes separable indicating element, separable weighing element, and load cells). **EPO NO. 1-2, 2.1.2**

2. Type approval. **B&P 12500.5**

3. Scale position. **G-UR.3.3 [1.10]; B&P 12510(f)**

   3.1. Readability from a reasonable "customer" position (applies particularly to direct sale devices).

4. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

5. Level condition. **UR.4.2 [2.20]**

   5.1. Scale should be tested in "as found" condition. If errors exceed required tolerance values, consider enforcement action.

Pre-Test Determinations

1. Basic tolerances (acceptance or maintenance). **T.N. [2.20]**

   1.1. Scale is MARKED with an accuracy class, use Table 6, Class III. **EPO NO. 3-2; T.N.3.1 [2.20]**

   1.2. Scale is UNMARKED with an accuracy class, calculate the number of divisions on the scale.

$$\text{(number of scale divisions)} = \frac{\text{capacity of scale}}{\text{value of minimum divisions}}$$

   1.2.1. Where n $\leq$ 5000, use Table 6 Class III. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

   1.2.2. Where n > 5000, the maintenance tolerance is 0.1% of the test load. Acceptance tolerance is 0.05% of the test load. **T.1.1 [2.20]; EPO NO. 3-1**

2. Minimum tolerance - The smallest tolerance value that can be applied to a scale.

   2.1. On scales that are MARKED with an accuracy class or UNMARKED scales where n $\leq$ 5000, use Table 6. (The minimum maintenance tolerance is 1d. Acceptance tolerance is one-half of maintenance tolerance.) **T.N.3 [2.20]; T.1.1 [2.20]; EPO NO. 3-2**

   2.2. For UNMARKED scales where n > 5000, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 "d", whichever is less. **T.1.1 [2.20]; EPO NO. 3-1**

3. Suitability of equipment - minimum used load. **UR.3.1 [2.20]; EPO NO. 1-7; Table 8 [2.20]**

4 Suitability of load cells. **EPO NO. 1-2, 1.5**

Tests

1. SR tests or sensitivity tests. If the scale is equipped with a weighbeam indicator, balance in error weights at this time. Conduct SR test at zero-load and maximum capacity. **EPO NO. 2-6, 3.3**

2. Shift test (EPO NO. 4-1, 4-A-1 shows positions). **N.1.3.1 [2.20]**

   2.1. Bench or counter scales - Conduct at one-half capacity with test weights centered successively at each of four points equidistant between the center and the front, left, back, and right edges of the scale platform.

   2.2. All other types of platform scales - test load equal to 1/4 of scale capacity centered successively over each main load support, <u>or</u> 1/2 capacity centered on each quarter of the platform. **N.1.3 [2.20]; N.1.3.8 [2.20]**

2.3. Shift test at 1/2 or 1/4 capacity.

2.3.1. On UNMARKED scales, the results obtained must be within maintenance tolerance for that load as determined under Pre-Test Determinations 1.2.
T.1.1 [2.20]; EPO NO. 3-1

2.3.2. On MARKED scales, the maximum allowable difference between any two results must be within absolute value of maintenance tolerance for that load (even when acceptance tolerance applies to the scale). See EPO NO. 8-A-4 for an example of absolute tolerance value application. **T.N.3.1 [2.20]; T.N.4.4 [2.20]; EPO NO. 3-2**

3. Increasing-load test. **T.1.1 [2.20]**

3.1. Test all weighbeam bars (if so equipped) at several points throughout their range to determine the scale's linearity.

3.2 Ratio test - for scales equipped with counterpoise weights in addition to the weighbeam. Test weights should alternately be substituted for slotted counterpoise weights and appropriate tolerances applied. **N.1.7 [2.20]; EPO NO. 2-10, 3.7; T.N.2.5 [2.20]**

3.3. Distribute test weights in a uniform pattern on platform until capacity is reached. Keep in mind, use of error weights to determine errors for weighbeams. Also, test dial indicators at 1/4, 1/2, 3/4, and full capacity.

3.4. Scales equipped with combination indicators (digital/analog).

3.4.1. Observe and record separately performance of each unit. Apply tolerances.
T.N.4.1 [2.20]

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (See EPO NO. 2-8, 3.6 for the method of testing discrimination.)
N.1.5 [2.20]

4. Decreasing-load test (automatic indicating only).

4.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. **N.1.2.2 [2.20]; T.1.1 [2.20]**

4.1.1. Where n > 5000, the tolerance is 1-1/2 times the basic tolerance. **EPO NO. 3-1**

4.1.2. Where n $\leq$ 5000, the tolerance is the same as basic tolerance (Table 6). **EPO NO. 3-2**

4.2. On scales MARKED with an accuracy class and with n ≥ 1,000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance level. Tolerance is shown in Table 6, Class III. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

4.3. On scales MARKED with an accuracy class and with n < 1,000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6, Class III. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

5. Zero-load balance change.

5.1. Each time loads are removed from the platform, the scale shall be capable of repeated zero-load indications within the minimum tolerance applicable for that device. **N.1.9 [2.20]**

PRESCRIPTION AND JEWELERS SCALES

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

   1.1. Manufacturer's or distributor's name, model number, serial number, and capacity on the scale. **S.6.3 [2.20]**

   1.2. If the device was manufactured after January 1, 1986, it must have a marked accuracy class. **S.6.3 [2.20]; Tables S.6.3(a)(b) [2.20]**

      1.2.1. **CAUTION:** If the device is marked Class I or II, Class F standards are not suitable.

2. Type approval. **B&P 12500.5**

3. Scale position. **B&P 12510(a)6; G-UR.3.3 [1.10]**

   3.1. Readability from "customer" position.

4. Balance condition. **UR.4.1 [2.20]**

5. Level condition. If a scale is equipped with a level indicating means, the scale shall be maintained in level. **UR.4.2 [2.20]**

   NOTE: Scales shall be equipped with a level - indicating means if its weighing performance causes the scale to weigh outside of acceptance tolerance values when the scale is placed out-of-level by 5% (approximately 3 degrees). (Nonretroactive January 1, 1986.)

6. Supports. A portable scale shall be so positioned that it is firmly and securely supported. **UR.2.1 [2.20]**

7. Check the following:

   7.1. Pan or tray clearance. Must have clearance empty and throughout weighing range. **UR.2.4 [2.20]**

   7.2. Indicator return to starting point after each time load is removed. **N.1.9 [2.20]**

   7.3. A jewelers or prescription scale shall be equipped with appropriate means for arresting the oscillation of the mechanism. **S.2.5 [2.20]**

   7.4. Balance indicator required, except on digital indicating devices. **S.2.2.1 [2.20]**

   7.5. Poises (see EPO NO. 2-5, 3.1). **S.1.6 [2.20]**

Pre-Test Determinations

1. Basic tolerance. **T.N. [2.20]**

    1.1. Scale is MARKED with an accuracy class, use Table 6.
    T.N.3.1 [2.20]; T.N.3.2 [2.20]; EPO NO. 3-2

    1.2. Scale is UNMARKED with an accuracy class (maintenance, acceptance and minimum).
    T.1.1 [2.20]; EPO NO. 3-1

        1.2.1. Prescription scales use ± 0.1% of test load, but never less than 0.1 grain (6 milligrams).

        1.2.2. Jewelers scales. Tolerance shall be ± 0.05% of the test load, except that for graduated scales, the tolerance value shall never be less than ± 0.5d; and for ungraduated scales, never less than the sensitivity of the scale or the smallest associated weight, whichever is less. **T.1.1 [2.20]**

2. Minimum pan travel for equal arm scales. **S.3.1 [2.20]; Tables 2 or 2M [2.20]**

3. Suitability of equipment - minimum load. **UR.3.1 [2.20]; Table 8 [2.20]**

Tests

1. SR or sensitivity tests at zero-load and at capacity if required (weighbeam scales only).
N.1.4 [2.20]; EPO NO. 2-6, 3.3

2. Shift test - Should be conducted with a one-half capacity test load. **N.1.3 [2.20]; EPO NO. 4-2**

    2.1. Test positions (see EPO NO. 4-2).

        2.1.1. Bench or counter scales. **N.1.3.1 [2.20]**

        2.1.2. On equal arm scales. **N.1.3.3 [2.20]**

    2.2. Tolerance application.

        2.2.1. On MARKED scales - Any two results obtained during the shift test must be within absolute value of maintenance tolerance for that load (even when acceptance tolerance applies to the scale). See EPO NO. 8-A-4 for an example of absolute tolerance value application. **T.N.4.4 [2.20]**

        2.2.2. On UNMARKED scales - Results obtained during the shift test must be within maintenance tolerance values for that load. **T.1.1 [2.20]; EPO NO. 3-1**

3. Ratio test at half and full capacity. **N.1.7 [2.20]**

4. Increasing-load test. **N.1.1 [2.20]**

   4.1. MARKED scales at each tolerance level.

   NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

   4.2. UNMARKED scales, the minimum test is at full and half capacity.

5. Decreasing-load test. Automatic indicating scales only. **N.1.2 [2.20]**

   5.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. Tolerance is 1-1/2 times the basic tolerance for the applied load. **T.1.1 [2.20]; EPO NO. 3-1**

   5.2. On scales MARKED with an accuracy class and with $n \geq 1{,}000$, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance level. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; EPO NO. 3-2**

   5.3. On scales MARKED with accuracy class and $n < 1{,}000$, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

6. No-load indications (zero-load balance).

   6.1. Record balance changes.

   6.2. Tolerance is equal to minimum tolerance applicable. **N.1.9 [2.20]**

7. Test equal-arm weights (see EPO NO. 22).

AUTOMATIC BULK WEIGHING SYSTEMS

This code applies to automatic bulk weighing systems, that is, weighing systems adapted to the automatic weighing of commodities in successive drafts of pre-determined amounts, automatically recording the no-load and loaded weight values, and accumulating the net weight of each draft.

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

    1.1. Load cells on scales manufactured or converted after January 1, 1986. **S.6.3 [2.20]; Tables 6.3(a)(b) [2.20]**

    (a) Accuracy class.

    (b) Maximum number of divisions (in units of 1,000) for which accuracy class requirements are met.

    (c) "S" or "M" for single or multiple cell applications in conjunction with n_{max} for each accuracy class and application.

    (d) Direction of loading, if not obvious.

    (e) Working temperature limits if other than -10 °C to 40 °C (14 °F to 104 °F).

    (f) Name and address of manufacturer, model designation, minimum dead load, maximum capacity, safe load limit, and load cell verification interval (v_{min}).

    NOTE: Required information may be on data plate attached to load cell or may be on an accompanying document. If on the document, serial number of the load cell must be marked on load cell plate and must be printed on the document.

2. Type Approval. **B&P 12500.5**

    2.1. Includes separable indicator/controller, hopper scale weighing element, load cells on scales manufactured or converted after January 1, 1986, and recording element. **EPO NO. 1-2, 2.1.2**

3. Permanent means for direct communication either oral or visual. **G-UR.2.2 [1.10]; EPO NO. 1-6, 7.1**

4. Adequate facilities and assistance for applying weights. **G-UR.2.3 [1.10]; EPO NO. 1-6, 6.1; EPO NO. 4-A-1**

5. Provisions shall be made to indicate <u>and</u> record a no-load reference value and if no-load reference value is a zero value indication, to indicate <u>and</u> record an out-of-balance condition on both sides of zero. **S.1.1 [2.22]**

   5.1. A digital zero indication shall define zero balance condition to ± 1/2 value of the scale division. **S.1.1.1 [2.22]**

6. The value of a scale division shall be equal to 1, 2, 5; or a decimal multiple or submultiple of 1, 2, or 5 (example: 10, 20, 50 or .01, .02, .05); or it may be a binary submultiple (example: 1/2, 1/4, 1/8, 1/16). **S.1.2 [2.22]**

7. Capacity indication.

   7.1. An indicator or recorder shall not indicate or record any value when the gross load exceeds 105% of the capacity of the system. **S.1.3 [2.22]**

8. Weighing and recording sequence. **S.1.4 [2.22]**

   8.1. A system used to receive product into storage shall determine and record a no-load reference value at the beginning of each weigh cycle. A system used to deliver product from storage shall determine and record the no-load reference value after the gross load of the draft is determined.

   8.2. Weight values must remain visible until the recording of the value by the printer is complete. **S.1.5 [2.22]**

9. Provision for sealing.

   9.1. Provision shall be made to seal access to adjustments. **S.1.6 [2.22]**

10. Design of balance and damping mechanism.

    10.1. The weighing system must have a manual or semi-automatic "push-button zero" means by which the zero-load balance or no-load reference value indication may be adjusted. Automatic zero setting mechanism is prohibited. **S.2.1 [2.22]**

    10.2. A manual zero-load or no-load reference value setting mechanism shall be operable or accessible only by a tool outside of or entirely separate from the zero mechanism or enclosed in a cabinet. **S.2.1.1 [2.22]**

    10.3. A semi-automatic "push-button zero" zero-load reference value setting mechanism shall be tool operable like the manual zero or it will not operate until the indication is stable within ±3 divisions and further it must not operate during a weighing operation. **S.2.1.2 [2.22]**

10.4. The system shall have adequate damping to bring the scale to equilibrium and permit the recording of weight only when the scale is stable within ± 3 divisions if the scale has 10,000 divisions or ±1 divisions if the scale has less than 10,000 divisions. **S.2.2 [2.22]**

11. Interlocks and gate control. **S.3 [2.22]**

11.1. Gate position. Provisions shall be made to clearly indicate to the operator the position of the gates leading directly to and from the weigh hopper. **S.3.1 [2.22]**

11.2. Interlocks. Each automatic bulk weighing system shall have operating interlocks to provide for the following: **S.3.2 [2.22]**

(a) Product cannot be cycled and weighed if the weight recording element is disconnected or subjected to a power loss.

(b) The recording element cannot print a weight if either of the gates leading directly to or from the weigh hopper is open.

(c) A "low paper" sensor, when provided, is activated.

(d) The system will operate only in the proper sequence in all modes of operation.

(e) When an overfill alarm is activated, the system shall indicate and record an overfill condition.

11.3. Overfill sensor. The weigh hopper shall be equipped with an overfill sensor which will cause the feed gate to close, activate an alarm, and inhibit weighing until the overfill condition has been corrected. **S.3.3 [2.22]**

12. Protection from environmental factors. The indicating elements, the lever system or load cells, the load-receiving element, and any permanently installed test weights shall be adequately protected from environmental factors such as wind, weather, and RFI that may adversely affect the operation or performance of the system. **UR.2.1 [2.22]**

13. Foundation, supports and clearance. The foundation and supports of any system shall be such as to provide strength, rigidity and permanence of all components, and clearance shall be provided around all live parts so that no contact can result before or during operation of the system. **UR.2.2 [2.22]**

<u>Pre-Test Determination</u>

1. Minimum tolerance applicable to automatic bulk grain weighing systems shall not be less than half the value of the scale division. For systems used to weigh construction materials, the minimum maintenance and acceptance tolerance shall be 0.1% of the weighing capacity of the system or the value of the scale division, whichever is less. **T.2 [2.22]; T.2.1 [2.22]**

2. Basic maintenance tolerance for grain scales shall be 1 lb per 1,000 lb. of test load (0.1%). For all other systems, the basic maintenance tolerance shall be 2 lb. per 1,000 lb. of test load (0.2%). **T.3.2 [2.22]; T.3.3 [2.22]**

   The basic acceptance tolerance shall be one-half the basic maintenance tolerance. **T.3.1 [2.22]**

3. Suitability of load cells. **EPO NO. 1-1**

<u>Tests</u>

1. Attach chains or hooks as necessary to accommodate weights for tests.

2. Tare off weight of added hardware. (Re-zero indicators or note "no-load" indications.)

3. Add test weights equal to at least 10% of the capacity of the system.

   3.1. For hoppers with a capacity exceeding available test weights, perform substitution test using the maximum amount of known test weight that can be applied. **EPO NO. 4-A-1**

      3.1.1. Note/record indicator reading.

      3.1.2. <u>Remove</u> test weights, request an operator to load material into the hopper until indicator reading of <u>known</u> test load is reached, and reapply test weights.

      3.1.3. Apply basic tolerances to the total amount of weight (material plus test weights) that has been applied.

      3.1.4. This procedure should be repeated to load hopper to use capacity.

   3.2. As an alternative to the substitution test, a strain test may be performed. If, during Step 3.1.2, extra material is inadvertently added, a strain test has been initiated. **EPO NO. 4-A-1**

      3.2.1. Tolerances shall be applied only to <u>errors resulting from the addition of test weights</u> during strain tests. **EPO NO. 4-A-1**

4. Operate the printer during the above tests.

5. Observe operation of automatic controls to determine compliance with S.1.4, S.5, and S.3 [2.22].

6. After the removal of any test load, check for a change in zero balance or no-load reference value. The change shall not be more than the minimum tolerance applicable. **N.1.4 [2.22]**

7. If the weighing system fails to repeat indications, the venting system may need correction so that external pressure will not affect the accuracy of the system. **S.4.4 [2.22]**

8. Zone of uncertainty test shall be conducted under controlled environmental conditions, such as lack of wind or vibrations, so that the conditions will not affect the test.

   8.1. Add test weights in steps of 0.ld until the weight display begins to flash between adjacent divisions. This serves as the starting point to determine the width of the zone.

   8.2. Add additional test weights in steps of 0.ld until a solid indication of the larger load division is obtained. The weights added in this step represent the width of the zone of uncertainty at this load.

   8.3. Repeat Steps 8.1 and 8.2 at capacity load and in the other operating mode of pound or kilogram if the scale has the dual indication capability. The zone of uncertainty should not exceed 0.3d.

9. At constant test conditions (including temperature), the indication 20 seconds after the application of a load and the indication after one hour shall not differ more than the absolute value of the applicable tolerance for the applied load. (Nonretroactive as of January 1, 1987.) **T.4 [2.22]**

RAILWAY TRACK SCALES

Pre-Test Inspection

1. Identification - Refer to Newly Installed Weighing Devices, EPO NO. 1, for those devices manufactured after January 1, 1986.

2. Type approval. **B&P 12500.5**

   2.1. Electronic and levertronic scales (includes separable indicating element, weighing element, load cells, and recording element).

3. Printer. Scales **must be** equipped with a recording element. (Nonretroactive as of January 1, 1996) **UR.1.5 [2.20]**

4. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

5. Provisions for visual or oral communication. **G-UR.2.2 [1.10]**

6. Installation requirements. **UR.2.4 [2.20]**

Pre-Test Determinations

1. Refer to EPO NO. 2 for information on type of indicator being used and corresponding tests involved.

   1.1. Suitability of load cells. **EPO NO. 1-3**

2. Basic tolerances.

   2.1. Maintenance, acceptance, and minimum tolerances for railway track scales, UNMARKED or MARKED are given in Table 6, Class III L. (The minimum maintenance tolerance is 1d.) **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3. Shift/section test tolerance. (Scales MARKED OR UNMARKED.) Any two results obtained shall agree within the absolute value of maintenance tolerance for the load (even when acceptance tolerance applies). See EPO NO. 8-A-4 for an example of absolute tolerance value application. **T.N.4.4 [2.20]**

4. SR or sensitivity test (weighbeam equipped scales).

   4.1. Scales UNMARKED with an accuracy class, the SR shall be 100 lb. or 3 divisions, whichever is less. **T.2.8 [2.20] EPO NO. 2-6, 3.3**

   4.2. Scales MARKED with an accuracy class, the sensitivity is 1 division at zero and 2 divisions at maximum test load. **T.N.6.1(b) [2.20] EPO NO. 2-7, 3.5**

5. Determine availability of "strain-test" load (if needed) to load scale up to capacity or normal use weight range. Minimum weight load 30,000 lb. **N.3.1.3 [2.20]; EPO NO. 4-A.1**

Tests (Static-Uncoupled)

1. Refer to EPO NO. 5 for information on tests for electromagnetic interference.

2. SR or sensitivity test at zero load (if required). **T.2.8 [2.20]; T.N.6.1 [2.20]**

3. Section test. The test load should be successively distributed over or to the right and left of the two load bearing points that support each section of the scale. The test load is not to exceed the capacity of the section. **N.1.3.5 [2.20]**

4. Strain or increasing-load test. **N.1.1 [2.20]**

   4.1. Should be made with a "certified" railway test car.

   4.2. A strain-load test may be used with any load (unknown weight) available that will fit on the scale with the known test load and which will provide some value at or below scale capacity when the known test load is added to it. Tolerances shall be applied only to errors resulting from the addition of the known test load. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 4-A-1**

5. SR or sensitivity test at maximum load applied - weighbeam equipped scales. **N.1.4 [2.20]**

   NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

6. On automatic indicating railway track scales, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. **N.1.2 [2.20]; N.1.2.2 [2.20]**

   6.1. Scales MARKED or UNMARKED with an accuracy class receive the tolerance shown in Table 6 for the test load. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

7. No-load indications. Each time loads are removed from the platform, the scale shall be capable of repeating no-load indications within the minimum tolerance applicable for that device. **N.1.9 [2.20]**

VEHICLE SCALES

Pre-Test Inspection

1. Identification. Refer to Newly Installed Weighing Devices, EPO NO. 1, for those devices manufactured after January 1, 1986.

2. Type approval. **B&P 12500.5**

   2.1. Electronic and levertronic scales (includes interfaced computer software, separable indicating element, weighing element, load cells, and recording element). When interfaced software is part of a "system", it must be approved for use with all components of the system. **EPO. NO. 13, 14 and 15**

3. Balance condition. A scale shall be maintained in balance. **UR.4.1 [2.20]**

4. Provisions for visual or oral communication. **G-UR.2.2 [1.10]**

5. Installation requirements. Refer to EPO NO. 1-6, 5 for new installations. **UR.2.4 [2.20]**

   5.1. Foundation, supports and clearance. It is recommended that portable vehicle scales be installed in accordance with California Department of Transportation standard specifications. An excerpt from their requirements is included at the end of this EPO for your information.

Pre-Test Determinations

1. Refer to EPO NO. 2 for information on the type of indicator being used and corresponding tests involved.

   1.1. Suitability of load cells. **EPO NO. 1-4, 3.4**

2. Basic tolerance.

   2.1. Maintenance, acceptance, and minimum tolerances for vehicle scales UNMARKED or MARKED are given in Table 6 Class III L (the minimum maintenance tolerance is 1d.). **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

3. Shift/section test tolerance - (scales MARKED or UNMARKED). Any two results obtained shall agree within the <u>absolute</u> value of <u>maintenance</u> tolerance for the load (even when acceptance tolerance applies). See EPO NO. 8-A-4 for example of absolute tolerance value application. **T.N.4.4 [2.20]**

4. SR and sensitivity test (weighbeam equipped scales).

   4.1. Scales UNMARKED and MARKED with an accuracy class.

      4.1.1. Equipped with balance indicator: ld. **T.2.7.1 [2.20]; T.N.6.1(a) [2.20]**

      4.1.2. Not equipped with balance indicator: 2d or 0.2% of scale capacity, whichever is less. **T.2.7.2 [2.20]; T.N.6.1(a) [2.20]**

5. Minimum Test Weights and Loads (Table 4) refer to EPO NO. 1-6, 8 for weight determinations and application amounts. **EPO NO. 4-A-1**

6. Determine availability of "strain-test" load, if needed, to load scale to capacity or normal use weight range.

Tests

1. Refer to EPO NO. 5 for information on tests for electromagnetic interference.

2. SR or sensitivity test at zero load, if required. **T.3 [2.20]; T.N.6.2 [2.20]; EPO NO. 2-7, 3.4; 2-7, 3.5**

3. Shift Test. At least one shift test shall be conducted with a minimum test load of 12.5% of scale capacity and may be performed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below. **N.1.3.4 [2.20]**

   (a) Prescribed Test Pattern. The prescribed test pattern shall be described by an area at least 4 feet long and a width equal to the width of the scale platform. **EPO NO. 4-1**

   (b) Maximum Loading. When loading the scale for testing, one side of the test pattern shall be loaded to no more than one-half of the concentrated load capacity before loading the other side. The maximum test load applied to the prescribed test pattern shall not exceed the concentrated load capacity, or for scales installed prior to January 1, 1989, the rated section capacity.

   (c) Shift Test With Test Truck. The test truck can be used to verify sections (rear axle of the truck on the load bearing elements). Those weight trucks equipped with hydraulic "RAMS" can concentrate the rear axle weight over a shorter distance.

   Then unload known standards of the truck so that the truck weight is near but not exceeding a high tolerance "break point (500d increments determined from Table 6)" and place the truck anywhere back on the scale deck and apply tolerance values - this could be a section that is "at" an absolute maintenance tolerance limit.

   Example: Scale capacity 120,000 x 20 lb, test truck weighs 26,320 lbs. Maintenance tolerance is ± 60 lbs (20 lb divisions). Unload 6,320 lbs maintenance tolerance is now ± 40 lbs (on 20,000 lbs).

4. Increasing-load test.

   4.1. Increasing-load tests should be made with applied test loads up to the maximum known weight available with loads distributed on platform. **N.1.1 [2.20]**

   NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

   4.2. A strain-load test may be used with any load of unknown weight available that will fit on the platform with the known test load and which will provide some value at or below scale capacity when the known test load is added to it. Tolerances shall be applied only to errors resulting from the addition of the known test load. **EPO NO. 4-A-1; N.3 [2.20]; Table 4 [2.20]**

5. SR or sensitivity test at maximum load applied, if required. **N.1.4 [2.20]**

6. Decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test. **N.1.2 [2.20]; N.1.2.2 [2.20]**

   6.1. Scales MARKED and UNMARKED with an accuracy class receive the tolerance shown in Table 6 for the test load. **T.1.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

7. No-load indications. Each time loads are removed from the platform, the scale shall be capable of repeated no-load indications within the minimum tolerance applicable for that device. **N.1.9 [2.20]**

8. Ratio test, if required. **N.1.7 [2.20]; T.N.2.5 [2.20]; EPO NO. 2-10, 3.7**

EXCERPT FROM STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
STANDARD SPECIFICATIONS
Section 9-1.01 Page 9-1 (July 1995)

All under-supports for scale bearing points shall be constructed of portland cement concrete produced from commercial quality aggregates and cement, which contains not less than 275 kg of cement per cubic yard. Under-supports shall be constructed in a manner to prevent any shifting or tilting of the support. They shall have a minimum height of 350 mm above ground line. The footings shall have a minimum depth of 150 mm below the ground line. The bearing surface of the footings shall have a minimum width of 760 mm and shall be of such area that the pressure does not exceed 200 kPa (or kilopascal). Adequate drainage shall be provided to prevent saturation of the ground under the scale. Scale bulkheads shall be of adequate material and strength to resist displacement. If timber bulkheads are used, the minimum cross section shall be 200 mm x 200 mm. Wedges shall not be used to shim the supports. If shimming is necessary, it shall be done by securely attached metal shims, or by grouting. Shimming shall not exceed 75 mm. The approach ramps shall be level with the scale deck for a distance of not less than 1/2 the length of the scale deck. The mechanical indicating elements shall be installed level and plumb and shall be rigidly mounted upon a concrete foundation.

BELT-CONVEYOR SCALES

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

   1.1. Manufacturer's name or trademark, model number, and serial number on major components.

2. Type approval. **B&P 12500.5; S.1.1 [2.21]**

   2.1. Units installed after January 1, 1986 must be equipped with a recording element and a rate of flow indicator and recorder.

3. Marking requirements. **S.4 [2.21]**

   3.1. Rated capacity - units of weight per hour, both maximum and minimum. **S.4(a) [2.21]**

   3.2. The value of the scale division. **S.4(b) [2.21]**

   3.3. The belt speed in terms of feet or meters per minute at which the belt will deliver the rated capacity. **S.4(c) [2.21]**

   3.4. The load in terms of pounds per foot or kilograms per meter. **S.4(d) [2.21]**

   3.5. On all new units installed after January 1, 1986, the operational temperature range if it is other than 14 °F to 104 °F. **S.4(e) [2.21]**

Pre-Test Determinations

1. Determine if the conveyor scale is suitable for the amount of product weighed.

   1.1. The belt-conveyor scale system shall be operated between 35 and 98 percent of its rated capacity. **UR.1 [2.21]**

   1.2. Delivered quantities of less than the minimum test load shall not be considered a valid weighment. **UR.1.1 [2.21]**

   1.3. Material must not slip on the belt due to the angle of belt incline. **UR.2.2 [2.21]**

2. Recording elements and recorded representations. The value of the scale division of the recording element shall be the same as that of the indicating element. The belt-conveyor scale system shall record the initial indication and the final indication of the master weight totalizer*, the quantity delivered*, the unit of measurement (i.e., kilograms, tonnes, pounds, tons, etc.), the date, and time. This information shall be recorded for each delivery*. (Nonretroactive as of January 1, 1986.) (*Nonretroactive as of January 1, 1994.) **S.1.4 [2.21]**

3. Value of the scale division. **S.1.3 [2.21]**

   3.1. Scales installed after January 1, 1986 must have a scale division not greater than 1/1000 of the minimum totalized load (0.1 percent). **S.1.3.1 [2.21]**

   3.2. Scales installed before January 1, 1986 must have a scale division not greater than 1/1200 of the rated capacity of the device. **S.1.3.2 [2.21]**

   Example:

   Belt Scale Capacity = 1000 tons/hour

   $$\text{Max. Smallest Unit} = \frac{1000}{1200} = .83 \text{ ton}$$

4. Determine the minimum amount of material to pass over the belt-conveyor scale for materials test.

   4.1. Each test is to be not less than 1,000 scale divisions, at least three revolutions of the belt, and 10 minutes of operation or a normal weighment. **N.2 [2.21]**

5. Determine tolerance requirements.

   5.1. Zero-load test. ±1 scale division when the instrument is operated at no-load for a period of time equivalent to that required to deliver the minimum totalized load of 1,000 scale divisions. **N.3.1 [2.21]**

   The zero-load test shall be conducted over a whole number of belt revolutions of not less than 3 revolutions or 10 minutes of operation, whichever is greater.

   The totalizer shall not change more than three scale divisions during any portion of the zero-load test.

   5.2. Materials test. Maintenance and acceptance tolerances shall be ±0.25 percent (1/400) of test load. **T.1 [2.21]**

   5.3. Repeatability test. The variation in the values obtained during the conduct of the materials test (2 individual tests are required) shall not be greater than 0.25 percent (1/400). **T.2 [2.21] N.3.2(f) [2.21]**

6. Determine accuracy of checkweighing scale. (Refer to checkweighing scale test procedure in EPO NO. 13, item 1 under Pre-Test Determinations.)

7. Arrange to preweigh or postweigh material over the checkweigh scale.

Tests

1. Zero-load test.

   1.1. If the belt has been idle 2 hours or more, run empty for 30 minutes if temperature is 41 °F or above (longer if temperature is less than 41 °F) before starting zero load test. **N.3.1 [2.21]**

   1.3. Run the empty belt-conveyor scale for a period of time necessary to deliver the minimum totalized load of 1,000 scale divisions. The totalizer indication should not change more than ±1 scale division. **N.3.1 [2.21]**

   If the belt conveyor scale has not run three complete revolutions and ten minutes, allow the test to continue until both conditions are satisfied. The totalizer shall not change more than three scale divisions from its initial indication.

2. Material test.

   2.1. At the start of the test, write down the starting totalizer reading. Pass material over weight belt using either preweighed material with controlled delivery or weigh material delivered from the belt. Belt must be loaded so that the rate of flow indicator is maintained between 35% and 100% of rated hourly capacity. **N.3.2 [2.21]; S.1.5 [2.21]**

   2.2. Compare net weight of material passed over belt as shown by belt totalizer with net weight established by checkweigh scale and determine error.

   Example: Calculate error and tolerance when 101.7 tons of preweighed material are passed over a 500 ton per hour belt scale and the final totalizer reading is 101.9 tons.

Belt totalizer reading	101.9 tons
Preweighed material	101.7 tons
Error +	0.2 ton

$$\% \text{ error} = \frac{+0.2}{101.7} = +0.197\% \text{ (O.K.)}$$

3. Repeatability test. Material test should be performed 2 times to determine repeatability of scale. It must repeat within 0.25% on all tests. **T.2 [2.21]**

4. Simulated test. A simulated test may be performed after material test has established scale accuracy. **N.3.3 [2.21]**

WEIGHTS, EQUAL-ARM AND COUNTERPOISE

Pre-Test Inspection

1. Material. **S.1 [2.23]**

2. Design - Smooth surface, no thick, soft, or brittle coating material. Weights over 50 grains or 2 grams shall not have sharp edges, points or corners. Rings shall not be split or removable. **S.2.1 [2.23]; S.2.2 [2.23]**

3. Adjusting material. Shall be securely positioned and shall not project beyond the weight surface. **S.3 [2.23]**

4. Marking of nominal and counterpoise values. **S.4 [2.23]**

5. Cleanliness. **G-UR.4.1 [1.10]; G-S.2 [1.10]**

Pre-Test Determinations

1. Type and multiple of scale with which weights are used.

2. Tolerance requirements applicable - acceptance or maintenance values. **Tables 1, 2, 3 [2.23]; Pg. D2-40, 41, 42**

Test

Commercial weights should be tested on a precision balance using standard weights, which when used without correction, the errors do not exceed 1/3 of the smallest tolerance to be applied. **N.1 [2.23]**

1. Place on the left pan of the balance the weight to be tested, and on the other pan place a standard weight (or an accumulation of standard weights) of the same nominal value.

2. If the pans do not balance exactly (or the indicator does not oscillate equally on both sides of the center of the graduated scale), place on the high pan a standard weight equal to the tolerance of the weight under test. If this brings the high pan to balance position or lower, the weight under test may be considered acceptable; if not, the weight is unacceptable.

Alternative Procedure

If the scale with which the weight under test is used conforms to official requirements, it may be used (although certainly not with the confidence with which the precise balance is used) to test its equal-arm or counterpoise weights.

For Equal-Arm Weights

1. Balance the equal-arm scale with a standard weight equal in nominal value to the weight under test on the left pan and with any appropriate balancing material on the right pan.

2. Replace the standard weight on the left pan with the weight under test.

3. If the pans do not now exactly balance, place on the high pan a standard weight equal to the tolerance of the weight under test. If this brings the high pan to balance position or lower, the weight under test may be considered acceptable; if not, the weight is unacceptable.

POSTAL AND PARCEL POST SCALES/WEIGHT CLASSIFIERS

This Examination Procedures Outline (EPO) addresses those scales and weight classifiers designed for use in determining shipping weight or delivery charges by private shipping companies.

NOTE: We have no jurisdiction over U.S. Postal Service Scales. Scales and weight classifiers are conspicuously marked designating their usage (i.e., "Postal Scale", "Weight Classifier for Rate Determination Only", or "Weight Classifier for Postal Use").

NOTE: Many other suitable scales not so labeled are used by industry for postal and parcel post/mail purposes.

DO NOT use the following outline to test these scales, but use procedures outlined in the appropriate EPO.

Pre-test inspection information pertaining to postal and parcel post scales/weight classifiers follows. The remaining outline is divided into two sections covering pre-test determinations and test procedures specific to:

23-A. Postal and Parcel Post Scales.
23-B. Weight Classifiers.

Pre-Test Inspection

1. Identification. **EPO NO. 1-1**

   NOTE: Postal scales and weight classifiers for postal or rate determination use are an exception to the single unit of measure requirements (thus lb. and oz. may both be displayed). **S.1.2.1 [2.20]**

2. Type approval. **B&P 12500.5; EPO NO. 1-2**

3. Scale position.

   3.1. Readability from customer and operator position. If shown on operator's side with digital indications such as net weight, price per pound, or total price, shall be similarly displayed on customer's side. (Nonretroactive as of 1971.) **B&P 12510(a)6; S.1.8.3 [2.20]; G-UR.3.3 [1.10]**

4. Balance condition. **UR.4.1 [2.20]**

   4.1 This user/maintenance regulation requires that a scale shall be maintained in balance. Appropriate enforcement action should be taken for scales found with the zero balance improperly maintained.

5. Level condition. If a scale is equipped with a level indicating means, the scale shall be maintained in level. **UR.4.2 [2.20]**

6. Check the following items (pan or tray may be moved with hands).

   6.1. Pan or tray must have clearance at zero load and throughout weighing range. **UR.2.4 [2.20]**

   6.2. Indicator return to starting point within minimum tolerance (observe each time load is removed). **N.1.9 [2.20]**

   6.3. Oscillations. Automatic-indicating scales and balance indicators shall be effectively dampened. **S.2.5 [2.20]**

   6.4. Motion detection. Electronic scales equipped with printers shall record values only when the indication is stable within plus or minus one scale division. Printed indications shall be within applicable tolerance for applied test load. **S.2.5.1 [2.20]**

   6.5. Indicator visibility (dirt, lights, brightness of display). **G-UR.4.1 [1.10]**

POSTAL AND PARCEL POST SCALES

Pre-Test Determinations

1. Basic tolerances (acceptance or maintenance).

   1.1. Scale is MARKED with an accuracy class, use Table 6. **T.N.3.1 [2.20]; EPO NO. 3-2**

   1.2. Scale is UNMARKED with an accuracy class.

      1.2.1. If scale is used to weigh loads < 2 lb., use Table T.1.1. **T.1.1 [2.20]; EPO NO. 3-1**

      1.2.2. If scale is used to weigh loads ≥ 2 lb., use Table 5. **T.1.2 [2.20]**

Table 5
Maintenance and Acceptance Tolerances for
UNMARKED Postal and Parcel Post Scales

Scale Capacity	Test Loads	Maintenance Tolerances (±)		Acceptance Tolerance (±)	
(Pound)	(Pound)	(Ounce)	(Pound)	Ounce	Pound
0 to 4, inclusive	0 to 1, inclusive	1/32	0.002	1/32	0.002
	Over 1	1/8	0.008	1/16	0.004
0 to 4*	0 to 7, inclusive	3/16	0.012	3/16	0.012
	7 to 24, inclusive	3/8	0.024	3/16	0.012
	24 30, inclusive	1/2	0.030	1/4	0.015
	Over 30	0.1% of Test Load		0.05 of Test Load	
* See Table T.1.1 [2.20] for scales designed and/or used to weigh loads less than 2 lb.					

Test Loads	Maintenance Tolerance (±)		Acceptance Tolerance (±)	
Pound	Ounce	Pound	Ounce	Pound
40	11/16	.040	11/32	.020
50	13/16	.050	13/32	.025
60	1	.060	1/2	.030
70	1-1/8	.070	9/16	.035
80	1-5/16	.080	21/32	.040
90	1-1/2	.090	3/4	.045
100	1-5/8	.10	13/16	.050
125	2	.125	1	.062
200	3-1/4	.20	1-5/8	.100
250	4	.25	2	.125
300	4-13/16	.30	2-13/32	.150
400	6-7/16	.40	3-7/32	.200
500	8	.50	4	.250
600	9-5/8	.60	4-13/16	.30
700	11-1/4	.70	5-5/8	.35
800	12-13/16	.80	6-13/32	.40
900	14-7/16	.90	7-7/32	.45
1000	16	1.00	8	.50

Tests

1. Maximum capacity with test weights. **S.1.7 [2.20]**

   1.1. Scales shall not indicate or record values exceeding 105% of nominal capacity.

2. Decreasing-load test.

   2.1. On UNMARKED automatic indicating scales, the decreasing-load test shall be conducted with a test load equal to one-half the maximum load applied in the increasing-load test. The tolerance is 1-1/2 times the basic tolerance. **N.1.2.2 [2.20]; T.1.1 [2.20]**

   2.2. On scales MARKED with an accuracy class and with $n \geq 1000$, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance break point. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]; EPO NO. 3-2**

2.3. On scales MARKED with an accuracy class and n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]**

3. Shift test at 1/2 capacity (see EPO NO. 4-2 for test positions). Tolerance is the basic tolerance determined under Pre-Test Determinations 1.1 or 1.2. **N.1.3.1 [2.20]**

3.1. On UNMARKED scales, the results obtained must be within maintenance tolerance for that load as determined under Pre-Test Determinations 1.2. **T.1.1. [2.20]**

3.3. On MARKED scales, the maximum allowable difference between any two results must be within absolute value of applicable maintenance tolerances for that load (even when acceptance tolerance applies to the scale). See EPO NO. 8-A-4 for example of absolute tolerance value application. **T.N.4.4 [2.20]**

4. Analog price charts for accuracy and alignment. **G-S.2 [1.10]**

5. Recheck zero load balance indication after removal of any test load. Zero balance should not change by more than the minimum tolerance applicable. **N.1.9 [2.20]**

6. Increasing-load test.

6.1. Add test weights in 1 oz. increments from zero-load to 1 lb. For electronic digital scales, add test weights in .01 lb. increments from no-load to 0.1 lb. and by 0.1 lb. to 1 lb. If the value of d is less than 0.01 lb., use appropriate test weights to verify indications. **N.1.1 [2.20]**

6.2. Add test weights from 1 lb. to capacity in 1 lb. increments, deleting those values previously tested. (This is considered a minimum test.) **N.1.1 [2.20]**

NOTE: Discrimination requirements. On MARKED automatic indicating scales only. This test should be conducted if you suspect a problem in scale performance such as erratic readings. (Refer to EPO NO. 2-8, 3.6 for the method of testing discrimination.) **N.1.5 [2.20]**

WEIGHT CLASSIFIERS

Pre-Test Determinations

1. Basic tolerance (acceptance or maintenance).

    1.1. If the scale is MARKED with an accuracy class, use Table 6. **T.N.3.1 [2.20]**

    1.2. If the scale is UNMARKED with an accuracy class use Table T.1.1. (NOTE: Refer to "Other Postal and Parcel Post Scales".) **Table T.1.1**

2. Minimum tolerance. The smallest value that can be applied to a scale. **T.N.3.1 [2.20]**

    2.1. On scales that are MARKED with an accuracy class or UNMARKED scales where n $\leq$ 5000, use Table 6. (The minimum maintenance tolerance is 1d.) **T.N.3.1 [2.20]; T.1.1 [2.20]**

    2.2. On scales which are UNMARKED where n > 5000, the minimum tolerance is 0.05% (1/2000) of scale capacity or 1/2 d, whichever is less. **T.1.1 [2.20]**

Tests

1. Tolerance application (background).

    A weight classifier scale does not round off in the same manner as a customary digital scale which rounds off or has a break point in the center of the division. Instead, the weight classifier rounds all values up to the next higher division and the break point is located at the division itself. For example, on a normal digital scale indicating by 0.1 lb, the scale will indicate 1 lb if the load is 1.04 lb and 1.1 lb if the load is 1.06 lb rounding up or down to the nearest scale division. On a weight classifier, the scale will indicate 1.0 lb if the load is 0.99 lb (and perhaps for the load of 1.00 lb), but will indicate 1.1 lb if the load is 1.01 lb. The examples assume that the scale has no error.

    Example of tolerances that are applied to the weight classifier based upon the verification scale division (where e = 0.02 lb.). **T.N.3.1 [2.20]**

    The tolerance structure outlined below is based on Table 6.

Test Load (e)	Test Load (lb)	Acceptance Tolerance	Maintenance Tolerance
0 - 500	0 - 10.0	0.5 e = 0.01 lb	1 e = 0.02 lb
501 - 2000	10.02 - 40.0	1.0 e = 0.02 lb	2 e = 0.04 lb
2001 - 4000	40.02 - 80.0	1.5 e = 0.03 lb	3 e = 0.6 lb
4001 - 5000	80.02 - 100.0	2.5 e = 0.05 lb	5 e = 0.10 lb

Test load application and tolerance determination are as follows:

1.1. Balance in error weights equal to the maximum scale tolerances. Place a test load on the platform and observe the indicated weight value. The displayed weight value must indicate either a weight value equivalent to the test load or one division higher than the test load.

1.2. If the scale indicated a weight equivalent to the test load, add an amount of weight equal to the tolerance at that load. The scale must now indicate the next higher division.

1.3. If the scale indicates a weight value one division higher than the test load, remove an amount of weight equivalent to the tolerance at that load. The display must return to the value equal to the test load. If not, the scale is out of tolerance.

2. Test procedures.

2.1. Maximum capacity with test weights.

2.1.1. Scales shall not indicate or record values exceeding 105% of nominal capacity. **S.1.7 [2.20]**

2.2. Decreasing-load test (automatic indicating only).

2.2.1. On UNMARKED scales, the decreasing-load test shall be conducted with a test load equal to one-half the maximum load applied in the increasing-load test. The tolerance is 1-1/2 times the basic tolerance. **N.1.2.2 [2.20]; T.1.1 [2.20]**

2.2.2. On scales MARKED with an accuracy class and with n $\geq$ 1000, the decreasing-load test shall be conducted with test loads equal to the maximum test load at each tolerance break point. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]**

2.2.2. On scales MARKED with an accuracy class and n < 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test. Tolerance is shown in Table 6. **N.1.2.1 [2.20]; T.N.3.1 [2.20]**

2.3. Shift test at one-half capacity (see EPO NO. 4-2 for test positions). Tolerance is the basic tolerance determined under Pre-Test Determinations 1.1 or 1.2. **N.1.3.1 [2.20]**

2.3.1. On UNMARKED scales, the results obtained must be within maintenance tolerance for that load as determined under Pre-Test Determinations 1.2. **T.1.1 [2.20]**

2.3.2. On MARKED scales, the maximum allowable difference between any two results must be within <u>absolute</u> value of applicable <u>maintenance</u> tolerances for that load (even when acceptance tolerance applies to the scale). See EPO NO. 8-A-4 for example of absolute tolerance value application. **T.N.4.4 [2.20]**

2.4. Analog price charts for accuracy and alignment. **G-S.2 [1.10]**

2.5. Recheck no-load indication after removal of any test load. Zero balance should not change by more than the minimum tolerance applicable. **N.1.9 [2.20]**

2.6. Increasing-load test. **N.1.1 [2.20]**

2.6.1. Add test weights representing the smallest scale verification increment (e) from no-load to 1 lb.

2.6.2. Add test weights from 1 lb. to capacity in 1 lb. increments, deleting those values previously tested. (This is considered a minimum test.)

NEWLY INSTALLED LIQUID-MEASURING DEVICES

The following information may be used as a suggested checklist to obtain compliance for problems most commonly found on newly installed devices. The most logical time to obtain such compliance is during the first examination by weights and measures officials.

A gravimetric method suitable for many products like oil, lacquer thinner, or anti-freeze is contained in EPO REF-P.

1. Identification. **G-S.1 [1.10]**

   1.1. Each meter shall have a minimum of one <u>permanent</u> and <u>conspicuous</u> identification marking with the following information.

   It shall be located so that it is readily observable without the necessity of disassembly of a part requiring the use of any means separate from the device. **G-S.1 [1.10]; G-UR.2.1.1 [1.10]**

      1.1.1. Manufacturer's or distributor's name, initial or trademark. **G-S.1 [1.10]**

      1.1.2. Model number. **G-S.1 [1.10]**

      1.1.2. Nonrepetitive serial number. For devices installed after January 1, 1986, the number must be prefaced by words or symbol that clearly identifies the number as the required serial number. **G-S.1 [1.10]**

      1.1.4. Except for retail gasoline devices rated less than 25 GPM and water meters, the maximum and minimum flow rates must be marked on the meter.
      S.4.3.1 [3.30]; S.4.4 [3.30]; S.5.2 [3.31]; S.4.2 [3.32]; S.5.2 [3.34]

      1.1.5. Limitation of use. If any, these must be marked clearly on the meter as:
      S.4.1 [3.30]; S.5.1 [3.31]; S.4.1 [3.32]; S.5.1 [3.33]

         (a) products having certain properties; or

         (b) under specific installation or operating conditions; or

         (c) when used in conjunction with specific accessory equipment.

2. Type approval. **B&P 12500.5**

   2.1. Devices intended for commercial use shall be type approved and a weights and measures "seal" shall be applied only on correct, type approved devices. Provision has been made to permit the commercial use of devices undergoing type approval evaluation. (Temporary use permit.)

2.2. Unapproved devices are not to be tested or sealed by weights and measures officials. Yellow "unapproved device" tags are to be affixed to devices which are not approved. **B&P 12500.10**

3. Suitability of equipment.

   3.1. "Commercial equipment shall be suitable for the service in which it is used...including capacity of the computing device if used, its rate of flow, location of temperature probes, and customer readability." **G-UR.1.1 [1.10]; G-UR.3.3 [1.10]; G-UR.3.2 [1.10]**

   3.2. Minimum Divisions - The minimum delivery for liquid-measuring devices shall be no less than 100d, except that the minimum delivery for retail analog devices shall be no less than 10d. **G-UR.1.3 [1.10]**

4. For primary indicators separately located from their metering elements. **G-UR.2.2 [1.10]**

   4.1. "...there shall be convenient and permanently installed means for direct communication, oral or visual, between an individual located at a primary indicating or recording element and an individual located at the weighing or measuring element."

5. Installation and positioning of retail (direct sale) equipment.

   5.1. A device used in retail trade shall be placed so the indications and measuring operations may be seen from a reasonable "customer" and operator position. **B&P 12510(a)(6); G-UR.3.3 [1.10]**

6. Assistance in testing operations. If the design, construction, or location of any device is such as to require a testing procedure involving special equipment or accessories or an abnormal amount of labor, such equipment, accessories, and labor shall be supplied by the owner or operator of the device as required by the weights and measures official. **G-UR.4.4 [1.10]**

RETAIL MOTOR FUEL DEVICES

This Examination Procedures Outline for retail motor fuel devices is divided into six categories. Inspection and test items common to all are detailed in the procedure for Basic Dispensers. Additional information is included for the other devices as listed.

26-A. Basic Dispensers
26-B. Blended Product Dispensers
26-C. Gas/Oil Mixing Dispensers
26-D. Money Acceptance Consoles
26-E. Remote Consoles (Keylock, card acceptor devices, and receipt/ticket printers)
26-F. Vapor Recovery Systems-Field Compliance Testing

Metric equivalents shall be used instead of customary units where appropriate.

BASIC DISPENSERS

Pre-Test Inspection

1. Identification.

    1.1. Manufacturer's or distributor's name or trademark, model number and serial number. **G-S.1 [1.10]; S.4.4.2(a, b, c) [3.30]**

2. Type approval. **B&P 12500.5**

3. Indicating elements.

    3.1. Readability (must be clear and easily read). **G-S.5.1 [1.10]**

    3.2. Advancement only by mechanical operation. **S.1.3 [3.30)**

    3.3. Return to zero (readily returnable to definite zero). **S.1.6.3 [3.30)**

    3.4. Unit price and product identity (must be displayed on each face of the device). **S.1.6.4 [3.30); G-S.2 [1.10]**

        3.4.1. A system shall not permit a change to the unit price "during" delivery. (Retroactive)

        3.4.2. When a product or grade is offered for sale at more than one unit price, the selection of the unit price shall be made prior to delivery using controls on the device or other customer-activated controls. (Effective and nonretroactive January 1, 1991.) **S.1.6.5.4 [3.30]**

NOTE: Do not seal a dispenser if the indications are accessible because of broken or missing glass (maintenance of equipment). **G-UR.4.1 [1.10]**

3.5. Totalizers are interlocked to the primary indicator and therefore should indicate the same.

NOTE: Retail motor-fuel dispensers shall be equipped with a non-resettable totalizer (non-retroactive as of January 1, 1995). **S.5. [3.30]**

3.6. Three-wheel-money computing registers. Once placed "out-of-order" must be replaced with full computing register. **EPO-REF-D; G-UR.1.1 [1.10]**

3.7. Indications shall be available to complete transaction in event of power loss. **S.1.6.2.1 [3.30]**

3.8. When a delivery is completed, the total price and quantity for that transaction shall be displayed on the face of the dispenser for at least 5 minutes or until the next transaction is initiated. (Effective and nonretroactive as of January 1, 1994.) **S.1.6.5.5 [3.30]**

4. Vapor elimination. Must have effective means for vapor and air elimination. On self-contained units, an air eliminator vent tube must not be plugged or crimped. **S.2.1 [3.30]**

5. Inspect equipment for leaks, exposed wiring, etc. If it appears unsafe, do not test. Report conditions to operator and responsible authority (supervisor, fire marshal, E.P.A. representative, environmental health representative, etc.). **G-UR.2.1 [1.10]; G-UR.4.1 [1.10]**

6. Discharge line.

6.1. Length of discharge hose shall not exceed 18 feet unless it can be demonstrated that a longer hose is essential. (Does not apply to vapor recovery systems.) **UR.1.1 [3.30]; UR.1.1.1 [3.30]**

NOTE: At marinas or airports, if hose length exceeds 26 feet, it shall be adequately protected from the weather and environmental factors. **UR.1.1.2.2**

6.2. Diversion of measured liquid. With the exception of 6.3 below, measured liquid shall not be diverted from a single discharge line during delivery. **S.3.1 [3.30]; S.3.2 [3.30]**

6.3. Specifically for trucks, two outlets may be operated at one time to fuel a single truck provided measures are taken to prevent fraud or deception. For example: **S.3 [3.30]**

6.3.1. Explanation signs.

6.3.2. Physical barriers to adjacent driveways.

6.3.3. Visible valves or lighting systems indicating which outlets are in operation.

Pre-Test Determinations

1. Tolerances. Normal and special (slow) tests.
   G-T.1 [1.10]; G-T.2 [1.10]; T.2.1 [3.30]; T.2.1.1 [3.30]; T.2.1.2 [3.30]; EPO NO. 26-A-3

Measure	Maintenance Indication	Acceptance Indication
5 gallons	± 6 cu in	±3 cu in
19 liters (the zero indication is +4.5 cu in using 5 gal measure)	-1.5 cu in to +10.5 cu in	+1.5 cu in to +7.5 cu in
19 or 20 liters (gage plates)	±100 mL	±50 mL

   For "dry" test measures, add 1 cu. in. or 20 mL to measure.

2. Determine location and accessibility of storage tanks.

3. For safety reasons and to avoid product contamination and degradation, the following order of product testing should be followed:

   - Diesel
   - Unleaded
   - Unleaded Premium

Tests

SAFETY NOTE: When testing retail motor fuel dispensers, be sure to:
DMS NOTICE G-91-4; EPO REF-E;

- Ground the nozzle against the prover neck when dispensing product.

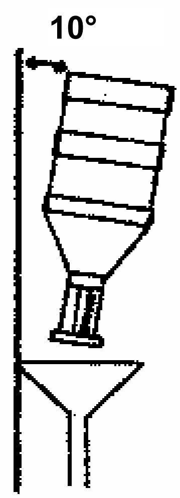
- Ground the neck of the prover against the metal funnel when returning product to the storage tank. **DO NOT** use a plastic cone.

- Ground the cart, if the test measure is left on the cart when dispensing product or returning product to the storage tank.

Allow the appropriate drain period each time the test standards is emptied:

Field Test Measure: Empty slowly enough that the main flow of liquid ceases after about 30 seconds. Then, hold the measure at about 10 degrees from the vertical and continue to drain for 10 seconds, and turn upright. Do **not** shake the measure during this final draining.

Bottom-Dump provers: Continue to drain for 30 seconds after the main flow of product ceases (or as otherwise labeled and certified by metrology).



1. Normal test.

1.1. Reset computer to zero (check both sides and all indicators).

1.2. Clear nozzle of any liquid downstream from valve into a suitable container, not the test measure, leaving nozzle valve handle closed.

NOTE: On balance system coaxial hose nozzles, which require a "tight seal", pull the boot back and elevate hose above the nozzle. This allows drainage of any liquid from the outer vapor space of the hose.

1.3. Turn the dispenser. Before dispensing any product, check to see if there is any advancement of the indicating and recording elements (computer jump).
G-UR.4.1 [1.10]; S.1.3 [3.30]

1.3.1. If there is any advancement of the volume and/or money values, stop the test and take appropriate enforcement action.

NOTE: Customers using dispensers equipped with card lock, credit/debit card, or cash acceptors will be charged the cash value of the computer jump. Those self serve customers who prepay a cashier would have difficulty proving the meter jumped and they did not dispense the fuel.

1.3.2. Dispensers that can be used simultaneously on both sides by different users and coaxial hose systems (balance and bootless nozzles) should be checked for internal leakage of valves, piping, seals between liquid, vapor spaces, or inner and outer hoses. After turning the dispenser on, observe the volume and money indications on both sides of the dispenser for advancement (even if the opposite side uses a different hose). Advancement of money indications on either side of the dispenser indicates a possible leak and diversion of measured product. Mark the device "out of order" if this condition exists.

NOTE: The dispenser shall show automatically its initial zero condition; however, the first 0.009 gallon or 0.03 liter and its associated total sales price need not be indicated (i.e., on a digital display, "up to" this amount can be suppressed internally, but the dispenser will still show zeros). **S.1.6.1 [3.30]**

1.4. Ground the nozzle spout on the rim of the test measure before dispensing product. **N.3.4 [3.30]**

Dispense five gallons (19 or 20 liters if metric) into test measure at maximum flow and observe error. On metric units, pause at 10 liters on the first draft to check for proper price extension. Exception: Dispense at least 50 gallons for truck stop dispensers at a location where the primary business is servicing trucks.

1.5. Check indications and computations on both sides of the dispenser for accuracy and agreement, if so equipped.

1.6. On <u>coaxial hose systems</u> (balance and bootless nozzles) check for internal leakage of seals between the liquid and vapor spaces by hesitating a few seconds and observing the computer display for a subtle advancement of dollar and/or volume amounts while holding the nozzle. If this condition exists, the device is "out of order."

2. Special test.

Special tests shall be made "as circumstances require". **N.4.2 [3.30]**

The "Special Test" of a dispenser is a diagnostic test used to evaluate performance at different flow rates. When conducting surveys of marketplace conditions, special tests will be conducted and special test compliance will be evaluated as a part of the survey.

Some local jurisdictions have adopted procedures wherein special tests are not always conducted. There are however situations or "circumstances" where special tests are required.

The following are examples of "circumstances" which require special tests on retail fuel dispensers:

- dispensers which have been placed into or being returned to service,
- devices where compromised "seal(s)" have been detected,
- locations or devices with indications of poor maintenance, and
- locations or service agents with a history of poor maintenance or non-compliance.

The above examples are not considered all-inclusive. It is strongly recommended that jurisdictions have specific guidelines in place before individual discretion with the special test of the dispenser.

NOTE: Officials should always receive training in using the following procedures for conducting special tests.

2.1. Dispense five gallons (19 or 20 liters) into test measure at a slow rate. Five gallons per minute, minimum marked on device, lowest notch, whichever is less. For vapor recovery systems, 3 gallons per minute, lowest notch or marked minimum, whichever is less. Observe error. **N.4.2 [3.30]; N.4.2.2 [3.30]**

2.2. Check indications and computations on both sides for agreement. Computation error shall not be greater than 1¢ for unit prices under $1.00 or 2¢ for unit prices over $1.00 for analog indications. Computations shall be within the nearest cent for digital indications.
G-S.5.5 [1.10]; S.1.6.5 [3.30]; S.1.6.5.1 [3.30]; S.1.6.5.2 [3.30]

3. Anti-drain valve test. **S.3.7 [3.30]**

3.1. Turn off pump.

3.2. Try to drain hose into container by opening nozzle discharge valve without raising hose above container level.

NOTE: Balance system - On intended tight seal nozzles, the boot must be held back.

3.3. With discharge valve open, hold nozzle over container and raise an arm's length of hose overhead. If flow resumes, the anti-drain valve is ineffective. **G-UR.4.1 [1.10]**

4. Interlock test. Dispensers vary in design, but basically this test insures that once a customer has completed dispensing fuel and the nozzle is returned to its designed slot or "hang up" position the pump is turned off, and the next customer cannot dispense fuel, until the display is returned to zero.

4.1. Remove nozzle from hanging position.

4.2. Reset computer to zero and turn on dispenser. **G-S.2 [1.10]**

4.3. Attempt to place nozzle in its <u>designed hanging position</u>, where the lock can be inserted, without engaging interlock or turning off the dispenser. **G-UR.4.1 [1.10]**

4.4. After placing nozzle in its <u>designed hanging position</u>, carefully remove it again and attempt to dispense liquid by moving control lever toward the "on" position and opening nozzle.
S.2.5 [3.30]

4.5. If liquid flows without resetting the indications, the interlock assembly is not functioning properly. **G-UR.4.1 [1.10]; G-S.2 [1.10]; S.2.5 [3.30]**

5. Control valve test. (Applies to remote <u>or submerged pump</u> dispensers and to dual self-contained single product dispensers.) **G-S.2 [1.10]; S.2.5(c) [3.30]**

5.1. Turn on one dispenser and let pump run while testing other dispensers of the same grade.

5.2. Complete the following steps for each dispenser connected to pump which is running.

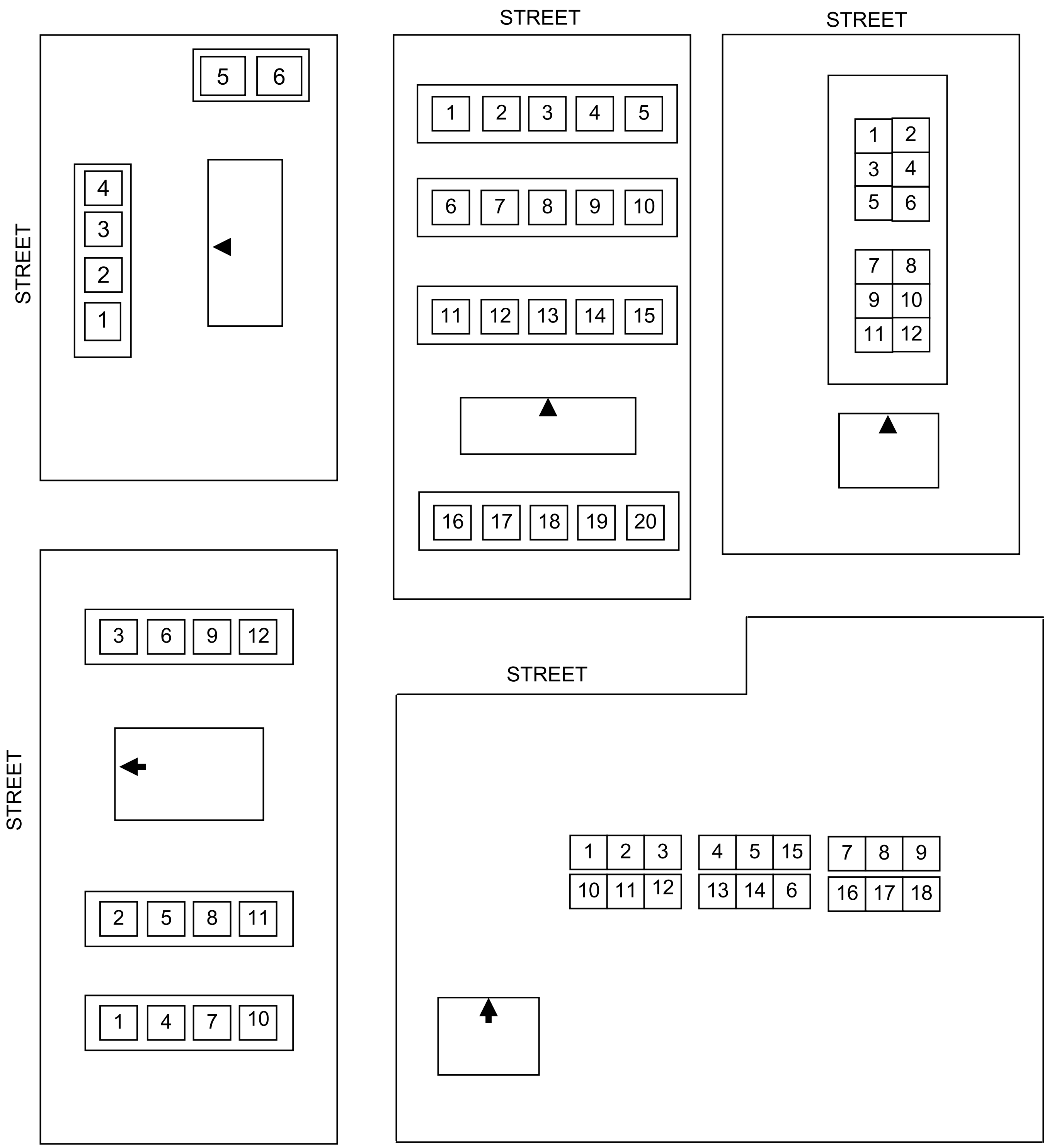
5.2.1. Remove nozzle from hanging position. <u>Do not turn dispenser on</u>.

5.2.2. Try to dispense product by opening discharge valve into container.

5.2.3. If liquid flows, the control valve assembly is not functioning properly. **G-UR.4.1 [1.10]**

5.3. Test the dispenser originally turned on by using another dispenser in the same system.

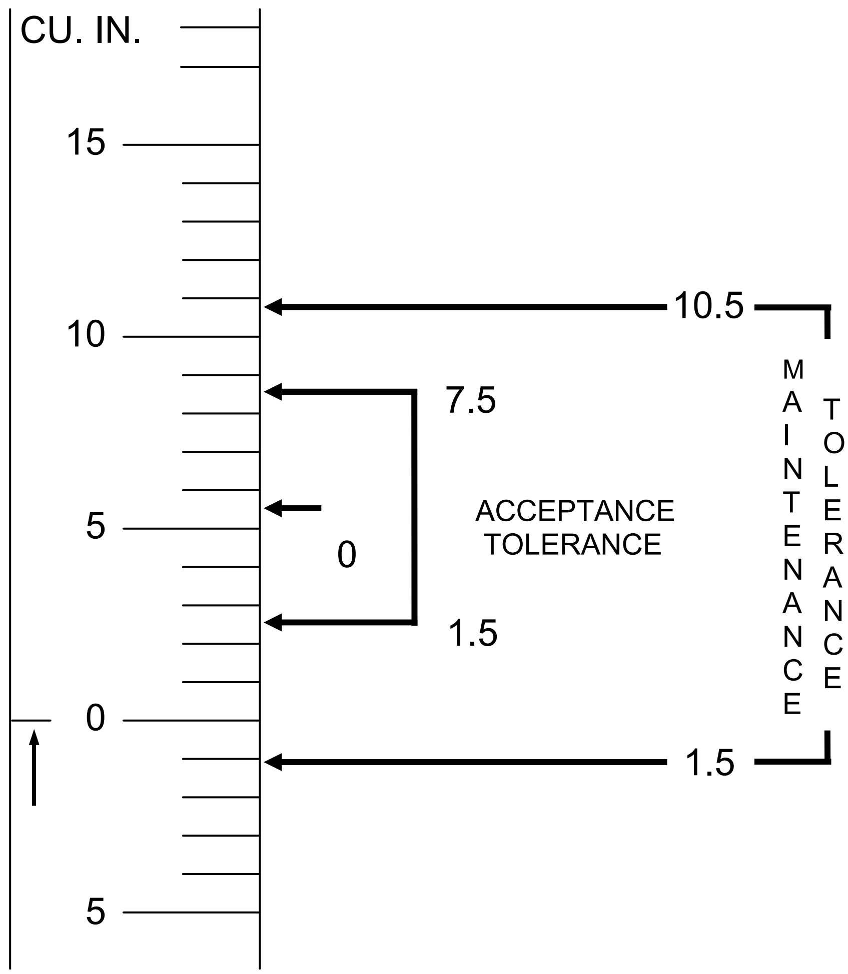
RETAIL LIQUID MEASURING DEVICES NUMBERING SYSTEM



Use this numbering system if dispensers are not numbered. From the kiosk or cashier's location, facing street of address, outer-most dispenser on left is number one. Count each dispenser continuing to the right until all dispensers on outside are counted. Go back to second row of dispensers on the left and count to right. Continue until all dispensers are counted in this manner. Multiple dispensers in one case will be counted as though the were separate units.

19 LITER TEST
USING 5 GALLON FIELD MEASURE

5 GALLON STANDARD
CUSTOMARY GAGE PLATE



BLENDED PRODUCT DISPENSERS

General

The **specifications and tolerances** listed under EPO NO. 26-A for Basic Dispensers shall apply to Blended Product Dispensers. For **tests** applicable to these blenders, see EPO NO 26-B-2. A blended-product dispenser is really <u>two</u> dispensing units. One unit delivers high-grade product, the other low-grade product. Either unit may be operated independently, or both may be operated simultaneously, combining high and low grade product to produce an intermediate grade. The computing device in a blended-product dispenser, whether electronic or mechanical, is far more complex than its counterpart in a single-product dispenser. It must integrate volume totals for both dispensing units and compute a price that will vary for each different blend available. For this reason, money-value computations must be checked for <u>all</u> blends.

Blend Ratios

Over the years, **fixed ratio blenders** are being replaced with **electronic blenders**. The **blend ratio** on these blenders can be set independently at each separate dispenser or even at the remote console. It is useful to determine the actual blend ratios for each dispenser at the time of initial set-up. On most dispensers, it is possible to check the blend ratio as outlined in step 3 below. The **audit trail** on some dispensers may display the blend ratio settings. This will assure that the dispensers have initially been configured with the correct blend ratios.

Audit Trail Information

It is also useful, on initial installation of a dispenser, to record the **audit trail event counter value** for each set-up parameter for future reference. These audit trail parameters often include liter to gallon and blend ratio changes and may include totalizer readings. On succeeding annual inspections or a consumer complaint, these values can be reverified. If these values have been incremented without notification, it may be an indication that the blend ratios or other parameters, such as gallon to liter to gallon, are being changed illegally. To access audit trail information, it becomes increasingly necessary to initially determine the <u>Manufacturer</u> and <u>Model Number</u> of dispensing systems and bring the appropriate <u>Type Approval</u> to the location.

Tests

1. Lowest octane. Set selector control valve for lowest octane and conduct <u>normal and special</u> tests (see page 26-A-5 item 2). **N.3.4, N.4.1, N.4.2.2 [3.30]**

    1.1. Check computed price (on both sides of dispenser, if applicable).

2. Highest octane. Set selector control for highest octane and conduct normal and special tests (see page 26-A-5 item 2). **N.3.4, N.4.1, N.4.2.2 [3.30]**

   2.1. Check computed price (on both sides of dispenser, if applicable).

3. Blend. Set selector control at any intermediate blend and conduct special test. **N.3.4, N.4.2.2 [3.30]**

   NOTE: Blend ratios may be determined by recording the high and low totalizer readings prior to the start of the special test and then again at the end. Subtract the beginning reading from the ending reading. On some dispensers, it may be necessary to access the audit trail to obtain these readings.

   3.1. Check computed price (on both sides of dispenser, if applicable).

   3.2. **Return the product used for testing blends to the storage tank with the lowest octane.**

4. Set selector control on each of the remaining blends and dispense one indicated gallon to check the computed price. **B&P 13489(b); S.1.6.4.1, S.1.6.4.2, UR.3.2 [3.30]**

   4.1. The dispenser mechanism shall not be capable of changing blends when the dispenser is in operation. **G.S.2 [1.10]**

   4.2 **Return the product used for testing blends to the storage tank with the lowest octane.**

GAS/OIL MIXING DISPENSERS

In addition to the specifications, tolerances and tests listed under EPO NO. 26-A for Basic Dispensers, the following tests should be conducted for gas/oil mixing dispensers on blending systems with single computers and those systems with separate computers and a "Sealer's Valve."

<u>Test - Single Computer Blending System</u>

1. "Regular" gasoline.

   1.1. Set selector control for "regular" gasoline only and conduct normal and special tests. **N.3.4 [3.30]; N.4.1 [3.30]; N.4.2.2 [3.30]**

   1.2. Check computed price on both sides of dispenser.

   1.3. Return product used for gasoline only tests to "regular" tank.

2. Pre-mix or outboard motor fuel.

   2.1. Set selector control for lowest ratio of gasoline to oil blend and conduct normal and special tests. **N.3.4 [3.30]; N.4.1 [3.30]; N.4.2.2 [3.30]**

   2.2. Check computer price on both sides of dispenser.

   2.3. Check computed price for remaining blends by taking one-gallon drafts for each blend.

   2.4. Return all blended product from pre-mix tests to "premix" or "outboard motor fuel" tank.

<u>Test - Separate Computer Blending System With "Sealer's Valve"</u>

1. Gasoline only.

   1.1. Set selector control for gasoline only and conduct normal and special tests. **N.3.4 [3.30]; N.4.1 [3.30]; N.4.2.2 [3.30]**

   1.2. Check gasoline computer price on both sides of dispenser.

2. Gasoline/oil mixture.

   2.1. With this system, separate meters and computers are used for gasoline and oil. In normal operation, blending takes place at the nozzle. For tests of oil delivery, a "sealer's valve" is provided.

   2.2. Remove lower cap from "sealer's valve". Use two wrenches to assure that check valve immediately above lower cap is not loosened or removed.

   2.3. Two persons are advisable for the following tests of oil delivery. With "sealer's valve" open, one person should observe oil delivery into a one-quart container while the other controls the delivery of gasoline into any suitable container.

   2.4. Select available ratios of gasoline oil mixture. Examples of delivery ratios are as follows:

Ratio	Gasoline Registered	Oil Registered and Delivered to Test Measure
16:1	4 gallons	1 quart
20:1	5 gallons	1 quart
24:1	6 gallons	1 quart
40:1	10 gallons	1 quart
50:1	12.5 gallons	1 quart

   2.5. At completion of tests, "sealer's valve" must be returned to original operating position. Replace and seal lower cap.

MONEY ACCEPTANCE CONSOLES

The specifications tolerances and tests listed under EPO NO. 26-A for Basic Dispensers shall apply to money acceptance pumps during manual operation.

<u>Test of Meter</u>

1. Have operator set pumps on manual operation.

2. Test each pump separately as outlined in EPO NO. 26-A for Basic Dispensers.

3. If pumps are accurate, have them set to money acceptance.

<u>Test of Money Acceptance Console</u>

1. The following procedure is recommended in order to test the three main relay switches on the console, which are 25¢, 50¢ and $1.00.

    1.1. It is not necessary to measure the volume as the pumps have been determined to be accurate.

2. Have operator put 25¢ in coin acceptor and open delivery valve. When pump stops automatically, close valve and check that money value equals 25¢. Do not hang up hose or reset computer.

3. Have operator insert 50¢ or two quarters, open valve and check that total price equals 75¢ when the pump stops automatically.

4. Have operator insert a $1.00 bill, open valve and check that total price equals $1.75 when the pump stops automatically.

REMOTE CONSOLES

KEYLOCK, CARD ACCEPTOR DEVICES, AND RECEIPT/TICKET PRINTERS

In the following procedure, the terms readout device or readout values are used to identify the remote indicator on a remote console, keylock, or card acceptor system, including debit systems and cash value cards.

NOTE: These procedures apply only to accessories connected to the system that can affect the accuracy of the device. Systems such as credit card printers, not interfaced to a type-approved console or retail metering system do not fall under weights and measures jurisdiction.

Pre-Test Determinations

1. Identification.

   1.1. Manufacturer's or distributor's name or trademark, model number and serial number (on identification plate attached to an exterior surface of the console/printer). **G-S.1 [1.10]**

2. Type approval. **B&P 12500.5**

3. Indicating elements.

   3.1. Readability (must be clear and easily read). **G-S.5.1 [1.10]**

   3.2. Advancement only by mechanical operation. **S.1.3 [3.30]**

   3.3. Return to zero (readily returnable to definite zero). **S.1.6.3 [3.30]**

4. Remote consoles (auxiliary element), keylock, and card acceptor devices may indicate one of the following terms: **S.1.6.6 [3.30]**

   4.1. Money value or debit.

   4.2. Money value and volume.

   4.3. Volume only.

5. For systems with analog dispenser indications and digital indications on the readout device, the readout device shall track the dispenser to the nearest minimum graduation. The readout in a card acceptor system is usually the printed output of the journal or logger printer which is usually located in the operator's office. **S.5.2.2(b) [1.10]**

6. For systems with digital indications on both dispenser and readout device. **G-S.5.2.2(a) [1.10]**

   6.1. For remote displays indicating money only, the money values must agree.

6.2. For remote displays indicating money and volume.

6.2.1. Money values must agree.

6.2.2. Volume indication differences are acceptable depending on equipment design limitations.

	DISPENSER	CONSOLE
Total Price	11.56 (11.5552)	11.56
Gallons	10.048	10.1 (10.052)
Unit Price	1.15/gallon	

6.3. For remote displays indicating volume only, indications must agree or "round off" to the nearest minimum unit that can be indicated or recorded. **G-S.5.2.2(c) [1.10]**

7. Master key or card must be available from owner/operator to perform tests.

Basic Remote Console Test

1. Tests for proper rounding in the conversion from analog to digital quantities, or for agreement on digital indications, may be accomplished without additional test drafts during the normal testing of the dispensers. If necessary, a small amount of product may be delivered on top of each test draft; (a) to advance the analog indicator to 0.3 distance between minimum graduations (see 1.1 below); and (b) to 0.7 distance between minimum graduations (see 1.2). **G-UR.4.4 [1.10]**

NOTE: Rounding on some systems may be to the nearest tenth of a gallon in lieu of to the nearest cent.

The dispenser can then be tested for anti-drain and interlock-control valve malfunction.

1.1. With the dispenser in operation, stop delivery at approximately 0.3 of the distance between two analog graduations of the dispenser. **G-S.5.2.2(b) [1.10]**

1.1.1. Turn the dispenser "off". The readout digital value shall round down to the lower analog value.

1.2. With the dispenser in operation again, stop delivery at approximately 0.7 of the distance between two analog graduations.

1.2.1. Turn dispenser "off". The readout digital value shall round up to the higher analog value.

1.3. During these tests, if a dispenser delivery is stopped between graduations at distances equivalent to 0.4, 0.5 or 0.6, the readout digital value may round up or down.

2. Test for prepay remote consoles.

2.1. Calculate the proper price extension to include two test drafts (as 10 gallons) and have the operator preset the console for an amount from 5-7 cents higher. This allows enough room in the second prover to "run the pump" out without first having to return product to storage.

2.2 Conduct <u>basic</u> pump tests as outlined in EPO NO. 26-A. At the completion of the <u>slow test</u> leave the dispenser "on", apply tolerances and then open the nozzle, allowing product to flow until the unit automatically shuts off with the nozzle open. (Shut-off shall occur within 3/10 of a cent of the preset amount if the dispenser is analog, and shall be the preset amount if digital.) **T.2.1.1 [3.30]; T.2.1.2 [3.30]; G-S.5.2.2 [1.10]**

2.3. Have the operator switch the console to a post-pay (or manual mode), reset dispenser and run one additional 5-gallon normal test. Include any computer jump in this test. System shall deliver within maintenance tolerance. (This test determines that the next "fill-up" customer after a "prepay" customer is assured full measure.) Check console for proper rounding on analog dispensers and for agreement on digital dispensers. **T.2.1.1 [3.30]; T.2.1.2 [3.30]**

At 0.3 of the distance between graduations, the console shall round down; at 0.7 the distance between graduations, the console shall round up.

3. Test for key lock and card acceptor systems.

3.1. In most cases, only one readout will be available for routine test in these systems. This will be the one actuated by the owner/operator master key or card. Using this key or card, conduct the tests outlined in EPO No. 26-E-2. If this readout passes the test, accept the entire system. **G-UR.4.4 [1.10]**

4. Receipt/ticket printer. (Computing type only.)

4.1. Printed receipt/ticket must have unit price, volume delivered, and total price. **G-S.5.5 [1.10]; UR.3.4 [3.30]**

4.2. Printed total price of sale must agree. **G-S.5.2.2 [1.10]**

4.2.1. All digital values must be identical.

4.2.2. Analog must agree to nearest minimum money value.

4.3. Printed volume delivered. **S.1.6.5 [3.30]; S.1.6.5.2 [3.30]**

4.3.1. Volume delivered must be printed to at least the nearest hundredth unit (example: 62.89 gallons).

4.4. Mathematical agreement. Printed volume delivered x unit price = total price ±1/2 cent. (The printed volume may differ from the dispenser and console displayed volumes due to equipment design and "rounding" of indications.)

Example:

	Dispenser	Console	Printer	
Total Price	11.56 (11.5552)	11.56	11.56	Console volume Derived by
Gallons	10.048	10.1 (10.05) or (10.052)	10.052	$\frac{11.56}{1.15/gal} = 10.052$
Unit Price	1.15/gallon	1.15/gallon	1.15/gallon	

VAPOR RECOVERY SYSTEMS FIELD COMPLIANCE TESTING

Discussion

This Examination Procedures Outline is directed primarily at those systems/nozzles requiring an "intended tight seal" and use of the "Field Compliance Test Unit".

Systems

Stage II vapor recovery systems are designed to control motor vehicle fuel vapors. The principle types of systems include:

1. Balance System - Where the fuel nozzles include a bellows and face plate designed to make an "intended tight seal" with the vehicle fill opening. Liquid entering a fuel tank displaces vapor which returns to storage.

2. Assist System - These systems may include more than one type of fuel delivery nozzle. One includes a bellows and face plate, but does not require a "tight seal". The other system includes a coaxial fill spout with perforations in the outer tube near its tip. Both systems allow visual observation of vehicle fill opening while filling, if desired, and both rely on some external mechanism to create a vacuum to remove fuel vapors. **4054, A1.1, A1.2**

Nozzles

All the systems utilizing vapor recovery type nozzles shall contain in each nozzle adequate and automatic means to prevent measured liquid from either recirculating, entering the vapor return line, or overflowing a vehicle fill opening. **4054.1, S.1**

All nozzle types shall have a primary shut-off device which automatically activates when liquid covers the primary shut-off sensing mechanism. **4054.1, S.1.1(a)**

Balance Type

These nozzles shall have a secondary shut-off device or other effective means to prevent liquid recirculation. These automatically activate after liquid has entered the vapor return line upon primary shut-off failure. **4054.1, S.1.1(b)**

Assist Type

These nozzles may have a secondary shut-off or some other effective means to avoid liquid overflowing a vehicle fuel tank because of primary shut-off failure. "Other effective means" include, but are not limited to, permitting liquid to be seen either by observing the vehicle pipe opening or hearing and seeing liquid overflow spillage. **4054.1, S.1.1(c)**

Pre-Test Inspection

1. Identification.

   1.1. Manufacturer's or distributor's name or trademark, model number and serial number. **Health & Safety Code 41958**

   (a) Systems may have an I.D. plate.

   (b) Nozzles may have this information cast in the nozzle body or on a metal I.D. tag depending on manufacturer.

2. Type approval. **B&P 12500.5**

   (a) Systems. **DMS Notice D-86-2**

   (b) Nozzles (new or rebuilt). **DMS Notice D-94-1**

Pre-Test Determinations

1. Equipment.

   1.1. Field Compliance Test Unit built as specified in California Code of Regulations, Section 4054.1, S.2.2. Design. **4055, N.1**

   NOTE: These units should be tested against Division of Measurement Standards area specialist Field Compliance Units for uniformity of performance.

2. Tolerances. **4005, N.2.1**

   2.1. Performance accuracy - primary shut-off devices.

   Primary shut-off device overrides. The required, additional attempts, in total, to override any nozzle primary shut-off device shall not increase the dispenser volume indication by more than 1/10 gallon. **4054.3**

Tests

SAFETY NOTE: Use grounding wires between Field Compliance Unit, nozzle, and dispenser prior to testing. **4055, N.2**

1. Initial test - primary shut-off.

   1.1. Dispense fuel into the Field Compliance Test Unit in accordance with common public usage. The nozzle shall shut-off automatically when the primary shut-off sensing mechanism is covered by liquid. After the initial primary shut-off device activates, dispense enough additional fuel into the test unit to immerse the nozzle primary shut-off sensing mechanism in liquid.

   1.2. Record the dispenser indicator gallons.

   1.3. Make 6 additional, consecutive override attempts duplicating a full range of potential customer usage and record the new indicated gallons. All 6 attempts shall result in automatic nozzle shut-off before the dispenser volume indicator increases more than the 1/10 gallon limit.

   NOTE: A test unit must be used for this procedure so the primary shut-off device sensing mechanism can be immersed in liquid.

2. Secondary shut-off device.

   2.1. Introduce sufficient fuel into the vapor return line (approximately 1/10 gallon) to block the return of vapors through the line.

   2.2. Hold in place a "U-shaped" configuration of the fuel discharge hose at a level lower than the nozzle to concentrate the liquid. Make one or more attempts to dispense fuel into an empty Field Compliance Test Unit (balance-type nozzles must make their intended tight seal at the fill pipe opening).

   2.3. The nozzles shall shut-off automatically before the dispenser volume indicator increases more than 3/10 gallon limit for each attempt as specified.

   NOTE: This test is not usually performed except for customer complaints regarding nozzle performance.

WHOLESALE METERS

The procedures in this Examination Procedures Outline pertain to noncompensated and temperature-compensated meters used primarily for measuring petroleum products.

A gravimetric method suitable for many products like oil, lacquer thinner, or antifreeze is contained in EPO REF-P.

Pre-Test Inspection

1. Identification.

    1.1. Manufacturer's or distributor's name or trademark, model number and serial number. (Nonretroactive as of 1968.) **G-S.1 [1.10]**

2. Type approval. **B&P 12500.5**

3. Indicating and recording elements.

    3.1. The smallest unit on the indicator or printer shall not exceed one gallon on wholesale devices. **S.1.2.3 [3.30]**

    3.2. Advancement of indicating and recording elements. **S.1.3 [3.30]**

        3.2.1. Shall be only by mechanical operation of the meter.

        3.2.2. If a meter is cleared by advancing its elements to zero:

            (a) The advancing movement, once started cannot be stopped until zero is reached; or

            (b) Such elements must be automatically obscured until they reach zero.

4. Measuring elements.

    4.1. Vapor eliminator. The system shall be equipped with vapor or air eliminator or other automatic means to prevent the passage of vapor and air through the meter. **S.2.1 [3.30]**

        4.1.1. Loading rack meters may be equipped or may be designed or operationally controlled by a method approved by weights and measures having control over the device that prevents the passage of air/vapor into the system. **S.2.1.1 [3.30]**

4.2. Automatic temperature compensators.

4.2.1. When a meter is equipped with a single temperature compensated indicating element, provisions shall be made to deactivate the temperature compensator so the meter will indicate an uncompensated volume. **S.2.7.2 [3.30]**

4.2.2. For test purposes, means shall be provided to determine the temperature of the liquid in the meter liquid chamber or in the inlet or discharge line right next to the meter. **S.2.7.4 [3.30]**

5. Marking requirements.

5.1. A wholesale device shall be marked to show its designed maximum and minimum discharge rates. Minimum discharge rate shall not exceed 20% of the maximum discharge rate. **S.4.3.1 [3.30]**

5.2. A device with an automatic temperature compensator shall have the indicator, printer and printed record marked to show that the volume delivered has been adjusted to 60 °F. **S.4.3.2 [3.30]**

5.3. Devices intended to measure accurately only the products having particular properties shall be so marked. **S.4.1 [3.30]**

Pre-Test Determination

SAFETY NOTE: Grounding - Connect a wire from a known ground to the prover, then connect a wire from the prover to the equipment being tested, and finally, for the "safety triangle", a wire from the equipment back to the original known ground. For properties or hazards associated with testing various chemicals or compounds and potential safety and contamination problems refer to the Material Safety Data Sheets. **EPO REF-E, Safety Guidelines; EPO REF-S**

1. Determine proper prover size to accommodate the amount delivered by the device in one minute at its maximum discharge rate and in no case less than 50 gallons. **N.3.5 [3.30]**

2. Determine tolerances. **T.2.3 [3.30]**

Agri-Chemical liquids **T.2.3.1 [3.30]**

Normal tests and special tests

Acceptance tolerance	0.3%
Maintenance tolerance	0.5%

Other liquids **T.2.3.2 [3.30]**

Normal tests

Acceptance tolerance	0.2%
Maintenance tolerance	0.3%

Special tests

Acceptance and maintenance 0.5%

Repeatability. When multiple tests are conducted at approximately the same flow rate and the size, the range of the test results shall not exceed 40% of the absolute value of the maintenance tolerance and the results of each test shall be within applicable tolerances. **T.2.3.4 [3.30]**

3. Equipment for temperature-compensated meters.

   3.1. At least two one-quart thermos bottles and a source for ice or hot water as needed.

   3.2. Two to four 30°F to 120°F thermometers as needed.

   3.3. A. 0. Smith thermometer well plug for testing Smith compensators. Available from:

   A. 0. Smith Corporation
   2257 South Saybrook Avenue
   Los Angeles, California 90022

4. Ticket printers. If the meter is equipped with ticket printer, the printer must be in the zero start position before starting any test.

Tests

NOTE: Normal Tests – These shall be made at the maximum discharge flow rate developed under the conditions of installation. Any additional tests at flow rates down to and including one-half the sum of the maximum and rated minimum shall be considered "Normal Tests". **N.4.1 [3.30]**

Tests for repeatability should include a minimum of three consecutive tests at the same flow rate and size. **N.4.1.2 [3.30]**

1. Nontemperature-compensated meters.

   1.1. Wet prover. Allow 30-second drain.

   1.2. Conduct normal test. **N.4.1 [3.30]**

   1.3. Conduct slow test (special). **N.4.2.4 [3.30]**

2. Temperature-compensated meters (single indicator).

    2.1. Wet prover. Allow 30-second drain.
    2.2. Conduct normal test with temperature compensator in normal operation (connected) and apply temperature correction factor to prover connected volume for product temperature as delivered. (Use "Manual of Petroleum Measurement Standards", Volume Correction Factors, from American Petroleum Institute.) **4002.8 3.30]; (a) Page D-9**

        2.2.1. Temperature measurements should be taken at various levels in the prover, according to its size, and also at the thermometer well in the meter.

    2.3. Conduct slow tests (special) with the temperature compensator in normal operation and apply temperature correction factors as previously noted. **N.4.2.4 [3.30]**

    2.4. If the test results at line temperature are within tolerance, conduct an additional temperature compensated test at normal discharge rate with the meter temperature-compensating sensor immersed in a temperature-controlled bath at a point different from the line temperature of the original tests. **S.2.7.2 [3.30]**

    NOTE: Make sure thermometer well plug is installed prior to pressurizing meter.

        2.4.1. Example of temperature to select: If first test was at 70°F, select a second temperature of 40 °F. If first test was at 60 °F, the second test could be either 40 °F or 90 °F.

        2.4.2. After immersing the temperature-compensating sensor in a temperature controlled bath, 50 to 100 gallons of product should be run through the meter prior to the next test to allow the temperature compensator to stabilize.

        NOTE: If temperature-compensating sensor is placed in a 40 °F bath, multiply the prover reading by 1.0133 (from API book). A prover indication of 1000 gallons multiplied by 1.0133 is corrected to 1013.3 gallons.

3. Combination temperature-compensated indicator (net register) and nontemperature-compensated indicator (gross register) on a single meter.

    3.1. Wet prover. Allow 30-second drain.

    3.2. Conduct normal tests with net register in normal operation. Compare reading of net register with temperature-corrected prover volume. Compare reading of gross register with uncorrected prover volume. Both results shall be within tolerance, although they need not agree with each other.

3.3. Conduct slow tests (special) and compare readings of both indicators to prover volumes as previously described (see Section 3.2. under Tests).

3.4. If both results are within tolerance, conduct an additional test of the net register using a temperature-controlled bath (see Section 2.4. under Tests).

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VEHICLE TANK METERS
PUMP DISCHARGE AND GRAVITY DISCHARGE

Pre-Test Considerations

Decide how best to conduct a test for the given product. A gravimetric procedure (EPO Ref. P) may work best for some viscous, hazardous, or pressurized liquids. Officials must make preparations before the test date as specified in the gravimetric test procedure.

NOTE: When a single meter is used to deliver various products with a range of viscosities or densities, performance tests should be made at least with the products of the extreme densities or viscosities. It should also be noted, that air elimination becomes much more critical with viscous liquids.

Hazardous Chemicals and Contamination Considerations

For vehicles that deliver chemicals, lubricants and other products from bulk, there have been questions regarding suitability and performance requirements for vehicle tank and wholesale meters. Many chemicals present potential safety or contamination problems and some are not readily susceptible to volumetric proving due to foaming, toxicity, corrosiveness, etc. The following are considerations frequently discussed.

1. Properties or hazards associated with various chemicals or compounds delivered from bulk.

   (a) Physical and chemical properties and hazards should be reviewed from current Material Safety Data Sheets. Officials should ensure that devices to be tested are approved and suitable for the particular application.

   (b) For hazardous materials, safety training, and supervision before and during inspections are responsibilities of the owner/user. Hazardous chemicals should not be tested unless safety precautions and procedures are in place, clearly understood, and followed. Before testing, the owner/user should be asked to supply a competent safety officer, equipped as necessary with supplies of protective clothing, spill containment, fire prevention and control, or other safety devices to assist weights and measures officials if required.

   Some jurisdictions may require documentation of safety officer competency from companies, and may require employees to certify to training received before following them to proceed. County safety officers should be consulted regarding county policy.

   The following are a few questions that should be considered and accommodated before initiating tests:

   - Will proving equipment contaminate the product being tested?
   - Will the company flush out any residue or would gravimetric testing, using the company's vessel, be possible?
   - Will the product destroy or corrode testing equipment?
   - Are densities or coefficients of expansion known or safely attainable?
   - Can the product be returned to storage after test?

2. Suitability of meters.

   (a) Approval for use with a specific or class of chemicals such as ethylene glycol, chlorinated solvents, methanol fuels, and liquid fertilizers can be verified by the approval certificate.

   (b) Range of delivery volumes. Some chemicals and lubricants are often dispensed in volumes that are typically "retail". They are also often dispensed from vehicle tank meters which require a minimum test draft of 50 gallons or 500 pounds (California Code of Regulations, Section 4000, N.3 [3.31]). The 50 gallon test draft for a vehicle tank meter may not be a reliable indication of accuracy for smaller "retail" deliveries.

   - Device users should not operate meters below the manufacturer's minimum rated flow.

   - To be suitable for its application, the minimum delivery for liquid-measuring devices shall be no less than 100 divisions, except that the minimum delivery for retail analog devices shall be no less than 10 division. Maximum division values and tolerances are stated in the specific codes.
     G-UR.1.3 [1.10]

Pre-Test Inspection

1. Identification. All equipment, except weights and separate parts necessary to the measurement process but not having any metrological effect, shall be clearly and permanently marked for the purposes of identification.
   G-S.1 [1.10]

   1.1. The name, initials, or trademark of the manufacturer or distributor.

   1.2. The model designation **shall be prefaced by the term "Model," "Type," or "Pattern"**. These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.) The abbreviation for the word "Model" shall be "Mod" or "Mod."
   [Nonretroactive as of January 1, 2003]

   1.3. The serial number **shall be prefaced by the words "Serial Number"** or an abbreviation of that term. Abbreviations for the word "Serial" shall, as a minimum, begin with the letter "S," and abbreviations for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., S/N, SN, Ser. No, and S No.
   [Nonretroactive as of January 1, 2001]

   1.4. For devices that have an NTEP Certificate of Conformance (CC), the CC number or a corresponding CC addendum number, **shall be prefaced by the terms "NTEP CC," "CC," or "Approval"**. These terms may be followed by the term "Number" or an abbreviation of that word. The abbreviation for the word "Number" shall, as a minimum, begin with the letter "N" (e.g., No or No.). [Nonretroactive as of January 1, 2003]

2. Type approval. **B&P 12500.5**

3. Indicating and recording elements.

   3.1. Value of smallest unit of indicator shall not exceed: **S.1.1.3 [3.31]**

      (a) 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk metering systems,

      (b) 0.5 L (0.1 gal) on meters with a rated maximum flow of 100 gpm or less used for retail deliveries of liquid fuel, or

      (c) 5 L (1 gal) on other meters.

   3.2. Advancement of indicating and recording elements. **S.1.1.4 [3.31]**

      3.2.1. Shall be only by mechanical operation of the meter.

      3.2.2. If a meter is cleared by advancing its elements to zero:

         (a) the advancing movement, once started, cannot be stopped until zero is reached; or

         (b) such elements must be automatically obscured until they reach zero.

      3.2.3. Elements shall return to a definite zero and shall be prevented from being returned beyond zero. **S.1.1.5 [3.31]**

   3.3. Ticket printer; customer ticket. Vehicle mounted metering systems shall be equipped with a ticket printer. The ticket printer shall be used for all sales. A copy of the ticket issued by the device shall be left with the customer at the time of delivery or as otherwise specified by the customer. (Nonretroactive as of January 1, 1995.) **4002.3 [3.31], UR.2.2**

   3.4. Computing-type device.

      3.4.1. Display of unit price. Means shall be provided for displaying outside the device, in a manner clear to the operator/observer, the unit price at which the device is set to compute. **S.1.4.1 [3.31]**

      3.4.2. Printed ticket. If a computing-type device issues a printed ticket displaying the total computed price, the ticket shall also have printed clearly thereon the total quantity of the delivery, the appropriate fraction of the quantity, and the price per unit of quantity. **S.1.4.2 [3.31]**

      3.4.3. Money value computations shall be of full-computing type. Value graduation intervals shall be 1¢. **S.1.4.3 [3.31]**

4. Measuring elements.

   4.1. Vapor elimination. Systems shall be equipped with an effective vapor eliminator or other automatic means, to prevent passage of vapor or air. Vent lines shall be made of suitable rigid material. **S.2.1 [3.31]**

5. Plumbing.

5.1. Directional flow valves to prevent reversal of flow shall be automatic in operation. On equipment used exclusively for fueling aircraft, such valves may be manual in operation. **S.2.3 [3.31]**

5.2. Diversion of measured liquid. No means shall be provided by which measured liquid can be diverted from a meter or discharge line during delivery unless automatic means are provided to permit product through only one outlet at a time and the direction of flow is definitely and conspicuously indicated. This provision does not apply to equipment used exclusively for fueling aircraft. **S.3.1 [3 31]**

5.3. Pump discharge units.

5.3.1. Discharge hose shall be a wet-hose with shut-off valve at outlet end. However, there may also be a dry hose without a shut-off valve at its outlet end if it is as short as practicable and an effective means adjacent to the meter to insure that liquid can flow thorough one hose at a time and that the meter and wet hose remain full of liquid at all times. **S.3.2 [3.31]**

5.3.2. An anti-drain valve shall be incorporated in discharge (shut-off) valve or adjacent thereto. **S.3.6 [3.31]**

5.3.2.1. A wet-hose, pressure-type device, shall have an effective anti-drain valve in the discharge valve or adjacent thereto.

5.3.2.2. Devices used exclusively for aircraft fueling <u>and</u> defueling need not have an anti-drain valve.

5.4. Gravity discharge units.

5.4.1. Discharge hose shall be a dry-hose with no shut-off valve at outlet end. **S.3.3 [3.31]**

6. Marking requirements.

6.1. Limitations. A meter that is intended to measure accurately only certain products, or under certain conditions, shall have limitations clearly and permanently stated on the meter. **S.5.1 [3.31]**

6.2. Combination systems for fueling and defueling aircraft which are accurate only in the fueling mode shall have a sign on or near the meter stating the meter is not accurate for defueling and shall not be used for commercial measurement when defueling. **S.5.1 [3.31]**

6.3. Maximum and minimum discharge rates shall be marked on the meter. Minimum rate shall not exceed 20% of maximum rate. **S.5.2 [3.31]**

Pre-Test Determinations

1. Safety. For properties or hazards associated with testing various chemicals or compounds and potential safety and contamination problems involved refer to the Material Safety Data Sheets.

Testing

1. Safety. Connect a wire from a known ground to the prover, then connect a wire from the prover to the equipment being tested, and finally, for the "safety triangle", a wire from the equipment back to the original known ground. **EPO REF-E, Safety Guidelines**

2. Test liquid shall be the liquid to be commercially measured or one with the same general physical characteristics. If the meter is to be used for more than one product, it must be tested with all products to be measured. **N.1 [3.31]**

   NOTE: Do not empty or bleed the air (vapor) eliminator before the first run. Test as found.

3. Test drafts.

   3.1. Test drafts should be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate permitted by the installation, and shall in no case be less than 180 L (50 gal) or 225 kg (500 lb). **N.3 [3.31]**

4. Tolerances. **Table 1 [3.31]**

Table 1. Tolerances for Vehicle-Tank Accuracy Classes					
Accuracy Class	**Application**		**Acceptance Tolerance**	**Maintenance Tolerance**	**Special Test Tolerance**
0.3	Petroleum products including large capacity motor fuel devices [flow rates over 115 L/min (30 gpm)]**, heated products at or greater than 50 °C asphalt at or below temperatures 50 °C, all other liquids not shown where the typical delivery is over 200 L (50 gal).		0.15%	0.3%	0.45%
0.3A	Asphalt at temperatures greater than 50 °C.		0.3%	0.3%	0.5%
0.5*	Petroleum products delivered from small capacity [at 4 L/min (1 gpm) through 115 L/min (30 gpm)]** motor-fuel devices, agri-chemical liquids, and all other applications not shown.		0.3%	0.5%	0.5%
1.1	Petroleum products and other normal liquids from devices with flow rates** less than 1 gpm and devices designed to deliver less than one gallon.		0.75%	1.0%	1.25%
1.5	Water	Overregistration	1.5%	1.5%	1.5%
		Underregistration	1.5%	1.5%	5.0%

* For 5-gallon and 10-gallon test drafts, the tolerances specified for Accuracy Class 0.5 in the table above do not apply. For these test drafts, the maintenance tolerances on normal and special tests for 5 gallon and 10 gallon test drafts are 6 cubic inches and 11 cubic inches, respectively. Acceptance tolerances on normal and special tests are 3 cubic inches and 5.5 cubic inches.

** Flow rate refers to designed or marked maximum flow rate.

4.1. **Table 2 [3.31]**

Table 2. Tolerances for Vehicle-Mounted Milk Meters		
Indication	Maintenance	Acceptance
gallons	gallons	gallons
100	0.5	0.3
200	0.7	0.4
300	0.9	0.5
400	1.1	0.6
500	1.3	0.7
Over 500	Add 0.002 gallon per indicated gallon over 500	Add 0.001 gallon per indicated gallon over 500

Calculations for Meter Percent Error

Formula:

$$\frac{\text{Metered Quantity - Prover Reading}}{\text{Prover Reading}} \text{ X } 100 = \text{Meter Percent Error In Registration}$$

Examples:

Underregistration calculation example:

$$\frac{100.00 - 100.04}{100.04} \text{ X } 100 = -0.04\%$$

Overregistration calculation example:

$$\frac{100.01 - 99.98}{99.98} \text{ X } 100 = 0.03\%$$

NOTE: Repeatability. When multiple tests (a minimum of three consecutive tests drafts) are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40% of the absolute maintenance tolerance and the results of each test shall be within applicable tolerances. **T.3 [3.31]; N.4.1.2 [3.31]**

Test Procedures - Pump Discharge System

1. The meter manufacturer's maximum rated pressure shall not be exceeded on normal or special tests.

2. Normal test. A "normal" test shall be made at the maximum discharge rate permitted by the installation. Additional tests conducted at flow rates down to and including one-half the sum of the maximum discharge rate and the rated minimum discharge rate shall be considered "normal tests". **N.4.1 [3.31]**

    2.1. Check the delivery rate of the meter to determine proper prover size. Wet the prover. Allow a 30-second drain period each time the prover is emptied. **N.3 [3.31]**

    2.2. Make a test draft at the maximum discharge rate permitted by the installation. Meter flow must not exceed maximum name plate rating. **N.4.1 [3.31]**

    2.3. Apply test tolerance. **T.2. Table 2 [3.31]**

    2.4. Tests for repeatability should include a minimum of three consecutive tests drafts at approximately the same flow rate, size, and conditions. **N.4.1.2 [3.31]**

    2.5. Printer operation. Except for the sale of Aviation Fuel, the system shall be equipped with a printer. Check during tests to determine printer readability and agreement with meter indicator readings. (Be sure printer is in print mode during test.)
    G-S.5.2.2 [1.10]; G-S.5.6 [1.10]; S.1.4 [3.31]; UR.2.2 [3.3]; UR.2.2.1 [3.31]

3. Special tests.

    3.1. Use minimum discharge rate of 20% of marked maximum rate or the minimum rate marked on the meter, whichever is less. **N.4.2(a) [3.31]**

    3.2. May be tested in any manner system is to be used.

    NOTE: Slow tests to establish the operating characteristics of a meter shall be made at the same engine speed or throttle setting as used for the normal test. However, if this same engine speed causes pressures to exceed meter manufacturer ratings, then the engine speed shall be changed so that the pump pressure does not exceed the manufacturer's ratings.

    3.3. Vapor elimination or split-compartment test. (Normal flow rate.) **N.4.2(b) [3.31]**

        3.3.1. Start test from a compartment containing less test fluid than the capacity of the prover and permit test to continue until lack of fluid causes meter register to stop completely. (Keep pump in operation throughout the test.)

        3.3.2. Close internal valve and/or manifold valve (or disconnect swing-hose) from empty compartment.

        3.3.3. Open internal valve and/or manifold valve (or connect swing-hose) from compartment with adequate supply of fluid to complete test.

3.3.4. Apply special test tolerance. **T.2, Table 1 [3.31]**

NOTE: Air elimination must be effective under all conditions and configuration of the delivery equipment. Whenever possible, and especially on equipment placed into service for the first time, the compartment with the longest piping distance to the meter should be selected to be completely drained during the air eliminator test. Also, if a second delivery outlet from the meter is available, such as a dry hose outlet, the air eliminator's effectiveness must also be tested from that outlet.

4. Anti-drain valve shall prevent draining of the discharge hose after pump pressure in the system has been released (close internal valve). **N.4.3 [3.31]**

<u>Test Procedures, Gravity Discharge System</u>

1. Inlet to prover <u>must</u> be lower than meter outlet. **S.3.3. [3.31]**

2. Normal test. A "normal" test shall be made at the maximum discharge rate permitted by the installation. Additional tests conducted at flow rates down to and including one-half the sum of the maximum discharge rate and the rated minimum discharge rate shall be considered "normal tests". **N.4.1 [3.31]**

    2.1. Check the maximum delivery rate of the meter to determine prover size (in no case less than 50 gallons). Wet the prover. Allow a 30-second drain period each time the prover is emptied. **N.3 [3.31]**

    2.2. Make a test draft from a full compartment at the maximum discharge rate permitted by the installation. Drain the discharge line after each draft. **N.4.1 [3.31]**

    2.3. Apply test tolerance. **T.2. Table 1 [3.31]**

    2.4. Make a test draft from partially filled compartment at the maximum discharge rate permitted by this condition. The compartment should contain approximately 1-1/2 times prover capacity. **N.4.1 [3.31]**

    2.5. Apply test tolerance. **T.2. Table 1 [3.31]**

    2.6. Tests for repeatability should include a minimum of three consecutive test~~s~~ drafts at approximately the same flow rate, size, and conditions. **N.4.1.2 [3.31]**

    2.7. Printer operation. Check during tests to determine printer readability and agreement with meter indicator readings. (Be sure printer is in printer mode during test.)
    G-S.5.2.2 [1.10]; G-S.5.6 [1.10]; S.1.4 (3.31]; UR.2.2 [3.31]; UR.2.2.1 [3.31]

3. Special tests.

    3.1. Use minimum discharge rate of 20% of the marked maximum rate or the minimum rate marked on the meter, whichever is less. **N.4.2(a) [3.31]**

    3.2. May be tested in any manner system is to be used.

3.3. Vapor elimination or split-compartment. (Normal flow rate.) **N.4.2(b) [3.31]**

3.3.1. Start test from a compartment containing less test fluid than the capacity of the prover and permit test to continue until lack of fluid causes meter register to stop completely.

3.3.2. Close internal valve and/or manifold valve (or disconnect swing-hose) from empty compartment.

3.3.3. Open internal valve and/or manifold valve (or connect swing-hose) from compartment with adequate supply of fluid to complete test.

3.3.4. Apply special test tolerance. **T.2 Table 1 [3.31]**

LIQUEFIED PETROLEUM GAS LIQUID METERS

Pre-Test Inspection

1. Identification and marking. **G-S.1 [1.10]**

   1.1. Manufacturer's or distributor's name, model number, and serial number on meter, indicator and temperature compensator if so equipped.

   1.2. Meter shall be marked with maximum and minimum discharge rates. **S.4.2 [3.32]**

   1.3. Temperature compensator and recorded representations shall be marked to show delivered volume has been adjusted to the volume at 60 °F. **S.4.3 [3.32]**

2. Type approval. **B&P 12500.5**

3. Meter shall be installed in accordance with manufacturer's instructions. Inspect plumbing to ensure there are separate lines for vapor and liquid from storage to the measurement system. **G-UR.2.1 [1.10]**

4. Indicating elements.

   4.1. Return to zero. The indicating element shall be readily returnable to zero. **S.1.4.2 [3.32]**

   4.2. Means shall be provided to prevent a return beyond zero. **S.1.4.2 [3.32]**

   4.3. If a meter is cleared by advancing its elements to zero, (a) the advancing movement, once started, cannot be stopped until zero is reached; or (b) such elements must be automatically obscured until they reach zero. **S.1.1.4 [3.32]**

   4.4 The value of the smallest unit of indication shall not exceed one pint on retail devices or one gallon on wholesale devices. **S.1.1.3 [3.32]**

   4.5. Ticket printer; customer ticket.

      4.5.1. Vehicle-mounted meters shall be equipped with a ticket printer. A ticket shall be printed for all sales and a copy left with the customer at the time of delivery. **U.R.2.6 [3.32]**

5. Measuring elements.

   5.1. Vapor elimination. A device shall be equipped with an effective vapor eliminator or means to prevent the measurement of vapor. **S.2.1 [3.32]**

5.2. Pressure differential valve. Shall be of the type with a pressure balance line connected to tank vapor pressure. **S.2.4 [3.32]**

5.3. Diversion of measured liquid. Only one hose per meter is permitted unless a three-port, two-way valve is provided at the meter discharge. May have blow-down outlet for maintenance. **S.3.1 [3.32]**, **G-UR.2.1 [1.10]**

5.4. Security seals - broken or missing. **B&P 12508**

5.5. Directional flow valves shall be automatic in operation. **S.2.3 [3.32]**

5.6. Thermometer well shall be installed. **S.2.5 [3.32]**

5.7. Inspect piping, meter and hoses for leaks or any other unsafe conditions, also for suitability to the proving procedure. This includes provisions for connecting a vapor return line from the prover and also a liquid return line from the prover. **G-UR.4 [1.10]**

6. Automatic temperature compensation is required for all meters with a manufacturer's nameplate rating exceeding 20 gpm. **4002.4 [3.32]; (a.) Page D3-24**

7. Money values shall be in mathematical agreement. **G-S.5.5 [1.10], S.1.1.5 [3.32], S.1.3 [3.32]**

8. Invoices generated pertaining to compensated sales, by weight or volume, must reflect that the volume delivered has been adjusted to the volume at 60 °F. **UR.2.4.3 [3.32]**

9. A price schedule must be shown for all transactions including any minimum charges - except vehicle mounted meters. **4002.4 [3.32]; (e.) Page D3-27**

<u>Pre-Test Determinations</u>

1. Determine availability of electric power to operate prover pump (test with volt meter when in doubt).

2. Inspect test area for sources of ignition. <u>SAFETY FIRST.</u> **EPO REF-E, Safety Guidelines**

3. Test draft. Determine that prover is proper size to accommodate normal flow rate for at least one minute. **N.3 [3.32]**

NOTE: Look at the percent gage on storage tank/truck. The volume must be at least 20% to insure <u>stable test results</u>. If below this amount when returning "test product" back to storage, the liquid temperature will heat up. The product, through pump cavitation (both truck and prover pumps), will become saturated with vapor and can cause inconsistent or "out of tolerance" test results.

4. Determine test flow rates.

   4.1. Normal test shall be conducted at the maximum flow rate permitted by the installation. Any test conducted at flow rates down to and including one-half the sum of the maximum discharge rate (developed under the condition of the installation) and the rated minimum discharge flow rate are considered normal tests. **N.4.1 [3.32]**

      4.1.1. Repeatability tests. This should include a minimum of three consecutive drafts of approximately the same flow rate and size. **N.4.1.2 [3.32]**

   4.2. Special test minimum flow rates. **N.4.2 [3.32]**

      4.2.1. For retail devices. A retail device shall be tested at a rate not less than: **N.4.2.2 [3.32]**

         (a) The minimum discharge rate that can be developed under the condition of installation; or

         (b) The minimum discharge rate marked on the device.

      4.2.2. For wholesale devices. A wholesale device shall be so tested at a minimum discharge rate of: **N.4.2.3. [3.32]**

         (a) 40 L (10 gal) per minute for a device with a rated maximum discharge less than 180 L (50 gal) per minute.

         (b) 20 percent of the marked maximum discharge rate for a device with a rated maximum discharge of 180 L (50 gal) per minute or more; or

         (c) the minimum discharge rate marked on the device, whichever is least.

5. Tolerances (maintenance and acceptance).

   5.1. Maintenance tolerance for normal and special tests is 1.0% of indicated quantity. **T.2 [3.32]**

   5.2. Acceptance tolerance for normal tests is 0.6% of indicated quantity. Acceptance tolerance for special tests is 1.0% of indicated quantity. **T.2 [3.32]**

   5.3. Repeatability. When multiple tests of the same draft size are conducted at approximately the same flow rate, the range of test results shall not exceed 40% of the absolute value of maintenance tolerance and the results of each test shall be within applicable tolerance. This tolerance does not apply to the test of the automatic temperature compensating system. **T.3 [3.32]**

   NOTE: This tolerance does not apply to the test of the automatic temperature compensating system.

5.3. Automatic temperature compensating systems. The difference or spread between the temperature compensated test percent error and the uncompensated test percent error shall not exceed: **T.4. [3.32]**

1.0 percent for mechanical compensators
.5 percent for electronic compensators

The result of each test shall be within applicable maintenance or acceptance tolerance values.

Example:

Mechanical Temperature Compensator, Normal Run

Maximum permitted spread between compensated and uncompensated test is 1.0%.

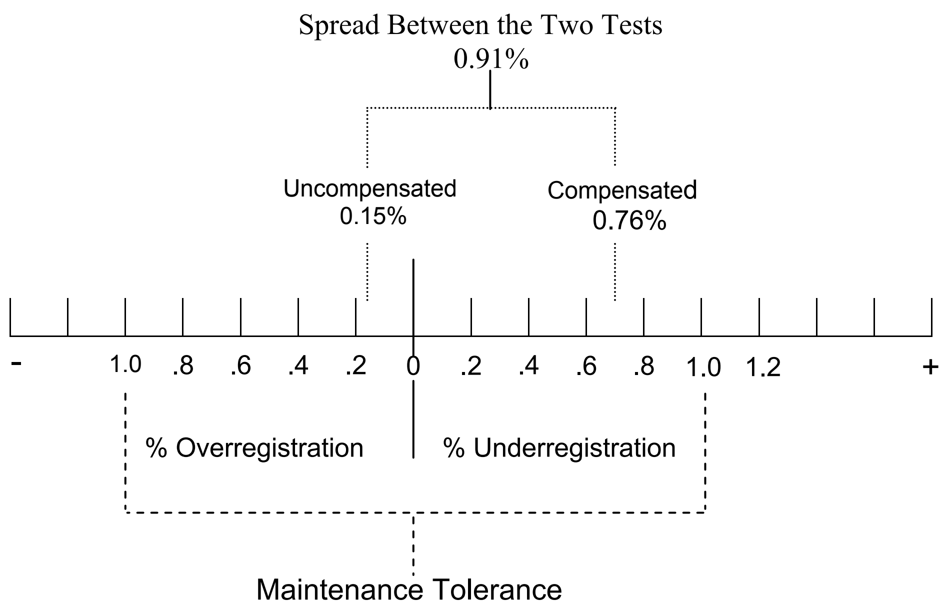
Compensated corrected results show an error (E^c) of 0.76% underregistration. ($E^c = +0.76$)

Uncompensated corrected results show an error (E^u) of 0.15% overregistration. ($E^u = -0.15$)

The spread between these errors is the absolute value of the difference between the percent errors of compensated and uncompensated tests:

$$\left|(E^c) - (E^u)\right| = \text{Difference}$$

$$\left|(0.76) - (-0.15)\right| = 0.91$$



The difference between compensated and uncompensated errors is within 1.0% and both results are within maintenance tolerance.

If the uncompensated result had been 0.52% *overregistration*, the difference between percent errors would have exceeded 1.0% (0.76 + 0.52 = 1.28%). Even though both results fell within maintenance tolerance values.

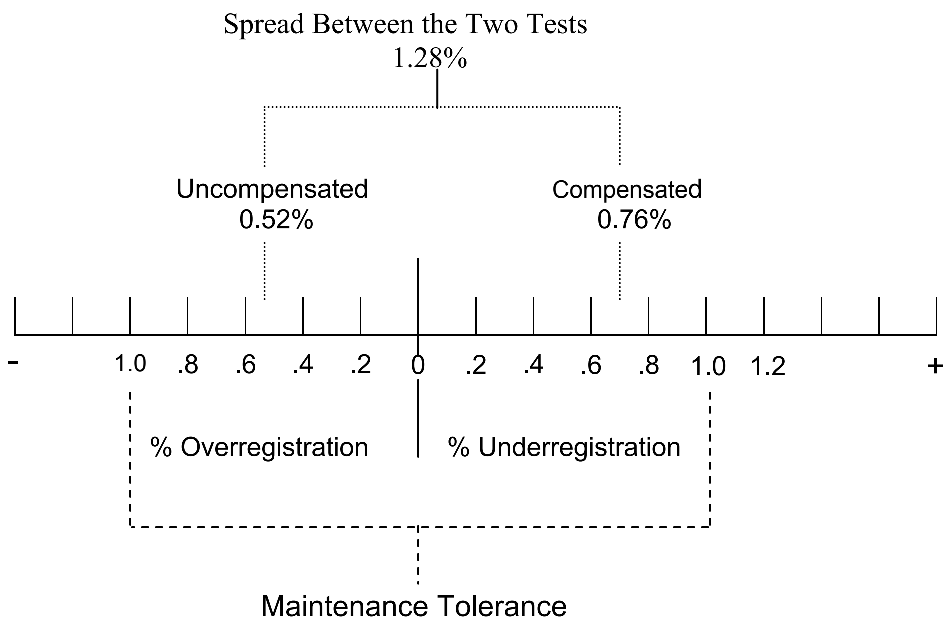
Compensated corrected results show an error (E^c) of 0.76% underregistration. (E^c = +0.76)

Uncompensated corrected results show an error (E^u) of 0.52% overregistration. (E^u = -0.52)

The spread between these errors is the absolute value of the difference between the percent errors of compensated and uncompensated tests:

$$\left|(E^c) - (E^u)\right| = \text{Difference}$$

$$\left|(0.76) - (-0.52\right| = 1.28$$



The difference between compensated and uncompensated errors is greater than the 1.0% allowed.

Example:

Electronic Temperature Compensator, Normal Run

Maximum permitted spread between compensated and uncompensated test is 0.5%.

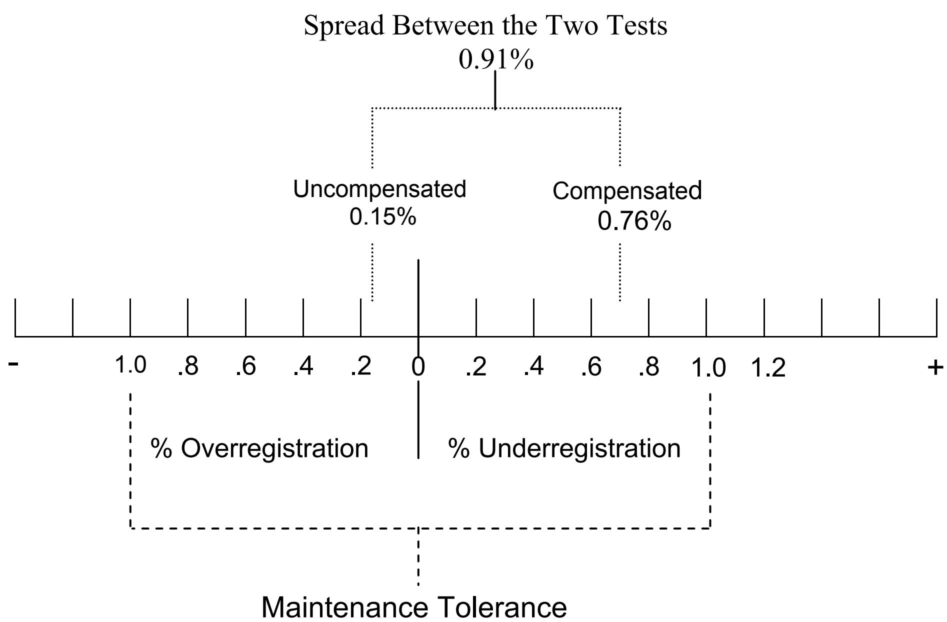
Compensated corrected results show an error (E^c) of 0.76% underregistration. (E^c = +0.76)

Uncompensated corrected results show an error (E^u) of 0.15% overregistration. (E^u = -0.15)

The spread between these errors is the absolute value of the difference between the percent errors of compensated and uncompensated tests:

$$\left|(E^c) - (E^u)\right| = \text{Difference}$$

$$\left|(0.76) - (-0.15)\right| = 0.91$$



Both results are within maintenance tolerance but the difference between compensated and uncompensated errors is greater than the 0.5% allowed.

<u>Tests</u>

1. Preparation. **EPO REF-E, Safety Guidelines**

   1.1. Set up and level prover at least 50 feet from any source of ignition. <u>SAFETY FIRST</u>.

   1.2. Position prover near meter for visibility.

   1.3. Locate fire extinguisher. <u>SAFETY FIRST</u>.

   1.4. Check fittings and adapters required for hookup.

   1.5. Fill out test data form. Test form is needed so the inspector may analyze the test data and be able to make a determination as to whether the device under test will pass inspection.

   1.6. Place thermometers in thermometer wells where needed.

   1.7. Check that all prover valves are closed.

   1.8. Shut off all internal combustion engines in test area while connecting or disconnecting test equipment. <u>SAFETY FIRST</u>.

   1.9. Wear insulated neoprene gloves while connecting or disconnecting test equipment. <u>SAFETY FIRST</u>.

   1.10. Connect the meter delivery hose to prover inlet line.

   1.11. Connect vapor elimination test adapter assembly. One end to supply tank, the other (with valve) to the pump suction inlet. (This applies to truck meters <u>only</u>.)

   1.12. Connect the vapor equalizing line to the meter supply tank vapor connection.

   1.13. Connect the prover liquid return line to meter supply tank liquid inlet connection.

   1.14. <u>Slowly</u> open <u>all</u> vapor valves and liquid valves.

   1.15. Check pressures on prover and tank pressure gages. (Note difference, if any.)

   1.16. Open meter hose valve.

   1.17. Inspect all connections for leaks. <u>SAFETY FIRST</u>.

2. Priming the prover, vapor elimination test, flow reversal test and pressure differential valve tests.

   NOTE: Leave automatic temperature compensator (ATC) connected during initial tests, when present.

2.1. Start meter pump and operate at normal r.p.m. **N.4 [3.32]**

2.2. Slowly open prover inlet valve.

2.3. Check flow rate (GPM).

2.4. Check pressures. (Note differences for possible closed valve, etc.)

2.5. Three methods of testing vapor elimination on LPG vehicle tank meters.

NOTE: Select the method of testing which is best adaptable for each individual installation.

(a) Testing with a cross-over hose assembly. (It is imperative, that prior to hooking this assembly up, the inspector give the truck's plumbing a visual inspection and determine that the liquid return line fitting does go to the truck's pump.) Connect the cross-over hose between this liquid return fitting and the vapor return. Keep the cross-over hose valve closed at this point. Attach prover vapor equalizing and liquid return hoses as for a normal test. Begin test as for a normal flow test (can be done during the prime run).

With 20-30 gallons of liquid metered into the prover, have the operator close the main liquid supply valve on the pump suction line and simultaneously open the valve on the cross-over assembly allowing a supply of vapor to the pump. With pump operating at normal r.p.m., continue pumping until meter indicating elements cease to move. If the indicating element continues to register and the liquid has disappeared from the sight flow indicator, the vapor eliminator is defective. Close the valve on the cross-over assembly and slowly open the main liquid valve on the pump suction (sometimes the excess flow valve snaps shut at this point and it might become necessary to have the operator disengage the pump and wait for equalization of pressures before being able to resume). Continue metering liquid into prover as for normal flow testing.

NOTE: When the cross-over valve is open, if the meter indicating elements continue to register and there is a substantial flow of liquid in the sight indicator at the prover inlet, the main liquid supply valve is not closed or is leaking.

(b) Pumping all liquid from vehicle tank method. To begin test, have approximately 30 gallons in the vehicle tank. Connect to prover and meter all liquid from vehicle tank into prover as for a normal flow test. Continue pumping until indicating elements cease to move. If the indicating element continues to register, the vapor eliminator is defective. Disengage pump. Pump an additional amount of liquid into vehicle tank so as to be able to fill prover to capacity. Engage vehicle pump and complete metering into prover as for normal flow testing.

(c) Connecting vapor return line to pump suction method. Begin test as for a normal flow test. When meter registers approximately 20 gallons, disengage pump. Disconnect vapor return line. Connect vapor return line to pump suction. Usually this is a three and one-half inch line, acme threaded, fitting. Have the main liquid valve closed on pump suction line. Open vapor return line valves. Engage pump. Operate at normal rpm until indicating elements cease to move. If the indicating element continues to register, the vapor eliminator is probably defective. Disengage pump. Connect vapor return line as for normal flow testing. Open main liquid valve on pump suction line. Engage pump and continue metering into prover as for normal testing.

2.6. Near capacity of prover, close the prover inlet valve and check for meter creep, which would indicate a possible ruptured diaphragm in the differential pressure valve, resulting in diversion of measured liquid.

2.7. Complete filling prover to capacity.

2.8. Close prover inlet valve when liquid appears in prover neck.

2.9. Stop meter pump.

2.10 Return liquid in prover to storage.

2.11. To check pressure differential valve for proper operation, close vapor return valve and lower vapor pressure in prover and 30 to 40 PSI using bottom blow-down valve. Open prover inlet valve. The liquid in the meter discharge hose will then drain into prover. Meter creep will indicate a malfunctioning pressure differential valve. Refill meter discharge hose for further testing.

NOTE: If an electronic valve is used to control the delivery then this must be activated (with PTO disengaged and internal valve open) to do the Differential Valve Test. Otherwise, failure of the differential valve will not be apparent.

2.12. Return liquid in prover to storage.

2.12.1. <u>Dry-bottom provers</u> - Listen for change in pump rpm. Shut off pump and outlet valve. After a 30 second drain, evacuate any remaining liquid in prover with bottom blow down valve.

2.12.2. <u>Wet-bottom provers</u> - As product is returned to the system storage tank, <u>monitor</u> the lower neck gauge. As the liquid appears in the top of the lower neck gauge, quickly close the outlet valve and start timing a 30 second drain. Shut off the pump motor. Zero the liquid level in the lower neck gauge of the prover. If the liquid level is still slightly above the zero line, open the bleed valve and make it so.

2.13. To test stationary meters for automatic means to prevent reversal of flow, close the vapor return valve when priming the prover. When the meter flow rate is reduced to almost zero, slightly open vapor return valve and allow liquid to slowly fill prover to sight glass level.

When the liquid appears in sight glass, immediately close vapor return valve and switch off pump, leaving prover inlet valve open. The liquid in the sight glass should not recede to a lower level.

NOTE: Request specific instructions from the Division of Measurement Standards.

3. Notes.

3.1. **CAUTION** - Do not start prover pump with liquid valves in a closed position.

3.2. The initial priming of the prover allows the prover temperature to become equal to that of the liquid from the meter supply tank.

3.3. In the case of a pressure increase while filling prover or a pressure decrease while pumping from prover, check for a closed valve, a check valve, a closed excess flow valve, or some other restrictions in the vapor equalizing lines.

3.4. Unless vapor pressure equalization between the prover and meter supply tank can be maintained during proof test runs and during prover pump-out, testing should be discontinued. Testing accuracy cannot be maintained if vapor pressure equalization is not maintained.

3.5. While pumping liquid from the prover tank, observe the sight flow indicator in the vapor line. If liquid is in the vapor line, extreme care must be exercised to prevent unmeasured liquid from entering the prover while performing the remaining tests.

3.6. The pump on vehicle tank meters shall be operated for both normal and special tests at the normal rate of pumping used by the driver. The engine rpm shall be approximately the same when conducting either test.

3.7. The pumping rate should not exceed the meter manufacturer's rated capacity. **UR.1.1 [3.32]**

3.8. Repeat any test close to the tolerance value of that particular test.

3.9. On all meters equipped with ticket printers, the printer must be in the delivery mode (zero print position) with ticket in place before starting any test. The meter may test out of tolerance if this procedure is not followed.

4. Normal test. This test is performed in the "as found" mode or with the temperature compensator activated. It is **strongly recommended** that this test also be performed with the temperature compensator deactivated. Request the owner/operator to disconnect the compensator. At the conclusion of non-compensated tests, make sure to retest the meter in the compensated mode to insure results reasonably repeat previous compensated test results. **G-UR.2.3, 4.4**

NOTE: It may not be necessary to disconnect the compensator on some electronic indicators, as the gross/net volumes and temperature of fuel delivered are sometimes displayed or printed in the customer invoice. If this is the case, verify that the temperature and conversion figures are correct.

4.1. Start meter pump and operate at normal rpm.

4.2. Reset meter to zero and insert ticket if meter is equipped with a printer. (If equipped with key lock or card acceptor, refer to EPO NO. 26-E.)

4.3. Open prover inlet valve.

4.4. Check and record flow rate.

4.5. Record meter temperature on nontemperature compensated meter tests at 30% and 70% of prover capacity and average the readings.

4.6. Close vapor return line as liquid enters prover neck.

4.7. Close prover inlet valve as slow as is possible when a readable level is obtained in prover neck.

4.8. Record the prover temperature. (On automatic temperature compensated meters, it is unnecessary to record meter temperatures.)

4.9. Print ticket and compare with visual indicating elements. **G-S.5.2.2 [1.10]**

NOTE: If price computing, the ticket must show price per gallon, total volume in terms of gallons and fractions of gallons and total price.

4.10. Record data, apply appropriate meter-to-prover correction factors, determine error, and apply tolerance values.

4.11. Return liquid to storage.

5. Special test.

5.1. Proceed as for normal flow test, but restrict flow at prover inlet valve to flow rate as specified in section 4.2 under Pre-Test Determinations.

5.2. Record data, apply appropriate meter-to-prover correction factors, determine error, and apply tolerance values.

5.3. Apply appropriate seals if meter is correct.

TABLE 1. Temperature Corrections to Indicated Volume of LPG Liquid Meter Prover. **N.5 [3.32]**

NON-TEMPERATURE COMPENSATED

Temperature of liquid in prover	Coefficient of Expansion					
	Propane Specific Gravity .505*		Propane Specific Gravity .510*		Butane Specific Gravity .580*	
°F	Cu. In./°F	Gal./°F	Cu. In./°F	Gal./°F	Cu. In./°F	Gal./°F
Over –20 to -10	.339	.00147	.330	.00143	.237**	.00103**
Over –10 to –0	.341	.00148	.334	.00145	.240**	.00104**
Over 0 to 10	.346	.00150	.340	.00147	.244**	.00106**
Over 10 to 20	.357	.00154	.347	.00150	.244**	.00106**
Over 20 to 30	.366	.00159	.353	.00153	.244**	.00106**
Over 30 to 40	.370	.00160	.357	.00155	.245	.00106
Over 40 to 50	.377	.00163	.364	.00158	.246	.00106
Over 50 to 70	.393	.00170	.370	.00160	.254	.00110
Over 70 to 80	.393	.00170	.377	.00163	.254	.00110
Over 80 to 90	.397	.00172	.388	.00168	.254	.00110
Over 90 to 100	.406	.00176	.393	.00170	.261	.00113
Over 100 to 110	.413	.00179	.398	.00172	.262	.00113
Over 110 to 120	.420	.00182	.405	.00175	.265	.00115

* Approximate specific gravities for some commercial LPG products.
** Butane boils at 31.1°F. Prover pressure will be less than one atmosphere below boiling point.

NOTE: Use the appropriate specific gravity table if known, otherwise default to Specific Gravity of .510 (propane) or .580 (butane). Determine which factor to apply, then multiply the value by the prover draft size. This will give you the correction factor. The appropriate correction factor should be multiplied by the number of degrees difference between the meter and the prover temperatures. If the temperature at the meter is higher than the temperature of the prover, the correction should be added to the prover gage reading to compensate for the contraction of the liquid that has taken place after the liquid was measured by the meter. If the temperature at the meter is lower than the temperature of the prover, the correction should be subtracted from the prover gage reading to compensate for the expansion of the liquid that has taken place after the liquid was measured by the meter.

Example: Prover draft size is 20 gallons and the specific gravity of propane is unknown and the temperature of the prover to be 80°F. With the information provided we determined that it is between 80 and 90 degrees and we select Specific Gravity of .510 by default. By taking both information we determine the factor to be .00168, now we take the factor and multiply by the prover draft size (.00168 x 20 gallons) this results a correction factor of .0336.

Correction factors or multipliers in the following table are to be used for correcting prover volume when testing temperature compensated LPG Liquid Meters (ATC activated).

TEMPERATURE COMPENSATED METER

TABLE 2. Reduction of Volume to 60 °F for Propane
(Specific Gravity .505 to .514)

Temp °F	Mult.	Temp °F	Mult.	Temp °F	Mult.	Temp °F	Mult.	Temp °F	Mult.
11	1.073	31	1.045	51	1.014	71	0.982	91	0.947
12	1.071	32	1.043	52	1.012	72	0.981	92	0.946
13	1.070	33	1.042	53	1.011	73	0.979	93	0.944
14	1.069	34	1.040	54	1.009	74	0.977	94	0.942
15	1.068	35	1.039	55	1.008	75	0.976	95	0.940
16	1.066	36	1.037	56	1.006	76	0.974	96	0.939
17	1.065	37	1.036	57	1.005	77	0.972	97	0.937
18	1.064	38	1.034	58	1.003	78	0.970	98	0.935
19	1.062	39	1.033	59	1.002	79	0.969	99	0.933
20	1.061	40	1.031	60	1.000	80	0.967	100	0.932
21	1.060	41	1.030	61	0.998	81	0.965	101	0.930
22	1.058	42	1.028	62	0.997	82	0.963	102	0.928
23	1.057	43	1.027	63	0.995	83	0.962	103	0.927
24	1.055	44	1.025	64	0.994	84	0.960	104	0.925
25	1.054	45	1.024	65	0.992	85	0.958	105	0.923
26	1.052	46	1.022	66	0.990	86	0.956	106	0.921
27	1.051	47	1.021	67	0.989	87	0.955	107	0.919
28	1.049	48	1.019	68	0.987	88	0.953	108	0.917
28	1.048	49	1.018	69	0.985	89	0.951	109	0.915
30	1.046	50	1.016	70	0.984	90	0.949	110	0.913

Example for use of Table 2 (LPG Liquid Meters).

The following formula may be used for determining the meter error when testing LPG temperature compensated liquid meters:

Corrected Prover Reading x Correction Factor = Corrected Volume to 60 °F

Meter error is the difference between the meter reading and the corrected volume.

PROVER THERMAL CORRECTION TABLE

This table was included only for the example following. Counties must use the table provided by Metrology for their individual prover.

Table 3. Volume Corrections for Thermal Expansion or Contraction of a Low Carbon Steel LPG Prover

Prover Temperature	20 Gallon Prover	100 Gallon Prover
°F	Gallon	Gallon
-20	-.03	-0.15
-15	-.028	-0.14
-10	-.026	-0.13
- 5	-.024	-0.12
0	-.022	-0.11
5	-.020	-0.10
10	-.018	-0.09
15	-.016	-0.08
20	-.014	-0.07
25	-.014	-0.07
30	-.012	-0.06
35	-.01	-0.05
40	-.008	-0.04
45	-.006	-0.03
50	-.004	-0.02
55	-.002	-0.01
60	0	0
65	+.002	+0.01
70	+.004	+0.02
75	+.006	+0.03
80	+.008	+0.04
85	+.01	+0.05
90	+.012	+0.06
95	+.014	+0.07
100	+.014	+0.07
105	+.016	+0.08
110	+.018	+0.09
115	+.020	+0.10
120	+.022	+0.10

Example for combined use of Tables 1, 2 and 3. **4002.4(c) [3.32]**

The following formula may be used for determining the Corrected Prover Volume when testing LPG meters: **N.5 [3.32]**

<u>Automatic Temperature-Compensated Meters</u>

Observed Prover Volume + Prover Pressure Correction ± Prover Thermal Correction x Volume to 60°F Correction Factor = Corrected Prover Volume.

<u>Non-Temperature-Compensated Meters</u>

Observed Prover Volume + Prover Pressure Correction ± Prover Thermal Correction ± [Meter/Prover Temperature Difference Between the Prover and the Meter x Correction Factor from Table 1 (EPO No. 30-12)] = Corrected Prover Volume.

	A	B	C	D	E	F	G	H	I	J	K	L	
T/C	GPM Flow Rate	Gallons Meter	Gallons Observed Prover	Pressure Correction Prover	Thermal Correction Prover	Volume Correction Prover	Corrected Prover Volume	Gallons Error	Tolerance	Meter Temp.	Prover Temp. °F	% Error	Out Of Tol.
AUTOMATIC TEMPERATURE COMPENSATION METER TEST													
					Table 3	Table 2	(C+D+E)F	G-B	G x 1% Or .6T	1/3 & 2/3 Cap.		H/G*100	
	45	99.7	100.21	170 psi +.17 gal	+.06 gal	x.949	95.16	-5.54	.95	N/A	90	- 4.77	
	50	104.3	100.10	80 psi + .08 gal	-.04 gal	X1.034	103.54	- .76	1.04	N/A	38	- .73	
NON-AUTOMATIC TEMPERATURE COMPENSATION METER TEST													
					Table 3	Table 1							
	15	20.10	20.00	100 psi + .02 gal	+ .004 gal	-.066 gal	19.96	-.14	.20	70	72	-.70	
	5	19.90	20.00	75 psi + .015 gal	= .01 gal	+ .093 gal	20.01	.11	.20	40	37	0.55	

NOTE: - = Overregistration
+ = Underregistration

STATE OF CALIFORNIA
DEPARTMENT OF FOOD AND AGRICULTURE
DIVISION OF MEASUREMENT STANDARDS
46-014 (Rev. 9/99)

LPG LIQUID METER TEST DATA

8500 FRUITRIDGE ROAD
SACRAMENTO, CA 95826

DATE ______ COUNTY ______ LAST SEALED ______ TEMPERATURE COMPENSATED: YES ☐ NO ☐

NAME ______ ADDRESS ______ CHECK VALVE: SATIS. ☐ UNSATIS. ☐

LICENSE NO.: ______ VEHICLE NO.: ______ TRUCK ☐ STATIONARY ☐ DIFFERENTIAL VALVE: SATIS. ☐ UNSATIS. ☐

METER ______ MODEL ______ SIZE: ______ CAPACITY ______ SERIAL NO. ______

VAPOR ELIMINATOR SATIS. ☐ UNSATIS. ☐

REGISTER / PRINTER: SATIS. ☐ UNSATIS. ☐

PRICE SIGN: MOTOR FUEL: SATIS. ☐ UNSATIS. ☐
CYLINDER: SATIS. ☐ UNSATIS. ☐

T/C	A G.P.M. FLOW RATE	B GALLONS METER	C GALLONS OBSERVED PROVER	D PRESSURE CORRECTION	E THERMAL CORRECTION	F VOLUME CORRECTION PROVER	G CORRECTED GALLONS	H GALLONS ERROR	I TOLERANCE	J METER TEMP.	K PROVER TEMP.	L % ERROR	OUT OF TOL.

REMARKS: ______

SEALED AS IS ______ ADJUSTED ______ UNSATISFACTORY ______ SECURITY SEALS: INTACT ☐ BROKEN ☐

CHARGE: ______ FINISH ______ START ______ TOTAL USED ______ SPECIALIST ______

EPO NO. 30-16
LPG-LMD

SUGGESTED ACCESSORIES FOR LP-GAS PROVER

1. Adaptors - To facilitate connections to various types of LP-gas dispensers. (Other than those supplied with prover, if found needed.)

2. Thermometers - A supply of liquid-in-glass thermometers, -30 °F to 130 °F, by 1 °F, at least 12-inches in length and of the 3-inch immersion type. These are quite fragile, so an ample supply, at least 6, is necessary.

   NOTE: Digital thermometers are also available.

3. Fire Extinguishers - A portable dry chemical extinguisher is suggested as the most effective extinguisher for LP-gas fires. At least two should be obtained (Class B requirements).

4. Tools - Pipe and crescent wrenches and other tools should be carried in an appropriate equipment box.

5. Extension Cord - A heavy duty 3-wire extension power cord and 3-prong receptacle adaptor should be provided to reach remote electric power outlets. Number 14 wire is considered a minimum size.

6. Cleaning Solvent - A supply of cleaning solvent (including a bulb syringe) is suggested so that both the meter and prover thermometer wells can be filled with a temperature-conducting liquid. A one quart plastic bottle with a leak-proof cap may be used to carry the solvent.

7. Pipe Joint Compound - A can or stick of pipe joint compound, suitable for high-pressure liquid gas, should be available for use in resealing pipe joints and fittings if necessary.

8. Stop Watch - A stop watch is necessary for timing rates of flow, prover discharge, drainage, etc.

9. Caution Signs - It is suggested that two signs be made for use in the area near the prover during the testing operation. The signs may be painted to read “Hazardous Area-Flammable Gas” - “No Visitors” - “No Smoking”.

10. Test Forms.

11. Protective Gloves and Glasses - Several pairs of protective neoprene gloves, with gauntlets, and safety eyeglasses should be kept with the equipment.

12. First-Aid Kit - An adequate first-aid kit with appropriate burn ointment, bandages, gauze, adhesive tape, etc., should also be kept with the equipment.

TABLE 2.* REDUCTION OF VOLUME TO 60°F AGAINST SPECIFIC GRAVITY 60/60°F LIQUIFIED PETROLEUM GASES (ABRIDGED TABLE)

Observed Tempera-ture °F	SPECIFIC GRAVITY 60/60°F 0.495 to 0.504	0.505 to 0.514	0.515 to 0.524	0.525 to 0.534	0.535 to 0.544	0.545 to 0.554	0.555 to 0.564	0.565 to 0.574	0.575 to 0.584	0.585 to 0.594	0.595 to 0.604
	FACTOR FOR REDUCING VOLUME TO 60°F										
-20	1.120	1.114	1.109	1.104	1.099	1.095	1.090	1.086	1.082	1.079	1.076
-19	1.118	1.113	1.108	1.103	1.098	1.094	1.089	1.085	1.081	1.078	1.075
-18	1.117	1.111	1.106	1.101	1.097	1.093	1.088	1.084	1.080	1.077	1.074
-17	1.115	1.110	1.105	1.100	1.095	1.091	1.086	1.082	1.079	1.076	1.073
-16	1.114	1.108	1.103	1.098	1.094	1.090	1.085	1.081	1.078	1.075	1.072
-15	1.112	1.107	1.102	1.097	1.093	1.089	1.084	1.080	1.077	1.074	1.071
-14	1.111	1.106	1.101	1.096	1.092	1.088	1.083	1.079	1.076	1.073	1.070
-13	1.109	1.104	1.099	1.095	1.091	1.087	1.082	1.078	1.075	1.072	1.069
-12	1.108	1.103	1.098	1.093	1.089	1.085	1.081	1.077	1.074	1.071	1.068
-11	1.106	1.101	1.096	1.092	1.088	1.084	1.080	1.076	1.073	1.070	1.067
-10	1.105	1.100	1.095	1.091	1.087	1.083	1.079	1.075	1.072	1.069	1.066
- 9	1.104	1.099	1.094	1.090	1.086	1.082	1.078	1.074	1.071	1.068	1.065
- 8	1.102	1.098	1.093	1.089	1.085	1.081	1.077	1.073	1.070	1.067	1.064
- 7	1.101	1.096	1.091	1.087	1.083	1.080	1.076	1.072	1.069	1.067	1.063
- 6	1.099	1.095	1.090	1.086	1.082	1.079	1.075	1.071	1.068	1.066	1.062
- 5	1.098	1.094	1.089	4.085	1.081	1.078	1.074	1.070	1.067	1.065	1.061
- 4	1.097	1.093	1.088	1.084	1.080	1.077	1.073	1.069	1.066	1.064	1.060
- 3	1.096	1.092	1.087	1.083	1.079	1.076	1.072	1.068	1.065	1.063	1.059
- 2	1.094	1.090	1.086	1.082	1.078	1.075	1.071	1.068	1.065	1.063	1.059
- 1	1.093	1.089	1.085	1.081	1.077	1.074	1.070	1.067	1.064	1.062	1.058
0	1.092	1.088	1.084	1.080	1.076	1.073	1.069	1.066	1.063	1.061	1.057
1	1.090	1.086	1.083	1.079	1.075	1.072	1.068	1.065	1.062	1.060	1.056
2	1.089	1.085	1.081	1.077	1.074	1.070	1.067	1.064	1.061	1.059	1.055
3	1.088	1.084	1.080	1.076	1.073	1.069	1.066	1.063	1.060	1.058	1.054
4	1.086	1.082	1.079	1.075	1.071	1.068	1.065	1.062	1.059	1.057	1.054
5	1.085	1.081	1.077	1.074	1.070	1.067	1.063	1.061	1.058	1.055	1.053
6	1.084	1.080	1.076	1.072	1.069	1.065	1.062	1.059	1.057	1.054	1.052
7	1.082	1.078	1.075	1.071	1.068	1.064	1.061	1.058	1.056	1.053	1.051
8	1.081	1.077	1.074	1.070	1.066	1.063	1.060	1.057	1.055	1.052	1.050
9	1.079	1.076	1.072	1.069	1.065	1.062	1.059	1.056	1.054	1.051	1.049
10	1.078	1.074	1.071	1.067	1.064	1.061	1.058	1.055	1.053	1.050	1.048
11	1.077	1.073	1.070	1.066	1.063	1.060	1.057	1.054	1.052	1.049	1.047
12	1.075	1.071	1.068	1.064	1.061	1.059	1.056	1.053	1.051	1.048	1.046
13	1.074	1.070	1.067	1.063	1.060	1.057	1.054	1.052	1.050	1.047	1.045
14	1.072	1.069	1.066	1.062	1.059	1.056	1.053	1.051	1.049	1.046	1.044
15	1.071	1.068	1.064	1.061	1.058	1.055	1.052	1.050	1.047	1.045	1.043
16	1.070	1.066	1.063	1.060	1.056	1.054	1.051	1.048	1.046	1.044	1.042
17	1.069	1.065	1.062	1.058	1.055	1.052	1.050	1.047	1.045	1.043	1.041
18	1.067	1.064	1.061	1.057	1.054	1.051	1.049	1.046	1.044	1.042	1.040
19	1.066	1.062	1.059	1.056	1.053	1.050	1.047	1.045	1.043	1.041	1.039
20	1.064	1.061	1.058	1.054	1.051	1.049	1.046	1.044	1.042	1.040	1.038
21	1.063	1.060	1.056	1.053	1.050	1.048	1.045	1.043	1.041	1.039	1.037
22	1.061	1.058	1.055	1.052	1.049	1.046	1.044	1.042	1.040	1.038	1.037
23	1.060	1.057	1.053	1.051	1.048	1.045	1.043	1.041	1.039	1.037	1.036
24	1.058	1.055	1.052	1.049	1.046	1.044	1.042	1.040	1.038	1.036	1.035
25	1.057	1.054	1.050	1.048	1.045	1.043	1.041	1.039	1.037	1.035	1.034
26	1.055	1.052	1.049	1.047	1.044	1.042	1.039	1.037	1.036	1.034	1.033
27	1.054	1.051	1.048	1.045	1.043	1.041	1.038	1.036	1.035	1.033	1.032
28	1.052	1.049	1.047	1.044	1.041	1.039	1.037	1.035	1.034	1.032	1.031
29	1.051	1.048	1.045	1.043	1.040	1.038	1.038	1.034	1.033	1.031	1.030

TABLE 2.* REDUCTION OF VOLUME TO 60°F AGAINST SPECIFIC GRAVITY
60/60°F LIQUIFIED PETROLEUM GASES
(ABRIDGED TABLE) - Continued

	SPECIFIC GRAVITY 60/60°F										
Observed Tempera-ture °F	0.495 to 0.504	0.505 to 0.514	0.515 to 0.524	0.525 to 0.534	0.535 to 0.544	0.545 to 0.554	0.555 to 0.564	0.565 to 0.574	0.575 to 0.584	0.585 to 0.594	0.595 to 0.604
	FACTOR FOR REDUCING VOLUME TO 60°F										
30	1.049	1.046	1.044	1.041	1.039	1.037	1.035	1.033	1.032	1.030	1.029
31	1.047	1.045	1.042	1.040	1.038	1.036	1.034	1.032	1.031	1.029	1.028
32	1.046	1.043	1.041	1.038	1.036	1.035	1.033	1.031	1.030	1.028	1.027
33	1.044	1.042	1.040	1.037	1.035	1.034	1.032	1.030	1.029	1.027	1.026
34	1.043	1.040	1.038	1.036	1.034	1.032	1.031	1.029	1.028	1.026	1.025
35	1.041	1.039	1.037	1.035	1.033	1.031	1.029	1.028	1.027	1.025	1.024
36	1.039	1.037	1.035	1.033	1.031	1.030	1.028	1.027	1.025	1.024	1.023
37	1.038	1.036	1.033	1.032	1.030	1.029	1.027	1.026	1.024	1.023	1.022
38	1.036	1.034	1.032	1.031	1.029	1.027	1.026	1.025	1.023	1.022	1.021
39	1.035	1.033	1.031	1.029	1.028	1.026	1.025	1.024	1.022	1.021	1.020
40	1.033	1.031	1.029	1.028	1.026	1.025	1.024	1.023	1.021	1.020	1.019
41	1.031	1.030	1.028	1.027	1.025	1.024	1.023	1.022	1.020	1.019	1.018
42	1.030	1.028	1.027	1.025	1.024	1.023	1.022	1.021	1.019	1.018	1.017
43	1.028	1.027	1.025	1.024	1.022	1.021	1.020	1.019	1.018	1.017	1.016
44	1.027	1.025	1.023	1.022	1.021	1.020	1.019	1.018	1.017	1.016	1.015
45	1.025	1.024	1.022	1.021	1.020	1.019	1.018	1.017	1.016	1.015	1.015
46	1.023	1.022	1.021	1.020	1.018	1.018	1.017	1.016	1.015	1.014	1.014
47	1.022	1.021	1.019	1.018	1.017	1.016	1.015	1.015	1.014	1.013	1.013
48	1.020	1.019	1.018	1.017	1.016	1.015	1.014	1.013	1.013	1.012	1.012
49	1.019	1.018	1.017	1.015	1.015	1.014	1.013	1.012	1.012	1.011	1.011
50	1.017	1.016	1.015	1.014	1.013	1.013	1.012	1.011	1.011	1.010	1.010
51	1.015	1.014	1.013	1.013	1.012	1.011	1.011	1.010	1.010	1.009	1.009
52	1.014	1.012	1.012	1.011	1.010	1.010	1.009	1.009	1.009	1.008	1.008
53	1.012	1.011	1.011	1.010	1.009	1.009	1.008	1.008	1.008	1.007	1.007
54	1.010	1.009	1.009	1.008	1.008	1.007	1.007	1.007	1.007	1.006	1.006
55	1.009	1.008	1.008	1.007	1.007	1.006	1.006	1.006	1.006	1.005	1.005
56	1.007	1.006	1.006	1.005	1.005	1.005	1.005	1.005	1.004	1.004	1.004
57	1.005	1.005	1.005	1.004	1.004	1.004	1.004	1.003	1.003	1.003	1.003
58	1.003	1.003	1.003	1.003	1.003	1.002	1.002	1.002	1.002	1.002	1.002
59	1.002	1.002	1.002	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001
60	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
61	0.998	0.998	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999	0.999
62	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998	0.998	0.998	0.998
63	0.995	0.995	0.995	0.996	0.996	0.996	0.996	0.997	0.997	0.997	0.997
64	0.993	0.994	0.994	0.994	0.994	0.995	0.995	0.995	0.996	0.996	0.996
65	0.991	0.992	0.992	0.993	0.993	0.993	0.994	0.994	0.994	0.995	0.995
66	0.990	0.990	0.990	0.991	0.992	0.992	0.993	0.993	0.993	0.993	0.994
67	0.988	0.989	0.989	0.990	0.990	0.991	0.991	0.992	0.992	0.992	0.993
68	0.986	0.987	0.987	0.988	0.989	0.990	0.990	0.990	0.991	0.991	0.992
69	0.985	0.985	0.986	0.987	0.987	0.988	0.989	0.989	0.990	0.990	0.991
70	0.983	0.984	0.984	0.985	0.986	0.987	0.988	0.988	0.989	0.989	0.990
71	0.981	0.982	0.983	0.984	0.984	0.986	0.986	0.987	0.988	0.988	0.989
72	0.979	0.981	0.981	0.982	0.983	0.984	0.985	0.986	0.987	0.987	0.988
73	0.978	0.979	0.980	0.981	0.982	0.983	0.984	0.985	0.986	0.986	0.987
74	0.976	0.977	0.978	0.980	0.980	0.982	0.983	0.984	0.985	0.985	0.986
75	0.974	0.976	0.977	0.978	0.979	0.980	0.981	0.983	0.983	0.984	0.985
76	0.972	0.974	0.975	0.977	0.978	0.979	0.980	0.981	0.982	0.983	0.984
77	0.970	0.972	0.973	0.975	0.976	0.978	0.979	0.980	0.981	0.982	0.983
78	0.969	0.970	0.972	0.974	0.975	0.977	0.978	0.979	0.980	0.981	0.982
79	0.967	0.969	0.970	0.972	0.974	0.975	0.977	0.978	0.979	0.980	0.981

TABLE 2.* REDUCTION OF VOLUME TO 60°F AGAINST SPECIFIC GRAVITY 60/60°F LIQUIFIED PETROLEUM GASES (ABRIDGED TABLE) – Continued

	SPECIFIC GRAVITY 60/60°F										
Observed Tempera-ture °F	0.495 to 0.504	0.505 to 0.514	0.515 to 0.524	0.525 to 0.534	0.535 to 0.544	0.545 to 0.554	0.555 to 0.564	0.565 to 0.574	0.575 to 0.584	0.585 to 0.594	0.595 to 0.604
	FACTOR FOR REDUCING VOLUME TO 60°F										
80	0.965	0.967	0.969	0.971	0.972	0.974	0.975	0.977	0.978	0.979	0.981
81	0.963	0.965	0.967	0.969	0.971	0.973	0.974	0.975	0.977	0.978	0.980
82	0.961	0.963	0.966	0.968	0.969	0.971	0.972	0.974	0.976	0.977	0.979
83	0.959	0.962	0.964	0.966	0.968	0.970	0.971	0.973	0.975	0.976	0.978
84	0.957	0.960	0.962	0.965	0.966	0.968	0.970	0.972	0.974	0.975	0.977
85	0.956	0.958	0.960	0.963	0.965	0.967	0.969	0.971	0.972	0.974	0.976
86	0.954	0.956	0.959	0.961	0.964	0.966	0.967	0.969	0.971	0.973	0.975
87	0.952	0.955	0.957	0.960	0.962	0.964	0.966	0.968	0.970	0.972	0.974
88	0.950	0.953	0.955	0.958	0.961	0.963	0.965	0.967	0.969	0.971	0.973
89	0.948	0.951	0.954	0.957	0.959	0.962	0.964	0.966	0.968	0.970	0.972
90	0.946	0.949	0.952	0.955	0.958	0.960	0.962	0.964	0.967	0.968	0.971
91	0.944	0.947	0.951	0.954	0.956	0.959	0.961	0.963	0.965	0.967	0.970
92	0.942	0.946	0.949	0.952	0.955	0.957	0.959	0.962	0.964	0.966	0.969
93	0.940	0.944	0.947	0.950	0.953	0.956	0.958	0.961	0.963	0.965	0.968
94	0.938	0.942	0.946	0.949	0.952	0.954	0.957	0.959	0.962	0.964	0.967
95	0.937	0.940	0.944	0.947	0.950	0.953	0.956	0.958	0.961	0.963	0.966
96	0.935	0.939	0.942	0.946	0.949	0.952	0.954	0.957	0.959	0.962	0.965
97	0.933	0.937	0.941	0.944	0.947	0.950	0.953	0.956	0.958	0.961	0.964
98	0.931	0.935	0.939	0.943	0.946	0.949	0.952	0.954	0.957	0.960	0.963
99	0.929	0.933	0.937	0.941	0.945	0.948	0.950	0.953	0.956	0.959	0.962
100	0.927	0.932	0.936	0.940	0.943	0.946	0.949	0.952	0.954	0.958	0.961
101	0.925	0.930	0.934	0.938	0.941	0.945	0.948	0.951	0.953	0.957	0.960
102	0.923	0.928	0.932	0.936	0.940	0.943	0.947	0.950	0.952	0.956	0.959
103	0.921	0.927	0.931	0.935	0.938	0.942	0.945	0.948	0.951	0.954	0.958
104	0.919	0.925	0.929	0.933	0.937	0.940	0.944	0.947	0.950	0.953	0.957
105	0.917	0.923	0.927	0.931	0.935	0.939	0.943	0.946	0.949	0.952	0.956
106	0.915	0.921	0.925	0.929	0.933	0.938	0.942	0.945	0.948	0.951	0.955
107	0.913	0.919	0.923	0.928	0.932	0.936	0.940	0.943	0.947	0.950	0.954
108	0.911	0.917	0.922	0.926	0.930	0.935	0.939	0.942	0.945	0.949	0.953
109	0.909	0.915	0.920	0.925	0.929	0.933	0.937	0.940	0.944	0.948	0.952
110	0.917	0.913	0.918	0.923	0.927	0.932	0.936	0.939	0.943	0.947	0.951
111	0.905	0.911	0.916	0.921	0.926	0.931	0.935	0.938	0.942	0.946	0.950
112	0.903	0.909	0.914	0.920	0.924	0.929	0.934	0.937	0.941	0.945	0.949
113	0.901	0.908	0.913	0.918	0.923	0.928	0.932	0.935	0.939	0.943	0.948
114	0.899	0.906	0.911	0.917	0.921	0.926	0.931	0.934	0.938	0.942	0.947
115	0.897	0.904	0.909	0.915	0.920	0.925	0.930	0.933	0.937	0.941	0.946
116	0.895	0.902	0.907	0.913	0.918	0.924	0.929	0.932	0.936	0.940	0.945
117	0.893	0.900	0.905	0.912	0.917	0.922	0.927	0.931	0.935	0.939	0.944
118	0.891	0.898	0.904	0.910	0.915	0.921	0.926	0.929	0.933	0.938	0.943
119	0.889	0.896	0.902	0.909	0.914	0.919	0.924	0.928	0.932	0.937	0.942
120	0.887	0.894	0.900	0.907	0.912	0.918	0.923	0.927	0.931	0.936	0.941

HYDROCARBON GAS VAPOR METERS

(For Vapor Laboratory Requirements See REF V)

Pre-Test Considerations

1. All temperature values used in formulas to determine percent error must be converted to absolute temperature (Rankine) by adding 460 to the temperature value (i.e., 460 + 70°F = 530).

Pre-Test Inspection

1. Identification and marking requirements. **G-S.1 [1.10], S.4 [3.33]**

    1.1. Manufacturer's or distributor's name, model number and serial number.

    1.2. Rated capacity.

    1.3. If a meter is equipped with an automatic temperature compensator, this shall be indicated on the badge (identification plate) or immediately adjacent to the badge and on the register. (Nonretroactive as of January 1, 1995.) **4002.5 [3.33]; (b.) Page D3-31**

    1.4. Limitation of use.

2. Type approval. **B&P 12500.5**

3. Indicating elements.

    3.1. Shall indicate in terms of cubic feet or cubic meters. **S.1.1.2 [3.33]**

    3.2. Value of smallest unit. The value of the smallest unit of indicated delivery and recorded delivery, if the device is equipped to record, shall not exceed: **S.1.1.3 [3.33]**

    (a) 100 cubic feet or 1 cubic meter when the maximum rated gas capacity is less than 10,000 cubic feet per hour.

    (b) 1,000 cubic feet or 10 cubic meter when the maximum rated gas capacity is 10,000 cubic feet per hour up to but not including 60,000 cubic feet per hour.

    (c) 10,000 cubic feet or 100 cubic meter when the maximum rated gas capacity is 60,000 cubic feet per hour or more.

    3.3. Advancement of indicating and recording elements. Primary indicating and recording elements shall advance digitally or continuously and be susceptible of advancement only by the mechanical operation of the device. **S.1.1.4 [3.33]**

4. Meters removed for complaint.

    4.1. Meters removed because of complaint should be held in testing room at least 16 hours with inlet and outlet ports open to allow temperature equalization. **N.2 [3.33]**

4.2. Proof testing shall be done with meter in same condition as received.

4.3. The first set of results (open and check rate) shall be recorded and used as the official test.

5. Meters removed for routine test.

   5.1. Inspect for loose screws and obvious damage to seals, glass, case and threads.

   5.2. Indexes should be removed for inspection as necessary and left off until completion of leak test.

   5.3. Inspect indexes for type of registration, alignment of numbers and freedom of movement. Record total registration in the case of meters that will be returned to service in the same location.

   NOTE: Indexes on American W series meters should not be removed as the seal between drive shaft and 0 ring is disturbed and may cause subsequent leaks.

<u>Pre-Test Determinations</u>

1. Temperature requirements.

   1.1. Before beginning proof test, meters should be held in prover room at least 16 hours after leak test with inlet and outlet ports open to allow temperature equalization. **N.2 [3.33]**

   1.2. Proof testing may be done within a temperature range of 60°F to 90°F.

   1.3. Temperature range between prover room air, bell prover oil, and meter under test shall be held within 2°F (a difference of 5°F will result in a test error of about 1 percent). Testing is not recommended if the environmental temperature fluctuates greater than ±2°F during the test or if temperature between bell prover oil and outlet air are greater than 1°F. **N.2 [3.33]**

   1.4. Temperature range between the air outlets of the prover and meter should be held to 1°F. If temperature range exceeds 1°F, a correction will need to be applied to proof results (see proof testing).

2. Bell prover requirements.

   2.1. Operating pressure of 2 cu. ft. to 10 cu. ft. bell provers shall be 1.5 inch of water column.

   2.2. Bell provers should be tested for leaks prior to use. A leak test can be made by setting prover at a specific mark. If there is no perceptible movement in ten minutes, the prover may be considered to be leak free.

3. Preparation of test rate caps.

   3.1. Meters are proof tested at two rates, a capacity (open) rate and a check rate of 20% of marked capacity or the check rate, if marked on the device, whichever is less. **N.4 [3.33]**

3.2. Rate caps are drilled to a specific size orifice to release air at the desired rate and thus control the meter speed.

3.3. The flow rate of a particular meter rate cap in cubic feet per hour may be determined by using a stopwatch as follows:

3.3.1. Flow rate caps to be used with a bell prover at a pressure of 1.5 inch water column can be timed for 1 cu. ft. on the prover scale. Record pressure of bell prover during establishment of pilot load rate cap flow rate for purpose of setting regulator during pilot load test.

3.3.2. To determine the correct rate caps to be used with meter capacity rated for other than air, apply the following equation by using the information supplied from the ID badge of the meter undergoing proof testing.

$$\text{Air Capacity} = \text{Gas Capacity X} \sqrt{\text{Specific Gravity of Gas}}$$

Example: Meter "AXYZ" rated capacity is 110 cfh with propane.

$$\text{Using Air as a Test Medium} = 110 \text{ x } \sqrt{1.53 \text{ sp.gr. (Propane)}}$$

Air Capacity = 136 cfh

Reference:	Propane	=	1.53 sp. gr.
	Natural Gas	=	0.60 sp. gr.
	Air	=	1.00 sp. gr.
	Butane	=	2.006 sp. gr.

Note: Meters Flow capacity are normally based on specific gravity of 0.60 unless otherwise specified on the ID badge.

3.4. Using the following formula to determine flow-rate/hour:

$$\text{Cubic Feet/Hour} = \frac{3600}{\text{Time (in seconds)}}$$

3.5. Rate cap drill sizes are determined by trial and error. Start with smallest hole in center of cap and test for rate/hour using above formula. Increase drill size as necessary to obtain proper rate cap flow rate.

Tests

1. Leak test.

1.1. Slowly pressurize the meter (not exceeding 5 psi per second) to the maximum allowable operating pressure (MAOP) of the meter. Submerge meter at flow rate equivalent to one revolution in one minute. Do not subject meter to pressure exceeding 1.5 times the rated MAOP. **4002.5 [3.33]; (a.) Page D3-32**

NOTE: This test should be done with water temperature at ambient temperature or allow meters to equalize 16 hours after removal, but prior to "proof testing".

1.2. While the meter is submerged, examine case and index drive shaft for leaks. A meter that leaks at any point is unsatisfactory.

1.3. After removing meter from water, dry index compartment thoroughly with compressed air before reinstalling cover. Dry out the index recess before installing index and cover.

1.4. Use caution in meshing index drive gears. On some models, the gears will turn off the shaft if turned opposite to direction of normal rotation.

2. Low flame test. **N.4.2.2 [3.33]**

2.1. Meters shall be given a low flame (pilot) test as prescribed by Table 1. **N.4.2.2 [3.33]**

Table 1. Capacity Of Low Flow Test Rate Orifices With Respect To Device Capacity

Rated Hydrocarbon Gas Capacity	Nominal Low Flow Test Rate
U.S. Customary Units	
Up to and including 250 ft^3/h	0.25 ft^3/h
Over 250 ft^3/h up to and including 500 ft^3/h	0.50 ft^3/h
Over 500 ft^3/h	0.1 percent of capacity rate
Metric Units	
Up to and including 7 m^3/h	0.007 m^3/h
Over 7 m^3/h up to and including 14 m^3/h	0.014 m^3/h
Over 14 m^3/h	0.1 percent of capacity rate

2.2. Circulate air through the meter being tested to take up all the slack in the bellows, gears, etc., before performing the low flame (Pilot) test. Start the test with pointer of proving indicator at a convenient division on the upswing.

2.3. During pilot load test, it is important to maintain a constant pressure equal to the pressure of the bell prover when the rate cap flow rate drill size was established, especially when using a regulator with a timer.

2.4. Meter is unsatisfactory if there is no continuous movement when air, at a pressure of 1.5 inches water column, is passed through a proper drill size orifice on the outlet side of the meter being tested within 60 minutes.

3. Proof testing. (See EPO NO. 31-2, 1.1.)

3.1. Connect meter to prover and differential pressure gage. (Use small amount of grease on meter fitting threads.)

3.2. Make leak test of meter and hose connections as follows before installing rate cap:

3.2.1. Block fitting on outlet side of meter with palm of hand or plug.

3.2.2. Pressurize fittings and meter by opening prover outlet valve.

3.2.3. Close prover outlet valve and watch for pressure drop on manometer, which would indicate a leak.

3.2.4. Small leaks can be found by brushing soapsuds on all fittings and connections.

3.3. Install capacity flow rate cap on meter outlet.

Purge small meters (630 ft^3 or less) with 5 cu. ft. of air and larger sizes (greater than 630 ft^3) with 10 cu. ft. of air.

3.4. Position meter proving hand on upswing by opening prover outlet valve. When meter proving hand reaches predetermined point, stop it by closing prover outlet valve.

3.5. Position prover at desired starting point.

3.6. Test Run

(a) Before beginning test run, recheck prover and meter for exact position.
(b) Open prover outlet valve and allow meter to run.
(c) While air is flowing through the meter, record the temperature on the outlet side of both prover and meter.
(d) When meter has run through desired number of cubic feet, stop meter proving circle hand at exact starting point with prover outlet valve.
(e) Record the reading from the prover scale or fine reader.
(f) Calculate meter % error.
(g) Record the results.

NOTE: Examples are on pages EPO No. 31-6 and 31-7 calculation of meter % error.

NOTE: When calculating, use the following number of decimal places and proper rounding to determine the digit final value:

0.0	Temperature Readings
0.00	Percent Error
0.000	Volume Indications
0.0000	Correction Factors

3.7. Repeat the preceding steps with check rate cap. Record results.

3.8. Tolerances. Maintenance and acceptance tolerances for hydrocarbon gas vapor-measuring devices are 3% of the test draft on underregistration and 1.5% of the test draft on overregistration. **T.1 [3.33]**

3.8.1. If the difference in airflow temperature between the prover and meter is maintained at **1°F or less**

Calculation of Meter % Error

Note: In the following calculations for temperature correction you must use Rankine absolute temperature values (Temperature in °F + 460 = °Rankine). Round off calculations to the fourth digit.

In the formulas:
V_m = Volume registered by meter
V_p = Prover volume - uncorrected
T_b = Base temperature (60ºF)
T_p = Temperature at outlet side of prover

Example: A meter registers that 2 cubic feet have passed through it, and the prover indicates 2.025 cubic feet. The prover airflow temperature indicates 72°F while airflow at the outlet side of meter under test indicates 72.8°F. Temperature difference is 0.8°F.

<u>For non-temperature compensated meters:</u>

$$\frac{\mathbf{V_m - V_p}}{\mathbf{V_p}} \mathbf{\ x\ 100 = \%\ \text{Error in meter indication}}$$

$$\frac{2\text{ cf} - 2.025\text{ cf}}{2.025\text{ cf}} \text{ x } 100 \ \frac{-0.025}{2.025} \text{ x } 100 = \underline{-1.23\%\ \text{(underregistration)}}$$

<u>For temperature compensated vapor meters:</u>

The volume of air metered by a temperature compensated meter is automatically corrected to 60ºF. This formula corrects the volume of the bell prover to 60ºF using (T_b/T_p) (V_p)

$$\frac{\mathbf{V_m - [(T_b/T_p)(V_p)]}}{\mathbf{(T_b/T_p)(V_p)}} \mathbf{\ x\ 100 = \%\ Error}$$

$$\frac{2\text{ cf} - [((60°F + 460)/72°F + 460))(2.025\text{ cf})]}{[((60°F + 460/(72°F + 460))(2.025\text{ cf})]} \text{ x } 100 = \%\text{ Error}$$

$$\frac{2 - [(520/532)(2.025)]}{(520/532)(2.025)} \text{ x } 100 = \%\text{ Error}$$

$$\frac{2 - [(0.9774)(2.025)]}{(0.9774)(2.025)} \text{ x } 100 = \%\text{ Error}$$

$$\frac{2 - 1.979}{1.979} \text{ x } \underline{100 = 1.06\%\ \text{(overregistration)}}$$

3.8.2. If the difference in airflow temperature between the prover and meter is **greater than 1°F**

Calculation of Meter % Error

Note: In the following calculations for temperature correction you must use Rankine absolute temperature values (Temperature in °F + 460 = °Rankine). Round off calculations to the fourth digit.

In the formulas:

V_m	=	Volume registered by meter
V_p	=	Prover volume - uncorrected
T_b	=	Base temperature (60ºF)
T_m	=	Temperature at outlet side of meter
T_p	=	Temperature at outlet side of prover

Example: A meter registers that 2 cubic feet have passed through it, and the prover indicates 2.030 cubic feet. The prover airflow temperature indicates 72°F while airflow at the outlet side of meter under test indicates 70.7°F. Temperature difference is 1.3°F.

For non-temperature compensated meters:

$$\frac{V_m - [(T_m/T_p)(V_p)]}{(T_m/T_p)(V_p)} \times 100 = \%\ \text{Error in meter indication}$$

$$\frac{2\text{ cu. ft.} - [((70.7°F + 460)/72°F + 460))(2.030\text{ cu. ft.})]}{[((70.7°F + 460)/72°F + 460))(2.030\text{ cu. ft.})]} \times 100 = \%\ \text{Error}$$

$$\frac{2 - [(530.7/532)(2.030)]}{(530.7/532)(2.030)} \times 100 = \%\ \text{Error}$$

$$\frac{2 - 2.025}{2.025} \times 100 = \underline{1.23\%\ \text{(underregistration)}}$$

For temperature compensated meters:

The volume of air metered by a temperature compensated meter is automatically corrected to 60ºF. This formula corrects the volume of the bell prover to 60ºF using $(T_b/T_p)(V_p)$.

$$\frac{V_m - [(T_b/T_p)(V_p)]}{(T_b/T_p)(V_p)} \times 100 = \%\ \text{Error}$$

$$\frac{2\text{ cu. ft.} - [((60°F + 460)/72°F + 460))(2.030\text{ cu. ft.})]}{[((60°F + 460)/(72°F + 460))(2.030\text{ cu. ft.})]} \times 100 = \%\ \text{Error}$$

$$\frac{2 - [(520/532)(2.030)]}{[(520/532)(2.030)]} \times 100 = \%\ \text{Error}$$

$$\frac{2 - 1.984}{1.984} \times 100 = \underline{0.81\%\ \text{(overregistration)}}$$

3.9. While making proof tests with check rate caps, observe pressure differential gauge for excessive fluctuations which could indicate more than normal friction in the meter. If at any time during the check run the differential pressure gauge indication exceeds .5 inch, reject the meter for exceeding manufacturer's differential working pressure.

4. Amount of test run.

4.1. Proving circles: Meters with a 1 cu. ft. proving circle shall be tested on a Bell prover for 2 cu. ft. Meters with a 2 cu. ft. proving circle are tested for 2 cu. ft. or even multiples of 2 cu. ft. which result in a complete circle of the proving hand to the original starting point. Larger meters with 5 or 10 cu. ft. proving circles are tested at multiples of 5 or 10 cu. ft.

5. Meter sealing. **S.2.2 [3.33]**

5.1. Sealing should be done with a corrosion resistant type of wire and in such a manner as to prevent removal of index cover or adjustment cover without breaking seal.

5.2. Inlet and outlet ports of meter should be plugged to prevent entry of dirt and insects during transportation or storage.

6. Hydrocarbon vapor meter invoices. **UR.2.2 [3.33]**

The invoice shall clearly and separately show the following:

(a) The opening and closing meter readings and the dates of those readings.

(b) The altitude correction factor (from Table 2, 11 inch WC for propane). **UR.2.3 [3.33]**

(c) The total cubic meters (cubic feet) billed, corrected for elevation.

(d) The charge per cubic meter (cubic foot) after correction for elevation.

(e) All periodic charges independent of the measured gas, such as meter charges, meter reading fees, service charges or a minimum charge for a minimum number of cubic meters (cubic feet).

(f) The total charge for the billing period.

NOTE:

(a) If the vapor meter is temperature compensated, the invoice must also reflect that the volume has been adjusted to the volume at 60°F.

(b) Meters operating higher than 1 psi uses a multiplier instead of altitude correction factor, since the altitude correction factor is already incorporated in the volume multiplier. **UR.2.3. [3.33]**

COMPRESSED NATURAL GAS (CNG) MOTOR FUEL DISPENSERS

This Examination Procedures Outline (EPO) for CNG dispensers is divided into two categories. Inspection and test items are common in both categories as listed below.

32-A. Basic Dispensers
32-B. Remote Consoles (Key and Codelock, Card Reader Devices, and Receipt and Ticket Printers)

SAFETY NOTE: The inspector is reminded of the importance of evaluating potential safety hazards involved when working with flammable compressed gases. It is imperative that the inspector read and be familiar with the introductory section on Safety at the beginning of this EPO and other safety notes and policies listed elsewhere in this guideline.

BASIC DISPENSERS

Introduction

Except for fleet sales and other contract sales, a CNG dispenser used to fuel vehicles shall indicate the quantity, the unit price, and the total price of each delivery. (Added 1994) **S.1.2 [3.37]**

During the inspection and test of the dispenser, the mass measured for each transaction shall be displayed continuously either externally, through an accessible internal display, or display the quantity in mass units by using controls on the device. **S.1.2 [3.37]**

Pre-Test Inspection

1. Identification. **S.5 [3.37]; G.S.1, G-UR.2.1.1 [1.10]**

   1.1. Pattern approval mark (i.e., type approval number).

   1.2. Manufacturer's or distributor's name or trademark.

   1.3. Model designation or product name.

   1.4. Non-repetitive serial number.

   1.5. Accuracy class for CNG motor fuel dispensers is 2.0. (Nonretroactive as of January 1, 1995.)

   1.6. Maximum and minimum flow rates in pounds per unit of time.

   1.7. Maximum working pressure.

1.8. Applicable temperature range if other than -50°F to 120°F (-10°C to 50°C).

1.9. Minimum measured quantity.

1.10. Product limitations, if applicable.

2. Type approval. **B&P 12500.5**

3. Indicating elements.

3.1. Readability (must be clear and easily read). **G-S.5.1 [1.10]; S.1.1 [3.37]**

3.2. Return to zero (readily returnable to definite zero). **S.2.1 [3.37]**

3.3. Unit price (must be displayed on each face of a device of the computing type). **S.2.5.1 [3.37]; S.1.2 [3.37]**

3.4. Product identity (must be displayed on each side of the dispenser). **S.2.5.2 [3.37]**

3.5. The maximum value of the mass division shall not exceed 0.001 lb or 0.001 kg. The division for gasoline gallon equivalent (GGE) shall not exceed 0.001 GGE. The division for gasoline liter equivalent (GLE) shall not exceed 0.01 GLE. **S.1.3.3(b) [3.37]**

3.6. Indications shall be available to complete trans-action in event of power loss. **S.2.4.1 [3.37]**

3.7. Selection of unit price shall be made prior to delivery and shall not permit change until after delivery has been completed. Nonretroactive as of January 1, 1998. **S.2.5.3 [3.37]**

3.8 Dispenser shall have a non-resettable totalizer. Nonretroactive as of January 1, 1998. **S.7 [3.37]**

4. Measuring element.

4.1. Directional flow valves shall be automatic in operation. **S.4.3 [3.37]**

5. Inspect equipment for leaks, exposed wiring, etc. If it appears unsafe, **DO NOT TEST**. Report conditions to operator and responsible authority (supervisor, fire marshal, EPA representative, etc.).

6. Discharge line.

6.1. Delivery hose with automatic vent back valve shall automatically pressurize before registration of a delivery. **S.3.7 [3.37]**

6.2. Measured vapor, with the exception of 6.3. below, shall not be diverted from a single discharge line during delivery. **S.4.1 [3.37]**

6.3. Two outlets may be operated at one time usually to fuel large commercial vehicles (trucks, buses, etc.) provided measures are taken to prevent fraud or deception. **S.4.1 [3.37]**

7. Automatic temperature compensation. Volume-measuring devices with automatic temperature compensation used to measure natural gas as a motor vehicle engine fuel shall be equipped with an automatic means to determine and correct for changes in product density, both for the temperature and composition of the product. **S.3.6(b) [3.37]**

8. Marking Required: 1 gasoline gallon equivalent (GGE) = 5.660 lb. of natural gas; or 1 gasoline liter equivalent (GLE) = 0.678 kg of natural gas. **S.5.1 [3.37]**

Pre-Test Determinations

1. Determine availability of electric power if applicable for scale.

2. Inspect test area for sources of ignition. **SAFETY FIRST.**

3. Weather Conditions - If windy or raining, the scale will have to be protected from these environmental factors. If necessary, the test tank will have to be carried from the pump site to sheltered area for weighing.

4. Scale used for testing (checkweigh scale).

   4.1. Scale capacity must be large enough to weigh test tank when it is full of product.

   4.2. The value of the scale division should not exceed 1/10 of the smallest tolerance applied to the device.

   4.3. Test Weights - Enough to verify scale's accuracy throughout its range. Use class "F" weights and apply error weight corrections.

   4.4. Supports - Wedges or similar instruments to secure the receiving vessel on the scale platform.

   4.5. Scale shall be leveled and free of obstruction prior to testing.

5. Test drafts (recommended minimums).

   5.1. Normal Test.

   The recommended minimum test draft shall be the greater of;

   (a) the quantity delivered at 40% of the maximum flow rate of the installation in one minute, or

   (b) 5 pounds, and

   in no case less than 300 times the minimum division of the checkweigh scale.

5.2. Special Test.

The recommended minimum test draft shall be the greater of;

(a) the quantity delivered at the minimum flow rate of the installation in two minutes, or

(b) 5 pounds, and

in no case less than 300 times the minimum division of the checkweigh scale.

6. Tolerances.

6.1. Normal and special tests. **T.2 [3.37]**

(a) Acceptance tolerance +/- 1.5%.
(b) Maintenance tolerance +/- 2.0%.

6.2. Repeatability. **T.3 [3.37]**

When multiple tests are conducted at approximately the same flow rate, the range of test results shall not exceed 40% of the applicable tolerance. **T.3 [3.37]**

<u>Test</u>

1. Test runs.

1.1. Record the weight of the empty test tank.

1.2. Connect nozzle to test tank. Open manual valve (if equipped).

1.2.1. Turn dispenser on; observe the computer "jump". If this condition exists, shut dispenser off. Take appropriate enforcement action. The dispenser shall automatically show its initial zero condition. **G-S.2 [1.10]**

1.2.2. For auto-vent hose type, hold nozzle in hand and turn on dispenser, observe computer "jump". Take appropriate action. The dispenser shall show its initial zero condition. If there is no "jump", then connect hose to test tank. **G-S.2 [1.10]**

1.3. Turn nozzle to "on" position and turn on dispenser. Dispense appropriate amount, but not less than minimum test draft. If delivery pressure exceeds the pressure safety limits, manually shut off the dispenser and nozzle.

1.3.1. After delivery, turn nozzle to the "off" position, then "vent" positions and remove the nozzle. Turn off dispenser and hang up the nozzle.

1.3.2. For auto-vent hose type, simply turn dispenser "off" and disconnect hose.

1.4. Record the checkweigh scale indication, dispenser indication, and any recorded representation that is involved in a transaction.

1.5. Check indications and computations on both sides of the dispenser for accuracy and agreement if so equipped. **G-S.5.2 [1.10]**

1.6. Calculate the error of the dispenser. Subtract the mass value indicated by the dispenser from the scale indication. Divide the difference by the scale indication and multiply by 100. The result is the percent error of the meter.

1.7. Conversion factors: **S.5.1 [3.37]**

1 Gasoline Gallon Equivalent (GGE)	=	5.660 lb of natural gas
1 Gasoline Liter Equivalent (GLE)	=	0.678 kg of natural gas

To verify that the correct conversion factor has been programmed into the dispenser, divide the mass value indicated by the dispenser by the GGE or GLE conversion factor. The calculated value must agree with the volume indicated by the dispenser. Volume calculations that have more places to the right of the decimal point than the dispenser display must be rounded to the nearest dispenser indication (if that number is 5 followed by zeros, then the dispenser volume is allowed to round up or down).

Example: Indicated Volume = 1.828 gal
Indicated Mass = 10.344 lb
Calculated Volume = 10.344 lb ÷ 5.660 lb/gal = 1.827561837 gal (rounded to 1.828 gal)

1.8. Apply applicable tolerance. **T.2 [3.37]**

1.9. Return of Product to storage. **UR.3.8. [3.37]**

Provisions at the site shall be made for returning product to storage or disposing of the product in a safe and timely manner during or following testing operations. Such provisions may include return lines, or cylinders adequate in size and number to permit this procedure.

SAFETY NOTE: Make sure the test equipment is grounded and there is adequate ventilation around power operated equipment. Check station supply tank delivery pressure to determine if test tank will be suitable for testing. Check EPA restrictions, they may or may not allow product to be vented to atmosphere. If allowed, a riser will be necessary to vent to atmosphere. **SAFETY FIRST**; take extreme caution when venting. Be aware of possible sources of ignition; otherwise, a compressor station with vapor recovery capability will be required.

2. Interlock test.

   2.1. Remove nozzle from hanging position.

   2.2. Reset computer to zero and turn dispenser "on."

   2.3. Attempt to return the nozzle to its designed hanging position without engaging interlock or turning off the dispenser. **S.3.8(b) [3.37]**

   2.4. After placing nozzle in its designed hanging position, carefully remove it again and connect nozzle to the test tank and open the test tank valve. Attempt to dispense product by turning the nozzle toward the "on" position. **S.3.8(a) [3.37]**

   2.5. If product flows without resetting the indications to zero, the interlock assembly is not functioning properly.

3. Low-flow cut-off valve.

   3.1. Connect nozzle to empty test tank and dispense product. Throttle down the valve on the test tank (not the nozzle) to the minimum flow that can be obtained on the installation and time the flow rate. If flow is less than the minimum rate on the identification plate, then dispenser is unsatisfactory. **UR.2.3(a)(b) [3.37]**

CNG REMOTE CONSOLES

KEY/CODELOCK, CARD ACCEPTOR DEVICES, RECEIPT/TICKET PRINTERS

In the following procedure, the terms readout device or readout values are used to identify the remote indicator on a remote console, key/codelock or card acceptor systems, including debit systems and cash value cards.

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**
    1.1. Manufacturer's or distributor's name or trademark.
    1.2. Model number (on identification plate attached to an exterior surface of the console/printer).
    1.3. Non-repetitive serial number.
2. Type approval. **B&P 12500.5**
3. Indicating elements.
    3.1. Readability (must be clear and easily read). **G-S.5.1 [1.10]**
    3.2. Return to zero (readily returnable to definite zero). **S.2.1 [3.37]**
4. Digital indications.
    4.1. All digital indications shall agree. **G-S.5.2.2(a) [1.10]**
    4.2. All mathematical computations shall agree.

Tests

1. Remote system.
    1.1. Dispense product as outlined in the "Basic Dispenser" test.
    1.2. Compare all indications and tickets for digital and mathematical agreement. **G-S.5 [1.10]**

2. Test for pre-pay remote consoles.

    2.1. Calculate the proper price extension for a pre-determined draft and have operator to pre-set console for test draft amount. The total sale and price unit shall be in mathematical computation agreement with the quantity measurement. **G-S.5.5 [1.10]**; **G-S.5.2 [1.10]**

    2.2. Have operator pre-set the console for a given price. After product is dispensed, calculate the price per unit and the quantity measurement. The quantity and price per unit shall be in mathematical agreement with the total sale. **G-S.5.5 [1.10]**; **G-S.5.2 [1.10]**

3. Test for key/codelock and card systems.

    3.1. In most cases, only one readout will be available for routine test in these systems. This will be the one actuated by the owner/operator master key/code or card. Using this key/code or card, conduct the test, as outlined in this EPO section. If this readout passes test, accept the entire system. **G-UR.4.4 [1.10]**; **G-S.5.2 [1.10]**

4. Receipt/ticket printer. (Computing type only)

    4.1. Printed receipt/ticket must have the unit price, quantity delivered, and the total price. **G-S.5.5 [1.10]; G-S.5.6 [1.10]**

    4.2. Printed total price of sale must agree with the indicated total price. **G-S.5.2.2 [1.10]**

    4.3. All digital representations of like values must agree. **G-S.5.2.2 [1.10]**

    4.4. Printed quantity delivered must be to at least three decimal places for the gasoline gallon equivalent (GGE) and to at least two decimal places for the gasoline liter equivalent (GLE) (e.g., 15.125 GGE, 57.25 GLE).

DOMESTIC COLD WATER METERS

Pre-Test Inspection

1. Identification.

   1.1. Manufacturer's or distributor's name, model and serial number. **G-S.1 [1.10]**

   1.2. Verify that devices submitted for test are intended for legally submetered locations. Please review **EPO REF-T Part 1** and utilize the Laboratory or field checklist for submeter pre-test information. If it is not a legal installation do not test the meters.

2. Type approval. **B&P 12500.5**

3. Indicating and recording elements.

   3.1. Shall indicate and record if equipped to record in terms of liters, gallons, cubic feet or binary, or decimal subdivisions thereof. **S.1.1.2 [3.36]**

   3.2. Value of smallest unit. **S.1.1.3 [3.36]**

      3.2.1. 10 gallons.

   3.3. Advancement of indicating and recording elements. **S.1.1.4 [3.36]**

      3.3.1. Shall be only by the mechanical operation of the meter.

Pre-Test Determinations

1. Test equipment. Components must be adequate for precise control of the flow rate.

2. Condition of meter. Test meters removed from service as soon as possible to minimize formation of deposits in the measuring chamber.

3. Inlet PSI and temperature of the test liquid. Tests should not be performed at less than 30 static PSI. Test water should not exceed 80°F.

4. Prover size. Test drafts are determined by the meter size in Table N.4.1. or Table N.4.2. The draft shall be at least equal to one minute's maximum flow rate.
   Table N.4.1. and N.4.2. [3.36]; N.3 [3.36]

   NOTE: If adequate provers are not available, use the Gravimetric Testing of Liquid Meters method outlined in EPO REF-P. Any receiving vessel may be used as long as its capacity accommodates the required drafts.

Table N.4.1. Flow Rate and Draft Size for Water Meters Normal Tests			
Meter Size (inches)	Rate of Flow (gal/min)	Maximum Rate Meter Indication/Test Draft	
		gal	ft^3
Less than 5/8	8	50	5
5/8	15	50	5
3/4	25	50	5
1	40	100	10
1 1/2	80	300	40
2	120	500	40
3	250	500	50
4	350	1 000	100
6	700	1 000	100

Table N.4.2. Flow Rate and Draft Size for Water Meters Special Tests						
Meter Size (inches)	Intermediate Rate			Minimum Rate		
	Rate of Flow (gal/min)	Meter Indication/ Test Draft		Rate of flow (gal/min)	Meter Indication/ Test Draft	
		gal	ft^3		gal	ft^3
Less than or equal to 5/8	2	10	1	1/4	5	1
3/4	3	10	1	1/2	5	1
1	4	10	1	3/4	5	1
1 1/2	8	50	5	1 1/2	10	1
2	15	50	5	2	10	1
3	20	50	5	4	10	1
4	40	100	10	7	50	5
6	60	100	10	12	50	5

5. Tolerances. Refer to Table T.1 for accuracy limits. **Table T.1 [3.36]**

Table T.1. Accuracy Classes and Tolerances for Water Meters

Accuracy Class	Application		Acceptance Tolerance	Maintenance Tolerance	Tolerance for Special Tests Conducted at the Minimum Flow Rate
1.5	Water, Other than Multi-Jet Water Meters	Overregistration	1.5%	1.5%	1.5%
		Underregistration	1.5%	1.5%	5.0%
1.5	Water, Multi-Jet Water Meters	Overregistration	1.5%	1.5%	3.0%
		Underregistration	1.5%	1.5%	3.0%

6. Meter placement. Meters may be tested in vertical positions or tilted no more than five degrees from horizontal unless the meters are marked to indicate that they must be installed horizontally and level. However, meters approved and intended for installation in unrestricted orientations may be tested in any manner consistent with the manufacturer's mounting instructions. **G-S.2 [1.10]; G-S.3 [1.10]**

   NOTE: When testing meters in the vertical position, care must be taken to start and end the test with each meter's most sensitive pointer in an upswing position. When testing cubic foot meters with gallon gage type provers, a 50-gallon test is usually not valid because both readings cannot be made with the dial hand on the upswing (6.684 cubic feet).

Tests

1. Wet test measure.

    1.1. For 10-gallon test measure or smaller, unless equipped with discharge valve, allow to drain 10 seconds after main flow ceases. **NIST Handbook 105-3**

    1.3. For test measures equipped with a discharge valve, allow to drain 30 seconds after main flow ceases. **NIST Handbook 105-3**

NOTE: Initially flow a minimum of 10 cubic feet (74.805 gallons) of water through the meters under test to remove any air that may be trapped in the meters before conducting official tests.

2. Test drafts.

    2.1 Normal tests shall be made at the maximum flow rate allowed shown in Table N.4.1. **N.4.1. [3.36]**

    2.2. Special tests may be made at the flow rates given in Table N.4.2. **N.4.1. [3.36]**

    2.3. Repeatability. When multiple tests are conducted at approximately the same flow rate, the range of the test results shall not exceed 0.6 % for tests performed at the normal and intermediate flow rates, and 1.3 % for tests performed at the minimum flow rate, and each test shall be within the applicable tolerance. **T.1.1. [3.36]**

3. Test procedure.

    3.1. Secure meter(s) in the test unit. When testing multi-jet meters, maintain a distance between meters at least equal to 5 diameters of the inlet bore of the meter.

    3.2. Open outlet valve between test unit and prover.

    3.3. Gradually open the water supply valve to the test unit and fill prover.

    3.4. Close outlet valve and drain prover. (Use the following procedure for provers equipped with discharge valves.)

        3.4.1. Open discharge valve of prover.

        3.4.2. Allow to drain 30 seconds after main flow ceases.

        3.4.3. Close discharge valve of prover.

3.5. Record meter reading(s). See NOTE under Pre-Test Determination #6.

3.5. If test unit is equipped with bleeder valves, the meter(s) test indicator may be set to a reference mark.

3.7. Open outlet valve rapidly (but not instantly) to the desired rate.

3.8. When using a graduated narrow neck prover fill the prover to a point near the required test quantity needed for the test and close the outlet valve in one deliberate motion.

If you are using a galvanized Ford 1 or 10 cubic foot prover the test must be stopped exactly at the nominal value (i.e., 100 gallons or 10 cubic feet etc.). Ford wide neck provers are not linear and are only certified at the following values:

1 cubic foot prover – 5 gallons, 10 gallons, and 1 cubic foot
10 cubic foot prover – 50 gallons, 100 gallons, and 10 cubic feet

3.9 Record prover reading and meter reading(s), then apply tolerances from Table T.1.

Difference between meter readings at the end and beginning of a test draft is “metered quantity”.

$$\frac{\text{Metered Quantity - Prover Reading}}{\text{Prover Reading}} \times 100 = \text{Meter Percent Error in Registration}$$

Underregistration calculation example:

$$\frac{1.015 - 1.045}{1.045} \times 100 = -2.87\%$$

Overregistration calculation example:

$$\frac{1.015 - 0.985}{0.985} \times 100 = 3.05\%$$

4. Printer and remote display operation. If system is equipped with a printer or additional displays, check during tests to determine printer readability and agreement with meter indicator readings. **G-S.5.6 [1.10], G-S.5.2.2 [1.10]**

5. Meter removal. When tests are completed, use the following procedures for removal of meter(s) from test unit.

5.1 Close inlet valve first.

5.2 Open the outlet valve to release line pressure.

5.3 Remove meter(s).

WATER METER TEST REPORT

1 Cubic Foot	=	7.48052 Gallons	DATE	:____________________
1 Gallon	=	0.1337 Cubic Feet	INSPECTOR	:____________________
10 Gallons	=	1.337 Cubic Feet	PARK OWNER:	____________________
15 Gallons	=	2.005 Cubic Feet	METER MFG	:____________________
50 Gallons	=	6.684 Cubic Feet		

CPM = Cu. Ft./Min. x 7.48052

METER SERIAL	TYPE	GAL --------------------- CU. FT.	END READING ST. READING DIFFERENCE	GPM	PERCENT ERROR	REMARKS	O/O
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				
		GAL. --------------------- CU. FT.	ST.				

Note: An excel spreadsheet may be available from the Sacramento LMD Laboratory.

BATCH PLANT WATER METERS

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

    1.1. Manufacturer's or distributor's name, model and serial number.

2. Type approval. **B&P 12500.5**

3. Indicating and recording elements.

    3.1. Shall indicate and record in terms of gallons, liters or decimal subdivisions thereof. **S.1.1.2 [3.36]**

    3.2. Value of smallest unit. **S.1.1.3 [3.36]**

        3.2.1. 1/10 gallon for meters delivering less than 100 gpm.

        3.2.2. 1 gallon for meters delivering 100 gpm or more.

    3.3. Advancement of indicating and recording elements. **S.1.1.4 [3.36]**

    3.4. Return to zero. A meter shall be designed so indications may be readily returned to a definite zero. Means shall be provided to prevent returning beyond zero. **S.1.1.5 [3.36]**

4. Design of measuring elements.

    4.1. Air elimination. System shall be equipped with effective means to prevent the passage of air through the meter. **S.2.2.1 [3.36]**

5. Installation requirements.

    5.1. A filter or strainer shall be provided upstream of the meter if it is determined that the water contains excessive amounts of foreign material (batch plant only). **UR.1.1 [3.36]**

    5.2. Siphon breaker. An automatic siphon breaker or other effective means shall be installed in the discharge piping at the highest point of outlet (but in no case below top of the meter). **UR.1.2 [3.36]**

Pre-Test Determinations

1. Determine if there are acceptable provisions for testing the meter. **UR.1.3 [3.36]**

2. Prover size. Test drafts are to be determined by the meter size in Table 1. The draft shall be at least equal to one minute's maximum flow rate. **N.3 [3.36]**; **EPO NO. 33-A-3; Table 1 [3.36]**

3. Tolerances. Refer to Table 1 for flow rates and accuracy limits. **T.1 [3.36]**

Tests

1. Wet test measure.

   1.1. For 10-gallon test measure or smaller, unless equipped with a discharge valve, allow to drain 10 seconds after main flow ceases. **NIST Handbook 105-3**

   1.4. For test measures equipped with a discharge valve, allow to drain 30 seconds after main flow ceases. **NIST Handbook 105-3**

2. Normal test - at maximum rate permitted by the installation. **N.4.1 [3.36]**

   Meters with maximum gpm ratings higher than Table 1 values may be tested up to the meter rating.

3. Special test.

   3.1. Tests may be conducted according to the rates and quantities shown in Table 1. **N.4.2 [3.36]**

4. Printer operation. If system is equipped with a printer, check during tests to determine printer readability and agreement with meter indicator readings. **G-S.5.6 [1.10]**; **G-S.5.2.2 [1.10]**

FARM MILK TANKS

The basic inspection frequency for Farm Milk Tanks (Section 4070) provides for an initial volumetric test to full capacity and subsequent annual visual inspections. **4070 CCR Table 1**

All tanks, exceeding 1,000 gallon capacity, newly installed or relocated shall be calibrated at the farm before the acceptance test is performed. **4002.7 [4.42], (a.) Page D4-10**

This EPO includes two standard methods for volumetric testing (water in and water out) and a procedure for visual inspection.

Pre-Test Inspection

1. Identification.

   1.1. Manufacturer's or distributor's name or trademark, model number and serial number. **G-S.1 [1.10]**

   1.2. A tank and any gage rod or surface gage and associated volume chart shall have common serial numbers. **S.6 [4.42]**

   1.3. Capacity shall be permanently marked on a surface visible after installation. (Nonretroactive as of 1979.) **S.2.4 [4.42]**

2. Type approval.

   2.1. Type approval is not required for farm milk tanks prior to sale and installation. Each tank installation is to be evaluated for compliance with applicable requirements of the California Code of Regulations. (Acceptance test.) **Definitions (acceptance test)**

   Inspection Checklist (EPO NO. 34-7) can be used to determine compliance with code requirements prior to performing volumetric tests.

3. Tank construction and installation.

   3.1. Level. The tank shall be so constructed that it will maintain its condition of level under all normal conditions of lading. **S.2.1 [4.42]**

   3.2. Level indicating means. A tank with a nominal capacity of 500 gallons or greater shall have two (2) level indicating means in opposite positions on the tank. A level, level lugs, or support and reference index for a plumb bob shall be permanently attached. **S.2.2.1 [4.42]**

   3.3. Installation. A milk tank shall be rigidly installed in level without the use of removable blocks or shims under the legs. If such tank is not mounted permanently in position, the correct position on the floor for each leg shall be clearly and permanently defined. **UR.1 [4.42]**

4. Indicating elements.

4.1. Gage rod. A tank with a gage rod shall have a substantial and rigid bracket or support for positioning the rod. A rod properly positioned and released shall automatically seat itself. When seated, there shall be a minimum clearance of three (3) inches between the graduated rod face and any tank wall or other surface that it faces. It shall be graduated from capacity down to 5% of capacity or 500 gallons, whichever is less. **S.3.1 [4.42]**; **S.3.2 [4.42]**

4.2. Surface gage. Bracket or support requirements are the same as for a gage rod. The gage assembly indicator, if not permanently mounted on the tank, shall automatically seat itself in a correct operating position and the graduated element shall be securely held in a vertical position at any height to which it may be set. **S.3.4 [4.42]; S.3.5 [4.42]**

4.3. Column gage tube. The graduations for a column gage tube shall be on a metal plate located adjacent to the transparent tube and the plate shall be permanently attached to the milk tank. A reading indicator shall also be provided to align the liquid level with a graduation mark or line. **S.3.6 [4.42]**

4.3.1. The gage tube shall be borosilicate glass or approved rigid plastic or rigidly supported flexible tubing with a uniform internal diameter not less than 3/4 inch. **S.3.6.2 [4.42]**

4.3.2. External gage tubes shall be adequately vented and not be adversely affected by attachments. **S.3.6.5 [4.42]**

4.4. Column gage tube required on all new tanks exceeding 2,000 gallons capacity. **S.3.8 [4.42]**

4.5. Gage graduations. A gage associated with only one (1) tank may read directly in gallons. Otherwise, graduations in inches or a numerical series shall be associated with a volume chart with values in gallons corresponding to the gage graduations. Center to center spacing of graduations shall be not more than 1/16 inch and not less than 1/32 inch. There shall be a clear interval between graduations of not less than 1/64 inch. **S.3.7.1 [4.42]**; **S.3.7.2 [4.42]**

4.5.1. Value of gage or column gage glass plate graduated intervals. **S.3.7.3 [4.42]**

Value Shall Not Exceed		Tank Capacity (Gallons)
1/2 gallon	for	250 or less
1 gallon	for	251 to 500
1-1/2 gallon	for	501 to 1,500
2 gallons	for	1,501 to 2,500

Add 1 gallon for each 2,500 gallons or fraction thereof of nominal capacity above 2,500 gallons. **S.4 [4.42]**

4.6. Minimum volume chart values.

Value at Least to Nearest		Tank Capacity (Gallons)
1/4 gallon	For	250 or less
1/2 gallon	For	251 to 500
1 gallon	For	Greater than 500 gallons

Pre-Test Determinations

1. Tolerance values.

   1.1. Minimum tolerance. On a particular tank, the maintenance and acceptance tolerance applied shall be not smaller than the volume corresponding to the graduated interval at the point of test draft on the indicating means or 1/2 gallon, or 2 L, whichever is greater. **T.2 [4.42]**

   1.2. Maintenance and acceptance tolerance (prover method). The tolerance shall be 0.2% of the volume of test liquid in the tank at each test draft. **T.3 [4.42]**

   1.3. Maintenance and acceptance tolerances for master meter method shall be 0.4% of the volume of the test liquid in the tank at each test draft. **T.4 [4.42]**

Tests

1. Gravity-in or pump-in method.

   1.1. Spray tank with water and allow to drain for 30 seconds after the main drainage flow has ceased. **N.1 [4.42]**; **N.3 [4.42]**

   1.2. Position testing equipment so that complete delivery is ensured.

   1.3. If so equipped, clean gage rod thoroughly with a thick paste of non-detergent powdered cleanser, rinse with clean water, and dry with a clean paper towel.

   1.4. With the use of a closely woven cloth sack (handkerchief, etc.), dust gage rod with a light film of powered cleanser. Making sure water is absolutely still, place rod in proper position for reading without disturbing the surface of the liquid.

   1.5. Remove gage rod with care and observe reading. The line caused by water level must be straight and parallel to the graduations. To ensure a true reading, wash and re-dust rod thoroughly prior to each reading.

   1.6. If tank is equipped with a column gage glass, readings are to be taken at the top of the center of the meniscus. **N.6 [4.42]**

1.7. Observe and record reading at each draft to the nominal capacity of the tank. Convert readings to gallons or liters by use of chart and apply tolerances.

1.8. As described in visual inspection outline (step 3 below). Scribe outside of the tank. **S.2.2.1 [4.42]**; **EPO NO. 34-4, 3.1.1**

1.9. Place an official paper seal on the chart in a location which will not obscure any required information. **B&P 12505**

2. Pump-out method.

2.1. Fill milk tank to capacity with water. **N.1 [4.42]**

2.2. Before first reading, prime pumping system to eliminate all air.

2.3. If so equipped, clean gage rod thoroughly as in Step 1.3. Take readings as in Steps 1.4., 1.5. and 1.6.

2.4. Observe reading at each draft. Convert to gallons or liters by use of chart and record on test form. Follow this procedure until the tank is nearly emptied, <u>being careful to prevent air entering the pumping system</u>.

2.5. Close tank discharge valve and disconnect pumping unit. (Water contained in pumping system is not included in tank's capacity.)

2.6. Drain and measure liquid remaining in tank.

2.7. Record final result and calculate each draft. Apply tolerances. **T.3 [4.42]**

2.8. As described in visual inspection outline (step 3 below). Scribe outside of the tank. **S.2.2.1 [4.42]**; **EPO NO. 34-4, 3.1.1**

2.9. Place an official paper seal on the chart in a location which will not obscure any required information. **B&P 12505**

3. Visual inspection. **B&P 12505**

3.1. Check level condition. **UR.2.1 [4.42]**

3.1.1. For the purpose of this inspection it is necessary to have a sensitive level, at least three (3) feet long, a plumb bob (if tanks are so equipped) or a flexible tube liquid level indicator. If a flexible tube liquid level is used, scribe marks should have been placed on the outside of the tank at the time of volumetric testing in four (4) opposite positions. If a level only is used to scribe the marks, there should be two (2) marks at least one (1) foot apart at each of four (4) opposite places on tank. **S.2.2.1 [4.42]**

3.2. Check condition of volume chart. It shall be protected and easily readable. **S.4.1 [4.42]**

3.3. Check tank, chart and gage rod or surface gage for common serial number. **S.6 [4.42]**

3.4. Check position of legs on floor. **UR.1 [4.42]**

3.5. Make out a "Certificate of Inspection" and leave a copy at the dairy. Note any corrections to be made on the certificate. If a volumetric test is found to be necessary, note that it will be done in the near future. Mark the certificate "Visual Inspection".

3.6. Paper Seal. If there is a place on the chart which will not cover up vital readings, and the visual inspection revealed no errors which would necessitate a volumetric test, place a paper seal marked "Visual Inspection" with the date of inspection in a separate place from the paper seal which denoted the last volumetric test.

FARM MILK TANK INSPECTION CHECKLIST

Owner ______ Address ______

Manufacturer ______ Address ______

Model ______ Capacity ______ Serial # ______ Graduations ____1/32"
____1/16"

Maximum Value
of Graduation _______ Gage Rod ______ Column Gage Glass _____ Surface Gage

G-S.l [1.10]	Identification - manufacturer, model, serial number
G-S.2 [1.10]	Facilitation of Fraud
G-S.3 [1.10]	Permanence of Components
G-S.4 [1.10]	Interchange of Components
G-S.5 [1.10]	Indications - appropriate, adequate, easily read
G-S.5.2.3 [1.10]	Uniform Graduations
G-S.5.2.4 [1.10]	Values of Graduations Defined
G-S.5.2.5 [1.10]	Permanence of Graduations
G-UR.2.1 [1.10]	Installed Properly
S.l [4.42]	Components - tank, gage, chart
S.2.1 [4.42]	Level - design and construction to maintain
S.2.2 [4.42]	Level - indicating means
S.3.2 [4.42]	Gage Rod Bracket - automatic position, 3 inch clearance between graduated face and tank wall.
S.3.3 [4.42]	Gage Rod - graduated from 5% of capacity or 500 gallons, whichever is less
S.3.6.1 [4.42]	Column Gage Glass - equipped with indicator (sliding mechanism)
S.3.6.3 [4.42]	Column Gage Glass - scale plate to be within 1/4 inch
S.3.6.5. [4.42]	Column Gage Glass – vented at top, open to atmosphere
S.3.7.1 [4.42]	Graduations - centers 1/32 inch to 1/16 inch, at least 1/64 inch apart
S.3.7.2 [4.42]	Values of Graduations - read directly or from chart
S.3.7.3 [4.42]	Value of Graduated Interval - 1/2 gallon for capacity of 250 gallons or less, 1 gallon from 251 to 500, 1-1/2 gallons from 501 to 1,500, 2 gallons from 1,501 to 2,500, and add 1 gallon for each 2,500 gallons or fraction thereof above 2,500 gallons.
S.4.1 [4.42]	Design of Volume Chart - values as required, protected
S.6 [4.42]	Identification - chart, tank, gage rod (common serial number)
UR.l [4.42]	Installation - rigid, level

Inspector ______ Title ______

FABRIC MEASURING DEVICES

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

   1.1. Manufacturer's or distributor's name or trademark, model number and serial number.

2. Type approval. **B&P 12500.5**

3. Indicating elements.

   3.1. Units. A fabric measuring device shall indicate lengths or 10 cm (1/8 yd), 25 cm (1/4 yd), 50 cm (1/2 yd), and meters (yd). Additional lengths may be any or all of the following: 30 cm (1/3 yd), 6 cm (1/16 yd), meters and centimeters (feet and inches). Digital indicators may indicate values in decimal fractions. **S.1 [5.50]**

   3.2. Money value computations (if so equipped). **S.2.3 [5.50]**

   3.3. Return to zero. Primary indications shall be readily returnable to a definite zero with means to prevent a return beyond a correct zero position. **S.2.4 [5.50]**

4. Marking requirements. Fabric measuring limitations shall be marked on the device. **S.3 [5.50]**

Pre-Test Determinations

1. Testing medium. (Shall have been certified for accuracy by DMS.)

   1.1. Suitable tape approximately 3 inch wide with graduated length of at least 12 yards. **N.1 [5.50]**

2. Return to zero. Primary indicating elements shall be returnable to zero and prevented from being returned beyond zero. **S.2.4 [5.50]**

3. Tolerances. The following table lists maintenance and acceptance tolerances for fabric measuring devices. (Tolerance figures are in inches.) **T.1 [5.50]**

Device Indication Yards	Maintenance Tolerance		Acceptance Tolerance	
	Underregistration	Overregistration	Underregistration	Overregistration
2 or less	3/8	1/4	14	1/8
3	3/8	5/16	1/4	5/32
4	1/2	5/16	1/4	5/32
5	5/8	3/8	5/16	3/16
6	3/4	3/8	3/8	3/16
7 & 8	1	1/2	1/2	1/4
9	1-1/4	5/8	5/8	5/16
10 & 11	1-1/2	3/4	3/4	3/8
12 & 13	1-3/4	7/8	7/8	7/16
14 & 15	2	1	1	1/2
Over 15	Add 1/8 inch per indicated yard	Add 1/16	Add 1/16	Add 1/32

Tests

1. Insert the testing tape carefully (do not cut) and advance this to the point where a precise tape reading of zero is obtained. Do not allow tape to wander while passing through. Check tension on roller to see that no slippage will occur.

2. Clear the device to produce a zero indication. **UR.2.2 [5.50]**

3. Advance the tape until the indicator of the device is in coincidence with the first graduation. Read the error from the tape and determine whether the error is within the applicable tolerance. **T.1 [5.50]**

4. Advance the tape until the indicator is in coincidence with the 1/2 yard graduation. Read the error from the tape and determine whether the error is within the applicable tolerance. **S.4 [5.50]**

5. Advance the tape several inches and then reestablish coincidence of the indicator and the 1/2 yard graduation, moving the tape in a backward direction. The difference between the tape readings on Steps 4 and 5 is the backlash error. Rejection of the device is proper if the actual error developed on the backward observation exceeds the applicable tolerance. **S.4 [5.50]**

6. Continue test to include at least tests at each 1/4 yard interval up to and including one yard; thereafter, at each subsequent yard indication up to and including 12 yards.

WIRE AND CORDAGE MEASURING DEVICES

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

    1.1. Manufacturer's or distributor's name or trademark, model number and serial number.

2. Type approval. **B&P 12500.5**

3. Indicating elements. **S.1 [5.51]**

    3.1. Units. A wire or cordage-measuring device shall indicate in terms of feet, yards or meters. Minimum increment shall not exceed the equivalent of 0.1 yard or if metric, 1 decimeter.

    3.2. Return to zero. Primary indication shall be readily returnable to a definite zero indication. **S.2.3 [5.51]**

4. Marking requirements. Measuring limitations shall be clearly and permanently stated on the device. **S.4.1 [5.51]**

5. Installation. Device shall be securely supported and firmly fixed in position. **UR.1.1 [5.51]**

Pre-Test Determinations

1. Testing medium. Device shall be tested with the type of material being measured at a particular location. This material shall then be measured by a steel tape not less than 15 m (50 ft) in length that has been certified for accuracy by DMS. A steel tape may be used to test the device if device construction allows accurate measurement with the tape. **N.1 [5.51]**

2. Minimum test. Tests shall be conducted at a minimum initial interval of 5 m (20 ft) and appropriate increments up to at least 15 m (50 ft). **N.2 [5.51]**

3. Tolerances. The following table lists maintenance and acceptance tolerances for wire and cordage measuring devices. **T.1 [5.51]**; **Table 1 [5.51]**

TABLE 1

Device Indication Feet	Maintenance & Acceptance Tolerances	
	Underregistration Inches	Overregistration Inches
20	6	3
Over 20-30	8	4
Over 30-40	10	5
Over 40-50	12	6
Over 50	Add 2 inches per indicated 10 feet	Add 1 inch per indicated 10 feet

Tests

1. Start tape or testing material through machine. (If tape is used, stop at zero to line up with measuring edge on device. If material is used, mark zero point on material with suitable substance such as chalk, colored pencil, or string in line with zero point on machine.)

2. Reset device indications to zero. **UR.2.2 [5.51]**

3. Move tape or material forward 5 feet.

4. Return tape or material to zero. **S.5 [5.51]**

5. Check zero indications--(this will detect slippage or backlash in gear train). **S.5 [5.51]**

6. Reset tape or material and machine indications to zero. **UR.2.2 [5.51]**

7. Move tape or testing material forward and check at each 5 feet of machine indication up to and including at least 50 feet. If material is used, mark each 5 feet. Be guided by the tolerance table under pre-test determinations. **T.1 [5.51]**; **Table 1 [5.51]**

NOTE: If material is used in the testing, make two separate tests using the smallest and largest thicknesses or diameters marked on the device. Use the same procedure outlined above for each test. **UR.2.1 [5.51]**

ODOMETERS
(PASSENGER VEHICLES, TRUCKS AND BUSES)

This EPO for odometers includes general information and tolerances for odometers and test procedures for the Fifth-Wheel Test and the Road Test.

<u>Pre-Test Inspection</u>

1. Indicating elements. **S.1 [5.53]**

   1.1. The primary indicating elements may be any of the following: **S.1.1 [5.53]**

      1.1.1. The mileage traveled portion of the "speedometer" assembly.

      1.1.2. A special cable-driven distance indicating device.

      1.1.3. A hub odometer attached to the hub of a wheel on a motor vehicle.

   1.2. Value of minimum indication on an odometer shall be 0.1 mile or 0.1 kilometer. **S.1.3 [5.53]**

2. Inflation of tires.

   2.1. The tire pressure necessary for correct odometer registration shall be determined and so maintained that accuracy will not be affected under normal operating conditions (record tire pressures "as found"). Do not adjust tire pressures. **N.1.3.2 [5.53]**

   2.2. The correct tire pressure for that particular odometer shall be posted in the vehicle. **UR.1 [5.53]**

<u>Pre-Test Determinations</u>

1. Test standards.

   1.1. <u>Fifth-wheel</u>. Should be tested on measured mile course prior to each session or at least once a month if used frequently.

   1.2. <u>Measured course</u>. Measured course should be inspected to determine that starting and ending points or intermediate mileage marks are clearly defined.

2. Vehicle loading.

   2.1. Passenger load. During the distance test of an odometer, the vehicle may carry two persons. **N.1.3.3(a) [5.53]**

2.2. Truck cargo load. Odometers shall be tested by <u>one</u> of the following methods: **[N.1.3.3(b) [5.53**

2.2.1. The truck is loaded with one-half the maximum cargo load.

2.2.2. Unloaded, if <u>unloaded</u> test tolerances are applied.

3. Tolerances.

3.1. <u>Loaded</u> trucks. Maintenance and acceptance tolerances on odometers shall be 4.0% of the interval under test (± 422 feet on a 2 mile test run). **T.2 [5.53]**

3.2. <u>Unloaded</u> trucks. Maintenance and acceptance tolerances shall be 5% for underregistration and 3% for overregistration on the interval under test. **T.2.1 [5.53]**

FIFTH-WHEEL TEST

<u>Test</u>

1. Record starting odometer reading.

2. Attach fifth-wheel assembly to rear bumper of the vehicle. (Place wheel as close as possible to the center of the bumper in order to minimize variations from turns.) **N.1.2 [5.53]**; **N.1.2.1 [5.53]**; **N.1.3.1 [5.53]**

3. Make a tire temperature stabilizing run of at least five miles. Fifth-wheel should be in operating during this run. Odometer tests shall include at least 2 test runs of at least 2 miles in length at a speed between 30 and 45 miles per hour. Odometer is to be tested with tire pressures as found.

4. Position the vehicle so that the 1/10 mile odometer indication is in a suitable starting position such as the top of the "5" or "7" at the top of the instrument frame opening, keeping parallax in mind.

   NOTE: Some odometers rotate from top to bottom. In this case, the bottom of the "2" positioned at the bottom of instrument frame opening is a good starting point.

5. With the transmission in the forward position, reset the fifth-wheel indicator to zero and release the brake. With normal acceleration, increase speed to between 30 and 45 miles per hour.

6. Hold this speed for a minimum of 1.8 miles. Anticipate the end of the test and slowly bring vehicle to a stop with the 1/10 mile odometer indication in precisely the same position as in Step 4. **T.2 [5.53]**

7. Record error determined by fifth-wheel indicator and apply tolerances.

8. Repeat Steps 4 through 7.

9. Upon return of vehicle, record final odometer reading and compute total miles if required by owner of vehicle.

ROAD TEST

Test

1. Record starting odometer reading.

2. Make a tire temperature stabilizing run of at least five miles. Odometer tests shall include at least 2 test runs of at least 2 miles in length at a speed between 30 and 45 miles per hour. Odometer is to be tested with tire pressures as found. **N.1.2.1 [5.53]**; **N.1.3.1 [5.53]**

3. Position vehicle precisely at starting point of the measured course.

4. Observe and record odometer reading and note exact position of 1/10 mile indication. Draw a picture if necessary, keeping parallax in mind.

5. With transmission in forward position, release the brake and with normal acceleration, increase speed to between 30 and 45 miles per hour.

6. Hold this speed for a minimum of 1.8 miles. Anticipate end of the test and slowly bring the vehicle to a stop with the 1/10 mile indication in precisely the same position as in Step 4.

7. Observe position of vehicle as compared to tolerance marks on course or, if no marks, measure distance from vehicle to mileage mark.

8. Record errors and apply tolerances.

9. Repeat Steps 3 through 8. **T.2 [5.53]**

10. Upon return of vehicle, record final odometer reading and compute total miles if required by owner of vehicle.

SIMULATED ROAD TEST

See EPO 38-B. **N.1.1(c) [5.53]**

TAXIMETERS

This Examination Procedures Outline for taximeters is divided into three parts as follows:

38-A. Basic Taximeter Information, Requirements, Pre-Test Determinations, and Time Tests.
38-B. Distance Test Procedures using Fifth-Wheel or Road Simulator.
38-C. Distance Test Procedures using Measured Course (Road test).

BASIC TAXIMETER

Introduction

A taximeter displays both a charge for distance traveled and a charge for time elapsed on a single display in terms of money value only. Meters must be designed so that, based on a preset rate or rates, only one mechanism, the time mechanism or the distance mechanism activates the display at any given time. Taximeters include both mechanical and electronic types.

There is a point at which either the time or distance mechanism drives the meter display at the same rate. At vehicle speeds below this "interference point", the distance mechanism is disengaged and the time mechanism is the only force activating the meter display. Conversely, at speeds greater than the "interference point", the distance mechanism becomes the primary driving force activating the meter display.

Because of these variables, we must isolate the various components of a given meter, test them in accordance with their usage, and apply tolerances.

Pre-Test Inspection

1. Identification.

    1.1. Manufacturer's name, model number, and serial number. **G-S.1 [1.10]**

2. Type approval. **B&P 12500.5**

3. Indicating elements.

    3.1. Numbers clean and easily read by seated passengers. **G-S.5.1 [1.10]; UR.2 [5.54]**

    3.2. Meter indications properly illuminated for use at night. **UR.2 [5.54]**

    3.3. Indications protected by glass or other suitable material. **S.1.8 [5.54]**

4. "Extras" mechanism if so equipped.

   4.1. Shall indicate as a separate item and be identified by the word "extras" or by an equivalent expression. **S.1.7 [5.54]**

   4.2. Shall be inoperable when meter is cleared. **S.3.3 [5.54]**

   4.3. If not used, must be disconnected or permanently obscured. **S.1.7.1 [5.54]**

5. Operating condition and control.

   5.1. Shall indicate character of fare such as "Hired", "Time Not Recording", "Out of City", etc. **S.1.5 [5.54]**

   5.2. When a taximeter is cleared, the indication "not registering", "vacant", or equivalent shall be shown. **S.1.5.1 [5.54]**

   5.3. Control lever or button in proper condition.

      5.3.1. Delay mechanism working so that indications have time to return to starting position. **S.3.1 [5.54]**

      5.3.2. If mechanical, all mechanical positions defined. **S.3.1 [5.54]**

6. Statement of rates. **UR.3 [5.54]**

   The distance and time rates for which a taximeter is set, including the initial distance interval and initial time interval:

   6.1. Shall be conspicuously displayed inside the front and rear passenger compartments.

   6.2. Shall be of permanent character or protected by glass or other suitable transparent material.

   6.3. Shall be fully informative, self-explanatory, and readily understandable.

   6.4. Shall include all charges such as "extras" if used and "multi-tariff rates" if used.

7. Inflation of tires (user responsibility).

   7.1. At the completion of test run or runs, the tires of the vehicle under test shall be checked to determine that the tire pressure is as posted, record "as found" pressures. At your discretion, allow the owner/user of the vehicle to adjust vehicle tire pressures. Retest taximeter as necessary. **N.1.3.2 [5.54]; UR.1 [5.54]**

   7.2. The operational tire pressure shall be posted in the vehicle and tire pressures shall be so maintained. **UR.1 [5.54]**

Pre-Test Determinations

1. Review rate schedules of meters to be tested and determine all tolerances and tests to be used. Enter data on inspection form. **EPO NO. 38-A-9**

   NOTE: The fifth-wheel road simulator is calibrated to make 1,000 revolutions per mile (5,280 feet). Wheel diameters may vary.

   One (1) revolution = 5.28 feet

   Ten (10) revolutions = 1% on a one (1) mile test

2. Formulas and Examples:

   These formulas may be used to determine initial time interval, subsequent time interval, and interference test speed (based on rate schedules for a given meter). The initial time interval may be longer or shorter than successive subsequent time intervals. **T.1.3 [5.54]**

   EXAMPLE 1:

   Of a Typical Rate Schedule:

60¢	First 4/7 mile or 4 minutes or fraction thereof	(initial distance, time interval)
20¢	Each additional 2/7 mile or part	(subsequent distance interval)
20¢	Each 2 minutes waiting time and/or traffic delay	(subsequent time interval)
$6.00/hour basic time rate		

   2.1. Subsequent time interval. **EPO NO. 38-A-7, Formulas**

$$\text{Seconds/Subsequent Time Interval} = \frac{3600}{\dfrac{\text{Waiting Time}}{\text{Rate/Hour}} \div \dfrac{\text{Value of Each}}{\text{Subsequent time Interval}}}$$

   NOTE: The initial time interval (or money drop) is a minimum charge and therefore disregarded when figuring "subsequent" time intervals.

   THEN:

$$\text{Subsequent Time Interval} = \frac{3600}{\$6.00 \div \$0.20} = 120\,\text{sec. or } 2\text{ min.}$$

   ($0.20 x 30 - 2 min. intervals in an hour = $6.00 per hour)

2.2. Initial time interval. **EPO NO. 38-A-7, Formulas**

Formula applies to all rates.

$$\text{Seconds/Initial Time Interval} = \frac{\begin{matrix}\text{(Distance of Initial} \\ \text{Distance Interval)}\end{matrix} \times \begin{matrix}\text{(Seconds/Subsequent} \\ \text{Time Interval)}\end{matrix}}{\text{Distance of Subsequent Distance Interval}}$$

Using the rate schedule in 2.1:

$$\text{Initial Time Interval} = \frac{4/7 \times 120}{2/7} = \text{240 sec. or 4 min.}$$

2.3. Interference (crossover) speed. This is the vehicle speed in MPH where the timing and distance mechanisms drive the meter at the same rate. The meter will be tested at 2-3 MPH faster than the amount determined in the formula (to allow the timing mechanism a chance to overrun the distance drive if defective). **N.3 [5.54]**

$$\text{Interference Speed} = \frac{\text{Waiting Time}}{\text{Rate/Hour}} \times \frac{\text{Distance for Subsequent Distance Interval}}{\text{Charge for Subsequent Distance Interval}}$$

$$\text{Interference Speed} = \$6.00 \times \frac{2/7}{0.20} = \text{8.57 mph}$$

Interference test speed = 8.57 + 2-3 mph = 11-13 mph

EXAMPLE 2

Of a Typical Rate Schedule:

\$1.80	minimum charge	
20¢	for first mile or 6 minutes or fraction thereof	(initial distance, time interval)
20¢	for each additional 1/6 mile	(subsequent distance interval)
\$12.00/hour basic time rate		

If the \$ value of the subsequent time interval is not displayed it can be determined from:

$$\text{\$ Value of Subsequent Time Interval} = \frac{\text{Basic Time Rate}}{\begin{matrix}\text{Initial Time Interval} \\ \text{(in seconds)}\end{matrix} \times \text{Subsequent Distance Interval}}$$

THEN:

$$\$\text{ Value of subsequent time interval} = \frac{\$12.00}{300 \times 1/6} = \$0.20$$

$$\text{Subsequent Time Interval} = \frac{3600}{\$12.00 \div \$0.20} = 60\text{ sec.}$$

$$\text{Initial Time Interval} = \frac{1 \times 60}{1/6} = 360\text{ sec. or 6 min.}$$

$$\text{Interference Speed} = \frac{\$12.00 \times 1/6}{\$0.20} = 10\text{ mph}$$

The interference test speed will be 12-13 MPH

3. Vehicle lading - 2 persons. **N.1.3.1 [5.54]**

<u>Time Tests</u> [vehicle stationary - meter in time recording mode (time on)]

1. Initial Interval.

    1.1. Simultaneously start the meter and timing standard (stopwatch). **N.2 [5.54]**

    1.2. Stop timing standard precisely at end of initial time interval. Do not turn meter off. Record error and apply tolerances. **T.1.2.1 [5.54]**

        1.2.1. Tolerance for initial interval.

            Overregistration 5% (3 seconds per minute)
            Underregistration 15% (9 seconds per minute)

    Continue with Step 2.

2. Subsequent Intervals

    2.1. Start the timing standard at the start of a time interval other than the initial time interval. **N.2 [5.54]**

    2.2. Stop the timing standard at the end of the time interval. Do not turn off meter. Record error and apply tolerances. **T.1.2.1 [5.54]**

    2.3. Repeat step 2.1 until four time intervals have been tested.

2.2.2. Tolerance for subsequent intervals.

Overregistration	5% (3 seconds per minute)
Underregistration	10% (6 seconds per minute)

Continue with Step 3.

3. Average time test.

3.1. Start the timing standard at a time interval other than the initial time interval and continue for a minimum of four intervals. **N.2 [5.54]**

3.2. Stop timing standard on predetermined interval. Record error and apply tolerances. **T.1.2.2 [5.54]**

3.2.1. Tolerance for average time test (initial interval excluded).

Overregistration	0.33%	(0.2 seconds per minute)
Underregistration	5%	(3 seconds per minute)

TOLERANCE VALUES FOR TAXIMETER TESTS			
		Tolerance	
Test	Name of Test	On Over-registration	On Under-registration
A.	Initial Time Interval	5%	15%
B.	Subsequent Time Interval	5%	10%
C.	Average Time Test - Min. of 4 Subsequent Time Intervals	0.33%	5%
D.	Distance Test - Initial Interval Included	1%	4% plus 100 ft
E.	Distance Test - Initial Interval Excluded	1%	4%
F.	Initial Distance Interval Only	1%	4% plus 100 ft
G.	Multiple Tariffs Test - For each additional fare, perform test "E" with a min. of 3 subsequent time intervals or 1 mile, whichever is greater	1%	4%
H.	Interference (Time On)	Time and distance must agree with test "E" results within 1%	

FORMULAS			
1.	Waiting Time Per Rate/Hour	=	$\frac{3600 \times \text{\$ Value of Subsequent Time Interval}}{\text{Seconds Per Subsequent Time Interval}}$
2.	Seconds/Subsequent Time Interval	=	$\frac{3600}{\text{Waiting Time Rate/Hour} \div \text{\$ Value of Each Subsequent Time Interval}}$
3.	Seconds/Initial Time Interval	=	$\frac{\text{(Distance of Initial Distance Interval)} \times \text{(Seconds/Subsequent Time Interval)}}{\text{Distance of Subsequent Distance Interval}}$
4.	Interference Test Speed	=	$\frac{\text{Waiting Time Rate Per Hour}}{\text{Rate Per Distance}} + 3\text{ mph}$

METHODS USED TO COMPUTE TOLERANCE VALUES FOR			
Measure Mile Course		Fifth-Wheel or Simulator	
Test		Test	
E. & G.	D. & F.	E. & G.	D. & F.
Underregistration = Test mile(s) x 5,280 x 0.04	Underregistration = Test Mile(s) x 5,280 x 0.04 +100	Underregistration = Test Mile(s) x 1,000 x 0.04	Underregistration - Test Mile(s) x 1,000 x 0.04 + 19
Overregistration = Test Mile(s) x 5,280 x 0.01	Overregistration = Test Mile(s) x 5,280 x 0.01	Overregistration = Test Mile(s) x 1,000 x 0.01	Overregistration = Test Mile(s) x 1,000 x 0.01
NOTE: Tolerance is expressed in feet		NOTE: Tolerance is expressed in 1/1000 of a mile Unit	

TABLE 1
Converting Fifth-Wheel Revolutions to Feet.
To be used to determine errors.
Based on 1,000 Rev. per mile, 5.28 feet per Rev.

1 Rev. = 5.28 Ft.	26 Rev. = 137.28 Ft.	51 Rev. = 269.28 Ft.	76 Rev. = 401.28 Ft.
2 Rev. = 10.56 Ft.	27 Rev. = 142.56 Ft.	52 Rev. = 274.56 Ft.	77 Rev. = 406.56 Ft.
3 Rev. = 15.84 Ft.	28 Rev. = 147.84 Ft.	53 Rev. = 279.84 Ft.	78 Rev. = 411.84 Ft.
4 Rev. = 21.12 Ft.	29 Rev. = 153.12 Ft.	54 Rev. = 285.12 Ft.	79 Rev. = 417.12 Ft.
5 Rev. = 26.4 Ft.	30 Rev. = 158.4 Ft.	55 Rev. = 290.4 Ft.	80 Rev. = 422.4 Ft.
6 Rev. = 31.68 Ft.	31 Rev. = 163.68 Ft.	56 Rev. = 295.68 Ft.	81 Rev. = 427.68 Ft.
7 Rev. = 36.96 Ft.	32 Rev. = 168.96 Ft.	57 Rev. = 300.96 Ft.	82 Rev. = 432.96 Ft.
8 Rev. = 42.24 Ft.	33 Rev. = 174.24 Ft.	58 Rev. = 306.24 Ft.	83 Rev. = 438.24 Ft.
9 Rev. = 47.52 Ft.	34 Rev. = 179.52 Ft.	59 Rev. = 311.52 Ft.	84 Rev. = 443.52 Ft.
10 Rev. = 52.8 Ft.	35 Rev. = 184.8 Ft.	60 Rev. = 316.8 Ft.	85 Rev. = 448.8 Ft.
11 Rev. = 58.08 Ft.	36 Rev. = 190.08 Ft.	61 Rev. = 322.08 Ft.	86 Rev. = 454.08 Ft.
12 Rev. = 63.36 Ft.	37 Rev. = 195.36 Ft.	62 Rev. = 327.36 Ft.	87 Rev. = 459.36 Ft.
13 Rev. = 68.64 Ft.	38 Rev. = 200.64 Ft.	63 Rev. = 332.64 Ft.	88 Rev. = 464.64 Ft.
14 Rev. = 73.92 Ft.	39 Rev. = 205.92 Ft.	64 Rev. = 337.92 Ft.	89 Rev. = 469.92 Ft.
15 Rev. = 79.20 Ft.	40 Rev. = 211.20 Ft.	65 Rev. = 343.20 Ft.	90 Rev. = 475.20 Ft.
16 Rev. = 84.48 Ft.	41 Rev. = 216.48 Ft.	66 Rev. = 348.48 Ft.	91 Rev. = 480.48 Ft.
17 Rev. = 89.76 Ft.	42 Rev. = 221.76 Ft.	67 Rev. = 353.76 Ft.	92 Rev. = 485.76 Ft.
18 Rev. = 95.04 Ft.	43 Rev. = 227.04 Ft.	68 Rev. = 359.04 Ft.	93 Rev. = 491.04 Ft.
19 Rev. = 100.32 Ft.	44 Rev. = 232.32 Ft.	69 Rev. = 364.32 Ft.	94 Rev. = 496.32 Ft.
20 Rev. = 105.6 Ft.	45 Rev. = 237.6 Ft.	70 Rev. = 369.6 Ft.	95 Rev. = 501.6 Ft.
21 Rev. = 110.88 Ft.	46 Rev. = 242.88 Ft.	71 Rev. = 374.88 Ft.	96 Rev. = 506.88 Ft.
22 Rev. = 116.16 Ft.	47 Rev. = 248.16 Ft.	72 Rev. = 380.16 Ft.	97 Rev. = 512.16 Ft.
23 Rev. = 121.44 Ft.	48 Rev. = 253.44 Ft.	73 Rev. = 385.44 Ft.	98 Rev. = 517.44 Ft.
24 Rev. = 126.72 Ft.	49 Rev. = 258.72 Ft.	74 Rev. = 390.72 Ft.	99 Rev. = 522.72 Ft.
25 Rev. = 132 Ft.	50 Rev. = 264 Ft.	75 Rev. = 396 Ft.	100 Rev. = 528 Ft.

EPO NO. 38-A-9

STATE OF CALIFORNIA
DEPARTMENT OF FOOD AND AGRIUCLTUR3E
DIVISION OF MEASUREMENT STANDARDS
(Rev. 8/04)

TAXIMETER INSPECTION REPORT

1. DATE	2. TIME A.M. P.M.	3. REPORT NO.
4. COUNTY NAME		

5. NAME OF INDIVIDUAL OR FIRM | CITY | STATE | ZIP

6. NAME OF OPERATOR / DRIVER	7. CAR. NO.	8. LICENSE NO.	9. MAKE	10. VEH. YEAR
11. NAME OF METER MANUFACTURER	12. MODEL NO.	13. SERIAL NO.	14. ACTUATING TIRESS PSI POSTED	

15. ACTUATING TIRE PRESSURE AS FOUND
LEFT PSI, RIGHT PSI

16. VEHICLE TIRE SIZE

17. RATES POSTED (Front & Rear) ☐ YES ☐ NO

18. OTHER TARIFFS, OR CHARGES POSTED ☐ YES ☐ NO

19. METER LIGHT ☐ YES ☐ NO

20. MODE OF OPERATIONS IDENTIFIED ☐ YES ☐ NO

21. SECURITY SEALS INTACT ☐ YES ☐ NO

22. INITIAL INDICATION $________________

23. POSTED MILEAGE RATES:

$ ___________ INITIAL ___________ MILE

$ ___________ EACH ADD'L ___________ MILE

24. WAITING TIME AND TRAFFIC DELAY:

$ ___________ PER HOUR

$ ___________ INITIAL ___________ SECONDS

$ ___________ EACH ADD'L ___________ SECONDS

INTERFERENCE TEST SPEED _____________ MPH

25. TOTALIZER READING (Trips)

FINISH ________________

START ________________

26. TIME TESTS	27. TIME ON	OFF	28. TEST START $	29. TEST STOP $	30. CALCULATED CORRECT TIME VALUES	31. MAX. LIMIT OVERREGISTRATION (TOLERANCE APPLIED)	32. TEST STANDARD INDICATION	33. MAX. LIMIT UNDERREGISTRATION (TOLERANCE APPLIED)	34. CHECK IF OUT OF TOLERANCE
A. INITIAL INTERVAL	X								
B. SUBSEQUENT INTERVAL	X								
C. AVERAGE TIME TEST	X								

35. MILEAGE TESTS Fifth Wheel – Road Test	36. TIME ON	OFF	37. TEST START $	38. TEST STOP $	39. CALCULATED CORRECT MILES OR REVS.	40. MAX. LIMIT OVERREGISTRATION (TOLERANCE APPLIED)	41, TEST STANDARD INDICATION	42. MAX. LIMIT UNDERREGISTRATION (TOLERANCE APPLIED)	43 CHECK IF OUT OF TOLERANCE
D. INITIAL INTERVAL INCL.		X							
E. INITIAL INTERVAL EXCL.		X							
F. INITIAL INTERVAL ONLY		X							
G. MULTIPLE TARIFF TEST		X							
H. INTERFERENCE*	X								

*** NOTE: THE VALUE IN COLUMN 41 FOR TEST E AND H MUST AGREE WITHIN 1%.**

44. TEST RESULTS ☐ ACCEPT ☐ REJECT	45. OUT OF ORDER NO.	46. TO BE REPAIRED BY

47. REMARKS

48. SIGNATURE OF OWNER/AGENT ▶	TITLE	49. INSPECTED BY	TITLE

FIFTH-WHEEL AND ROAD SIMULATOR TEST PROCEDURES

Pre-Test Determinations

1. Review rate schedules of meters to be tested and determine all tolerances and tests to be used. Enter data on inspection form. **EPO NO. 38-A-9**

   NOTE: The fifth-wheel road simulator is calibrated to make 1,000 revolutions per mile (5,280 feet). Wheel diameters may vary.

   One (1) revolution = 5.28 feet

   Ten (10) revolutions = 1% on a one (1) mile test

Tests (record totalizer readings before starting tests) **N [5.54]**

1. Distance test preparations.

   1.1. Fifth-wheel. **N.1.1 (b) [5.54]**

   1.1.1. Attach wheel assembly as close as possible to center of vehicle rear bumper to minimize variations from turns.

   1.1.2. With fifth-wheel attached for temperature stabilization, proceed with vehicle to suitable test location.

   1.1.3. Check fifth-wheel tire for proper pressure (determined by calibration on measured mile).

   1.2. Road simulator. **N.1.1(c) [5.54]**

   1.2.1. Safety concerns - follow set-up procedures applicable to your county equipment.

   1.2.2. Set vehicle on simulator so that driven wheels are cradled between rollers.

   1.2.3. Stabilize tire temperature and pressure by running vehicle necessary distance. **N.1.3.2 [5.54]; UR.1 [5.54]**

2. Distance test.

   2.1. Set meter distance only mode (time off). Zero the fifth-wheel or simulator indicator and switch to the “on” position.

   2.2. Bring the vehicle to normal operating speed, not to exceed 30 miles per hour, if a fifth-wheel is used.

2.3. Continue test to include a minimum of three intervals or one mile, whichever is greater (initial interval included). Anticipate end of test and stop fifth-wheel or simulator indicator precisely at the predetermined money interval (do not re-zero the meter). **N.1.2 [5.54]**

2.4. Determine error and apply tolerances. **T.1.1 [5.54]**

Overregistration 1%
Underregistration 4% + 100 feet
(initial interval included)

2.5. With meter still in the "time off" position and with vehicle again traveling at normal operating speed, clear fifth-wheel or simulator indicator and restart on the next interval of the meter.

2.6. Continue test to include a minimum of three intervals or one mile, whichever is greater. Anticipate the end of the test and stop fifth-wheel or simulator indicator precisely on the predetermined money interval. **N.1.2 [5.54]**

2.7. Record the fifth wheel or simulator indicator reading.

2.8. Determine error and apply tolerances. **T.1.1 [5.54]**

Overregistration 1%
Underregistration 4%

The results of this test will be used for comparison with the interference test (Step 4).

3. Radio frequency interference (RFI) test for electronic taximeters.

An RFI distance test similar to Steps 2.5, 2.6, and 2.8 shall be performed to verify that radio transmitters do not adversely affect the taximeter. **G.N.2 [1.10]**

3.1. When performing the RFI distance test, "key the microphone" of the taxi's radio transmitter "on" and "off" at approximately one cycle per second.

4. Interference test.

Shall agree with the meter's performance in the distance only (initial interval excluded) condition (Step 2) within "plus or minus" (±) 1% for the distance represented.
S.4 [5.54]; N.3 [5.54]; T.1.3.1 [5.54]

4.1. Set the meter in the time and distance mode (time on). Zero the fifth-wheel or simulator indicator and switch to the "off" position. **N.3 [5.54]**

4.2. Adjust vehicle speed to about three MPH faster than the predetermined interference speed and hold this speed throughout entire test.

NOTE: If at any time during this test the speed drops below the predetermined interference speed, disregard test and repeat.

4.3. Precisely upon any interval other than the initial interval, switch the fifth-wheel or simulator indicator control to the "on" position.

4.4. Continue test for a distance equal to the distance traveled in Step 2.6. Anticipate the end of the test and stop the fifth-wheel or simulator indicator control precisely on the predetermined money interval.

4.5. Using the results found in Step 2 as your baseline (zero reference), the results of the interference test must be within (+) 1% of this same distance (standard tolerances do not apply to this test). **T.1.3.1 [5.54]**

5. Initial interval test.

5.1. Set the meter in the distance only mode (time off) and the fifth-wheel or simulator indicator on zero with the indicator control in the "on" position. **N.1.2 [5.54]**

5.2. Using normal driving methods, accelerate to a normal operating speed.

5.3. Anticipate the end of the first interval and stop fifth-wheel or simulator indicator precisely on the money interval.

5.4. Record the fifth wheel or simulator indicator reading.

5.5. Determine error and apply tolerances. **T.1.1 [5.54]**

Overregistration 1%
Underregistration 4% + 100 feet

5.6. Initial interval test may be repeated as required.

6. Multiple tariff test.

If the meter is a multiple tariff type, a minimum test similar to Steps 2.5 and 2.8 must be run for the remaining tariffs. Check to verify that the rate cannot be changed during test runs. **G-S.2 [1.10]**

NOTE: All taximeters, including mechanical and "single rate" meters, should be checked to determine that rates cannot be changed during runs and tested to verify the accuracy of all rates programmed and available. **S.1.7 [5.54]**

7. "Extras" mechanism test - verify the meter charges against the posted extra rates. **S.1.7 [5.54]**

8. Before releasing vehicle, be sure to record ending totalizer readings.

MEASURED COURSE (ROAD TEST)

Pre-Test Determinations

1. Review rate schedules of meters to be tested and determine all tolerances and tests to be used. Enter data on inspection form. **EPO NO. 38-A-9**

Tests (record totalizer readings before starting tests) **N [5.54]**

2. Distance test.

   2.1. Position vehicle on starting point of test course and set meter distance only position (time off).

   2.2. Using normal driving methods, accelerate to a normal operating speed.

   2.3. Continue test to include a minimum of three intervals or one mile, whichever is greater, initial interval included. Anticipate end of test and slow vehicle in order to stop precisely at the predetermined money interval. **N.1.2 [5.54]**

   2.4. Observe position of vehicle as compared to tolerance marks on the course or, if no marks, measure distance from vehicle to mileage mark.

   2.5. Determine error and apply tolerances. **T.1.1 [5.54]**

      2.5.1. All tests which include initial interval.

         Overregistration 1%
         Underregistration 4% + 100 feet (100 feet = .019 mile)

   2.6. Return to original starting point.

   2.7. Set meter in the time and distance mode (time on). Do not move vehicle.

   2.8. Immediately upon the next money interval, switch the meter to the distance only mode (time off).

   2.9. Using normal driving methods, accelerate to a normal operating speed.

   2.10. Continue test to include a minimum of three intervals or one mile, whichever is greater. Anticipate end of test and slow vehicle in order to stop precisely at the predetermined money interval. **N.1.2 [5.54]**

2.11. Determine error and apply tolerances. **T.1.1 [5.54]**

2.11.1. All tests <u>without</u> initial interval, except interference. **T.1.1 [5.54]**

Overregistration 1%
Underregistration 4%

NOTE: The results of this test will be compared against results of the interference test (Step 4).

3. Radio frequency interference (RFI) test for electronic taximeters.

An RFI distance test similar to Steps 2.9, 2.10, and 2.11 shall be performed to verify that radio transmitters do not adversely affect the taximeter.

3.1. When performing the RFI distance test, "key the microphone" of the taxi's radio transmitter "on" and "off" at approximately one cycle per second. **G.N.2 [1.10]**

4. Interference test. **N.3 [5.54]**

Initial interval not included in this test

4.1. Position vehicle on starting point. Set the meter in the time and distance mode (time on).

4.2. Immediately upon the next money interval, accelerate quickly to a speed equal to about two to three miles per hour faster than the established interference speed.

4.3. Continue test for a distance equal to the distance traveled in Step 2.10. Anticipate end of test and mark location of money interval without slowing vehicle.

NOTE: If at any time during this test, with the exception of starting, the speed drops below the predetermined interference speed, disregard test and repeat.

4.4. Using the results found in Step 2.11 as your baseline (zero reference), the results of the interference test must be within ($\pm$) 1% of this same distance (standard tolerances do not apply to this test). **T.1.3.1 [5.54]**

5. Initial interval test. **N.1.2 [5.54]**

5.1. Position vehicle on starting point. Set meter in the distance only mode (time off).

5.2. Using normal driving methods, accelerate to a normal operating speed.

5.3. Anticipate end of first interval and slow vehicle in order to stop precisely at the money interval.

5.4. Determine error and apply tolerance.

5.4.1. Initial interval.

Overregistration	1%
Underregistration	4% + 100 feet

5.5. Initial interval test may be repeated as required. **T.1.1 [5.54]**

6. Multiple tariff test.

If the meter is a multiple tariff type, a minimum test similar to Steps 2.6 through 2.11 must be run for the remaining tariffs. Check to verify that the rate cannot be changed during test runs. **G-S.2 [1.10]**

NOTE: All taximeters, including mechanical and "single rate" meters, should be checked to verify that rates cannot be changed during runs and tested to verify the accuracy of all rates programmed and available.

7. "Extras" mechanism test. Verify the meter charges against the posted extra rates. **S.1.7 [5.54]**

8. Before releasing vehicle, be sure to record final totalizer readings.

ELECTRIC METERS

NOTE: Before starting meter testing, contact apartment or mobile home park manager, then individual tenants to inform them of your purpose and of the fact that their electric power may be off for a short period of time.

The resources referenced here are EPO, California Code of Regulations, and California Business and Professions Code.

SPECIAL SAFETY NOTE

There is an inherent danger and possibility of a damaging explosion and/or severe electrical shock when testing electrical meters. Before an official is assigned to this program, the official should receive formal classroom training. Inspectors must have "hands-on" training before testing meters of 240 volts and less.

DMS strongly recommends that officials **do not test** meters where the service voltage at the meter **exceeds 240 volts** between phases.

The utilities have recognized the danger in high voltage testing (voltages exceeding 240 volts). Their practice is to train meter-persons for lengthy periods under close supervision, a procedure which is not feasible in most weights and measures jurisdictions.

Pre-Test Inspection

Note: EPO Ref. T provides additional information on utility billing rules, meter complaints, and meter safety.

1. **Identification**. **G-S.1 [1.10]**

   1.1. Each meter shall have the following information legibly marked on the front of the nameplate or register: **4027.1, S.6**

   (a) Manufacturers' name or trademark, type designation, and serial number.
   (b) Voltage rating.
   (c) Test amperes (**TA**).
   (d) Maximum amperes (**CL**) {meter class}.
   (e) Watt-hour or disk constant ($\mathbf{K_h}$) {expressed as watt-hours per revolution}.
   (f) Register ratio ($\mathbf{R_r}$) and multiplier (if 10 or larger).
   (g) Frequency rating (**Hz**).
   (h) Number of meter stator(s) or elements (polyphase).
   (i) Ratio or rating of auxiliary devices.

2. **Type approval**.

Place an unapproved device tag on the meter if the meter is not type approved. **B&P 12500.5** Note any information about the meter that will help in testing.

3. **Overall condition of meter.**

3.1. Terminals, seals, glass, and insulation. **G-UR.4.1 [1.10]; 4027.1, S.2, S.3, S.5.**

Note: Read and consider **EPO Ref. T** as a check before testing.

4. **Installed Meters.**

4.1. Can the meter be tested <u>safely</u>? (Wear appropriate personal protective equipment, glasses and gloves, etc.) **Safety First 4027.5, UR.2**

4.1.1. Exposed non-current carrying metal parts of fixed equipment, metal boxes, cabinets, and fittings which are not electrically connected to grounded equipment, shall be grounded as required by National Electrical Code, Article 250. **Equipment Grounding 4027.1, S.4**

4.1.2. The terminals of the meter shall be arranged so that the possibility of short circuits in removing or replacing the cover, making connections and adjusting the meter is minimized. **Terminals 4027.1, S.3**

4.1.3. The main circuit breaker or main switch and fuses and their auxiliary equipment shall be installed in the load service near its entrance as supplied to the tenant. It is intended to constitute the main control and means of cut-off for the supply to the tenant. **Thermal Overload Protectors 4027.5, UR.2.5**

4.1.4. Unobstructed entrance and standing space. **Location of Meter 4027.5, UR.3.1**

4.1.5. Meter shall be located not less than 30 inches nor more than 75 inches above standing surface. **Meter Heights 4027.5, UR.3.2**

4.1.6. Verify that socket voltages across A and B matches the designed meter form and voltage. Some locations may be served by several different distribution circuits and voltages. Remember the “A” position in the socket is always energized.

4.1.7. <u>**Do not**</u> test meters exceeding 240 volts between phases. **EPO REF-K**

4.2. Mechanical meters must be installed in a level and perpendicular manner in accordance with manufacturer’s specifications. **G-UR.2.1 [1.10]**

4.3. Remote meter installation. Check for ground faults; verify space being billed is only space served by each meter. Verify that common use areas such as street lights are not wired into the load side of the tenant’s circuit. **G-S.2 [1.10]; 4027.5, UR.3.3; B&P 12024; B&P 12024.1**

5. Suitability.

5.1. Meter class. Verify that CL equals or exceeds total amperage being sold (<u>plus</u> main disconnect rating). Remember, electric meters must have a minimum CL of 60. Older unmarked meters must use the following formula.
Also, see **EPO REF-K** for obsolete and unsafe meters

$$\text{Meter Class CL} = \text{Test Amperes TA}^{*} \quad x \quad \frac{\%\ \text{Overload Rating (from table, page 39-15)}}{100}$$

* This may be the Name Plate Amp Rating

Example: Duncan, Type MF, TA is15, Overload rating is 400% (from Table page 39-15

$$\text{CL} = 15 \ x \ \frac{400}{100} = 60$$

5.2. Meter constant. Verify that the product of the meter register ratio (Rr_m) and disk constant (Kh_m) equals the meter constant. This will verify the correct register is being used with the meter. Use the tables on pages 15, 16, 17, 18 for the appropriate meter constant.

4027.1, S.6; EPO No. 39-15, 39-16, 39-17, 39-18

$$Rr_m \ x \ Kh_m = \text{Meter Constant}$$

Example: Duncan Type MS, R_r is 13 8/9, Kh_m is 7.2

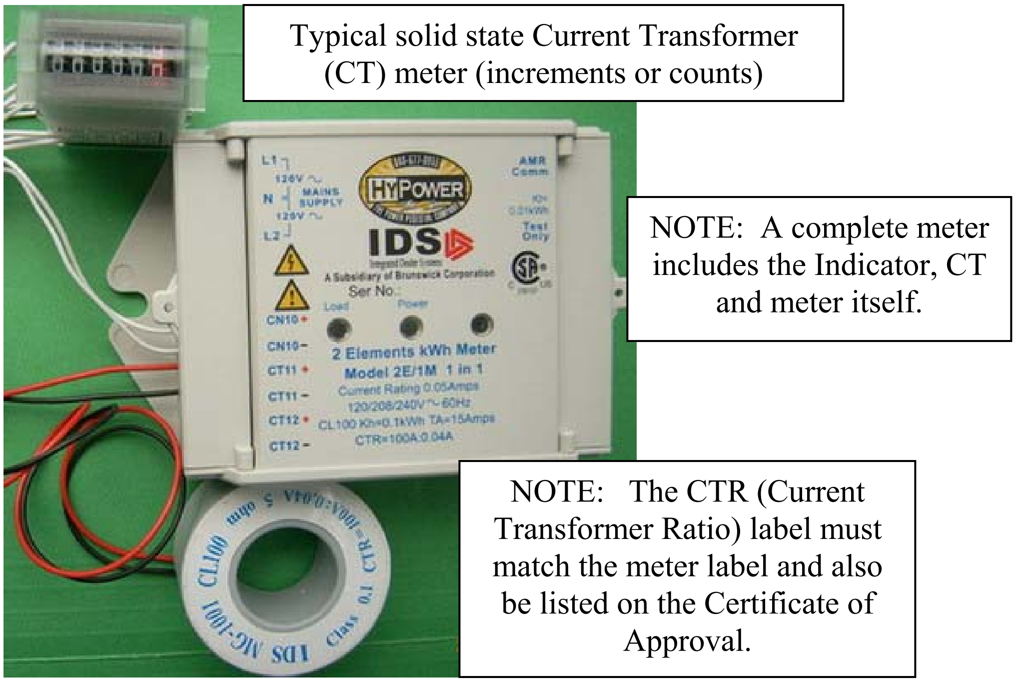
13 8/9 X 7.2 = 99.999 rounded to 100, (from table 39-15)

6. Pre-Test Determinations.

For solid state meters wherever the term revolution is used, it may be interpreted as increment or count.

Typical mechanical rotating disk socket meter (revolutions)

Typical solid state socket meter (increments or counts)



Determine value of meter revolution and minimum meter revolution for testing

Basic formula $Kh_s \ x \ R_s = Kh_m \ x \ R_m$

Where:

Kh_s Disk constant of the standard; this will change as different current loads are used.

R_s Number of revolutions of the standard or the value the standard should display. (minimum 8 revolutions on Knopp standards, minimum of 1 minute test for Probewell or other solid state standards)

Kh_m Disk constant of the meter being tested (stated on the name plate of the meter).

R_m Disk revolutions of the meter being tested; minimum 1 revolution, no partial disk revolutions.

4027.2, N.3.

Test Revolutions: In all tests, to reduce error and uncertainty, the standard requires a minimum of 8 revolutions for Knopp standards or minimum of a 1 minute test for solid state standards like Probewell, and the meter under test, one revolution; **CCR 4027.2, N.3**

Probewell Standard with a mechanical rotation disk meter

Knopp FS-8 Standard connected to a laboratory test board

These tables give the Kh_S for Knopp Standards based on Amp load and Voltage:

Table A

	Knopp FS-4,6,7,8&9 Kh Values Readout = Revolutions		
	Test Amp	120V	240V
	Load	Kh_S	Kh_S
	0.5	0.06	0.12
	1.5	0.18	0.36
Example 1	3	0.36	0.72
	5	0.6	1.2
	15	1.8	3.6
Example 2	30	3.6	7.2

Table B

Knopp FS-9 Kh Values Readout = Watthours		
Test Amp	120V	240V
Load	Kh_S	Kh_S
0.5	0.1	0.1
1.5	0.3	0.3
3	0.6	0.6
5	1	1
15	3	3
30	6	6

Note: The above information was used to create the tables located on pages 39-13 and 39-14.

Example 1: Light Load Test (3Amp)

Single stator, TA30, 120V, Kh_m 10 watt hours.

Kh_s = 0.36 from Table A above
Kh_m = 10
R_m = assume a meter revolution of 1

Solve for **R_s** using $R_s = \frac{Kh_m\,(R_m)}{Kh_s}$ substituting $R_s = \frac{10\,(1)}{0.36} = 27.778$

In the above example the value of one revolution of the meter is 27.778 revolutions of the standard.

In this example, **R_s** ≥ 8 so only one revolution is needed for this test. If **R_s** had been < 8, **R_m** would need to be increased in whole revolutions until **R_s** ≥ 8 (see Example 2 below). If a Probewell standard or other solid state standard is used, a minimum of 1 minute is required.

Thus, for a meter with no error, one revolution = 27.778 revolutions of the standard

To calculate percent error:

$$\frac{\text{Meter Indication} - \text{Standard Indication}}{\text{Standard Indication}}\, x\,100 = \%\,\textit{error}\text{ of meter}$$

Where value of meter indication for one revolution is 27.778 and the standard indicates 27.930 revolutions

Step 1: $\frac{27.778 - 27.930}{27.930}\ \text{x}\,100 = \%\ \text{error}$

Step 2: $\frac{-\,0.152}{27.930}\ \text{x}\ 100 = \%\ \text{error}$

Step 3: $-\,0.00547\ \text{x}\ 100 = -\,0.54\ \%$

Example 1 result: Meter is under-registering by 0.152 revolutions or 0.54%

Example 2: Full Load Test (30Amp)

Single stator, TA30, 120V, Kh_m 6 watt hours.

Kh_s = 3.6 from Table A, **EPO 39.5**
Kh_m = 6
R_m = assume a meter revolution of 1

Solve for **R_s** using $R_s = \frac{Kh_m\,(R_m)}{Kh_s}$ substituting $R_s = \frac{6\,(1)}{3.6} = 1.667$

In the above example the value of one revolution of the meter is 1.667 revolutions of the standard; less than the required minimum of 8 revolutions.

In this example, $\mathbf{R_s} < 8$. Increase $\mathbf{R_m}$ in whole revolutions until $\mathbf{R_s} \geq 8$

Using $R_m = \frac{Kh_s(R_s)}{Kh_m}$ $R_m = \frac{3.6(8)}{6}$ = 4.8 (R_m must be in whole revolutions)

Increase R_m to 5 and substitutes in $R_s = \frac{Kh_m(R_m)}{Kh_s}$ $= \frac{6(5)}{3.6}$ = 8.333

Thus, for a meter with no error, five revolutions = 8.333 revolutions of the standard

Note: Solid state standards (Probewell) require a minimum of a 1 minute test.

To calculate percent error:

$$\frac{\text{Meter Indication} - \text{Standard Indication}}{\text{Standard Indication}} x100 = \%\, error \text{ of meter}$$

Where value of meter indication for five revolutions is 8.333 and the standard indicates 8.125 revolutions

Step 1 $\frac{8.333 - 8.125}{8.125} \text{ x } 100 = \% \text{ error}$

Step 2: $\frac{0.208}{8.125} \text{ x } 100 = \% \text{ error}$

Step 3: $0.0256 \text{ x } 100 = 2.56$ %

Example 2 result: Meter is over-registering by 0.208 revolutions or 2.56%.

7. **Tolerances**. (Full and light loads.) **4027.4, T.2**

7.1. Maintenance = +/- 2%.

7.2. Acceptance = +/- 1%.

Note: Acceptance tolerance shall not exceed 1 percent for full and light loads. Acceptance tolerances shall be applied to new and rebuilt meters before they have been placed in service. **Tolerance Values, 4027.4 T.2.(b)**

In example 1, the meter under registered by 0.54%. It is in tolerance for both Maintenance and Acceptance for the light load 3 amp test.

In example 2, the meter over registered by 2.56%. It is out of tolerance for both Maintenance and Acceptance for the full load 30 amp test. If this test was conducted first there is no need to do the light load test. Mark the meter “Out of Order”. It should be removed from service or not installed.

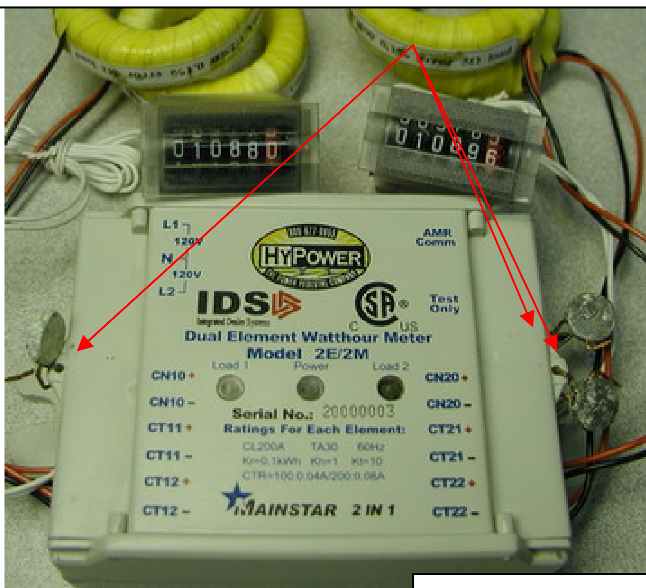
8. Provision for sealing.

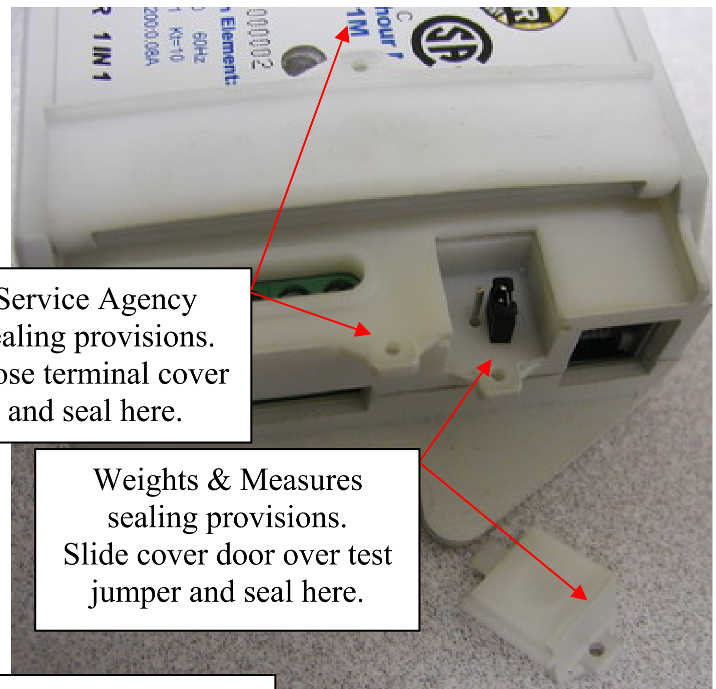
8.1. Provisions shall be made for applying a security seal to the meter cover, meter sealing ring, and terminal block cover. **4027.1, S.5.1**

Note: Do not remove the manufacturer's glass cover seal. This may void the meter warranty. However, a lead and wire seal may be used in addition to the manufacturer's seal.

8.2. Meter enclosures shall be so designed that the cover may be sealed. Provision shall be made for reading the meter without destroying the seal. **4027.1, S.5.2**

CT meters may have Weights & Measures sealing provisions for test jumpers. CT meters may also have Service Agent provisions for wiring terminals after installation.

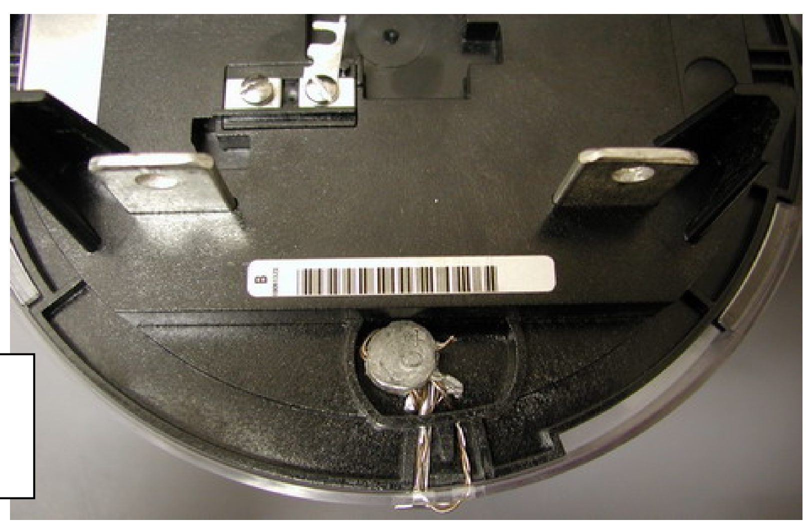




Service Agency sealing provisions. Close terminal cover and seal here.

Weights & Measures sealing provisions. Slide cover door over test jumper and seal here.

Examples of CT meter sealing provisions



Example of Socket meter sealing provisions (seals the cover to the meter body)

8.3. Thermal overload protector enclosures shall be designed to facilitate sealing. A provision shall be made for resetting circuit breakers or replacing fuses without destroying the seal.
4027.1, S.5.3

<u>Test Procedure</u>

Note: Review safety notes and inspect each installation to be tested. If unsafe, <u>do not test</u>. Notify property owner and local building officials.

1. Ensure field standard voltage switch **<u>matches</u>** line service voltage of system being tested.

2. Connecting field standard to meter.

   2.1. "A" base meters – See <u>Special Hazard Note</u> (EPO No. 39-20) prior to connecting test standard to meter.

   2.1.1. Ensure field standard current switch is in **<u>off</u>** position before connecting the standard to meter (if standard has an on/off switch).

   2.1.2. Turn off or disconnect electrical service to tenant while performing the meter test.

   2.1.3. Connect field standard to meter and observe warning lamps (Knopp standard). If glowing, **<u>DO NOT</u>** turn current switch "on". A correct hook-up is indicated by the warning lamps **<u>not</u>** glowing.

   Knopp exception: If lead C (blue lead) is not used, warning lamp will have dull glow, and this is ok.

   2.2. Socket base meters.

   2.2.1. Turn off or disconnect electrical service to tenant while performing meter test. **Note:** Service (line) terminals will still be powered and exposed.

   2.2.2. Remove meter from socket, top to bottom (pull A/B then C/D). **Note**: When removing socket meters, use the lower jaws as a fulcrum and pull the blades from the line-side jaws with a downward force on the meter before withdrawing the lower blades.

   2.2.3. <u>Carefully</u> install meter test jack into meter socket.

   2.2.4. Install meter into test jack.

   2.2.5. Connect field standard to test jack and observe warning lamps.

3. **Starting watts**. The rotor or indicator for a meter shall rotate or increment continuously when a load is applied equal to 0.5 ampere. **4027.2, N.1**
   Note: On Probewell standards, use 1 ampere load with 0.5 PF (power factor) setting.

4. **Creep test.** A meter disk that creeps more than one revolution or the digital register increments, the meter shall be removed from service. **4027.2, N.4**

5. **Meter tests.** Meters shall be tested at full load and light load. **4027.2, N.2**

   5.1. Full load test shall not be less than the test amperes (TA) of the meter.

   5.2. Light load test amperes shall be 5% to 10% of the meter TA. However, it may be 20 percent or 5 amps, whichever is less, of the TA when testing a 240-volt, 3-wire, single phase meter with an unbalanced load (energizing a single current coil).

   5.3 Full and light load tests shall require 8 or more revolutions of the test standard. Light and full load tests require at least 1 revolution of the meter under test. **4027.2, N.3**

6. Disconnect field standard from meter or test jack.

7. Remove meter from test jack, top to bottom (A/B then C/D).

8. Remove test jack from meter socket.

9. Apply appropriate seals if meter is correct. Tag meter "out of order" if it does not meet code requirements.
   B&P 12505 and 12506

10. Install meter into socket (C/D then A/B).
    Note: When installing a socket meter, line up the load jaws and meter blades, press these home; then using the bottom jaws as a fulcrum, rock the meter into place. Do not twist the meter in a manner to spring the jaws.

11. <u>Important</u>. Turn on electrical service to tenant.

ELECTRIC METER COMPLAINTS

1. Record meter reading. Compare present reading with the most current billing, invoice. This reading should be reasonably proportionate with the amount of energy consumed since the last meter reading on the invoice. Energy consumption may be influenced by tenant practices and the weather. Past billings from similar weather patterns may be helpful in determining usual consumption for the period in question. If meter readings are deemed incorrect, talk to the park owner/manager regarding proper methods of meter reading. Refer to EPO References O and T for jurisdiction and enforcement guidelines.

   Note: Each customer invoice shall clearly and separately show the opening and closing meter readings and the dates of those readings. All rates and quantities shall be clearly identified and shall include the applicable rate structure and the total charge for the billing period. The operator of a utility service system shall maintain all records of pertinent rate schedules, and individual customer billing for a period of at least 12 months. These records shall be made available at reasonable times to the customer and weights and measures officials. **CCR, Chapter 5, 4090**

2. Check the meter. **EPO 39-2**

   2.1. Is it installed in a level and perpendicular manner in accordance with manufacturer's specifications? **G-UR.2.1 [1.10]**

   2.2. Voltage. Using a voltmeter, make sure the correct meter has been installed for a given service entrance voltage, do not assume it is okay (i.e., 120, 240, or 208 volts). There is one exception; "A" position must always be hot. **EPO NO. 39-2, 4.1.7**

   2.3. Meter class. Verify that CL equals or exceeds total amperage being sold (main breaker plus any breakers wired in parallel to main). Also, a minimum CL of 60. For older unmarked meters, use the following formula. **EPO REF-K; EPO Nos. 39-15, 39-16, 39-17, 39-18**

$$\text{Meter Class} = \frac{\text{Name Plate Amp Rating x \% Overload Rating}}{100}$$

   2.4. Determine that the meter constant is correct for the meter.
   EPO Nos. 39-15, 39-16, 39-17, 39-18.

$$Rr_m \text{ x } Kh_m = \text{Meter Constant}$$

   2.5. Test the meter for accuracy. **EPO 39-9 Test Procedure**

3. Potential causes for increased electric usage: New major appliances, entertainment, occupants (guests, a new baby), space heaters, hot water heater, air conditioner (clogged filters), leaky faucets (hot water), using the cooking range for space heating, and extreme weather conditions. Incorrect wiring of common areas to the load side of the meter and mislabeling of meter circuit. Verify that the meter disconnect shuts off power to the correct tenant.

4. Ensure that the property is on the proper mastermeter/submeter rate schedule and that the billing is properly computed at the serving utility domestic tariff. Tenants should have received applications to enroll in rate reduction programs offered by the serving utility and, where qualified, should receive the rate discounts. Any interest and late charges must also follow the utility tariff rules. See EPO Reference T for more detailed information on investigating submeter complaints.

5. Miscellaneous. High bill complaints can originate when neighboring tenants compare electric meter disc speeds. A meter disc having a Kh = 2 will turn 6 times faster than one with a Kh = 12 for the same load. Both meters, of course, will indicate the same number of KWh consumed.

   Periodic rate increases also account for some customer high bill complaints.

6. On high usage complaints, try to determine if common area loads such as lighting, laundry, etc. are inoperable when the tenants main disconnect is off-line. If common area lighting or laundry is also off-line, the common area wiring must be removed from the tenants' service or load.

KNOPP FS-4, 6, 7, 8, 9 ELECTRIC METER STANDARDS

READOUT FOR STANDARD = ***REVOLUTIONS***

SINGLE STATOR METERS: Std. vs. Meter Test Ratios for ***Balanced*** Meter Tests Only

$$\frac{R_s}{R_m} = \frac{Kh_m}{Kh_s}$$

Meter Kh	Volt Range	30 AMP		3 AMP		15 AMP		1.5 AMP		5 AMP		0.5 AMP	
		Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter
2/3	120	8.33	45	11.11	6	11.11	30	11.11	3	10.00	9	11.11	1
	240	8.33	90	8.33	9	8.33	45	11.11	6	8.33	15	11.11	2
1	120	8.33	30	8.33	3	8.33	15	11.11	2	8.33	5	16.67	1
	240	8.33	60	8.33	6	8.33	30	8.33	3	8.33	10	8.33	1
1.2	120	8.33	25	10.00	3	10.00	15	20.00	3	10.00	5	20.00	1
	240	8.33	50	8.33	5	8.33	25	10.00	3	10.00	10	10.00	1
1-1/3	120	10.00	27	11.11	3	11.11	15	14.81	2	11.11	5	22.22	1
	240	8.33	45	11.11	6	10.00	27	11.11	3	10.00	9	11.11	1
1.5	120	8.33	20	8.33	2	8.33	10	8.33	1	10.00	4	25.00	1
	240	8.33	40	8.33	4	8.33	20	8.33	2	10.00	8	12.50	1
1-2/3	120	8.33	18	9.26	2	8.33	9	9.26	1	8.33	3	27.78	1
	240	8.33	36	9.26	4	11.11	24	9.26	2	8.33	6	13.89	1
1.8	120	10.00	20	10.00	2	10.00	10	10.00	1	9.00	3	30.00	1
	240	10.00	40	10.00	4	10.00	20	10.00	2	9.00	6	15.00	1
2	120	8.33	15	11.11	2	10.00	9	11.11	1	10.00	3	33.33	1
	240	8.33	30	8.33	3	8.33	15	11.11	2	8.33	5	16.67	1
2.4	120	10.00	15	13.33	2	8.00	6	13.33	1	8.00	2	40.00	1
	240	8.33	25	10.00	3	10.00	5	13.33	2	10.00	5	20.00	1
3	120	8.33	10	8.33	1	8.33	5	16.67	1	10.00	2	50.00	1
	240	8.33	20	8.33	2	8.33	10	8.33	1	10.00	4	25.00	1
3-1/3	120	8.33	9	9.26	1	11.11	6	18.52	1	11.11	2	55.56	1
	240	8.33	18	9.26	2	8.33	9	9.26	1	8.33	3	27.78	1
3.6	120	10.00	10	10.00	1	10.00	5	20.00	1	12.00	2	60.00	1
	240	10.00	20	10.00	2	10.00	10	10.00	1	9.00	3	30.00	1
6	120	8.33	5	16.67	1	10.00	3	33.33	1	10.00	1	100.00	1
	240	8.33	10	8.33	1	8.33	5	16.67	1	10.00	2	50.00	1
6-2/3	120	11.11	6	18.52	1	11.11	3	37.04	1	11.11	1	111.11	1
	240	8.33	9	9.26	1	11.11	6	18.52	1	11.11	2	55.56	1
7.2	120	10.00	5	20.00	1	8.00	2	40.00	1	2.00	1	120.00	1
	240	10.00	10	10.00	1	10.00	5	20.00	1	12.00	2	60.00	1
12	120	10.00	3	33.33	1	33.33	5	66.67	1	20.00	1	200.00	1
	240	8.33	5	16.67	1	10.00	3	33.33	1	10.00	1	100.00	1

TWO STATOR METERS: Std. vs. Meter Test Ratios for ***Balanced*** Meter Tests Only

$$\frac{R_s}{R_m} = \frac{Kh_m}{Kh_s \times 2}$$

Meter Kh	Std. Setting	30 AMP		3 AMP		15 AMP		1.5 AMP		5 AMP		0.5 AMP	
		Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter
3.6	120 2 Wire	8.00	16	10.00	2	8.00	8	10.00	1	9.00	3	30.00	1
7.2	120 2 Wire	8.00	8	10.00	1	8.00	4	20.00	1	12.00	2	60.00	1
14.4	120 2 Wire	8.00	4	20.00	1	8.00	2	40.00	1	12.00	1	120.00	1

NOTE: Kh_s = 0.6 @ 120V and 5 Amps

KNOPP FS-9 ELECTRIC METER STANDARD

READOUT FOR STANDARD = ***WATT-HOURS***

SINGLE STATOR METERS: Std. vs. Meter Test Ratios for ***Balanced*** Meter Tests Only

$$\frac{R_s}{R_m} = \frac{Kh_m}{Kh_s}$$

Voltage 120 or 240 Meter K_h	30 AMP		3 AMP		15 AMP		1.5 AMP		5 AMP		0.5 AMP	
	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter
2/3	8.00	72	10.00	9	8.00	36	11.11	5	10.00	15	13.33	2
1	8.00	48	8.33	5	8.33	25	10.00	3	8.00	8	10.00	1
1.2	8.00	40	10.00	5	8.00	20	8.00	2	12.00	10	12.00	1
1-1/3	8.00	36	11.11	5	8.00	18	13.33	3	12.00	9	13.33	1
1.5	8.00	32	10.00	4	8.00	16	10.00	2	12.00	8	15.00	1
1-2/3	8.33	30	8.33	3	8.33	15	11.11	2	8.33	5	16.67	1
1.8	11.11	37	9.00	3	9.00	15	12.00	2	9.00	5	18.00	1
2	8.00	24	10.00	3	8.00	12	13.33	2	8.00	4	20.00	1
2.4	8.00	20	8.00	2	8.00	10	8.00	1	12.00	5	24.00	1
3	8.00	16	10.00	2	8.00	8	10.00	1	9.00	3	30.00	1
3-1/3	8.33	15	11.11	2	10.00	9	11.11	1	10.00	3	33.33	1
3.6	12.00	20	12.00	2	12.00	10	12.00	1	10.80	3	36.00	1
6	8.00	8	10.00	1	8.00	4	20.00	1	12.00	2	60.00	1
6-2/3	10.00	9	11.11	1	11.11	5	22.22	1	13.33	2	66.67	1
7.2	12.00	10	12.00	1	12.00	5	24.00	1	14.40	2	72.00	1
12	8.00	4	20.00	1	8.00	2	40.00	1	12.00	1	120.00	1

TWO STATOR METERS: Std. vs. Meter Test Ratios for ***Balanced*** Meter Tests Only

$$\frac{R_s}{R_m} = \frac{Kh_m}{Kh_s \text{ x } 2}$$

Meter K_h	Std. Setting	30 AMP		3 AMP		15 AMP		1.5 AMP		5 AMP		0.5 AMP	
		Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter	Std.	Meter
3.6	120 2 wire	9.00	30	9.00	3	9.00	15	12.00	2	9.00	5	18.00	1
7.2	120 2 wire	9.00	15	12.00	2	12.00	10	12.00	1	10.80	3	36.00	1
14.4	120 2 wire	12.00	10	12.00	1	12.00	5	24.00	1	14.40	2	72.00	1

NOTE: Kh_s = 1.0 @ 120 or 240 V and 5 AMPS

DUNCAN ELECTRIC METERS
(LANDIS & GYR)

Meter Basic Kh (Based on 120 Volts 5 Amps)	Meter Type	Year Manufactured	Name Plate Amp Rating	% Overload of Name Plate Amp Rating	Meter Constant (Rr x Kh)
1/4	M	1912	All Ratings	110%	100
	M1	1913			
1/3	MD	1926	22 Amp	300%	133
			5 Amp		
			10 Amp		
			15 Amp		
			25 Amp		
			50 Amp	250%	
	MF	1934	All Ratings	400%	
	MFFE	1949			
6/10	MK	1954		666%	100
	MQ	1960			
	MS	1969			
	MSII	1977 to Present			
	MX	1997 to Present			200

NOTES:

1. Shaded Area on Table: Obsolete and Unsafe Electric Watt-Hour Meters (Refer to EPO-REF-K).

2. Meter Class (CL): (Name Plate Amp Rating) x (% Overload of Name Plate Amp Rating) ÷ 100

3. Minimum Meter Rating: Class 60

GENERAL ELECTRIC METERS

<table>
<tr><th>Meter Basic Kh (Based on 120 Volts 5 Amps)</th><th>Meter Type</th><th>Year Manufactured</th><th>Name Plate Amp Rating</th><th colspan="2">% Overload of Name Plate Amp Rating</th><th>Meter Constant (Rr x Kh)</th></tr>
<tr><td rowspan="5">3/10</td><td>(i)</td><td rowspan="2">1903</td><td rowspan="5">All Ratings</td><td colspan="2"></td><td rowspan="18">100</td></tr>
<tr><td>(i)-8</td><td colspan="2"></td></tr>
<tr><td>(i)-10</td><td rowspan="2">1910</td><td colspan="2">110%</td></tr>
<tr><td>(i)-14</td><td colspan="2" rowspan="2">200%</td></tr>
<tr><td>(i)-15</td><td>1915</td></tr>
<tr><td rowspan="13">6/10</td><td>(i)-16</td><td>1927</td><td>5 Amp</td><td colspan="2" rowspan="3">400%</td></tr>
<tr><td rowspan="3">(i)-18</td><td rowspan="3"></td><td></td></tr>
<tr><td></td></tr>
<tr><td>50 Amp</td><td colspan="2">250%</td></tr>
<tr><td>(i)-20 A</td><td rowspan="4">1934</td><td>5 Amp</td><td colspan="2" rowspan="3">400%</td></tr>
<tr><td>(i)-20 B</td><td>15 Amp</td></tr>
<tr><td>(i)-20 C</td><td>25 Amp</td></tr>
<tr><td>(i)-20 S</td><td>50 Amp</td><td colspan="2">300%</td></tr>
<tr><td rowspan="3">(i)-30</td><td rowspan="3">1937</td><td>5 Amp</td><td colspan="2" rowspan="2">400%</td></tr>
<tr><td>15 (12 2) Amp</td></tr>
<tr><td>50 Amp</td><td>A Base 300%</td><td>Socket 250%</td></tr>
<tr><td>(i)-50</td><td>1948</td><td>All Ratings</td><td colspan="2">400%</td></tr>
<tr><td>(i)-55, (i)-60, (i)-70</td><td>1955 to Present</td><td>All Ratings</td><td colspan="2">666%</td></tr>
</table>

NOTES:

1. <u>Shaded Area on Table:</u> Obsolete and Unsafe Electric Watt-Hour Meters. (Refer to EPO-REF-K)

2. <u>Meter Class (CL):</u> (Name Plate Amp Rating) x (% Overload of Name Plate Amp Rating) ÷ 100

3. <u>Minimum Meter Rating:</u> Class 60

SANGAMO ELECTRIC METERS
(SCHLUMBERGER)

<table>
<tr><th>Meter Basic Kh (Based on 120 Volts 5 Amps)</th><th>Meter Type</th><th>Year Manufactured</th><th>Name Plate Amp Rating</th><th>% Overload of Name Plate Amp Rating</th><th>Meter Constant (Rr x Kh)</th></tr>
<tr><td rowspan="3">5/24</td><td>B</td><td>1901</td><td>All Ratings</td><td>110%</td><td rowspan="8">200</td></tr>
<tr><td>H 1</td><td>1911</td><td rowspan="2">All Ratings</td><td rowspan="2">200%</td></tr>
<tr><td>H 2</td><td>1914</td></tr>
<tr><td rowspan="10">1/3</td><td rowspan="5">H c</td><td rowspan="5">1928</td><td>5 Amp</td><td rowspan="4">400%</td></tr>
<tr><td>10 Amp</td></tr>
<tr><td>15 Amp</td></tr>
<tr><td>25 Amp</td></tr>
<tr><td>50 Amp</td><td>250%</td></tr>
<tr><td rowspan="5">HF</td><td rowspan="5">1934</td><td>5 Amp</td><td rowspan="4">400%</td><td rowspan="9">100</td></tr>
<tr><td>10 Amp</td></tr>
<tr><td>15 Amp</td></tr>
<tr><td>25 Amp</td></tr>
<tr><td>50 Amp</td><td>250%</td></tr>
<tr><td rowspan="5">6/10</td><td>J</td><td>1940</td><td>All Ratings</td><td>400%</td></tr>
<tr><td rowspan="2">J2</td><td rowspan="2">1954</td><td>All Rating</td><td>666%</td></tr>
<tr><td>50 Amp</td><td>400%</td></tr>
<tr><td>J3</td><td>1960</td><td>All Ratings</td><td>666%</td></tr>
<tr><td>J4, J5</td><td>1970 to Present</td><td>All Ratings</td><td>666%</td><td>200</td></tr>
</table>

NOTES:

1. Shaded Area on Table: Obsolete and Unsafe Electric Watt-Hour Meters. (Refer to EPO-REF-K)
2. Meter Class (CL): (Name Plate Amp Rating) x (% Overload of Name Plate Amp Rating) ÷ 100
3. Minimum Meter Rating: Class 60

WESTINGHOUSE ELECTRIC METERS
(ABB)

Meter Basic Kh (Based on 120 Volts 5 Amps)	Meter Type	Year Manufactured	Name Plate Amp Rating	% Overload of Name Plate Amp Rating	Meter Constant (Rr x Kh)
	Metal Cover	1898 - 1902			
	Metal Cover "A"	1903			
	Metal Cover "B"	1905	All Ratings	110%	
	Metal Cover "C"	1907			
	Metal Cover "CA"	1911			
	OA Sub A	1912			
	OA Sub B	1914			
	OA Sub C	1915	All Ratings	200%	
1/3	OA Sub D	1916			
	OA Sub E	1917			
	OA Sub F	1926			1600
	OB	1924 - 1934	All Ratings	200%	
			5 Amp		
			10 Amp	200%	
	OC	1932 - 1941	15 Amp		1200
			25 Amp		
			50 Amp	400%	
	C	1937 - 1958	All Ratings	400%	
6/10	D	1955 - 1963	All Ratings	666%	100
	D2, D3, D4, D5	1963 to Present	All Ratings		

NOTES:

1. Westinghouse single-phase and polyphase meter types D, D2, D7 and D3 with serial numbers 30,000,000 to 39,999,999 are **not approved** and shall be taken out of service. If these types of meters do not have **original** manufacturer's serial number on the name plate, they are to be considered as part of the 30,000,000 to 39,999,999 series. (Refer to EPO-REF-K)

2. Shaded Area on Table: Obsolete and Unsafe Electric Watt-Hour Meters. (Refer to EPO-REF-K)

3. Meter Class (CL): (Name Plate Amp Rating) x (% Overload of Name Plate Amp Rating) ÷ 100

4. Minimum Meter Rating: Class 60

TESTING PROCEDURES FOR *2-STATOR* ELECTRIC METERS

This is the State of California testing policy for 2-stator **self-contained** and 2-stator Class 10 **transformer rated** (200:5A), rotating disk watt-hour meters using Knopp FS-4, -6, -7, -8, and -9 test standards or other compatible standards. The policy has been developed to promote uniform testing procedures for 2-stator type watt-hour submeters.

- A **self-contained** 2-stator meter shall be balance load tested and may be single stator tested if time permits.

- The *full load* test for a **self-contained** 2-stator meter shall be at its nameplate TA rating. The *light load* test current shall be at 10% of the meter TA. The *light load* current value shall be doubled if the meter is single stator tested.

- A **transformer rated** 2-stator meter shall be single stator tested and may be balance load tested. Each current transformer (C.T.) of a meter shall be energized by the standard's phantom load test current. The meter C.T.(s) shall drive the meter disk. Meter only testing, without the C.T. (s) in the metering circuit, is an unreliable test of the system.

- The *full load* test for a **transformer rated** 2-stator meter shall be at 60 amperes. This is accomplished by putting two loops of the test conductor through the C.T. core, for the stator being tested, and then selecting the 30 ampere range on the standard. The *light load* test shall be at 6 amperes. This is accomplished by selecting the 3 ampere range on the standard after the *full load* test is completed. The wiring hook-up is the same for *full load* and *light load* tests.

Conventional wiring diagrams have been developed by the Division of Measurement Standards to assist county personnel in the test procedures described above. They may be obtained from your State Area Device Specialist. There may be legitimate test procedures using other than the State developed wiring diagrams. Any alternate test procedure must be evaluated and determined to be correct by your State Area Device Specialist. For example, an alternate test procedure could be used where a county has specifically wired their laboratory test board for testing certain type electric meters.

SPECIAL HAZARD

When testing a 240 volt 3-wire ("A" Base) Meter

NOTE:

1. When testing a 240 volt 3-wire meter ("A" Base only) there is a serious short circuit hazard when connecting the STANDARD "D" alligator clip to the METER "D" screw position, if not done correctly.

2. To reduce this hazard to a minimum, *do not* squeeze open the Standard "D" alligator clip *before* touching it to the METER "D" screw position.

3. After touching the METER "D" screw with the STANDARD "D" alligator clip (closed) then open it in a horizontal plane (sideways) to make the connection.

4. If by error, the STANDARD "D" alligator clip is opened in a vertical plane (up and down) there is a good possibility of a 240 volt short circuit, through the STANDARD alligator clip, between the METER "D" screw and the meter potential link which is just above "D" screw (see the above picture).

5. This 240 volt short circuit has been made many times in the past and the results are violent. The meter is ruined and at times even the glass cover of the meter is shattered. Be very careful.

SELF-OPERATED RECYCLING MATERIALS, DEVICES AND SYSTEMS

Pre-Test Inspection

1. Identification.

   1.1. One identification plate for the entire machine shall be permanently placed in a conspicuous

   1.2. One identification plate for the entire machine shall be permanently placed in a conspicuous location with the following information: **G-S.1 [1.10]**

      1.2.1. Manufacturer's or distributor's name or trademark.

      1.2.2. Model designation.

      1.2.3. Non-repetitive serial number.

      1.2.4. Capacity. **UR.1.1, (a).1 [2.20]**

2. Type approval. **B&P 12500.5**

3. Installation. **UR.2 [2.20]**

   3.1. Adequate provisions shall be made for reach access to the working mechanism. **UR.2.5 [2.20]**

4. Accessibility for testing purposes.

   4.1. The owner/user of the device shall be readily available for assistance in testing (unlocking doors, explanation of verification codes, supplying cans). **G-UR.4.4 [1.10]**

5. Marking operational controls, indications, and features.

   5.1. Operating instructions shall be clearly and definitely identified. **G-S.6 [1.10]**

   5.2. Required markings and instructions shall be distinct and easily read. **G-S.7 [1.10]**

6. Method of operation. **G-UR.3.1 [1.10]**

   Equipment shall be operated only in the obvious manner indicated by its construction or indicated by instructions.

7. Responsibility, money-operated devices. **G-UR.3.4 [1.10]**

7.1. Name, address and telephone number of the local servicing agency of the device shall be conspicuously displayed along with adequate information detailing the method for the payment of monies when the device malfunctions. This requirement does not apply to devices at locations where employees are present and responsible for resolving any monetary discrepancies for the customer.

<u>Pre-Test Determinations</u>

1. Material test tolerance.

1.1. ± 5% of individual test load on devices which are in use. This test is "as used". The tolerance takes into account the minimum tolerance error at low test loads, dust and moisture loss as the cans are moved by blowers, foreign material in the cans that may be rejected, and pieces of accumulated debris that may fall into the weigh hopper. **Table T.1.1 [2.20]; T.N.3.9 [2.20]**

1.1.1. For devices that have a weight indicator visible to the customer, the basic tolerance is ± 5% of the weight of the preweighed aluminum cans.

EXAMPLE:	Preweighed Weight	1.64 lbs
	x 5% Basic Tolerance	<u>.05</u>
	= Basic Tolerance	.082 lbs
	+ 1/2 Minimum Indication	<u>.005</u> lbs
	= Total Tolerance	.087 lbs
	Rounds <u>DOWN</u> to	.08 lbs

1.1.2. For devices that do not have a weight indicator visible to the customer, the tolerance is ± 5% of the computed payout based on the weight of the preweighed aluminum cans.

EXAMPLE:	Preweighed Weight	1.64 lbs
	x 5% Basic Tolerance	<u>$.27</u>
	= Basic Tolerance	$.4428
	+ 1/2 Minimum Indication	<u>.05</u>
	= Total Tolerance	$.02214
	Rounds <u>TO NEAREST CENT</u>	$.02

1.2. The average error of ten or more test loads shall not exceed ± 2-1/2%.

<u>Tests</u>

1. Initial test. A material test using at least three typical consumer can deposits shall be conducted. A certified weight test of the hopper may be conducted, in which case a technician from the local servicing agency may need to be available. **N.1.8 [2.20]**

1.1. Materials test.

1.1.1. Pre-weigh aluminum cans. (Materials can be supplied by the local servicing agency.) **N.1.8 [2.20]**

1.1.1.1. The aluminum cans should be weighed at the test site.

1.1.1.2. The pre-weigh scale should have a resolution of at least 0.01 pound and be tested prior to the material test.

1.1.1.3. The aluminum cans should be reasonably dry and free of loose material such as dirt, rocks and cigarette butts.

1.1.2. Initiate the operating cycle of the machine and load the cans into the customer feed hopper.

1.1.3. When the cycle is complete, collect the money paid.

1.1.3.1. For devices that have a weight and/or money indicator visible to the customer.

1.1.3.1.1. The indicated weight must be within 5% of the weight of the pre-weighed aluminum cans as computed in Pretest Determinations 1.1.1.

1.1.3.1.2. Check the mathematical agreement of the transaction. The indicated weight x price per pound must equal the indicated money and actual money payout within 1/2 cent.

1.1.3.1.3. The actual money payout must agree with the indicated money, if provided.

1.1.3.2. For devices that do not have a weight indicator visible to the customer.

1.1.3.2.1. The money payout must be within the payout tolerance as computed in Pre-test Determinations 1.1.2.

1.1.3.2.2. The money payout must agree with the indicated money, if provided.

1.1.4. Repeat Steps 1.1.1 through 1.1.3 at two or more additional test loads.

WATER DISPENSERS

Pre-Test Inspection

1. Identification. **G-S.1 [1.10]**

    1.1. One identification plate for the entire machine shall be permanently placed in a conspicuous location, visible after installation, with the following information.

    1.1.1. Manufacturer's or distributor's name or trademark.

    1.1.2. Model designation shall be prefaced by the term "Model," "Type," or "Pattern" or an approved abbreviation of that term.

    1.1.3. Non-repetitive serial number shall be prefaced by the words "Serial Number" or an approved abbreviation of that term.

2. Type approval. **B&P 12500.5**

3. Measuring elements. **S.2 [3.36]**

    3.1. Air elimination. **S.2 [3.36]**

    The system shall be equipped with an effective means to prevent the passage of air through the measuring operation.

    3.2. Sealing provisions. **G.S.8 [1.10]; G-UR.4.5 [1.10]; S.2.2 [3.30]; S.2 [3.36]**

    The system shall have adequate means for sealing any measurement element(s) or control for controlling the delivery rate (i.e., configuration board) that effects the accuracy of delivery.

4. Installation requirements. **G-UR.2.1 [1.10]**

    4.1. Water dispenser machine should be installed in a level and plumb condition in accordance with manufacturer's specifications.

    4.2. No means shall be provided by which any measured liquid can be diverted from the measuring operation of the discharge line. Liquid can flow from only one outlet at one time and the direction of the flow is definitely and conspicuously indicated. **S.2.2.2 [3.36]**

5. Operating controls shall be clearly and definitely identified. Required markings and instructions shall be distinct and easily readable. **G.S.6 [1.10]; G.S.7 [1.10]**

6. Method of operation. **G-UR.3.1 [1.10]**

   Equipment shall be operated only as indicated by its construction or indicating instructions.

7. Responsibility, money-operated devices.

   7.1. Name, address and telephone number of the local servicing agency of the device shall be conspicuously displayed along with adequate information detailing the method for the payment of monies when the device malfunctions. This requirement does not apply to devices at locations where employees are present and responsible for resolving any monetary discrepancies for the customer. **G-UR.3.4 [1.10]**

Pre-Test Determinations

1. Test measure size.

   1.1. Must accommodate the output of the device for at least one delivery. If more than one delivery option is available, prover sizes must accommodate the smallest and largest deliveries as a minimum.

   1.2. If the required prover size will not fit under the delivery spout, another means for accommodating delivery to the prover must be devised.

2. Tolerances. ± 1.5% of test draft (maintenance and acceptance). **T.1, Table T.1. [3.36]**

3. Markings.

   3.1. The unit of measure must be identified on the device. **G-S.5.2.4 [1.10]; G-S.7 [1.10]**

Tests

1. Wet test measure(s), empty and allow a 10-second drain after main flow stops.

2. Position test measure, insert coin(s), currency or tokens, and activate the dispenser to deliver type of water selected. **N.1.1 [3.30]**

   2.1. Insure proper change is returned with any combination of inserted coin(s), currency or token(s). **G-S.2 [1.10]**

3. Let dispenser vend water, wait until main flow breaks and begins to drip, allow an appropriate (usually 10-second) drain. Read and record error from the test measure; calculate and record the flow rate and amount dispensed.

4. Check each type of dispensed product, and as a minimum, largest and smallest deliveries the dispenser vends. **N.3 [3.30]**

5. If required in the "Sealing" section of the applicable Certificate of Approval, verify sealing of the metrological parameters. **G-UR.4.5 [1.10]; G-S.8 [1.10]; S.2.2 [3.30]; S.2.4.3 [S.30]**

    5.1. Calibration – physical seal or audit trail.

    5.2. Flow Rate – adjustments.

    5.3. In-line filter replacement and maintenance.

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STATE OF CALIFORNIA

GRAY DAVIS, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE
Division of Measurement Standards
8500 Fruitridge Road
Sacramento, CA 95826

DMS NOTICE
D - 00 - 13

October 24, 2000

Discard: Retain

TO WEIGHTS AND MEASURES OFFICIALS

SUBJECT: Service Agency Regulations

New regulations relating to Service Agencies and Agents are now in effect.

The regulatory action filed by the Department was approved by the Office of Administrative Law and filed with the Secretary of State on October 23, 2000.

Normally, regulations become effective 30 days after filing with the Secretary of State. However, due to the need to license almost 4000 agents before January 1, 2001, the Division requested that the regulations become effective upon filing. This request was granted and the regulations are now in effect.

Counties now have the authority to administer Service Agent examinations.

Attached is the final text of the regulations.

Please contact Roger Macey at (916) 229-3047 if you have any questions.

Sincerely,

Mike Cleary
Director
(916) 229-3000

Attachment

CALIFORNIA CODE OF REGULATIONS
TITLE 4, DIVISION 9, CHAPTER 4

CHAPTER 4. REGISTRATION OF SERVICE AGENCIES FOR COMMERCIAL WEIGHING AND MEASURING DEVICES

4080. Application.

This chapter applies to any person performing duties as a service agency or service agent.

NOTE: Authority cited: Section 12027, Business and Professions Code. Reference: Section 12531, Business and Professions Code.

4081. Registration of Service Agencies and Service Agents Required.

(a) Each service agency shall forward to the Department, with the appropriate registration fee (Business and Professions Code Section 12535), the name and license number of a service agent within 30 days of hiring by the service agency.

(b) The registration of a service agent shall expire upon termination of employment with the service agency.

(c) Each service agency shall notify the Department within 30 days of the termination of a service agent.

NOTE: Authority cited: Section 12027, Business and Professions Code. Reference: Sections 12531 and 12532, Business and Professions Code.

4082. Fees.

(a) Any fee not paid when due, or sent by mail and postmarked five days or more after the due date, is overdue.

(b) The registration of a service agent shall expire upon termination of employment with the service agency.

(c) Each service agency shall notify the Department within 30 days of the termination of a service agent.

NOTE: Authority cited: Section 12027, Business and Professions Code. Reference: Sections 12531 and 12532, Business and Professions Code.

4083. Examinations/Licenses.

(a) Applicants for a service agent license must provide proof of identity by means of a picture identification, complete form number 44-013 (Est. 3/00) “Service Agent Examination for Weighing and Measuring Devices” which is incorporated by reference, and at the time of the examination, pay an examination fee of $35. The proctor and applicant shall certify under penalty of perjury that the examination was given in accordance with the procedures specified [see Section 4083(b)].

(b) Written examinations will be administered by a county weights and measures office or the Division of Measurement Standards. The examination shall be administered according to instructions issued by the Division of Measurements Standards “Administration of Service Agent Examination” (Est. 8/00), which is incorporated by reference. Applicants will be advised of the results on the day of the examination.

(c) An applicant must receive a minimum score of 70 percent to qualify for a service agent license. Successful applicants will be provided with a service agent license at that time. Such license shall be valid for a period of five years from date of issue.

(d) Completed examination forms will be retained in the county or state office where administered for a period of five years. County offices will provide to the Division of Measurement Standards within 30 days the names of individuals to whom service agent licenses have been issued.

(e) Applicants failing to receive a passing score may schedule an appointment to be reexamined. The fee specified in subsection (a) shall be paid each time the examination is taken. Reexaminations are subject to all the above conditions.

NOTE: Authority cited: Section 12027, Business and Professions Code. Reference: Section 12540, Business and Professions Code.

4084. Authority for Service Agency to Place a Device into Service.

Pursuant to Business and Professions Code Sections 12509 and 12532(d), a service agency may perform any of the following:

(a) place a correct device into service,

(b) remove an “out-of-order” notice to perform the service, and must replace the notice if the device can not be corrected, or

(c) remove an “out-of-order” notice from a corrected device and place it into service.

NOTE: Authority cited: Sections 12027, 12532(b), and 12509, Business and Professions Code. Reference: Sections 12531 and 12532, Business and Professions Code.

4085. Responsibility of a Service Agency.

(a) Each service agency shall be responsible for compliance with the following:

(1) **Repairing or Placing Devices into Service.** - Each service agency shall place into service, upon installation or following repair, a device in such a manner that it meets all the requirements of Division 5 of the California Business and Professions Code and all the requirements of the California Code of Regulations, Title 4, Division 9. Weighing or measuring devices which are not "correct", as defined by Section 12500(c) of the Business and Professions Code, shall not be placed into service.

(2) **Notice to County Sealer of Repairing or Placing of Device into Service by Service Agency. -** Each service agency shall notify the county sealer of the repairing or placing in service of any device. The notice shall be in writing, and transmitted to the county sealer within the 24-hour period following the repair, except as provided by Business and Professions Code Section 12515(b).

The notification shall include the following minimum identifying information;

(i) Name and address of service agency.
(ii) Location of device(s). Name and address, including if available the unique identifier used by the business (e.g., pump or checkstand number).
(iii) Name of service agent.
(iv) Date of adjustment, repair, placing, or replacing into service.
(v) Name of device manufacturer(s).
(vi) Model designation(s) and serial number(s) of the device(s).
(vii) On new installations, the National Institute of Standards and Technology or National Conference on Weights and Measures Certificate of Conformance number(s) for each separately approved component or device, if marked on the component or device.

(3) **Security Seal.** - Service agents shall replace a security seal on any adjustment mechanism where the seal was required to be removed for service, repair, or installation. Before placing a device into service, service agents shall install a security seal on any adjustment mechanism designed to be sealed.

(4) **Identification of Service Agency Work. -** Service agents shall identify their work on each device by applying an adhesive tag or label in a conspicuous location on the device. The adhesive tag or label shall show the name, registration number and business telephone number of the service agency, the license number of the service agent performing the work, and the date. Any security seal required pursuant to Section 12107 of the California Business and Professions Code shall show the registration number of the service agency and the year the security seal was placed on the device.

(5) **Certificate of Accuracy of Standards.** - A service agency shall, on request from a sealer, show a copy of the certification of accuracy for the standards used to place a device into service.

NOTE: Authority cited: Sections 12027 and 12107, Business and Professions Code. Reference: Sections 12515(a), 12531, 12532(h) and 12533, Business and Professions Code.

4086. Certification of Service Agency Standards.

Each service agency shall have its standards certified at the service agency's expense. Standards shall be tested and certified by either the Department or other metrology laboratories traceable to the National Institute of Standards and Technology (NIST). These laboratories include those in county weights and measures programs, industry, and other states that have been approved, certified, or accredited by NIST, or the Department in accordance with criteria established by NIST, or by other appropriate national or international accrediting organizations. The standards shall be certified as often as the Department deems necessary, based upon a review of supporting statistical data resulting from previous certifications, but in no event shall the period of time between certifications exceed 10 years. In the absence of supporting statistical data, standards shall be certified at least every two years.

NOTE: Authority cited: Sections 12027 and 12314, Business and Professions Code. Reference: Sections 12531(e), 12533, (a)(1) 12533(a)(2) and 12534, Business and Professions Code.

4087. Payments to Counties.

Payment to counties shall be subject to the following conditions:

(a) Each county shall report annually, before November 1, expenditures for the prior fiscal year, which shall be the period from July 1 through June 30.

(b) The county report, which shall be subject to audit, shall be submitted on form number 40-08A “County Annual Report” (Rev. 8/00), which is incorporated by reference.

(c) Any county not submitting a report by the prescribed date may be excluded from payment for that year.

(d) Payment for each fiscal year shall be based on the registration fees received for the same fiscal year.

(e) Payments to counties, based on expenditures which occurred during the previous fiscal year, will be made on or about January 31 of each year.

NOTE: Authority cited: Sections 12027 and 12537, Business and Professions Code. Reference: Sections 12209(c) and 12537, Business and Professions Code.

4088. Advisory Committee.

(a) Members of the Committee shall receive no compensation, but are entitled to payment of necessary traveling expenses in accordance with State Administrative Manual Section 0774 (Rev. 9/91) and the rules of the Department of Personnel Administration.

(b) The Committee shall be advisory to the Department and may make recommendations on all matters pertaining to service agencies and/or service agents.

(c) The Committee shall elect a chairman and other officers as it deems advisable.

(d) The Committee shall meet at the call of the chairman or the Department, or at the request of any four members of the Committee. The Committee shall meet at least once a year.

(e) A quorum shall consist of five members. A vote of the majority of the members present at a meeting at which there is a quorum shall constitute an act of the Committee.

NOTE: Authority cited: Sections 12027 and 12541 (a), Business and Professions Code; Government Code 19815.4(d). Reference: Section 12541(a)(d), Business and Professions Code.

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE

Division of Measurement Standards
8500 Fruitridge Road
Sacramento, California 95826

DMS NOTICE
D - 86 - 2

July 1, 1986

Discard: Retain

TO WEIGHTS AND MEASURES OFFICIALS

SUBJECT: Vapor Recovery System Repairs

Repairing of components in vapor recovery systems at gasoline service stations may either create or fail to correct problems in delivery or recirculation of product.

Because "o-rings" or other critical parts may be omitted or damaged in assembly, it is essential that repair or replacement of parts inside the nozzle be reported to the county sealer/director.

Notification as required by California Business and Professions Code Section 12515 includes notification for repair or replacement of the following:

- Complete nozzles
- Anti-drain valves
- Automatic shutoff mechanisms
- Spouts of nozzles
- Delivery poppets
- Anti-recirculation traps or valves
- Retractor parts on overhead hose systems

Sincerely,

Darrell A. Guensler

Darrell A. Guensler
Assistant Director
(916) 366-5119

STATE OF CALIFORNIA PETE WILSON, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE

Division of Measurement Standards
8500 Fruitridge Road
Sacramento, California 95826

DMS NOTICE
D - 94 - 1
(Re-Issue of D-91-3)

January 25, 1994

Discard: Retain

TO: WEIGHTS AND MEASURES OFFICIALS AND VAPOR RECOVERY NOZZLE REPAIRMEN

SUBJECT: Rebuilt and Repaired Vapor Recovery Nozzles

A number of questions have been asked about repairmen placing "rebuilt" or "repaired" vapor recovery nozzles into commercial use. In response to the inquiries, we are providing the following information.

The California Air Resources Board (CARB) states any work on "internal parts of a nozzle" or "nozzle body" requires testing and certification by CARB, DMS, and the State Fire Marshall. Any such work is defined as "rebuilding" a nozzle. "Repair" of a nozzle is limited to front end replacement of spouts, bellows, and scuff guards. Rebuilt vapor recovery nozzles placed into service by registered repairmen <u>must</u> have been rebuilt and identified by a company holding a California type approval certificate.

When repairmen install vapor recovery nozzles and place them into commercial service, they must comply with all requirements including identification, notification, installation, and performance. It has been reported that many repairmen installing vapor recovery nozzles do not possess equipment to test for proper operation of primary and secondary shut-off mechanisms in nozzles so equipped. A second complaint is that nozzles are being "rebuilt" by nonapproved rebuilders or repairmen.

Because a number of problems have been verified, a routine inspection of service station dispensers, equipped with vapor recovery nozzles, should include tests of three or four nozzles to screen for the probability of defective nozzles and possible violations by repair companies. If a defective nozzle is identified during this screening process, the remaining nozzles should be examined. When failures occur, officials should gather investigative information about installations, including:

- Who is the manufacturer, rebuilder, or repairman?
- Are vapor recovery nozzles new, rebuilt, or repaired?

DMS NOTICE
D - 94 - 1
Page Two

- If vapor recovery nozzles are new or "rebuilt", does the manufacturer or rebuilder have a certificate of approval?

- If a repairman placed vapor recovery nozzles into service, did they comply with all the requirements?

If you have questions, please contact the Measurement Standards Specialist in your area or Dennis Johannes at the number below.

Sincerely,

Darrell A. Guensler

Darrell A. Guensler
Assistant Director
(916) 387-4241

STATE OF CALIFORNIA GEORGE DEUKMEJIAN, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE

Division of Measurement Standards
8500 Fruitridge Road
Sacramento, California 95826

DMS - 10

Est.: 10-20-81
Rev.: 7-1-86

TO WEIGHTS AND MEASURES OFFICIALS

SUBJECT: Type Approval Requirements for One-of-a-Kind or Modified Devices

The California Business and Professions Code provides for approval of all types or designs of weights, measures, or weighing, measuring, or counting instruments or devices used for commercial purposes.

Devices which are one-of-a-kind, modifications to approved devices which result in a one-of-a-kind device, or devices for which the individual installation determines measurement characteristics so uniquely as to make them effectively one-of-a-kind, will be treated in this way: The inspection of such devices by the local sealer/director of weights and measures will constitute the type approval examination. Successful completion of this examination will be required for type approval certification which will be valid for that location only.

The following guidelines will govern "one-of-a-kind" devices:

1. Following an application to DMS, the determination of the applicability of this classification will be made by DMS after consultation with the manufacturer and the local sealer of weights and measures.

2. The initial testing for code requirements will conform to the applicable EPO and/or specified type approval procedures outlined by the NTEP checklists.

3. A second test will be conducted 20-30 days after successful completion of the initial test. The results must be within acceptance tolerances.

4. After successful completion of both tests, the results will be submitted to DMS which will issue the Certificate of Approval, valid for that installation only. Test results are to be submitted on forms provided by the Division of Measurement Standards.

5. Fees may be charged for the type approval according to the DMS Cost Recovery Fee Schedule. If fees are charged, it shall be the responsibility of the county to bill for and collect such fees. Cost recovery does not apply to routine, subsequent tests.

Agencies or owners who modify previously approved devices by means of a retrofit kit may apply for type approval of the kit. The approval retrofit kit will be assigned a model number which shall also be marked on the indicating element of the device. The original model number(s) of the device shall remain.

The following one-of-a-kind alterations will not require a new type approval examination but will be evaluated on an individual basis.

1. Alteration of a device by the exchange or incorporation of a compatible type approved component or a combination of several compatible type approved components not previously part of it.

2. Changing the width equally on each side by a total of 10% or less, or length equally on each end of the load receiving element by a total of 10% or less, or 5% or less on one end, but not changing the capacity. When the length is changed, the distance between the load bearing elements must be changed proportionately.

Agencies or owners proposing these one-of-a-kind modifications should write DMS regarding proposed changes so that an evaluation can be made of the impact the modifications will have on type approval for that device. Originators of such modifications must accept the responsibility for continued reliability and accuracy of the device.

Darrell A. Guensler
Assistant Director

7-1-86
Date

STATE OF CALIFORNIA PETE WILSON, *Governor*

DEPARTMENT OF FOOD AND AGRICULTURE

Division of Measurement Standards
8500 Fruitridge Road
Sacramento, California 95826

DMS NOTICE
G - 91 - 4

October 15, 1991

Discard: Retain

TO WEIGHTS AND MEASURES OFFICIALS

SUBJECT: Static Electricity Safety Hazards

Recently, fires have been reported to have occurred while fuel was being dispensed into containers at service stations, even when the nozzle and hose were properly grounded. It is suspected that these fires were started by a static spark when the fuel/air mixture was optimum for ignition. Although these were relatively isolated incidents, inspectors involved in testing retail and wholesale meters should take precautions to reduce the risk of fire caused by a static spark when filling test measures or fuel cans, or when pouring from a test measure or fuel can into a storage tank.

The following article printed in a May 1991 newsletter by Exxon Corporation presents safety warnings that should be considered while handling potentially volatile products:

"Static electricity buildup is a safety hazard to be aware of when checking meter calibrations on your dispensers. A spark from the buildup can result in 'flashing' during the filling of the 5-gallon test can.

As a precautionary measure, Exxon C & M developed the following safety practice guidelines when performing meter calibration testing. They recommend always being alert to these possible causes of flashing and observing the preventive practices described.

- Can Isolated - Place the can directly on the ground while filling it, not on a dolly or otherwise off the ground.
- Nozzle Not Grounded to Can - Before dispensing a product, touch the nozzle to the can and maintain contact while the product is flowing.
- Splash Loading - Run the product down the inside wall of the can. Avoid letting the product drop from the neck to the bottom of the can.
- Can Not Grounded - As an added precaution, retrofit the test can with a ground wire and an alligator clip, which can be attached to a suitable grounding point. The operating handle or any base metal on the dispenser will do.

- **Switch Loading - If testing all dispensers, start with the diesel dispenser, followed by gasoline tests. Diesel is a non-conducting liquid, which increases the possibility of static buildup. Gasoline vapors that may be left in the can are highly flammable.**

And for added safety, always have a fire extinguisher available during meter calibration testing."

After discussions with the State Fire Marshal's technical staff and engineers from industry, the following additional precautions are recommended to avoid a static spark in the presence of vapors.

- Before dispensing product from a nozzle, attach a bond wire between test measure or fuel can and the dispensing nozzle or metal hose fitting threaded into the nozzle (in addition to the ground wire).
- Before pouring from a test measure or fuel can into a storage tank, attach a bond wire between the metal funnel and the measure or fuel can.

We encourage you to check with manufacturers of test vehicles and carts or local safety officials regarding questions about proper measures to eliminate these static electricity sources as potential hazards when using such equipment. The attached publications may be helpful in providing more detail.

If you have questions, please contact your area specialist or Ken Lake at (916) 366-5119.

Sincerely,

Darrell A. Guensler

Darrell A. Guensler
Assistant Director
(916) 366-5119

Attachments

DMS NOTICE
G-91-4
Page Two

SUBJECT: CLARIFICATION OF BUSINESS AND PROFESSIONS CODE, SECTION 12014

A preliminary examination is an integral part of every test procedure, even though this may be so basic that the written procedure ignores it. A device may be incomplete, broken, or have external factors such that it does not warrant the application of standards to prove accuracy or inaccuracy.

A device may be marked "out of order" because of a deficiency found on the preliminary examination since this is a part of the test of the device. Section 12014 of the Business and Professions Code states that it is a misdemeanor to seal a device if it does not conform to the standards of the State, but the prohibition in the section against condemning without testing does not mention State standards.

For example, on a preliminary examination, it is found that there is no way that a beam scale can be balanced to a zero condition. It is a correct procedure to mark the scale "out-of-order" even though no test weights have been applied.

Est.: 7/86
Rev.: 9/99

SUBJECT: CHECKSTAND SCALES

California Code of Regulations Section G-S.l. [1.10] requires identification of a commercial device (manufacturer/distributor, model number and serial number) to be visible in a conventional installation.

Checkstand scales are often placed into recessed areas with only the platter (load receiving element) exposed. These scales are currently being approved with the required identification on the top of the scale housing where it is readily available and visible upon removal of the platter.

Scales which are in "wells" of checkstands and do not have the required identification in a visible location can be brought into compliance by either of the following means:

- Provide an opening or easily-opened door to gain direct line-of-sight access to the required identification.
- Installation of a permanently attached duplicate identification tag or label which has the same information as provided by the original identification. This tag or label must be readily visible upon removal of the platter.

Non-permanent identification markings are not acceptable and shall not be removed, relocated or obliterated to comply with G-S.1. [1.10].

"Permanent" markings addresses two aspects: (1) the printed information will withstand wear and cleaning, and (2) if the markings are on a plate or badge, then the marking badge must be "permanently" attached to the device. Permanence of attachment of the badge means that the identification information required by G-S.1. is not easily removed, and if removed, then it must be obvious that the badge or plate containing this information has been removed. All markings must be clear and easily readable. The identification marking must be permanent and attached with pop rivets or adhesive or equivalent permanent means. Removable bolts or screws are not permitted. A foil badge may be used provided that it is durable, difficult to remove, and exhibits obvious evidence of an attempt to remove the marking or badge such as destruction of the badge by tearing, permanent and extensive wrinkling, or repeated exposure of the word "VOID" upon removal of the badge.

Est.: 7/86
Rev.: 1/95

SUBJECT: ELECTRONIC CASH REGISTERS AND POINT-OF-SALE SYSTEMS

MARKING, SERIALIZATION REQUIREMENTS FOR POINT-OF-SALE SYSTEMS

Electronic cash registers (ECR) and point-of-sale (POS) systems are approved on the basis that they are separable major components of the weighing element (analogous to a smart printer). Each register must comply with the appropriate identification requirements. Identification data must be permanently and clearly marked on a surface visible after installation.

Visibility may be enhanced by placing a duplicate serial number badge on the front, side, or top of the ECR. This badge may be limited to the serial number if the other required information is visible elsewhere on the ECR.

Point-of-sale systems are available in integrated and modular units. Each unit may have “slave” components that merely print, display, or transmit information to a processing component. Slave modules do not need separate serial numbers since they are adequately identified by the serial number of the point-of-sale system. However, a serial number is required on any portion of a system that can operate as a stand-alone system. In addition to the manufacturer’s name, components of a modular point-of-sale system are to be marked as indicated below:

- Weighing element - model number and capacity statement. New scales installed after January 1, 1988 must also be marked with the accuracy class, the maximum number of scale divisions, and the minimum verification scale division.

  A serial number is required if the weighing element can operate independently as a self-contained bench/computer scale. The serial number must be identified by words, abbreviations, or a symbol that clearly identifies the number as a serial number (nonretroactive as of January 1, 1986).

- Printer - model number required (visible without the use of a tool).*

- Keyboard - model number required (visible without the use of a tool).*

- Remote scale display - model number and capacity statement with minimum increment. New systems installed after January 1, 1988 must be marked with an accuracy class and maximum number of scale divisions, n, for which the indicator complies with the applicable requirements.

  * Slave printers and keyboard modules will no longer be required to be approved since their compliance with the applicable performance requirements can be adequately controlled through existing field enforcement procedures.

- Control unit - model number and serial number required; model number and serial number shall be visible after installation.

The following components are not required by weights and measures to have any identification and do not require type approval:

- Card Readers and Bank Debit Keyboard
- Optical Scanner
- Change Dispenser
- Cash Drawer
- Back Room Computer
- Voice Synthesizer Module

New electronic cash registers are being designed to accept only the total price of a weighing transaction from a computing scale. These ECRs are not considered point-of-sale systems if they meet all the following conditions:

1. The computing scale displays the weight, unit price, and total price on both the customer and operator side of the scale.

2. The scale is positioned so the customer can accurately read the indications and observe the weighing operation.

3. The scale is equipped with motion detection.

4. The scale is not equipped with price look-up capability.

5. The computing scale is equipped with a tare capability.

6. The ECR cannot have any input to the computing scale in determining the total of a weighed transaction.

Under these conditions, the ECR is equivalent to a label printer and does not need to comply with California Code of Regulations Section S.1.8.4 [2.20]. All other electronic cash registers which accept weight information from an approved scale, compute the proper price extension, compute net weight, and provide printed weight information are considered point-of-sale systems.

Both ECRs and POS systems are subject to type approval and inspection by weights and measures officials.

CODE REFERENCES:

G-S.l [1.10], G-UR.3.2 [1.10]
S.6.1 [2.20], S.6.2 [2.20], S.6.3 [2.20], Tables S.6.3(a)(b) [2.20]

WEIGHTS AND MEASURES ENFORCEMENT POLICY

When out-of-order tags are issued in connection with a test of an ECR/POS, the entire system (checkstand) is considered rejected. The tag should be placed in a location where it is easily seen. No component of the system (ECR, scale or module) is to be used independently; nor is the system to be used until legally placed in service under the provisions of the California Business and Professions Code.

Est.: 7/86
Rev.: 9/99

SUBJECT: THREE-WHEEL REGISTERS

This EPO reference is no longer valid due to the retroactive provisions of Section 3.30., "U.R.3.3.(b) Computing Device."

Est.: 7/86
Rev.: 5/87

SUBJECT: ELECTRICITY - STATIC

Static electricity or any spark, regardless of its source, can ignite gasoline vapors, propane, and other volatile liquids and gases. This potential hazard should be kept in mind when testing equipment where such products are involved.

Tank trucks and other rubber-tired vehicles (such as some provers) are great potential generators of static electricity. An accumulation of this static electricity is often demonstrated by electrical sparks when a person touches the body of the vehicle, or by a slight shock when entering or leaving the vehicle.

One of the best methods of protection for inspectors is: Connect a wire from a known ground to the prover, then connect a wire from the prover to the equipment being tested, and finally, for the ultimate precaution, a wire from this equipment back to the original known ground.

Est.: 7/86

SUBJECT: LPG RECIPROCAL AGREEMENT

An agreement has been signed with the State of Arizona granting recognition of their testing and sealing of liquefied petroleum gas delivery truck meters.

LPG meters sealed in Arizona will have been tested in accordance with California Examination Procedures Outline Number 30 as amended.

Any LPG meter with an Arizona seal may also be retested at the discretion of any California Weights and Measures Official.

Est.: 7/86
Rev.: 1/95

SUBJECT: SAMPLING PROCEDURE FOR VAPOR METERS

The following sampling plan may be used for new or rebuilt vapor meters entering service in your counties.

Non-homogenous meters may be included in a "lot" originating from the same point of origin. A lot does not have to consist of the same brand and model of meter.

1. LOT DETERMINATION

The vapor meters in one specific location are considered a lot.

2. SAMPLE SELECTION

2.1. The sample size shall be determined from the following table:

Lot Size	Sample Size
1-20	All
21-50	21
51-70	24
71-90	26
91-110	28
111-150	30

2.2. The sample of vapor meters will be selected randomly from the lot. It is anticipated that a list of meters will be available for each lot, or that such a list will be established. The sample of meters will be selected from this list by using:

(a) A table of random numbers, or

(b) A calculator generating random numbers.

3. TESTING PROCEDURE

3.1. Determine the lot (see #1).

3.2. Select randomly the sample of 20 or more meters (see #2).

3.3. Inspect and test the selected meters following the procedures in EPO NO. 31, scoring defects on form 46-020 as follows:

(a) Overregistration = 1.5% 2 points.

(b) Overregistration error > 1.5% 5 points.

(c) Underregistration = 3.0% 2 points.

(d) Underregistration > 3.0% 5 points.

(e) The sample fails if any of the following is found:

(1) Points $\geq$ 10.

(2) More than one meter fails the leak test.

(3) More than one meter fails the low flame test.

(f) Otherwise the sample passes.

4. LOT ACCEPTANCE

If the sample passes, then the lot is accepted and all meters in the lot may be sealed and released for use except those meters which were found to be out-of- tolerance or failed to meet other performance requirements; these are to be tagged "out-of-order".

5. LOT REJECTION

If the sample fails, then the lot is rejected and no meters in the lot should be sealed. The person requesting the test (mobile home park owner, meter manufacturer or distributor) should be notified to recheck the entire lot and repair the meters as necessary.

Upon resubmission of the lot after repair, begin the sampling procedure in EPO NO. 1. If a lot fails two or more times, further appropriate enforcement action should be taken.

EPO REF-H
Page Two

HYDROCARBON GAS METER INSPECTION FORM

Makes:				
Rated Capacities:				
Meters are: ☐ New ☐ Repaired			Date:	
Prover Identification No.	Prover Capacity	Lot Size:	Sample Size:	Lot: ☐ ACC ☐ REJ

OPEN RATE TEST					
% OF ERROR	FREQUENCY OF ERROR				POINTS
0.0	00000	00000	00000	00000	______
0.1	00000	00000	00000	00000	______
0.2	00000	00000	00000	00000	______
0.3	00000	00000	00000	00000	______
0.4	00000	00000	00000	00000	______
0.5	00000	00000	00000	00000	______
0.6	00000	00000	00000	00000	______
0.7	00000	00000	00000	00000	______
0.8	00000	00000	00000	00000	______
0.9	00000	00000	00000	00000	______
1.0	00000	00000	00000	00000	______
1.1	00000	00000	00000	00000	______
1.2	00000	00000	00000	00000	______
1.3	00000	00000	00000	00000	______
1.4	00000	00000	00000	00000	______
1.5	00000	00000	00000	00000	______
1.6	00000	00000	00000	00000	______
1.7	00000	00000	00000	00000	______
1.8	00000	00000	00000	00000	______
1.9	00000	00000	00000	00000	______
2.0	00000	00000	00000	00000	______
2.0+	00000	00000	00000	00000	______
2.1	00000	00000	00000	00000	______
2.2	00000	00000	00000	00000	______
2.3	00000	00000	00000	00000	______
2.4	00000	00000	00000	00000	______
2.5	00000	00000	00000	00000	______
2.6	00000	00000	00000	00000	______
2.7	00000	00000	00000	00000	______
2.8	00000	00000	00000	00000	______
2.9	00000	00000	00000	00000	______
3.0	00000	00000	00000	00000	______
3.0	00000	00000	00000	00000	______
				TOTAL	

RESULTS OF RANDOM SAMPLE OF PALLETS								
LAYER NO.		SAMPLE NUMBERS						
	1							
	2							
	3							
	4							
	5							
	6							

Circle consecutive number(s) when meter(s) fail test:

LEAK	1.	2.	3.	4.	5.
LOW FLAME TEST	1.	2.	3.	4.	5.
DUPLICATE REJECTIONS	1.	2.	3.	4.	5.

REMARKS: ____

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____

____

____

INSPECTED BY	TITLE

Est.: 7-86
Rev.: 3-99

SUBJECT: SAMPLING PROCEDURES FOR TESTING ELECTRIC METERS

The following sampling plan may be used for new or rebuilt electric watt-hour meters entering service in your counties.

Non-homogenous meters may be included in a "lot" originating from the same point of origin. A lot does not have to consist of the same brand and model of meter.

1. LOT DETERMINATION

   The electric meters in one specific location are considered a lot. The maximum lot size is 300 meters. If, in a given location, the number of electric meters exceeds 300 units, all meters will be equally divided into two (or more) lots. Each lot will then be tested independently.

2. SAMPLE SELECTION

   The sample of electric meters will be selected randomly from the lot. It is anticipated that a list of electric meters will be available for each lot, or that such a list will be established. The sample of electric meters will be selected from this list by using:

   (a) A table of random numbers, or

   (b) A calculator generating random numbers.

3. TESTING PROCEDURE

   3.1. Determine the lot (see 1).

   3.2. Select randomly the sample of 20 electric meters (see 2).

   3.3. Inspect and test the selected electric meters following procedures in EPO NO. 39. A meter which fails to meet one or more requirements is scored as one defect.

   3.4. Evaluate the results (use Table I).

If # of defects	= 0	--	Accept the lot
	$\geq$ 4	--	Reject the lot
	= 1-3	--	Continue in testing (go to 3.5)

3.5. Same as 3.2 and 3.3.

3.6. Evaluate the inspection results (use Table I).

If # of defects = 1 -- Accept the lot

$\geq$ 5 -- Reject the lot

= 2-4 -- Continue in testing (go to 3.7)

3.7. Select randomly and inspect the sample of 10 electric meters.

3.8. Evaluate the inspection results (use Table I).

If # of defects = 2 -- Accept the lot

$\geq$ 6 -- Reject the lot

= 3-5 -- Continue in testing (go to 3.9)

3.9. Same as 3.7.

3.10. Evaluate the inspection results (use Table I).

If # of defects = 3 -- Accept the lot

$\geq$ 7 -- Reject the lot

= 4-6 -- Continue in testing (going to the next step - see Table I)

NOTE: Symbols $\geq$ means, equal to or greater than.

TABLE I
QUALITY CONTROL SEQUENTIAL METHOD

Step	Single	Cum.	Acc.	Rej.
1	20	20	0	4
2	20	40	1	5
3	10	50	2	6
4	10	60	3	7
5	10	70	4	8
6	10	80	5	8
7	10	90	6	8
8	10	100	7	8

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Page Two

4. LOT ACCEPTANCE

If the sample passes, then the lot is accepted and all meters in the lot may be sealed and released for use <u>except</u> those meters which were found to be out-of- tolerance or failed to meet other performance requirements. These are to be tagged "out-of-order".

5. LOT REJECTION

If the sample fails, then the lot is rejected and no meters in the lot should be sealed. The person requesting the test (mobile home park owner, meter manufacturer or distributor) should be notified to recheck the entire lot and repair the meters as necessary.

Upon resubmission of the lot after repair, begin the sampling procedure in EPO NO. 1. If a lot fails two more times, further appropriate enforcement action should be taken.

ELECTRIC METER INSPECTION REPORT

REPORT NO.	R.T. NO.	COUNTY	TIME AM PM	DATE

NAME ADDRESS

CITY STATE ZIP PHONE NO.

METER MANUFACTURER	MODEL NUMBER	VOLTS	AMPS	CLASS	Kh	Rr

LOT SIZE	SAMPLE SIZE	ACCEPT NUMBER	SUBJECT NUMBER

METERS REJECTED ___________ SAMPLED ___________

RATE PER KILOWATT HOUR $

LOT PASSED ☐ LOT REJECTED ☐

AVERAGE CONSUMER PER SPACE

NO DECISION-ADDITIONAL SAMPLE TAKEN ☐

SEQUENTIAL SAMPLE NUMBER

SPACE NUMBER	SERIAL NUMBERS	METER READINGS	% ERROR		AS FOUND		REMARKS
			± FL	± LL	IN	OUT	
			TOTALS				

OWNER OR AGENT TITLE SEALER: ___________

This is to certify that in accordance with this law, I have tested, inspected meters and have passed or rejected them as above set forth.

BY:

Form 46-021 (Rev. 1/95)

Est.: 7/86
Rev: 9/99

SUBJECT: B AND K REBUILT ELECTRIC METERS

San Diego County filed a civil action against B and K Meter Service of Los Angeles for selling unapproved rebuilt electric meters. Without admitting guilt to any of the changes, B and K has stipulated to a final judgement in the case.

The owner of B and K was assessed a total penalty of $1,500.00. The owner and the company are now under an injunction which prohibits the sale of unapproved devices in California, including those models for which B and K's type approval had been rescinded.

Certificate of Approval Number 1718-79 dated March 21, 1979 is the reference for determining which B and K rebuilt meters are approved for sale.

Questions concerning the judgment or regarding meters sold by B and K may be referred to Dan Reiswig or Ken Lake at (916) 229-3000.

File Under:
Electric Meters

CERTIFICATE NO. 1718-79

STATE OF
DEPARTMENT OF FOOD AND AGRICULTURE

Certificate of Approval

FOR WEIGHTS AND MEASURES

DIVISION OF
MEASUREMENT STANDARDS

SUBMITTED BY

B & K Meter Service
7009 North Figueroa Street
Los Angeles, California 90042

THIS CERTIFIES that the WEIGHING and/or MEASURING DEVICE designated below has been inspected and found to comply with the "Tolerances and Specifications," as adopted by the State of California, applicable to this particular device.

- B&K-MQ and B&K-MS (originally Duncan Meters)
- B&K-I50, B&K-I55, B&K-I60, and B&K-I70 (originally G.E. Meters)
- B&K-J3 and B&K-J4 (originally Sangamo Meters)
- B&K-D2 (except Serial Numbers 30,000,000 to 39,999,999), B&K-D3 and B&K-D4 (originally Westinghouse Meters)

This approval includes all classes of meters manufactured within each type listed above in either a socket or "A" base configuration.

Note: 1. Meters rebuilt and sold under previous type approvals which are to be cancelled by this approval, and installed prior to July 1, 1979, may be continued in service unless or until condemned for failure to meet applicable tolerances and specifications.

2. All type approvals which have been previously issued to B & K Meter Service are hereby cancelled effective July 1, 1979.

SACRAMENTO, CALIFORNIA March 21, 1979

Inspected by W. Thomas Michel
W. Thomas Michel
Electric Meter Technician

E. T. Dello
Chief, Division of Measurement Standards

46-001 (Rev. 10/78)

Est.: 7/86
Rev.: 2/01

SUBJECT: OBSOLETE AND UNSAFE ELECTRIC WATT-HOUR METERS

Section 12107 of Division 5 of the California Business and Professions Code authorizes the Secretary of the Department of Food and Agriculture to establish tolerances and specifications for weighing and measuring apparatus. Further, it is the policy of the Division of Measurement Standards to not test devices when an unsafe condition exists.

The following combinations of meters and line service are unsafe and in some instances inaccurate. These systems should be removed from service and not be tested.

- Metal-base socket meters designed for three-phase systems exceeding 240 volts.
- A 120 volt, 2 wire meter installed on a 240 volt, 3 wire service.
- A 240 volt, 3 wire meter installed on a 120 volt, 2 wire service.
  See **Exception and Hazard** EPO No. 39-2, 4.1.7.

Additionally, the electric watt-hour meters listed below are deemed not to meet safety, permanence, construction, and workmanship requirements for commercial use. Type approvals have been modified accordingly.

The following meters **shall not be tested, rebuilt, recalibrated or installed**:

- Duncan single-phase meter types M and MD.
- General Electric single-phase meter types I, I-8, I-10, I-14, I-15, I-16, I-18 and I-20.
- Sangamo single-phase meter types B, H, HC and HF.
- Westinghouse single-phase meter types OA, OB and OC.
- Self-contained meters rated less than Class 60 unless type approved after January 2, 2001.
- Westinghouse single-phase and polyphase meter types D, D2, D7 and D8 with serial numbers 30,000,000 to 39,999,999. If these types of meters do not have the original manufacturer's serial number on the nameplate, they are to be considered as part of the 30,000,000 to 39,999,999.

SUBJECT: REBUILT ELECTRIC WATT-HOUR METERS

Section 12107 of Division 5 of the California Business and Professions Code authorizes the Secretary of the Department of Food and Agriculture to establish tolerances and specifications for weighing and measuring apparatus. Further, it is the policy of the Division of Measurement Standards to refuse to test when an unsafe condition exists.

Single-phase electric watt-hour meters may be converted from 240 volt, 3-wire into a 120 volt, 2-wire configuration or vice-versa, only by moving the internal connections provided by the original manufacturer's design.

Any conversion that have been made, but not provided for by the original manufacturer, may cause out-of-tolerance errors that may require corrections, by adjustable means, not intended by the original manufacturer.

For this reason, a meter not designed by the original manufacturer to be a convertible meter but has been converted by someone else shall not be sold in California for use as a commercial device.

A type approved meter shall possess individual components as the original manufacturer intended for that particular design.

The voltage and amperage ratings of meter components shall be maintained as intended by the original manufacturer.

SUBJECT: FIELD TESTING OF ELECTRIC METERS

Safety considerations require that field testing of electric meters be performed only by trained, qualified inspectors.

The Division of Measurement Standards (DMS) will, as resources permit, provide "hands-on" training in the field for county inspectors who have not yet received it and whose duties include on-site inspection and testing.

Training videotapes, training seminars, and basic instruction in meter testing is considered sufficient for testing electric meters with test boards at county facilities under controlled conditions. Field testing, however, is an entirely different situation.

Field installations, such as those found in mobile home parks, often contain deceptive and potentially dangerous circuits which may result in interrupted service, fires, exploding meters, electrical shocks, physical injuries, or even death. Experience is required to properly evaluate voltage, phasing, grounding, breakers, and other factors directly associated with meter installations.

The Division recommends that no electric meter field testing be performed by a county inspector until that inspector has been given follow-up "hands-on" field training by DMS personnel.

Est.: 5/87
Rev.: 3/99

SUBJECT: SAMPLING PROCEDURE FOR DOMESTIC WATER METERS

The following sampling plan may be used for new or rebuilt domestic water meters entering service in your counties.

Non-homogenous meters may be included in a "lot" originating from the same point of origin. A lot does not have to consist of the same brand and model of meter.

1. LOT DETERMINATION

   The water meters in one specific location are considered a lot. The maximum lot size is 300 meters. If, in a given location, the number of water meters exceeds 300 units, all meters will be equally divided into two (or more) lots. Each lot will then be tested independently.

2. SAMPLE SELECTION

   The sample of water meters will be selected randomly from the lot. It is anticipated that a list of meters will be available for each lot, or that such a list will be established. The sample of water meters will be selected from this list by using:

   (a) A table of random numbers, or

   (b) A calculator generating random numbers.

3. TESTING PROCEDURE

   3.1. Determine the lot (see 1).

   3.2. Select randomly the sample of 20 water meters (see 2).

   3.3. Inspect and test the selected meters following procedures in EPO NO. 33-A. A meter which fails to meet one or more requirements is scored as one defect.

   3.4. Evaluate the results (use Table I).

If # of defects	= 0	--	Accept the lot
	$\geq$ 4	--	Reject the lot
	= 1-3	--	Continue in testing (go to 3.5)

3.5. Same as 3.2 and 3.3.

3.6. Evaluate the inspection results (use Table I).

If # of defects	= 1	--	Accept the lot
	$\geq$ 5	--	Reject the lot
	= 2-4	--	Continue in testing (go to 3.7)

3.7. Select randomly and inspect the sample of 10 meters.

3.8. Evaluate the inspection results (use Table I).

If # of defects	= 2	--	Accept the lot
	$\geq$ 6	--	Reject the lot
	= 3-5	--	Continue in testing (go to 3.9)

3.9. Same as 3.7.

3.10. Evaluate the inspection results (use Table I).

If # of defects	= 3	--	Accept the lot
	$\geq$ 7	--	Reject the lot
	= 4-6	--	Continue in testing (going to the next step - see Table I)

NOTE: Symbols $\geq$ means, equal to or greater than.

TABLE I
QUALITY CONTROL SEQUENTIAL METHOD

Step	Single	Cum.	Acc.	Rej.
1	20	20	0	4
2	20	40	1	5
3	10	50	2	6
4	10	60	3	7
5	10	70	4	8
6	10	80	5	8
7	10	90	6	8
8	10	100	7	8

4. LOT ACCEPTANCE

   If the sample passes, then the lot is accepted and all meters in the lot may be sealed and released for use except those meters which were found to be out-of-tolerance or failed to meet other performance requirements. These are to be tagged "out-of-order."

5. LOT REJECTION

   If the sample fails, then the lot is rejected and no meters in the lot should be sealed. The person requesting the test (mobile home park owner, meter manufacturer or distributor) should be notified to recheck the entire lot and repair the meters as necessary.

   Upon resubmission of the lot after repair, begin the sampling procedure in EPO REF 1. If a lot fails two more times, appropriate further enforcement action should be taken.

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Page Three

Est.: 2/88
Rev.: 1/95

SUBJECT: ELECTRIC SUBMETER REVIEW (see also EPO REF-T)

This reference is intended to clarify frequently asked questions pertaining to weights and measures and California Public Utilities Commission (CPUC) jurisdiction over electric meters.

1. What are electric submeters?

   Electric submeters are landlord-owned meters typically installed in either domestic or non-domestic electrical services to meter their tenants' electrical usage. Domestic submetered services are located in mobile home parks, apartment complexes and marinas. Non-domestic submetered services are located in shopping centers and industrial/commercial buildings.

   Tenants who receive electricity through a submeter are billed by their landlord. The landlord is billed by the serving utility for all the electricity that is consumed by that business which is registered on the utility-owned master meter.

2. What authority does the CPUC have regarding electric submeters?

   The CPUC's authority over submeters is contained in Public Utilities Code Section 739.5. The utility tariff rules and CPUC decisions pertaining to electric submeters and ordered by the CPUC apply only to privately-owned corporations which are public utilities and to cooperatives (co-ops). See Attachment 1 for the list of regulated companies.

   NOTE: All submetered non-domestic services under the jurisdiction of the CPUC are illegal if installed after May 15, 1962. There are relatively few legal non-domestic submetered systems falling under CPUC jurisdiction.

3. How are municipally-operated utilities governed?

   Municipally-operated utilities are governed by their own Board of Directors and are not subject to CPUC or weights and measures regulations, rules and decisions. However, weights and measures officials do have jurisdiction over privately-owned submeters that are served through the municipally-owned master meter. See Attachment 2 for the list of municipally-operated utilities.

4. What rules, regulations, and decisions should county weights and measures departments follow?

   County weights and measures departments have a responsibility to test electric submeters in accordance with California Code of Regulations (CCR) Title 4, Article 2.2. In addition, CPUC rules and decisions for submeters served by privately-owned corporations and co-ops should be followed when testing electric meters and responding to billing complaints. Contact CPUC for the rules and decisions pertinent to the specific privately-owned corporations and co-ops. Meters under the jurisdiction of CPUC are exempt from weights and measures jurisdiction. [Business and Professions Code, Division 5, Section 12510(d)]

5. Which submeter billing complaints require county weights and measures response?

   Weights and measures departments are required to respond to billing inquiries only for domestic utility services to ensure compliance with CCR, Title 4, Chapter 5, "Billing for Utility Services".

Attachment 3 is a chart summarizing weights and measures electric submeter jurisdictions.

ATTACHMENT 1

ELECTRIC UTILITIES
PRIVATELY-OWNED CORPORATIONS AND COOPERATIVES

(REGULATED BY THE CPUC)

CP National
General Office - Energy
P.O. Box 1709
201 W. Sixth Street
Medford, OR 97501

Pacific Gas & Electric Co.
77 Beale Street
San Francisco, CA 94106

Pacific Power & Light Co.
Public Service Building
920 Southwest Sixth Ave.
Portland, OR 97204

San Diego Gas & Electric Co.
P.O. Box 1831
San Diego, CA 92112

Sierra Pacific Power Company
P.O. Box 10100
Reno, NV 89520-0026

Southern California Edison Co.
P.O. Box 800
Rosemead, CA 91770

Surprise Valley Electrification (Corp.)
(CO-OP)
P.O. Box 691
Alturas, CA 96101

Valley Electric Association, Inc.
(CO-OP)
P.O. Box 237
Pahrump, NV 89041

Anza Electric Cooperative, Inc. (CO-OP)
P.O. Box 96
Anza, CA 92306

Plumas-Sierra Rural Electric
P.O. Box 1207
Portola, CA 96122

ELECTRIC UTILITIES
MUNICIPALLY-OPERATED

(NOT REGULATED BY THE CPUC)

City of Alameda
Bureau of Electricity
Department of Public Works
P.O. Drawer H
Alameda, CA 94501

City of Anaheim
Electric Engineering Division
P.O. Box 3222
Anaheim, CA 92805

City of Azusa
Light and Power Department
P.O. Box WWW
Azusa, CA 91702

City of Banning
P.O. Box 998
Banning, CA 92220

City of Biggs
Department of Utilities
P.O. Box 307
Biggs, CA 95917

City of Burbank
Public Service Department-Electric
P.O. Box 631
Burbank, CA 91503

City of Colton
Bureau of Light and Power
650 N. La Cadena Drive
Colton, CA 92324

City of Glendale
Public Service Department
119 No. Glendale Avenue
Glendale, CA 91206

City of Gridley
685 Kentucky Street
Gridley, CA 95948

City of Healdsburg
Electric Department
City Hall
P.O. Box 578
Healdsburg, CA 95448

Imperial Irrigation District
P.O. Box 937
Imperial, CA 92251

City of Lodi
Electrical Utility Department
Call Box 3006
Lodi, CA 95241-1910

City of Lompoc
Utility Services-Electric Div.
100 Civic Center Plaza
Lompoc, CA 93438

City of Los Angeles
Department of Water and Power
P.O. Box 111
Los Angeles, CA 90051

Metropolitan Water District of
Southern California
P.O. Box 54153
Los Angeles, CA 90054

Modesto Irrigation District
P.O. Box 4060
Modesto, CA 95352

ELECTRIC UTILITIES
MUNICIPALLY-OPERATED

(NOT REGULATED BY THE CPUC)

City of Needles
P.O. Box 887
Needles, CA 92363

Oroville-Wyandotte Irrigation Dist.
P.O. Box 117
Forbestown, CA 95941

City of Palo Alto
Department of Utilities
250 Hamilton Ave.
Palo Alto, CA 94303

City of Pasadena
P.O. Box 7115
Pasadena, CA 91109-7215

City of Redding
Electrical Department
760 Parkview Ave.
Redding, CA 96001

City of Riverside
Electrical Division
3900 Main Street
Riverside, CA 92522

City of Roseville
Electric Department
City Hall
316 Vernon Street
Roseville, CA 95678

Sacramento Municipal Utility Dist.
P.O. Box 15830
Sacramento, CA 95813

Hetch Hetchy Water and Power
1155 Market Street
San Francisco, CA 94103

City of Santa Clara
Municipal Electric Department
1500 Warburton Ave.
Santa Clara, CA 95050

Shasta Dam Area Public Utility District
P.O. Box 777
Central Valley, CA 96019

Oakdale & San Joaquin Irrigation Dist.
Star Route 1303
Sonora, CA 95370

Trinity County Public Utility District
P.O. Drawer V
Weaverville, CA 96093

Truckee-Donner Public Utility District
P.O. Box 309
Truckee, CA 95734

Turlock Irrigation District
P.O. Box 949
Turlock, CA 95381

City of Ukiah
City Hall
Office of City Manager
203 S. School Street
Ukiah, CA 95482

City of Vernon
4305 Santa Fe Ave.
Vernon, CA 90058

WEIGHTS AND MEASURES ELECTRIC SUBMETER JURISDICTION

SERVING UTILITY	SUBMETERS	All Submetered Mobile Home Parks	Submetered Domestic Multi-Unit Structure Built Before 6/13/78	Submetered Domestic Multi-Unit Structure Built After 6/13/78	All Submetered Marinas	Permanent Resident Recreational Vehicles (See Tariff Rule 18)	Residential Hotel (CPUC Does Not Allow Submetering)	Non-Domestic Submeters Installed Before 5/15/62	Non-Domestic Submeters Installed After 5/15/62	Enforce Submeter Billing Procedure in CCR Chapter 5
Privately-Owned Corporation (See Attached List #1)	DOMESTIC	X	X	O*	X	X	--	--	--	X
	NON-DOMESTIC	--	--	--	X	--	--	X	O*	X
Municipally-Operated Utilities (See Attached List #2)	DOMESTIC	X	X	X	X	X	X	--	--	X
	NON-DOMESTIC	--	--	--	X	--	--	X	X	X

X = Jurisdiction
0 = No Jurisdiction
* = Illegal, Notify CPUC

SUBJECT: GRAVIMETRIC TESTING OF LIQUID METERS

EQUIPMENT

1. Graduated flask conforming to National Institute of Standards and Technology (NIST) Handbook 105-2, 1 gallon, to contain, with neck graduation to 1 fl. dr. or smaller increments.

2. Thermometer.

3. Pipette.

4. Small capacity scale sufficient to weigh 1 gallon of test liquid plus the flask and sensitive to .002 lb. or less.

5. Platform or portable scale with sufficient capacity to weigh the gross load of the receiving vessel and at least as much product as will pass through the meter in one minute at the normal flow rate. The scale should be sensitive to .03% or less of the total net weight of the product in the receiving vessel.

6. Sufficient test weights to verify each scale up through the gross loads to be applied to each. (Errors at each test load should be recorded for later reference.)

PRE-TEST DETERMINATIONS

1. Decide on test logistics such as necessary plumbing, location of test, product supply and handling, communications, and scheduling with company representatives.

2. When testing temperature compensated meters, the weight per gallon must be corrected back to 60°F. When testing non-compensated meters, the weight per gallon must also be adjusted to the temperature of the metered liquid. This will require knowledge about the coefficient of expansion for the product or products to be metered commercially. If the coefficient of expansion is not known, it can usually be estimated by reading the volume change in a graduated flask at two temperatures preferably 20°F or greater in difference. Care must be taken to ensure that air bubbles are not present within the liquid with volume determinations. For volatile fluids, care should be exercised to ensure that some of the volume change is not due to evaporation. This can be monitored by weighing or guarded against by sealing the flask during cooling. Expansion and contraction of the glassware is generally insignificant for glassware conforming to NIST Handbook 105-2 specifications.

EXAMPLE:

at 81°F, the volume = 1 gallon and 1.5 fl dr = 1025.5 fl dr

at 58°F, the volume = 1023 fl dr

Calculation of coefficient of expansion:

$$C_e = \frac{V_i - V_e}{(T_i - T_e)(V_i)} = \frac{1025.5 \text{ fl dr} - 1023 \text{ fl dr}}{81\,°F - 58\,°F)(1025.5 \text{ fl dr})} = \frac{.000106}{°F}$$

3. Test both scales throughout the range of use. Record errors for each test load near the ranges the scales will be used for later reference.

4. Obtain a sample of the product to be metered. Weigh the empty graduated flask or set the tare with the flask on the smaller scale. After all entrapped air has settled out, adjust the fill to the 1 gallon graduation. Record the net weight correcting for any errors previously identified at the gross load on the scale.

   Immediately after weighing, take the temperature of the product in the graduate at or near the center of the volume excluding the neck.

   - For temperature compensated meters used for measuring petroleum products, estimate the weight per gallon at 60°F as follows:

$$W_c = [C_e (T_o - 60°F) + 1]\, W_o$$

Where:

W_c = Weight per gallon corrected to 60°F

C_e = Coefficient of expansion per °F

T_o = Observed temperature of product in graduate

W_o = Observed weight per gallon of product in graduate

EXAMPLE:

W_o = 7.235 lb/gal

T_o = 81.5°F

C_e = .00037/°F

$$W_c = [\frac{.00037}{°F}(81.5°F - 60°F) + 1]\frac{7.235 \text{ lb}}{\text{gal}}$$

$$= [.00037\,(+21.5) + 1]\ 7.235 \text{ lb/gal}$$

$$= [+\ .007955 + 1]\ 7.235 \text{ lb/gal}$$

$$= (1.007955)\ 7.235 \text{ lb/gal} = 7.293 \text{ lb/gal}$$

- For non-compensated meters, record the weight per gallon and the temperature for later reference. Errors in the scale will require correction of the observed net weight.

TESTING

1. On the large capacity scale, set or record the tare of the receiving vessel. Deliver product into the receiving vessel as required by the test. Stop the product delivery and record the indicated volume, flow rate, and all other pertinent information. Determine the net weight of the delivery. Errors in the scale will require correction of the observed weights.

2. A. For temperature compensated meters measuring petroleum products, divide the net weight by the weight per gallon corrected to 60°F as determined in Pre-test Determinations #4 to obtain the gallons delivered.

   B. For non-compensated meters, immediately record the temperature of the delivered product near the center of the volume of the receiving vessel. Determine the gallons delivered as follows:

$$W_c = [1 + (T_r - T_m) \times C_e]\, W_r$$

Where:

T_r = Reference temperature of 1-gallon sample

T_m = Temperature of the product during metering

C_e = Coefficient of expansion

W_r = Reference weight per gallon (Pre-Test Step 4)

W_c = Weight per gallon at delivery temperature

EXAMPLE:

- The 1-gallon sample net weight was 7.268 lb. at 73°F.
- The coefficient of expansion was found to be .00033/°F.
- The product temperature during the metering was 84.8°F.

$$W_c = [1 + ([73°F - 84.8°F] \times \frac{.00033}{°F})] \times \frac{7.268 \text{ lb}}{\text{gal}}$$

$$= [1 + ([-11.8°F \times \frac{.00033}{°F}])] \times \frac{7.268 \text{ lb}}{\text{gal}}$$

$$= [1 - .003894] \times \frac{7.268 \text{ lb}}{\text{gal}} = \frac{7.2397 \text{ lb}}{\text{gal}}$$

3. Divide the net weight of the delivery by the corrected weight per gallon to obtain the gallons delivered.

   NOTE: When a single meter is used to deliver various products with a range of viscosities or densities, performance tests should be made at least with the products of the extreme densities or viscosities. It should also be noted, that air elimination becomes much more critical with viscous liquids.

SUBJECT: LOAD CELLS

Load Cells S.6.3 [2.20], Table S.6.3(a) and (b) Notes [2.20]. Load cells for which Certificates of Conformance have been issued under the National Type Evaluation Program shall be marked as follows:

(a) Manufacturer's ID and model designation that positively ID's the pattern or design.

(b) Nonrepetitive serial number and prefix (nonretroactive as of January 1, 1986).

(c) Accuracy Class of I, II III, III L, or IIII as appropriate for the scale (nonretroactive as January 1, 1986).

(d) Special limits of working temperature, if other than 14°F to 104°F (nonretroactive as of January 1, 1986).

(e) Maximum number of scale divisions (n_{max}) in units of 1,000 (e.g., n: 10 is 10,000d) (nonretroactive as of January 1, 1988).

(f) An "S" or "M" denotes compliance for single or multiple cell applications (nonretroactive as of January 1, 1988).

(g) The direction of loading, if not obvious (nonretroactive as of January 1, 1988).

(h) Minimum dead load, maximum capacity, safe load limit, and load cell verification interval (v_{min}).

The required information may be given on a data plate attached to the load cell or, alternatively, in an accompanying document. If the document is the source of the information, the serial number of the load cell shall be marked on the load cell plate and also given in the document. (Nonretroactive as of January 1, 1988.) The manufacturer's name or trademark, the model designation, and identifying symbol for the serial number shall also be marked both on the load cell and in any accompanying document. (Nonretroactive as of January 1, 1991.)

COMMENTS

1. This section is intended to apply only to load cells that require separate testing during the type approval evaluation to ensure compliance with code Section T.N.8 [2.20], Influence Factors. Generally, during type evaluation, load cells are tested separately from the scale when the scale capacity is more than 2,000 lb. or when the scale size or configuration precludes testing in an environmental chamber. A scale converted to a levertronic must also use approved load cells.

2. California Certificates of Approval will be issued for load cells that have been tested separately and found to comply with code Section T.N.8 [2.20]. The Certificates of Approval will include the information necessary for an inspector to determine compliance with this section.

3. When load cells are approved separately, they have not been tested for off-center loading (shift test/deflection) and permanence over a 30-day period.

   Approved load cells are only a part of a weighing element. A weighing element that uses approved load cells is not considered approved unless the weighing element has a separate approval.

   EXAMPLES:

   - A hook, tray, or basket attached to a load cell becomes a hanging scale weighing element.
   - Load cells mounted under the corners of a tank or hopper become a hopper/tank scale weighing element.
   - Load cells under a metal plate become a bench, platform, or floor scale weighing element.
   - Load cells under a weighbridge designed to weigh vehicles become a vehicle scale weighing element.

   T.N.8 [2.20] Influence Factors. The following factors are applicable to tests conducted under controlled conditions only, provided that:

   (a) types of devices approved prior to January 1, 1986 and manufactured prior to January 1, 1988 need not meet the requirements of this section;

   (b) new types of devices submitted for approval after January 1, 1986 shall comply with the requirements of this section; and

   (c) all devices manufactured after January 1, 1988 shall comply with the requirements of this section.

COMMENTS

1. The influence factor requirements of Sections T.N.8 [2.20] through T.N.8.3.2 [2.20] are applicable to type approval evaluations only. The specific tests to determine compliance with these sections are primarily the concern of type evaluation technicians; however, it is important that county inspectors and weighing device distributors and repairpersons be able to determine whether specific devices have complied with these requirements or if they are required to comply.

Large capacity scales utilizing load cells that were approved under pre-1986 requirements that are manufactured after January 1, 1988 are required to use approved load cells. Upon request of the scale manufacturer and evidence that the load cells are approved, scale Certificates of Approval will be amended to include the load cell model and scale accuracy class, and to indicate compliance with the influence factor requirements.

2. The following guidelines are provided to clarify when replacement parts used in repair or modification must meet the new influence factor test requirements.

- If a load cell is installed in the steelyard rod and a digital indicator is installed, this is a modification of the original type. The load cell and digital indicator must have a current Certificate of Approval showing compliance with the influence factor requirements; this includes replacement of the indicator and load cell.

- If a scale had a type evaluation before 1986 and the load cells were not tested for compliance with the influence factor requirements, then the load cells may be replaced with load cells that have not been tested for compliance with the influence factor requirements. Consequently, a load cell manufacturer may utilize current inventory of present model load cells as replacement parts for scales approved prior to 1986 and manufactured prior to 1988.

- If a scale has load cells that meet the influence factor requirements, then the replacement load cells must meet the influence factor requirements and be listed on a current Certificate of Approval.

- All load cells used in new scales manufactured after January 1, 1988 must meet the influence factor requirements and be listed on a current Certificate of Approval.

- Approved load cells that are repaired after January 1, 1988 by the original manufacturer or its authorized representative do not require approval testing.

- Approved load cells that are repaired after January 1, 1988 by a company that is not authorized by the original manufacturer require approval testing and certification.

- Load cells that are remanufactured and installed in scales manufactured after January 1, 1988 require approval testing and certification and must retain the original manufacturer's identification information in addition to the remanufacturer's identification.

SUBJECT: TESTING OF VEHICLE TANK AND WHOLESALE LIQUID METERS

With increasing deliveries of chemicals, lubricants and other products from bulk, there have been questions regarding suitability and performance requirements for vehicle tank and wholesale meters. Many chemicals present potential safety or contamination problems and some are not readily susceptible to volumetric proving due to foaming, toxicity, corrosiveness, etc. The following are considerations frequently discussed.

1. Properties or hazards associated with various chemicals or compounds delivered from bulk.

   (a) Physical and chemical properties and hazards should be reviewed from current Material Safety Data Sheets. Officials should ensure that devices to be tested are approved and suitable for the particular application.

   (b) For hazardous materials, safety training, and supervision before and during inspections are responsibilities of the owner/user. Hazardous chemicals should not be tested unless safety precautions and procedures are in place, clearly understood, and followed. Before testing, the owner/user should be asked to supply a competent safety officer, equipped as necessary with supplies of protective clothing, spill containment, fire prevention and control, or other safety devices to assist weights and measures officials if required.

   Some jurisdictions may require documentation of safety officer competency from companies, and may require employees to certify to training received before allowing them to proceed. County safety officers should be consulted regarding county policy.

   The following are a few questions that should be considered and accommodated before initiating tests:

   - Will proving equipment contaminate the product being tested?

   - Will the company flush out any residue or would gravimetric testing, using the company's vessel, be possible?

   - Will the product destroy or corrode testing equipment?

   - Are densities or coefficients of expansion known or safely attainable?

   - Can the product be returned to storage after test?

2 Suitability of meters:

(a) Approval for use with a specific or class of chemicals such as ethylene glycol, chlorinated solvents, methanol fuels, and liquid fertilizers can be verified by the approval certificate.

(b) Range of delivery volumes. Some chemicals and lubricants are often dispensed in volumes that are typically "retail". They are also often dispensed from vehicle tank meters which require a minimum test draft of 50 gallons or 500 pounds (California Code of Regulations Section 4000, N.3 [3.31]). The 50-gallon test draft for a vehicle tank meter may not be a reliable indication of accuracy for smaller "retail" deliveries.

- Device users should not operate meters below the manufacturer's minimum rated flow.

- To be suitable for its application, the minimum delivery for liquid-measuring devices shall be no less than 100 divisions, except that the minimum delivery for retail analog devices shall be no less than 10 division. Maximum division values and tolerances are stated in the specific codes. **G-UR.1.3 [1.10]**

SUBJECT: UTILITY SUBMETERS

This procedure only addresses meter systems connected to a utility company or utility district distribution system with a master meter located upstream of the utility submeters.

Part 1: Testing Considerations and Utility Submeter Pre-Test Information

Before testing utility submeters, determine if new submeter installations are involved. Verify that submitted submeters comply with requirements of the serving utility distribution company tariff rules. These often contain provisions intended to provide equity for submeter customers in addition to weights and measures laws.

Due to the number of complaints reported involving illegal or incorrect submeter installations, it is suggested that utility submeters not be tested or sealed until verification is obtained by the user/installer that the submeters are acknowledged as "legal" and "suitable" for the proposed installations from the utility distribution company(ies) or district(s) having authority and responsibility to make the determination. If the meter owner or installer cannot obtain this information, direct communication with the utility company may reduce the potential issues and future complaints that may otherwise be received from tenants. It should also be determined by weights and measures officials how submeters will be installed and used before beginning to test. For example, if an intended submeter application results in "estimating" unmeasured quantities used in preparing the tenant's billing, such as measuring only the flow of water into hot water heaters, with the intent of billing for total water, for gas, or for charging for wastewater or electricity, etc., the meter **should not be tested and sealed**. Such practices violate fraud and suitability requirements under weights and measures laws, result in inaccurate computations of usage, and may violate CPUC rules or the tariff rules of the serving utility distribution company.

Commercial (Business) Energy Utility Submetering:

Commercial (business) **Energy Utility** submetering is usually **not** permitted under provisions of the California Public Utilities Code enforced by the California Public Utilities Commission (CPUC). However, the CPUC does permit business park/plaza and industrial and retail mall landlords to use utility meters to monitor utility usage by their commercial tenants for the purpose of periodically adjusting the "fixed" lease rates to recover the estimated utility consumption costs. Where "business utility submeters" exist, it is our understanding that utility consumption is not to be separately billed and the lease cannot fluctuate from month to month based on the monthly measured consumption.

Weights and measures jurisdictions receiving "business" submeters for testing should confirm with the submitter that they are not intended for billing tenants and, if so, weights and measures jurisdictions are not obligated to test and should **not** seal them. Complaints or questions involving "business" submeters should be directed to the utility distribution company's tariff unit and to the CPUC compliance staff.

Official testing should only proceed if the utility and the CPUC agree that the use of business submeters is legal, and it is within the means of the weights and measures jurisdiction to **safely** test and seal the submeters.

Note: This may not be applicable to water submeters where the utility distribution company is a municipality. Complaints and questions should still be directed to the utility and the CPUC water division compliance staff before proceeding.

New Residential Construction:

New residential construction in mobilehome parks and in multi-unit residential apartment complexes currently **cannot** be submetered for energy utility billing in California. We have been advised by the CPUC Energy Division, Compliance Unit, that this includes addition of new units or spaces in existing parks and complexes, as well as retrofitted apartments or spaces not previously metered. This exclusion is not applicable to marinas. However, the following precautions apply for all requests to weights and measures jurisdictions to test domestic utility submeters.

To confirm acceptance of utility submeter installations or "upgrades" by the responsible utility distribution company, including energy, water, or wastewater submeter installations, it is necessary that landlords work with the energy and water utility contacts listed in the attachments (there are no flow measurement devices currently approved for use with residential wastewater). For wastewater districts and other non-listed utilities, landlords should attempt to contact the **tariff staff** of the utility distribution company or utility district (serving and billing the landlord), to ensure that the installation of submeters or billing based on monthly usage is in conformance with existing rules. Enforcement of the tariff rules should be left with the district, utility distribution company, municipality, and the CPUC. CPUC regulated utility distribution companies are required to enforce the CPUC provisions while municipalities are free to adopt separate tariff rules which may or may not restrict submeter installations. In all cases, enforcement of submeter tariff rules is currently a primary responsibility of the utility distribution company or district. Weights and measures jurisdictions also have responsibility to ensure that bills resulting from extending the price(s)-per-unit are accurately computed (Business and Professions Code Section 12024.2). For serving utility distribution companies regulated by the CPUC, the company's interpretations of rules should be referred to the CPUC Energy or Water Division compliance staff whenever they appear inconsistent with CPUC code sections appearing later in this procedure.

See the Sample Letter to a serving utility company or municipality on next page.

EPO REF-T
Page 2

Sample Letter

Dear Tariff Administrator:

We have recently received a request to test [electric/gas/water] utility submeters for [*name of park or complex*] at [*address*]. After visiting the location it was noted that these submeters constitute a new installation where [energy/water] utilities were previously included in the monthly rent and/or a new installation or new construction.

We request acknowledgement that submetering is permissible under your tariff rules as applied to these new submeter installations at [*name of park or complex*].

Though the meters are type-approved under weights and measures statutes, we also need to know if you have any concerns regarding suitability of these meters to accurately measure [energy/water] consumption for the purpose of billing the tenants for utility usage under California Public Utilities Commission statutes and/or your utility tariff rules.

It is the policy of _______ County and the California Division of Measurement Standards not to test and seal submeter installations unless the serving utility or the CPUC determines they comply with legal requirements for use as submeters and that their installation and use conforms to the legal requirements for proper utility billing of the tenants.

If you determine the intended installations are properly configured for use of the [*submeter models and manufacturer*] [*utility type*] submeters (photos attached), the owners may need information regarding required use rules, rate schedules, and billing formats to prepare the tenants bills in conformance to your rules. The owners may be contacted directly at [*address, phone, and e-mail*].

If you need to inspect the meters or (review/approve) the billing format, you may contact the owners directly.

Please contact me with your findings since we need this information to proceed with this request to test the meters for accuracy.

Sincerely,

Sealer, _________ County Weights and Measures

Attachments

cc: CPUC water/energy compliance division
Park or complex
Third party billing/service repair agents

NOTE: The template above should be modified to provide the actual details about whether the units have been added to a location already being submetered, retrofitted, or new complex, etc. It also needs to be directed to each separate utility company such as gas, water, electricity, or sewage if submeters will play a role in determining the tenants charges for the service.

Verification of Approval Status:

Like other commercial devices, utility submeters need to be type approved and identified. Before testing, confirm the submitted submeters have an approval and that they do not conflict with the approval descriptions and the identification requirements. When installation of a utility submeter occurs the sealer should receive the required notification according to provisions of Section 12515 of California Business and Professions Code.

Laboratory or Field Checklist for Submeter Pre-Test Information

Before Testing Submeters:

1. Has the user/installer or service agency verified that the submeters are acknowledged as "legal" and "suitable" for the proposed installations with the utility distribution company(ies) or district(s) having authority to make the determination? This can be considered a responsibility placed upon the submitter. Ensure that the proper contact persons are provided to the submitter or the service agency to ensure an authoritative response from the utility company. An official may elect to contact the utility company directly.

   - Does submetering comply with the utility company tariff rules?
   - Are there requirements for rates and billing?
   - Are the meters considered suitable by the utility?
   - Are the proposed installations, meter locations, enclosures, clearance and installations compliant with building codes, the California Code of Regulations and any applicable safety rules, if any, of the serving utility?

   Though the meters are type-approved under weights and measures statutes, it is also necessary to know if the utility company has any concerns regarding suitability of the meters to accurately measure [energy/water] consumption for the purpose of billing the tenants for utility usage under CPUC statutes and/or your utility tariff rules.

2. Verify that submitted submeters comply with requirements of the serving Utility Distribution Company tariff rules.

3. Verify the meters are type-approved under weights and measures statutes. Read the certificate to verify that the device is being utilized properly as described in the certificate. Do you have any concerns regarding suitability of the meters to accurately measure [energy/water] consumption for the purpose of billing the tenants for utility usage under CPUC statutes and/or the utility tariff rules?

4. When installation of a utility submeter occurs, the sealer should receive the required notification according to provisions of Section 12515 of the California Business and Professions Code. Is the service agent properly registered? Does the service agency posses or have access to traceable standards? Were the meters properly, assembled, calibrated, sealed, and installed?

5. Determine if new submeter installations are involved (no previous metering existed). New installations are not allowed for natural gas and watt-hour energy submeters.

6. Determine how submeters will be installed and used before beginning to test. For example, if an intended submeter application results in "estimating" unmeasured quantities used in preparing the tenant's billing, such as measuring only the flow of water into hot water heaters, with the intent of extrapolating and billing for total water use, for gas consumption, or for charging for wastewater or electricity, etc., the meter should not be tested and sealed. Such practices violate fraud and suitability requirements under weights and measures laws, result in inaccurate computations of usage, and may violate CPUC rules or the tariff rules of the serving utility distribution company.

7. Anyone who submits a commercial device to a Sealer for verification is acting as a service agent (see "place into service") and must be properly registered, posses or have access to traceable standards, and comply with other applicable provisions.

8. Confirm the submitted utility submeters comply with the identification requirements. For example, proper labeling (Model Number XXX-XX and Serial Number XXXXX) prefacing the actual model and serial numbers. California Code of Regulations, Title 4, Division 9, Section 1.10 General Code G-S. Specifications.

9. Verify meter components are properly calibrated and completely assembled and sealed by the service agency.

10. Seal the meters after testing when they are found to comply with all requirements.

Part 2: Utility Submeter and Billing Complaints

Utility submeter complaints are received regularly by weights and measures jurisdictions and have been on the increase in recent years.

There are a few utility submeter complaints which are frequently received from tenants (or landlords) which may or may not be the result of errors or violations of weights and measures or other codes. Complaints of inaccurate transactions based on measured quantities are a high priority for weights and measures jurisdictions. Examples of complaints are:

- "My bill must be inaccurate, it has never been this high."
- "I am being billed for preparation of my bill", or "My bill contains mysterious charges that no-one will explain."
- "I am being billed for utilities but there are no meters."
- "The utility has issued rebates but the landlord is keeping them."
- "I am entitled to a discount but the landlord or the billing company are not implementing it."
- "The serving utility rates are not being made available."
- "My bill has hardly any information about how I am being billed."
- "The lighting or 'common areas' operated by the park are attached to my meter."
- "There is only one meter for billing two or more spaces."
- "I have a tenant who's meter usage has dropped dramatically but their use of heat and power seems higher than ever."

Some possible causes for complaints are: unusually high usage, inaccurate meter reading, inaccurate meters, increased rates, faulty recall concerning past use, lack of data transmission integrity, computational errors, an incorrect installation, diversion of the tenant's metered utility, leaks, application of an incorrect rate schedule, energy theft, or discord between the landlord and tenant(s).

First verify with the utility distribution company(ies) that submeter use or utility billing is legally permitted. Determine which problems, if present, could result from weights and measures violations. Suspected gas leaks or other safety concerns should be reported promptly to the tenant, the landlord, the utility distribution company, other safety and building code officials, and, for mobilehome parks, the Department of Housing and Community Development, as necessary to protect the public.

Review records. If the site is in the county weights and measures records there may be clues about potential or recurring problems. Determine if and where any violations exist.

Weights and measures officials who receive complaints should review customer invoices, requesting copies if necessary; should verify rate schedules; check the accuracy of computations; verify meter readings; examine seals; examine the meter installations; review compliance with required availability of meter indications and rates; and examine meters and invoices as appropriate to evaluate the complainant's inquiry. The URL address is:
http://www.cpuc.ca.gov/static/industry/electric/rates+and+tariffs/index.htm.

Many officials notify the utility distribution companies (PG&E, SMUD, EBMVD, etc.) directly when rate or billing violations are identified. Again, officials should obtain confirmation and maintain reports and records regarding whether or not a complainant's submeter installation and billing is consistent with weights and measures requirements and the serving utility's rules.

On-going communication with the utilities, the landlord, any billing agents, and the CPUC is often needed. **Caution:** Misinformation resulting from contact with an inappropriate individual(s) at any of these points has sometimes occurred. Written communications have a much better chance of being reviewed by the appropriate, responsible individual(s) (see attachments). Some parties may be reluctant to provide information. California Code of Regulations Section 4090, device inspection sections and cooperation by complainants generally provide sufficient information to begin working with other parties to resolve incorrect practices if identified.

While serving utilities generally review billing and submeter practices which have been referred to them by weights and measures officials, they are generally not equipped to pursue landlords who ignore their written findings, orders, or notifications. It has been unappealing to utility distribution companies to discontinue utility service to a park or complex which is operating in violation, since the tenants would also be without utility service. Written statements or letters from the utility distribution company augment weights and measures violations when documented in a factual report. Collected documents can also provide support for tenant(s) to present to the district or city attorney or small claims court if all violations identified are other than weights and measures. Whenever weights and measures violations are present, it is appropriate to include all noted violations from weights and measures as well as other statutes. Findings resulting from each complaint investigation should be reviewed to determine appropriate actions.

The following is a sample letter requesting utility or billing complaint review.

Sample Letter

Dear Tariff Administrator:

We have recently received an inquiry/complaint from [*tenant name*] at [*name of park or complex*] at [*address*] concerning [their utility bills,] [meter reading] [failure to receive discount/refund] [failure to post rates].

We are referring these items to you and have notified the tenant. Please provide a copy to us and the tenant regarding your findings and, if possible, any actions you are taking. We would like to include your findings in our file on this matter. If you want to discuss any issues that can help resolve this complaint please contact or e-mail me at [e-mail] or [phone number].

Weights and measures violations, when present, are misdemeanors and can be referred to the district attorney or city attorneys if appropriate. Where referrals to a prosecutor's office are made, we include violations identified in utility distribution company reviews. If an enforcement action is contemplated by our office, regarding violations of tariff rules or of the California Public Utilities Code, we will notify you. When cases are not referred by the weights and measures office, the tenant may use any weights and measures and utility company findings in small claims or other filings.

The submeter owners may be contacted at [*address, phone, and e-mail*].

If you have any comments or questions please contact me.

Sincerely,

Sealer, _________ County Weights and Measures

Attachment

cc: CPUC water/energy compliance division
Tenant
Case Number

Remember, you are investigating a complaint from the public. You, the complainant(s), or other impacted parties will need correspondence or statements as well as copies of bills, written notices, photographs, actual meters, etc., as appropriate, to present facts to the reviewing authorities. If violations result in overcharging tenants and cannot be equitably resolved, the district attorney can be consulted to review the facts. It may be helpful to develop and retain basic letter and form templates to expedite timely communication as well as provide evidence for an investigative file for common types of violations. Photographs of meters or of installation problems and investigative narratives are, at times, necessary to provide the best available facts.

Other Contacts:

Tenants can use other resources if there are issues other than submeter accuracy, submeter installation, incorrectly computed price extensions, incorrect meter readings, or California Code of Regulations Section 4090 requirements.

- Serving Utility Contacts (see attachment).
- Housing and Community Development (http://housing.hcd.ca.gov/) - Mobile Home Assistance 1-800-952-5275 (Health and Safety Code Section 18300 et. seq., and California Code of Regulations, Title 25, Part 1, Chapter 2).
- Golden State Manufactured Home Owners League (http://www.gsmol.org/) - Mobile Home Assistance 1-800-888-1727
- California Public Utilities Commission (www.cpuc.ca.gov) – 1-800-649-7570.

OTHER BILLING CONSIDERATIONS

If the utility meter is a submeter installation of a master-meter, which is regulated under the Public Utilities Code, Civil Code, or Water Code, the following laws and rules **may** apply in addition to those under the direct jurisdiction of weights and measures. Be sure to check the most current language at http://www.leginfo.ca.gov/calaw.html before citing language from the following codes.

- California Water Code

  Section 110. (a) Notwithstanding any other provision of law, every water purveyor who sells, leases, rents, furnishes, or delivers water service to any person shall require, as a condition of new water service on and after January 1, 1992, that a suitable water meter to measure the water service shall be installed on the water service facilities in accordance with Chapter 8 (commencing with Section 500). The cost of installation of the meter shall be paid by the user of the water, and any water purveyor may impose and collect charges for those costs.

  (b) For purposes of subdivision (a), "water purveyor," "person," "water service," and "water meter" have the same meaning as defined in Article 2 (commencing with Section 510) of Chapter 8.

  (c) Subdivision (a) applies only to potable water.

  (d) Subdivision (a) does not apply to a community water system which serves less than 15 service connections used by yearlong residents or regularly serves less than 25 year long residents, or a single well which services the water supply of a single family residential home.

  Section 530. Domestic cold water meters shall be in compliance with relevant standards of the American Water Works Association and shall be type approved by the Director of Food and Agriculture pursuant to Section 12500.5 of the Business and Professions Code.

- California Public Utilities Code

  Section 739.5. (April 3, 1998, selected paragraphs)

  The commission shall require that, whenever gas or electric service, or both, is provided by a master-meter customer to users who are tenants of a mobile home park, apartment building, or similar residential complex, the master-meter customer shall charge each user of the service at the same rate which would be applicable if the user were receiving gas or electricity, or both, directly from the gas or electrical corporation. The commission shall require the corporation furnishing service to the master-meter customer to establish uniform rates for master-meter service at a level which will provide a sufficient differential to cover the reasonable average costs to master-meter customers of providing sub-meter services, except that these costs shall not exceed the average cost that the corporation would have incurred in providing comparable services directly to the users of the service.

  (b) Every master-meter customer of a gas or electrical corporation subject to subdivision (a) who, on or after January 1, 1978, receives any rebate from the corporation shall distribute to, or credit to the account of, each current user served by the master-meter customer that portion of the rebate which the amount of gas or electricity, or both, consumed by the user during the last billing period bears to the local amount furnished by the corporation to the master-meter customer during that period.

  Every master-meter customer shall provide an itemized billing of charges for electricity or gas, or both, to each individual user generally in accordance with the form and content of bills of the corporation to its residential customers, including, but not limited to, the opening and closing readings for the meter, and the identification of all rates and quantities attributable to each block in the applicable rate structure. The master-meter customer shall also post, in a conspicuous place, the applicable prevailing residential gas or electric rate schedule, as published by the corporation. (The park must offer residents any low-income rates available to customers of the local utility company.)

- California Public Utilities Code

  Section 12821.5. (a) Whenever residential light, heat, or power is furnished through a submeter system by a master-meter customer for sale to users who are tenants of a mobilehome park, apartment building, or similar residential complex, the master-meter customer is responsible for maintenance and repair of its submeter facilities beyond the master meter, and nothing in this section requires a district to make repairs to or perform maintenance on the submeter system.

  (b) Every master-meter customer shall provide an itemized billing of charges for light, heat, and power to each individual user generally in accordance with the form and content of bills of the district to its residential customers, including, but not limited to, the opening and closing readings for the meter, and the identification of all rates and quantities under the applicable rate structure. The master-meter customer shall charge each user of the service at a rate which does not exceed the rate which would be applicable if the user were receiving residential light, heat, or power directly from the district. The master-meter customer shall also post, in a conspicuous place, the applicable prevailing residential rate schedule, as published by the district. The district shall notify each master-meter customer of its responsibilities to its users under this section.

- PUC General Order 58-A “Standards for Gas Service in the State of California”, Section 23, “Complaint”, states:

  (a) Each gas utility shall make a full and prompt investigation of all complaints made to it by its customers, either directly or through the Commission.

  (b) Each gas utility shall keep a record of all complaints received which shall show in each case the name and address of the complainant, the date of receiving a complaint, its general nature, the date and method of disposal, and the name of the service person responding to the complaint. The record shall be kept for a period of at least two (2) calendar years after the complaint has been resolved.

- PUC General Order 96-A, Rule 19, states:

  “As a further condition of submetering, the customer shall agree that (the serving utility) may inspect and examine customer’s billing procedures from time-to-time to determine that such service is made in accordance with this rule or as otherwise may be authorized by the commission.”

- California Civil Code - Section 798.41 (April 3, 1998)

  (a) Where a rental agreement, including a rental agreement specified in Section 798.17, does not specifically provide otherwise, the park management may elect to bill a homeowner separately for utility service fees and charges assessed by the utility for services provided to or for spaces in the park. Any separately billed utility fees and charges shall not be deemed to be included in the rent charged for those spaces under the rental agreement, and shall not be deemed to be rent or a rent increase for purposes of any ordinance, rule, regulation, or initiative measure adopted or enforced by any local governmental entity which established a maximum amount that a landlord may charge a tenant for rent, provided that at the time of the initial separate billing of any utility fees and charges the rent chargeable under the rental agreement or the base rent chargeable under the terms of a local rent control provision is simultaneously reduced by an amount equal to the fees and charges separately billed. The amount of this reduction shall be equal to the average amount charged to the park management for that utility service for that space during the 12 months immediately preceding notice of the commencement of the separate billing for that utility service.

  Utility services to which this section applies are natural gas or liquid propane gas, electricity, water, cable television, garbage or refuse service, and sewer service.

  (b) This section does not apply to rental agreements entered into prior to January 1, 1991, until extended or renewed on or after that date.

  (c) Nothing in this section shall require rental agreements to provide for separate billing to homeowners of fees and charges specified in subdivision (a).

(d) Those fees and charges specified in subdivision (a) shall be separately stated on any monthly or other periodic billing to the homeowner. If the fee or charge has a limited duration or is amortized for a specified period, the expiration date shall be stated on the initial notice and each subsequent billing to the homeowner while the fee or charge is billed to the homeowner.

NOTE: Nothing precludes utility charges from being included in the rent as long as they are not broken out as such and the rent does not vary month to month with usage.

SERVICE UTILITIES CONTACTS

California Investor-Owned Energy Utilities (Continue on Next Page)

KIRKWOOD GAS & ELECTRIC CO.
Tim Cohee, President
P.O. Box 1
Kirkwood, CA 95646
(209) 258-6000
(209) 258-8899

PACIFIC GAS & ELECTRIC COMPANY
Ron Jang
Pricing & Regulatory Support
P.O. Box 770000 - Mail Code H28H
San Francisco, CA 94177
(415) 973-2973
(415) 973-2384 FAX
Internet: roj3@pge.com

Mary Camby
Customer Services - Consumer Affairs
P.O. Box 770000 - Mail Code H28G
San Francisco, CA 94177
(415) 973-3036
(415) 973-8490 FAX
Internet: mmc7@pge.com

PACIFICORP (PACIFIC POWER & LIGHT)
Brian Teague
825 NE Multnomah, Suite 625
Portland, OR 97232
(503) 464-5114
(504) 464-6216 FAX

SAN DIEGO GAS & ELECTRIC
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8306 Century Park Ct., Suite 4210B
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(619) 654-1175 FAX
Internet: lower@imx.sdge.com

Jim Frank
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P.O. BOX 1831
San Diego, CA 92112-4150
(619) 696-4008
(619) 696-4027 FAX
Internet: Jfrank@imx.sdge.com

SIERRA PACIFIC POWER
Gene Williams
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P.O. BOX 10100
Reno, NV 89520
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SOUTHERN CALIFORNIA EDISON
Patricia Aldridge
Regulatory Policy & Affairs
2244 E. Walnut Grove, Room 306, GO 1
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(818) 302-4332 FAX
Internet: aldrid@sce.com

Gail Gonsalus
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SOUTHERN CALIFORNIA GAS
Denise Canning
Tariff Administration, ML 25A1
555 W. Fifth Street
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(213) 244-2517
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SOUTHERN CALIFORNIA WATER
Dan Dell'Osa
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(909) 394-3600 Ext. 759
(909) 394-0827 FAX

Roland Tanner
(909) 397-011 Ext. 333

California Investor-Owned Energy Utilities (Continued)

SOUTHWEST GAS
Keith Brown
Regulatory Affairs - LVB - 105
P.O. BOX 98510
Las Vegas, NV 89193-8510
(702) 876-7157
(702) 873-3820 FAX

Jessie de los Santos
(702) 876-7365
Internet: mcolledg@ix.netcom.com

WASHINGTON WATER & POWER
Tom Dukich
P.O. BOX 3727
Spokane, WA 99220
(509) 482-4724
(509) 482-4879 FAX
Internet: tdukich@wwp.co.com

Bruce Folsom
(509) 482-8706

Municipal Utility Districts (Continue on Next Page)

CALIFORNIA MUNICIPAL UTILITIES ASSOCIATION
915 L Street Suite 1640
Sacramento, CA 95814-3705
(916) 441-1733
http://www.cmua.org/

ALAMEDA BUREAU OF ELECTRICITY
2000 Grand Street
P.O. Box H
Alameda, CA 94501-0263
(510) 748-3900
http://electricity.ci.alameda.ca.us/

ANAHEIM PUBLIC UTILITIES DEPARTMENT
201 South Anaheim Blvd
Anaheim, CA 92803
(714) 254-0125
http://www.anaheim.net/

AZUSA LIGHT & WATER DEPARTMENT
729 North Azusa Avenue
Azusa, CA 91702
(626) 812-5225
http://www.azusa.ca.gov/

BANNING ELECTRIC DEPARTMENT
176 East Lincoln
P.O. Box 998
Banning, CA 92220
(909) 922-3260
http://paladin.cirrus.co.riverside.ca.us/city/banning/

BIGGS ELECTRICAL DEPARTMENT
P.O. Box 307
Biggs, CA 95917
(530) 868-5493

BURBANK PUBLIC SERVICE DEPARTMENT
164 West Magnolia Blvd.
Burbank, CA 91503-0631
(818) 238-3700

CITY OF COALINGA (GAS SERVICE)
155 West Durian Street
Coalinga, CA 93210
(559) 935-1533

East Bay Municipal Utility District
P.O. Box 24055
Oakland, CA 94623-1055
(510) 835-3000
http://www.ebmud.com/

GLENDALE PUBLIC SERVICE DEPARTMENT
141 North Glendale Avenue
Glendale, CA 91206
(818) 545-4332
(818)548-4080 ext. 1555
http://www.glendale.ci.ca.us/

GRIDLEY MUNICIPAL UTILITIES
685 Kentucky Street
Gridley, CA 95948
(530) 846-3631
email: gridley@manznet.com

HEALDSBURG MUNICIPAL ELECTRIC DEPT.
401 Grove Street
P.O. Box 578
Healdsburg, CA 95448
(707) 431-3346

HETCH HETCHY WATER & POWER
City & County of San Francisco
1155 Market Street, 4th Floor
San Francisco, CA 94103
(415) 554-0725

LODI MUNICIPAL ELECTRIC SYSTEM
1331 South Ham Lane
Call Box 3006
Lodi, CA 95242
(209) 333-6762
http://www.lodielectric.com

LOMPOC UTILITY SERVICES/ELECTRICAL
100 Civic Center Plaza
Lompoc, CA 93438
(805) 736-1261
http://www. ci.lompoc.ca.us/

Municipal Utility Districts (Continued)

LONG BEACH GAS DEPARTMENT
2 East Spring Street
Long Beach, CA 90806
(562) 570-2000
http://www.ci.long-beach.ca.us/gas/

LOS ANGELES DEPARTMENT OF WATER & POWER
111 North Hope Street
Los Angeles, CA 90051-0100
(213) 481-5411 or 1-800-342-5397 (toll free)
http://www.ladwp.com

CITY OF NEEDLES
817 Third Street
Needles, CA 92363
(760) 326-2113

PALO ALTO ELECTRIC UTILITY
250 Hamilton Avenue
Palo Alto, CA 94301
(650) 329-2161
http://www.ci.palo-alto.ca.us/

PASADENA WATER AND POWER DEPARTMENT
150 South Los Robles Avenue, Suite 200
Pasadena, CA 91101
(626) 744-4409
http://www.ci.pasadena.ca.us/departments/water_power.html

RIVERSIDE UTILITIES DEPARTMENT
3900 Main Street
Riverside, CA 92522
(909) 782-5781
http://www.ci.riverside.ca.us/utilities/

ROSEVILLE ELECTRIC DEPARTMENT
2090 Hilltop Circle
Roseville, CA 95747
(916) 774-5600

SACRAMENTO MUNICIPAL UTILITY DISTRICT
6201 S Street
P.O. Box 15830
Sacramento, CA 95852-1830
(916) 452-7811
http://www.smud.org/

SANTA CLARA ELECTRIC DEPARTMENT
1500 Warburton Avenue
Santa Clara, CA 95050
(408) 984-3044
http://www.alphais.com/santa-clara/3101.html

UKIAH MUNICIPAL UTILITY DISTRICT
300 Seminary Avenue
Ukiah, CA 95482
(707) 462-2971
http://www.ukiah.ca.us

VERNON MUNICIPAL LIGHT DEPARTMENT
4305 Santa Fee Avenue
Vernon, CA 90058
(323) 583-8811
http://www.vernongov.org

Rural Electric Cooperatives

ANZA ELECTRIC COOPERATIVE, INC.
P.O. Box 391909
Anza, CA 92539
(909) 763-4333

PLUMAS SIERRA
73233 Highway 70
Portola, CA 96122
(530) 832-4261
http://www.psln.com/psrec/

SURPRISE VALLEY ELECTRIFICATION CORP.
P.O. Box 691
Alturas, CA 96101
(530) 233-3511

Federal and State Agencies and Irrigation District Systems (Continue on Next Page)

U.S. BUREAU OF RECLAMATION
Department of the Interior
Federal Office Building
2800 Cottage Way
Sacramento, CA 95825-1898
(916) 978-5000
http://www.usbr.gov/

CALIFORNIA BUREAU OF RECLAMATION
Energy Division
1416 Ninth Street
P.O. Box 942836
Sacramento, CA 94236-0001
(916) 445-6687
http://www.usbr.gov/

CENTRAL CALIFORNIA POWER AGENCY
9500 Coldwater Creek Road
Kelseyville, CA 95451
(916) 732-6200

IMPERIAL IRRIGATION DISTRICT
333 East Barioni Blvd.
P.O. Box 937
Imperial, CA 92251
(760) 339-9225
http://www.iid.com/

LASSEN MUNICIPAL UTILITY DISTRICT
65 South Roop Street
Susanville, CA 96130
(530) 257-4174

MERCED IRRIGATION DISTRICT
P.O. Box 2288
Merced, CA 95344
(209) 722-5761
http://www.mercedid.org/

MODESTO IRRIGATION DISTRICT
1231 11th Street
Modesto, CA 95354
P.O. Box 4060
Modesto, CA 95352
(209) 526-7452
http://www.mid.org/

NEVADA IRRIGATION DISTRICT
Yuba-Bear River Project
28311 Secret Town Road
Colfax, CA 95713
(530) 273-8571
email: yubabear@foothill.net

NORTHERN CALIFORNIA POWER AGENCY
180 Cirby Way
Roseville, CA 95678
(916) 781-3636
http://www.ncpa.com/

OROVILLE/WYANDOTTE IRRIGATION DISTRICT
P.O. Box 581
Oroville, CA 95965-0581
(530) 534-1221

PLACER COUNTY WATER AGENCY
P.O. Box 667
Foresthill, CA 95631
(530) 885-6917

SHASTA DAM PUBLIC UTILITIES DISTRICT
P.O. Box 777
Central Valley, CA 96019
(530) 275-8827

TRANSMISSION AGENCY OF NORTHERN CALIFORNIA
P.O. Box 661030
Sacramento, CA 95866
(916) 924-1196

Federal and State Agencies and Irrigation District Systems (Continued)

TRINITY COUNTY PUBLIC UTILITY DISTRICT
P.O. Box 1216
Weaverville, CA 96093
(530) 623-5536

TRUCKEE-DONNER PUBLIC UTILITIES DISTRICT
11570 Donner Pass Road
Truckee, CA 96161
(530) 587-3896
email: tdpud@telis.org

TURLOCK IRRIGATION DISTRICT
333 East Canal Drive
P.O. Box 949
Turlock, CA 95381
(209) 883-8300
http://www.tid.org /

YUBA COUNTY WATER AGENCY
1402 D Street
Marysville, CA 95091
(916) 741-6278

CPUC- Regulated Water Companies (Continue on Next Pages)

AGATE BAY WATER CO.
Counties: **PLACER**
5424 TREE SIDE DRIVE
CARMICHAEL CA 95608
STEVE GLAZER, GENERAL MANAGER
Phone: (530) 525-6659 **Fax:** (530) 546-4218

ALCO WATER SERVICE
Counties: **MONTEREY**
249 WILLIAMS ROAD
SALINAS CA 93905
ROBERT ADCOCK, GENERAL MANAGER
Phone: (831) 424-0441 **Fax:** (831) 424-0611

ALPINE VILLAGE WATER CO.
Counties: **TULARE**
PO BOX 908
PORTERVILLE CA 93257
CHARLES W. ROBERTS, PARTNER
Phone: (209) 784-6326 **Fax:** (209) 784-6339

AMBLER PARK WATER UTILITY
Counties: **MONTEREY**
46 PASEO DE VAQUEROS
SALINAS CA 93908
CORNELIUS T. CRONIN, PRESIDENT
Phone: (831) 484-1445

ANTELOPE VALLEY WATER CORPORATION
Counties: **KERN, LOS ANGELES**
PO BOX 9351
LONG BEACH CA 90810
J.S. TOOTLE, VICE PRESIDENT-FINANCE
Phone: (310) 834-2625 **Fax:** (310) 834-8471

APPLE VALLEY RANCHOS WATER CO.
Counties: **SAN BERNARDINO**
PO BOX 7002
DOWNEY CA 90241
LEIGH K. JORDAN, SENIOR VICE PRESIDENT
REVENUE REQMTS
Phone: (760) 247-6484 **Fax:** (760) 247-1654

ARMSTRONG VALLEY WATER CO.
Counties: **SONOMA**
PO BOX 256
GUERNEVILLE CA 95446
PHILLIP E. GUIDOTTI, PRESIDENT
Phone: (707) 869-0050 **Fax:** (707) 869-1379

ARROWHEAD MANOR WATER CO., INC.
Counties: **SAN BERNARDINO**
PO BOX 146
CEDAR GLEN CA 92321
LANCE JOHNSON, OWNER
Phone: (909) 337-1641 **Fax:** (909) 337-9753

ARROYO CENTER WATER CO., INC.
Counties: **MONTEREY**
47475 ARROYO SECO ROAD
GREENFIELD CA 93927
JADE MANSFIELD, SECRETARY/TREASURER
Phone: (408) 675-0416

AUDRAIN STATION
Counties: **EL DORADO**
10265 CABALLO COURT
SACRAMENTO CA 95829
JAMES W. ANDERSON, OWNER
Phone: (916) 688-1726

B AND W RIVERVIEW ESTATES WATER CO.
Counties: **TEHAMA**
PO BOX 565
LOS MOLINOS CA 96055
N. E. & W. M. BARTOO, OWNERS
Phone: (530) 384-2443

BAKMAN WATER CO.
Counties: **FRESNO**
PO BOX 7965
FRESNO CA 93747
R. L. BAKMAN, VICE PRESIDENT
Phone: (209) 255-0324 **Fax:** (209) 255-3291

BASS LAKE WATER CO.
Counties: **MADERA**
PO BOX 109
BASS LAKE CA 93604
STEPHEN R. WELCH, PRESIDENT
Phone: (209) 642-2494 **Fax:** (209) 642-2517

BAYCLIFF SUBDIVISION
Counties: **LAKE**
13449 ANDERSON ROAD
LOWER LAKE CA 95457
PETER NOLASCO, OWNER
Phone: (707) 994-5869

CPUC- Regulated Water Companies (Continued)

BEAR TRAP ENTERPRISES, INC.
Counties: **TULARE**
PO BOX 271
POSEY CA 93260
WILLIAM W. GUENTHER, OWNER
Phone: (805) 536-8245

BEASORE MEADOWS WATER SYSTEM
Counties: **MADERA**
PO BOX 2245
OAKHURST CA 93644
VICTOR D. KLIEWER, CO-OWNER
Phone: (209) 683-4383

BENBOW WATER CORPORATION
Counties: **HUMBOLDT**
9 TERRACE COURT
AUBURN CA 95603
W. BENBOW, PRESIDENT
Phone: (530) 885-3340 **Fax:** (530) 885-1096

BIDWELL WATER CO.
Counties: **PLUMAS**
PO BOX 926
GREENVILLE CA 95947
TOM JERNIGAN, OWNER
Phone: (530) 284-6624 **Fax:** (530) 284-6624

BIG BASIN WATER CO., INC.
Counties: **SANTA CRUZ**
PO BOX 197
BOULDER CREEK CA 95006
JIM MOORE, OWNER-MANAGER
Phone: (831) 338-2933 **Fax:** (831) 338-0960

BIG HILL WATER CO.
Counties: **TUOLUMNE**
1240 NORTH SHAWS FLAT RD.
SONORA CA 95370
A. C. STILL, OWNER
Phone: (209) 532-3055

BIG LAGOON WATER CO.
Counties: **HUMBOLDT**
PO BOX 441
TRINIDAD CA 95570
BUD PELTONEN, OWNER
Phone: (707) 445-0446

BLACK BUTTE WATER CO.
Counties: **GLENN**
PO BOX 411
ORLAND CA 95963
CHARLES HARRIS, SR., CO-OWNER
Phone: (530) 865-4898 **Fax:** (530) 865-8828

BUHL WATER SYSTEM
Counties: **TULARE**
PO BOX 3407
VISALIA CA 93278
BRADLEY RALSTON, OWNER
Phone: (209) 625-0256 **Fax:** (209) 625-0256

CALIFORNIA HOT SPRINGS WATER SERV.
Counties: **TULARE**
PO BOX 146
CALIF HOT SPRINGS CA 93207
RONALD W. GILBERT, OWNER
Phone: (805) 548-6582 **Fax:** (805) 548-6623

CALIFORNIA WATER SERVICE CO.
Counties: **ALAMEDA, BUTTE, FRESNO, GLENN, KERN, LOS ANGELES, MONTEREY, SAN JOAQUIN, SAN MATEO, SANTA CLARA, SOLANO, TULARE, YUBA**
1720 NORTH FIRST STREET
SAN JOSE, CA 95112
FRANCIS S. FERRARO, VICE PRESIDENT-REGULATORY AFFAIRS
Phone: (408) 367-8200 **Fax:** (408) 367-8430

CALIFORNIA-AMERICAN WATER CO.
Counties: **LOS ANGELES, MONTEREY, SAN DIEGO, VENTURA**
880 KUHN DRIVE
CHULA VISTA CA 91914
JOHN BARKER, TREASURER, CRR
Phone: (619) 482-3747 **Fax:** (619) 656-2408

CAZADERO WATER CO.
Counties: **SONOMA**
P.O BOX 423
CAZADERO CA 95421
LOREN BERRY, OWNER
Phone: (707) 632-5225 **Fax:** (707) 632-5370

CENTRAL CAMP WATER CO, INC.
Counties: **MADERA**
46089 ROAD 208
FRIANT CA 93626
SANDRA McDOUGAL, MANAGER
Phone: (209) 822-2289

CENTRAL VALLEY WATER CO.
Counties: **TULARE**
PO BOX 1927
TULARE CA 93275
SANDRA KROSS, CO-OWNER
Phone: (209) 688-6132

CPUC- Regulated Water Companies (Continued)

CENTRAL WATER SYSTEM
Counties: **TULARE**
144 EAST OAK ST.
PORTERVILLE CA 93257
PATRICK A. MENA, CO-OWNER
Phone: (209) 781-3432

CITIZENS UTILITIES CO OF CALIF
Counties: **PLACER, SACRAMENTO, SAN MATEO, SANTA CRUZ, SONOMA**
PO BOX 15468
SACRAMENTO CA 95851
L. J. D'ADDIO, GENERAL MANAGER
Phone: (916) 568-4200 **Fax:** (916) 568-4260

COAST SPRINGS WATER CO, INC.
Counties: **MARIN**
454 WALTEN WAY
WINDSOR CA 95492
L. R. VANONI, PRESIDENT, C/O PAM COLLETTE
Phone: (707) 836-0357 **Fax:** (707) 836-0357

COBB MOUNTAIN WATER CO.
Counties: **LAKE**
PO BOX 2
COBB CA 95426
VINCENT B. ANDERSON, OWNER
Phone: (707) 928-5232

COLD SPRINGS WATER CO, INC.
Counties: **TUOLUMNE and the Peter Pan Subdivision and Santa Clara County(s) TUOLUMNE**
29820 HIGHWAY 108
COLD SPRINGS CA 95335
PETER J. KERNS, PRESIDENT
Phone: (209) 965-3716 **Fax:** (209) 965-4467

CONLIN STRAWBERRY WATER CO., INC.
Counties: **TUOLUMNE**
PO BOX 116
STRAWBERRY CA 95375
DANNY CONLIN, PRESIDENT
Phone: (209) 965-3286

COTTAGE SPRINGS WATER CO.
Counties: **CALAVERAS**
PO BOX 159
AVERY CA 95224
ROY P. MILLER, CO-OWNER
Phone: (209) 795-1401

COUNTRY ESTATES WATER CO., INC.
Counties: **KERN**
1508 18TH ST#320
BAKERSFIELD CA 93301
WALTER L. BERRY, MANAGER
Phone: (805) 323-1142 **Fax:** (805) 323-4829

COUNTY WATER CO.
Counties: **LOS ANGELES**
11829 E. 163 STREET
NORWALK CA 90650
JOHN A. ERICKSON, PRESIDENT
Phone: (562) 926-2311 **Fax:** (562) 926-6922

CURTIS WATER CO.
Counties: **KINGS**
PO BOX 41
HANFORD CA 93232
ALAN MOORE, CPA
Phone: (209) 582-0487 **Fax:** (209) 582-5641

DEL ORO WATER CO., INC.
Counties: **BUTTE**
DRAWER 5172
CHICO CA 95927
ROBERT S. FORTINO, PRESIDENT
Phone: (530) 894-1100 **Fax:** (530) 894-7645

DOMINGUEZ WATER CORPORATION
Counties: **KERN, LOS ANGELES, SACRAMENTO**
PO BOX 9351
LONG BEACH CA 90810
J. S. TOOTLE, VICE PRESIDENT-FINANCE
Phone: (310) 834-2625 **Fax:** (310) 834-8471

DONNER LAKE WATER CO.
Counties: **NEVADA**
DRAWER 5172
CHICO CA 95927
ROBERT S. FORTINO, PRESIDENT
Phone: (530) 894-1100 **Fax:** (530) 894-7645

EAST PASADENA WATER CO.
Counties: **LOS ANGELES**
3725 EAST MOUNTAIN VIEW AVENUE
PASADENA CA 91107
SHIRLEY KING, VICE PRESIDENT
Phone: (626) 793-6189 **Fax:** (626) 793-0503

CPUC- Regulated Water Companies (Continued)

EASTON ESTATES WATER CO.
Counties: **FRESNO**
PO BOX 5275
FRESNO CA 93755
FRANCIS H. FERRARO, PRESIDENT
Phone: (209) 439-0197 **Fax:** (209) 439-8430

ELK GROVE WATER WORKS
Counties: **SACRAMENTO**
9257 ELK GROVE BLVD
ELK GROVE CA 95624
J. B. JONES, PRESIDENT
Phone: (916) 685-3556 **Fax:** (916) 685-5376

EPTCO - VISALIA SYSTEM
Counties: **TULARE**
PO BOX 3407
VISALIA CA 93278
BRADLEY RALSTON, OWNER
Phone: (209) 625-0256 **Fax:** (209) 625-0256

ERSKINE CREEK WATER CO.
Counties: **KERN**
PO BOX 656
LAKE ISABELLA CA 93240
NICK SILICZ, VICE PRESIDENT
Phone: (760) 379-8309 **Fax:** (760) 379-5938

FOOTHILL DITCH CO.
Counties: **TULARE**
PO BOX 175
EXETER CA 93221
PATRICIA P. JACOBSEN, PRESIDENT
Phone: (209) 592-2104 **Fax:** (209) 592-1912

FRUITRIDGE VISTA WATER CO.
Counties: **SACRAMENTO**
1108 SECOND STREET, STE. 204
SACRAMENTO CA 95814
ROBERT C. COOK, JR., MANAGER
Phone: (916) 443-2607 **Fax:** (916) 443-3271

FULTON WATER CO.
Counties: **PLACER**
PO BOX 1903
TAHOE CITY CA 96145
JOHN A. FULTON, PRESIDENT
Phone: (530) 583-3644 **Fax:** (530) 583-9102

GARBERVILLE WATER CO, INC.
Counties: **HUMBOLDT**
PO BOX 516
GARBERVILLE CA 95542
FRED HURLBUTT, SECRETARY
Phone: (707) 923-3431

GARRAPATA WATER CO.
Counties: **MONTEREY**
36652 HWY 1, COAST ROUTE
MONTEREY CA 93940
BARBARA MORRIS LAYNE, PRESIDENT
Phone: (831) 624-8877

GERBER WATER WORKS, INC.
Counties: **TEHAMA**
4550 SHECKLER ROAD
FALLON NV 89406-9220
SANDRA SHERRINGTON, PRESIDENT
Phone: (702) 867-4764

GEYSERVILLE WATER WORKS
Counties: **SONOMA**
PO BOX 65
GEYSERVILLE CA 95441
HARRY BOSWORTH, CO-OWNER
Phone: (707) 857-3463 **Fax:** (707) 857-3163

GOODYEARS BAR WATER CO.
Counties: **SIERRA**
1200 - 44TH STREET
SACRAMENTO CA 95819
ELIZABETH B. SMART, SECRETARY-TREASURER
Phone: (916) 447-1040 **Fax:** (916) 447-3650

GRAEAGLE WATER CO, INC.
Counties: **PLUMAS**
PO BOX 310
GRAEAGLE CA 96103
DANIEL WEST, PRESIDENT
Phone: (530) 836-2612 **Fax:** (530) 836-2024

GRAND OAKS WATER CO.
Counties: **KERN**
PO BOX 188
LITTLE ROCK CA 93543
PHILLIP L. SHIRLEY, OWNER
Phone: (805) 723-0868

CPUC- Regulated Water Companies (Continued)

GRAND VIEW GARDENS WATER CO., INC.
Counties: **TULARE**
1393 NORTH MAIN STREET
PORTERVILLE CA 93257
THETA MCCOMB, PRESIDENT
Phone: (209) 784-3521

GREAT OAKS WATER CO.
Counties: **SANTA CLARA**
PO BOX 23490
SAN JOSE CA 95153-3490
BETTY B. ROEDER, PRESIDENT
Phone: (408) 227-9540 **Fax:** (408) 227-7126

GREENBELT WATER CO, INC.
Counties: **SANTA CRUZ**
PO BOX 1958
APTOS CA 95001
MICHAEL MILLS, GENERAL MANAGER
Phone: (831) 688-8997 **Fax:** (831) 688-9208

GRENADA WATER CO.
Counties: **SISKIYOU**
PO BOX 6167
CONCORD CA 94524
WAYNE LANGFORD, OWNER
Phone: (925) 798-8300 **Fax:** (925) 798-1286

HACIENDA WATER CO.
Counties: **SONOMA**
16654 WATSON ROAD
GUERNEVILLE CA 95446
BRIAN KERCHENKO,
Phone: (707) 869-3633

HAT CREEK WATER CO.
Counties: **SHASTA**
13387 CIRCLE DR
OLD STATION CA 96071
JOHN F. PARRISH, OWNER
Phone: (530) 335-7548

HAVASU WATER CO, INC.
Counties: **SAN BERNARDINO**
PO BOX 12316
ORANGE CA 92859
LAURIE MURPHY,
Phone: (714) 289-7072 **Fax:** (714) 289-7073

HAWKINS WATER SERVICE
Counties: **SONOMA**
830 YUBA DRIVE
SANTA ROSA CA 95407
COLEEN HAWKINS, CO-OWNER
Phone: (707) 527-0517

HILLCREST WATER CO., INC.
Counties: **SUTTER**
707 NO. GEORGE WASHINGTON BLVD.
YUBA CITY CA 95993
DARYL MORRISON, PRESIDENT
Phone: (530) 673-8053 **Fax:** (530) 673-6139

HILLVIEW WATER CO.
Counties: **MADERA**
PO BOX 2269
OAKHURST CA 93644
ROGER L. FORRESTER, PRESIDENT
Phone: (209) 683-4322 **Fax:** (209) 683-7775

IDYLWILD WATER SYSTEM
Counties: **SANTA CLARA**
20915 OLD SANTA CRUZ HIGHWAY
LOS GATOS CA 95030
BRUCE FRANKS, OWNER
Phone: (408) 353-1343 **Fax:** (408) 353-1400

INTERSTATE 5 UTILITY CO, INC.
Counties: **KERN**
2000 - 18TH STREET
BAKERSFIELD CA 93301
JAMES P. SEARS, PRESIDENT
Phone: (805) 325-5981

JAMES WATER CO, INC.
Counties: **KERN**
PO BOX 1655
KERNVILLE CA 93238
CLINT JAMES, OWNER
Phone: (760) 376-2622

JANUARY WATER CO.
Counties: **TULARE**
14002 AVENUE 232
TULARE CA 93274
JAMES HODGES, OWNER
Phone: (209) 686-5771

KENWOOD VILLAGE WATER CO.
Counties: **SONOMA**
4984 SONOMA HIGHWAY
SANTA ROSA CA 95409
KAREN BALL, MANAGER
Phone: (707) 539-6397 **Fax:** (707) 539-6399

CPUC- Regulated Water Companies (Continued)

KERN RIVER VALLEY WATER CO.
Counties: **KERN**
PO BOX 9351
LONG BEACH CA 90810
J. S. TOOTLE, VICE PRESIDENT-FINANCE
Phone: (310) 834-2625 **Fax:** (310) 834-8471

KINGS COUNTY CANAL CO.
Counties: **KINGS**
PO BOX 877
CORCORAN CA 93212
WALTER BRICKER, DIRECTOR
Phone: (209) 992-5011 **Fax:** (209) 992-3884

KLEIN HOMES WATER CO.
Counties: **SANTA CLARA**
201 BURLINGTON DR
UKIAH CA 95482
WILMA PRIBYL, PRESIDENT
Phone: (707) 462-4134

LA PORTE PINES COUNTRY CLUB
Counties: **PLUMAS**
PO BOX 204
LA PORTE CA 95981
DONALD A. MEYER, PRESIDENT
Phone: (530) 673-5527

LAKE ALPINE WATER CO, INC.
Counties: **ALPINE**
9601 STATE ROUTE #4
FARMINGTON CA 95230-9601
C. BRUCE ORVIS, PRESIDENT
Phone: (209) 899-2460 **Fax:** (209) 899-2460

LAKE FOREST UTILITY
Counties: **PLACER**
PO BOX 5627
TAHOE CITY CA 95730
DAVID ROBERTSON, MANAGER
Phone: (530) 581-2623

LAKEVIEW WATER CO.
Counties: **SAN BERNARDINO**
1373 LAS CANOAS ROAD
PACIFIC PALISADES CA 90272
ELEANOR BUCK, PRESIDENT
Phone: (310) 454-2124

LANDS OF PROMISE WATER SYSTEM
Counties: **KERN**
695 NEWELL ROAD
PALO ALTO CA 94303
JANET G. BROWN, TRUSTEE
Phone: (650) 322-0401 **Fax:** (650) 322-0401

LARKSPUR MEADOWS WATER CO.
Counties: **TEHAMA**
8140 E. ROSECRANS AVENUE
PARAMOUNT CA 90723
GEORGE JUE, PRESIDENT
Phone: (323) 636-8478

LAS FLORES WATER WORKS
Counties: **TEHAMA**
PO BOX 900
GERBER CA 96035
S. O. PATTERSON, CO-OWNER
Phone: (530) 385-1052 **Fax:** (530) 385-1305

LEWISTON VALLEY WATER CO., INC.
Counties: **TRINITY**
PO BOX 101
LEWISTON CA 96052
CHRIS ERICKSON,
Phone: (530) 778-3257 **Fax:** (530) 778-3257

LITTLE BEAR WATER CO, INC.
Counties: **MONTEREY**
51201 PINE CANYON ROAD, SPACE #125
KING CITY CA 93930
RICHARD HIWA, GENERAL MANAGER
Phone: (831) 385-3524

LIVE OAK SPRINGS WATER & POWER CO.
Counties: **SAN DIEGO**
PO BOX 1241
BOULEVARD CA 91905
NAZAR NAJOR, MANAGER
Phone: (619) 766-4288

LLANO DEL RIO WATER CO.
Counties: **LOS ANGELES**
32810 165TH STREET EAST
LLANO CA 93544
JAMES LOMBARDI, PRESIDENT
Phone: (805) 944-2939 **Fax:** (805) 944-2830

LONG CANYON WATER CO.
Counties: **KERN**
PO BOX 9351
LONG BEACH CA 90810
DAVID L. PRINCE, PRESIDENT
Phone: (213) 834-2625

CPUC- Regulated Water Companies (Continued)

LOS GUILICOS WATER WORKS
Counties: **SONOMA**
PO BOX 1175
KENWOOD CA 95452
DINO BOZZETTO, OWNER
Phone: (707) 833-5511 **Fax:** (707) 833-5752

LUCERNE WATER CO, THE
Counties: **LAKE**
PO BOX 1133
LUCERNE CA 95458
BOB STRAUSS, MANAGER
Phone: (707) 274-6624

LUKINS BROTHERS WATER CO, THE
Counties: **EL DORADO**
PO BOX 7622
SOUTH LAKE TAHOE CA 95731
MELVIN L. LUKINS, OWNER
Phone: (530) 541-2606 **Fax:** (530) 541-1746

LYTLE SPRINGS WATER CO.
Counties: **SAN BERNARDINO**
277 NO. LYTLE CREEK RD.
LYTLE CREEK CA 92358
BOB BOYTOR, GENERAL MANAGER
Phone: (909) 887-7070 **Fax:** (909) 880-2430

MACDOEL WATER WORKS
Counties: **SISKIYOU**
PO BOX 1417
YREKA CA 96097
ROSE ROBINSON, OWNER
Phone: (530) 842-4936

MADDEN CREEK WATER CO.
Counties: **PLACER**
PO BOX 264
TAHOMA CA 96142
EARL B. MARR, CO-OWNER
Phone: (530) 525-7555

MAR VISTA WATER CO, INC.
Counties: **SANTA CRUZ**
PO BOX 1026
APTOS CA 95001
JIM H. SMITH, OWNER
Phone: (831) 462-3449 **Fax:** (831) 462-3449

MATT DILLON WATER CO.
Counties: **TUOLUMNE**
PO BOX 1323
TWAIN HARTE CA 95383
HARVEY D. BEAUCHAMP, JR., OWNER
Phone: (209) 532-2536

MEADOW VALLEY WATER WORKS
Counties: **PLUMAS**
PO BOX 37
MEADOW VALLEY CA 95956
ROBERT L. FORBES, OWNER
Phone: (530) 283-2108

MEADOWBROOK WATER CO. OF MERCED
Counties: **MERCED**
2272 MEADOWBROOK AVE
MERCED CA 95340
FRED H. WALKER, OWNER
Phone: (209) 722-1069 **Fax:** (209) 722-1069

MECCHI WATER CO.
Counties: **SANTA CLARA**
PO BOX 59158
SAN JOSE CA 95159-0158
JESS LEDESMA, OWNER
Phone: (408) 293-7938

MESA-CREST WATER CO.
Counties: **LOS ANGELES**
PO BOX 257
LA CANADA CA 91012
TIMOTHY J. FLYNN, VICE PRESIDENT
Phone: (818) 790-2071 **Fax:** (818) 790-2074

METROPOLITAN WATER CO.
Counties: **FRESNO**
4719 E. MICHIGAN AVE
FRESNO CA 93703
O. GENE BULLER, OWNER
Phone: (209) 255-6101

MEYERS WATER CO.
Counties: **NAPA**
2081 SANDRA DRIVE
NAPA CA 94558
KENNY VAN GORDER, OWNER
Phone: (707) 255-2857

MINERAL CITY WATER SYSTEM
Counties: **TEHAMA**
PO BOX 146
MINERAL CA 96063
JOANNE PERKINS, SECRETARY-TREASURER
Phone: (530) 595-4408

CPUC- Regulated Water Companies (Continued)

MIRA MONTE WATER CO.
Counties: **TEHAMA**
PO BOX 900
GERBER CA 96035
S. O. PATTERSON, CO-OWNER
Phone: (530) 385-1052 **Fax:** (530) 385-1305

MOUNTAIN MESA WATER CO.
Counties: **KERN**
PO BOX 207
LAKE ISABELLA CA 93240
WM. W. KISSACK, PRESIDENT
Phone: (760) 379-2086

MOUNTAIN SPRINGS WATER CO.
Counties: **KERN**
PO BOX 18
TEHACHAPI CA 93581
CORA JANE HAINLINE, OWNER
Phone: (805) 822-4389

MT. CHARLIE WATER WORKS, INC.
Counties: **SANTA CRUZ**
540 NORTH SANTA CRUZ, STE. 270
LOS GATOS CA 95030
CHRISTOPHER ASHWORTH, RECEIVER
Phone: (831) 867-1573 **Fax:** (831) 867-4387

MULLEN WATER CO.
Counties: **TULARE**
PO BOX 622
SPRINGVILLE CA 93265
GILBERT E. MULLEN, OWNER
Phone: (209) 539-2450

NACIMIENTO WATER CO.
Counties: **SAN LUIS OBISPO**
PO BOX 1703
PASO ROBLES CA 93447
S. W. BEAN, PRESIDENT
Phone: (805) 472-2540 **Fax:** (805) 472-2540

NESSCO H2O
Counties: **SONOMA**
PO BOX 751356
PETALUMA CA 94975-1356
EDWARD J. NESSINGER, OWNER
Phone: (707) 769-1637 **Fax:** (707) 766-8445

NISH WATER CO.
Counties: **TULARE**
PO BOX 3407
VISALIA CA 93278
BRADLEY RALSTON, OWNER
Phone: (209) 625-0256 **Fax:** (209) 625-0256

NORTH GUALALA WATER WORKS
Counties: **MENDOCINO**
PO BOX 1000
GUALALA CA 95445
J. H. BOWER, PRESIDENT/OWNER
Phone: (707) 884-3579 **Fax:** (707) 884-1620

OWENS VALLEY WATER CO.
Counties: **INYO**
1835 SOUTH LA CIENEGA BLVD, SUITE 240
LOS ANGELES CA 90035
MEL GOLDSTEIN, PRESIDENT
Phone: (213) 454-0450

PARK WATER CO.
Counties: **LOS ANGELES, SAN BERNARDINO**
PO BOX 7002
DOWNEY CA 90241
LEIGH K. JORDAN, SENIOR VICE PRESIDENT - REVENUE REQMTS
Phone: (562) 923-0711 **Fax:** (562) 861-5902

PEERLESS WATER CO.
Counties: **LOS ANGELES**
PO BOX 117
BELLFLOWER CA 90706
J. W. ZASTROW, PRESIDENT
Phone: (562) 531-1500 **Fax:** (562) 531-3095

PENNGROVE WATER CO.
Counties: **SONOMA**
4984 SONOMA HIGHWAY
SANTA ROSA CA 95409
KAREN BALL, MANAGER
Phone: (707) 539-6397 **Fax:** (707) 539-6399

PIERPOINT SPRINGS RESORT WATER CO.
Counties: **TULARE**
PO BOX 85
CAMP NELSON CA 93208
BEN & MICHELLE RAY, OWNERS
Phone: (209) 542-2551

PINE FLAT WATER CO.
Counties: **TULARE**
31794 SHERWOOD AVENUE
McFARLAND CA 93250
JERRY WEDEL, PRESIDENT
Phone: (805) 325-8730

CPUC- Regulated Water Companies (Continued)

PINE MOUNTAIN WATER CO.
Counties: **TULARE**
31794 SHERWOOD AVE
MCFARLAND CA 93250
GERALD WEDEL, OWNER
Phone: (805) 792-2285

POINT ARENA WATER WORKS, INC.
Counties: **MENDOCINO**
PO BOX 205
POINT ARENA CA 95468
WILLIAM HAY, JR., PRESIDENT
Phone: (707) 882-2323

PONDEROSA SKY RANCH WATER SYSTEM
Counties: **TEHAMA**
33851 PONDEROSA WAY
PAYNES CREEK CA 96075
ORVILLE FIGGS, JR.,
Phone: (530) 597-2920

PONDEROSA WATER CO, INC.
Counties: **TUOLUMNE**
20636 GERBER ROAD
TUOLUMNE CA 95379
WILLIAM E. GERBER, PRESIDENT
Phone: (209) 928-3322

R.R. LEWIS SMALL WATER CO.
Counties: **SIERRA**
4500 EAST FREMONT STREET
STOCKTON CA 95215
WILLIAM L. OSTROM, MANAGER
Phone: (209) 948-8817

RAMONA WATER CO.
Counties: **RIVERSIDE**
PO BOX 910
PALM SPRINGS CA 92263
MICHAEL DUNN, PRESIDENT
Phone: (760) 325-1296 **Fax:** (760) 328-0657

RANCHO DEL PARADISO WATER CO.
Counties: **SONOMA**
PO BOX 256
GUERNEVILLE CA 95446
PHILLIP E. GUIDOTTI, PRESIDENT
Phone: (707) 869-0050 **Fax:** (707) 869-1379

RIO PLAZA WATER CO, INC.
Counties: **TULARE**
8698 ROSELAND AVE
MOORPARK CA 93021
JOHN C. NICKEL, PRESIDENT
Phone: (805) 525-5583 **Fax:** (805) 525-6263

RIVER ISLAND WATER CO.
Counties: **TULARE**
31910 COUNTRY CLUB DRIVE
PORTERVILLE CA 93257
MICHAEL LAUGHLIN, MANAGER
Phone: (209) 784-3508 **Fax:** (209) 782-4666

RIVERVIEW ACRES WATER CO.
Counties: **TRINITY**
PO BOX 81
SALYER CA 95563
WALTER CARPENTER, CO-OWNER
Phone: (530) 629-2232

ROGINA WATER CO, INC.
Counties: **MENDOCINO**
PO BOX 310
TALMAGE CA 95481
DANIEL D. ROGINA, PRESIDENT
Phone: (707) 462-4056 **Fax:** (707) 462-8534

ROLLING GREEN UTILITIES, INC.
Counties: **INYO**
117 TERRACE DR
BIG PINE CA 93513
ARNIE PETERSEN, MANAGER
Phone: (760) 938-3311 **Fax:** (760) 938-3311

ROSELLA WATER CO.
Counties: **TULARE**
217 EL TOVAR CT
BAKERSFIELD CA 93309-2210
ROLLIE MOORE, RECEIVER
Phone: (805) 834-1928 **Fax:** (805) 834-1928

RURAL WATER CO., INC.
Counties: **SAN LUIS OBISPO**
PO BOX 745
GROVER BEACH CA 93483
CHARLES BAKER, PRESIDENT/OWNER
Phone: (805) 481-8432 **Fax:** (805) 481-8432

CPUC- Regulated Water Companies (Continued)

RYAN WATER SYSTEM
Counties: **SANTA CLARA**
75 ROUNDTABLE DRIVE*
SAN JOSE CA 95111
ROBERT F. STREBEL,

SAN GABRIEL VALLEY WATER CO.
Counties: **LOS ANGELES, SAN BERNARDINO**
11142 GARVEY AVENUE
EL MONTE CA 91734
MICHAEL WHITEHEAD, PRESIDENT
Phone: (626) 448-6183 **Fax:** (626) 448-5530

SAN JOSE WATER CO.
Counties: **SANTA CLARA**
374 WEST SANTA CLARA ST
SAN JOSE CA 95196
FRED R. MEYER, VICE PRESIDENT,
REGULATORY AFFAIRS
Phone: (408) 279-7863 **Fax:** (408) 279-7934

SANTA CLARITA WATER CO.
Counties: **LOS ANGELES**
22722 W. SOLEDAD CANYON ROAD
SANTA CLARITA CA 91380
W. J. MANETTA, JR., PRESIDENT
Phone: (805) 259-2737 **Fax:** (805) 286-4333

SEA RANCH WATER CO, THE
Counties: **SONOMA**
PO BOX 301
THE SEA RANCH CA 95497
MARY CONDON, ASSISTANT TREASURER
Phone: (707) 785-2411 **Fax:** (707) 785-9756

SEARLES DOMESTIC WATER CO.
Counties: **SAN BERNARDINO**
PO BOX 577
TRONA CA 93592
AUDREY SCHUYLER, MANAGER
Phone: (760) 372-5326 **Fax:** (760) 372-2110

SEQUOIA CREST, INC.
Counties: **TULARE**
55124 REDWOOD DR
SPRINGVILLE CA 93265
SKIP ROUCH, PRESIDENT
Phone: (209) 542-2188 **Fax:** (209) 542-2188

SERENO DEL MAR WATER CO.
Counties: **SONOMA**
PO BOX 730
FORESTVILLE CA 95436
HAL WOOD, ADMINISTRATOR
Phone: (707) 887-7735

SIERRA CITY WATER WORKS, INC.
Counties: **SIERRA**
732 BUTLER ROAD
GRASS VALLEY CA 95945
CHARLES K. SMITH, PRESIDENT
Phone: (530) 273-6447

SLIDE INN/SNOBOWL WATER CO.
Counties: **TUOLUMNE**
PO BOX 286
SONORA CA 95370
SATOI MILLS, OWNER
Phone: (209) 532-5500

SONORA WATER CO.
Counties: **TUOLUMNE**
PO BOX 996
SONORA CA 95370
BEVERLY BROWN, MANAGER
Phone: (209) 532-4806

SORSOLI WATER CO, INC.
Counties: **PLUMAS**
PO BOX 6
CRESCENT MILLS CA 95934
SHERYL S. STOCKTON, SECRETARY-OFFICE
MANAGER
Phone: (530) 284-6799

SOUTHERN CALIFORNIA EDISON CO.
Counties: **LOS ANGELES**
PO BOX 800, ROOM 216
ROSEMEAD CA 91770
PETER S. GOEDDEL, MANAGER, PRICING
DESIGN & TARIFFS
Phone: (626) 302-2069 **Fax:** (626) 302-4829

CPUC- Regulated Water Companies (Continued)

SOUTHERN CALIFORNIA WATER CO.
Counties: **CONTRA COSTA, IMPERIAL, LAKE, LOS ANGELES, ORANGE, SACRAMENTO, SAN BERNARDINO, SAN LUIS OBISPO, SANTA BARBARA, VENTURA**
PO BOX 9016
SAN DIMAS CA 91773
JOSEPH F. YOUNG, VICE PRESIDENT - REGULATORY AFFAIRS
Phone: (909) 394-3600 **Fax:** (909) 394-1382

SPRECKELS WATER CO.
Counties: **MONTEREY**
PO BOX 1287
MANTECA CA 95336
DAVID A. DENNEHY, PRESIDENT, C/O SPRECKELS DEVELOPMENT
Phone: (209) 823-3121

SPRING CREST WATER & POWER CO.
Counties: **RIVERSIDE**
1350 SOUTH FARRELL DRIVE
PALM SPRINGS CA 92264
FRED R. RAZZAR, MANAGER
Phone: (760) 327-3117

STEWART WATER CO, INC.
Counties: **SAN BERNARDINO**
2905 WALL AVENUE
SAN BERNARDINO CA 92404
MARY STEWART, OWNER
Phone: (909) 883-8470

STIRLING BLUFFS CORPORATION
Counties: **BUTTE**
DRAWER 5172
CHICO CA 95927
ROBERT FORTINO, PRESIDENT
Phone: (530) 894-1100 **Fax:** (530) 894-7645

STONE CREEK WATER CO, INC.
Counties: **RIVERSIDE**
1111 E. TAHQUITZ CANYON WAY, STE. 212
PALM SPRINGS CA 92262
LEONARD J. WESTON, OWNER
Phone: (760) 322-2007

SUBURBAN WATER SYSTEMS
Counties: **LOS ANGELES, ORANGE**
1211 EAST CENTER COURT DR
COVINA CA 91724
ROBERT L. KELLY, MANAGER, REVENUE REQUIREMENTS
Phone: (626) 966-2090 **Fax:** (626) 331-4848

SUSAN RIVER PARK WATER CO.
Counties: **LASSEN**
30 SOUTH ROOP ST
SUSANVILLE CA 96130
RICHARD HERMAN, OWNER, C/O CAROL CURRY
Phone: (530) 257-2101 **Fax:** (530) 257-4119

TAHOE CEDARS WATER CO.
Counties: **EL DORADO, PLACER**
PO BOX 264
TAHOMA CA 96142
E. B. MARR, PRESIDENT
Phone: (530) 525-7555

TAHOE PARK WATER CO, INC.
Counties: **PLACER**
PO BOX 5627
TAHOE CITY CA 95730
DAVID ROBERTSON, GENERAL MANAGER
Phone: (530) 581-2623

TAHOE SWISS VILLAGE UTILITIES, INC.
Counties: **EL DORADO, PLACER**
PO BOX 102
HOMEWOOD CA 96141
STEVEN M. GLAZER,
Phone: (530) 525-6659

TEHACHAPI MOUNTAIN WATER CO.
Counties: **KERN**
STAR ROUTE 1
TEHACHAPI CA 93561
EVELYN GROOM, OWNER
Phone: (805) 822-5762

TIMBERLAND WATER SERVICE
Counties: **PLACER**
P0 BOX 7573
TAHOE CITY CA 96145
JOHN BALLARD, OWNER
Phone: (530) 583-3478

TORO WATER SERVICE, INC.
Counties: **MONTEREY**
PO BOX 5312
SALINAS CA 93915
R. T. ADCOCK, PRESIDENT
Phone: (831) 424-0732 **Fax:** (831) 424-0611

CPUC- Regulated Water Companies (Continued)

TRINITY VILLAGE WATER CO.
Counties: **TRINITY**
100 “M” STREET
EUREKA CA 95501
FRANCIS B. MATHEWS, SECRETARY-TREASURER
Phone: (707) 442-3758

TULARE COUNTY WATER CO, INC.
Counties: **TULARE**
PO BOX 1927
TULARE CA 93275
SANDRA KROSS, OWNER
Phone: (209) 688-6404

TULCO WATER CO.
Counties: **TULARE**
PO BOX 3407
VISALIA CA 93278
BRADLEY RALSTON, CO-OWNER
Phone: (209) 625-0256

TWIN LAKES ENTERPRISES
Counties: **MONO**
PO BOX 455
BRIDGEPORT CA 93517
ALPHA ANNETT, CO-OWNER
Phone: (760) 932-7071

TWIN VALLEY WATER CO, INC.
Counties: **SANTA CLARA**
PO BOX 433
MORGAN HILL CA 95038
STEVE HAVENS, PRESIDENT
Phone: (408) 776-0511 **Fax:** (408) 776-1131

VALENCIA WATER CO.
Counties: **LOS ANGELES**
24631 AVE. ROCKEFELLER
VALENCIA CA 91355
ROBERT DIPRIMIO, MANAGING DIRECTOR
Phone: (805) 294-1150 **Fax:** (805) 294-3806

VISTA GRANDE WATER SYSTEM
Counties: **TEHAMA**
PO BOX 900
GERBER CA 96035
S. O. PATTERSON, CO-OWNER
Phone: (530) 385-1052 **Fax:** (530) 385-1305

WALNUT RANCH WATER CO, INC.
Counties: **COLUSA**
707 N. GEORGE WASHINGTON BLVD.
YUBA CITY CA 95993
DARYL MORRISON, PRESIDENT
Phone: (530) 673-8053 **Fax:** (530) 673-6139

WARRING WATER SERVICE, INC.
Counties: **VENTURA**
PO BOX 189
PIRU CA 93040
GARY G. PACE, PRESIDENT
Phone: (805) 524-2068

WEIMAR WATER CO, INC.
Counties: **PLACER**
21470 MEADOW OAKS LN
WEIMAR CA 95736
FRED FAHLEN, OWNER
Phone: (530) 637-4441 **Fax:** (916) 773-8166

WENDELL WATER CO.
Counties: **SONOMA**
1156 WILDROSE DR
SANTA ROSA CA 95401
SUZAN JENSEN-WEESE, MANAGER, C/O SUZAN’S ACCTG. SERVICE
Phone: (707) 528-9672 **Fax:** (707) 578-4895

WEST RIVERSIDE CANAL CO.
Counties: **RIVERSIDE, SAN BERNARDINO**
PO BOX 3617
RIVERSIDE CA 92519
JOHN L. WEST, DIRECTOR
Phone: (909) 360-2070 **Fax:** (909) 360-2080

WEST SAN MARTIN WATER WORKS, INC.
Counties: **SANTA CLARA**
1005 HIGHLAND AVENUE
SAN MARTIN CA 95046
BOB UKESTAD, MANAGER
Phone: (408) 683-2098

WEST WATER CO.
Counties: **SONOMA**
335 ELSE WAY
CLOVERDALE CA 95425
TOM W. JOHNSON, OWNER
Phone: (707) 894-9017

CPUC- Regulated Water Companies (Continued)

YERBA BUENA WATER CO.
Counties: **VENTURA**
PO BOX 2669
PALOS VERDES CA 90274
ROBERT M. BERRY, PRESIDENT
Phone: (310) 542-8483

YERMO WATER CO.
Counties: **SAN BERNARDINO**
PO BOX 1703
BARSTOW CA 92312
DON WALKER, OWNER
Phone: (760) 255-2802 **Fax:** (760) 255-2802

YOSEMITE SPRING PARK UTILITY CO.
Counties: **MADERA**
30250-B YOSEMITE SPRINGS PARKWAY
COARSEGOLD CA 93614
JOHN ARNER, SR., PRESIDENT
Phone: (209) 658-7451 **Fax:** (209) 658-7866

YUBA INVESTMENT CO.
Counties: **YUBA**
PO BOX 190
OREGON HOUSE CA 95962
NANCY GEDDES, ADMINISTRATOR
Phone: (530) 692-1612 **Fax:** (530) 692-0304

SUBJECT: PARKING METERS

As a result of legislation enacted in 1998, Section 12209.6 was added to the Business and Professions Code. This section authorizes a county sealer to test parking meters owned by a city, county, or city and county and take certain actions for parking meters that provide less time than is paid for by a person using the metered parking space.

This legislation is permissive in that a "county sealer may test and certify the accuracy of all parking meters." The California Agricultural Commissioners and Sealers Association recommends that a cooperative relationship with the county sealer and the city and/or county parking authority be established and that parking meters only be tested on a complaint basis.

Nothing in this recommendation is intended to prevent a county sealer from entering into an agreement (contract, MOU, etc.) with the parking authority or establishing other types of parking meter testing or certification programs.

The following are recommended guidelines for receiving and processing complaints, and ultimately the on-site testing of the parking meter(s) in question. It is recommended that the county sealer only investigate meter complaints that relate to accuracy.

1. Determine if the complainant has already contacted the local parking authority. The complainant should be referred to the local parking authority for the initial appeal of a parking citation or violation.

2. If the complainant has already contacted the local parking authority, record the following information (if available).

    Name, address, city, zip, and daytime phone number
    Reason for contesting the citation
    Time and date of the violation
    Citation number
    Location of the meter (on the citation)
    Violation code
    Vehicle license number
    Meter number
    Amount of time purchased
    Combination of coins

3. Contact the local parking authority to notify them of the complaint and verify if the subject meter has been replaced and/or repaired. If the meter has been replaced or repaired, notify the complainant that no other action can be taken by weights and measures.

4. If the meter is still in place and has not been repaired, then an on-site test is appropriate using the following procedures:

   $ The meter should be tested with a stopwatch or other suitable timing standard that has been tested for accuracy.

   $ Check the meter for any visible jams that will prevent it from being tested.

   $ Note the amount of time purchased per coin stated on the meter.

   $ Electronic parking meters typically use prepaid cards to activate the meter. Instructions for the purchase of time on the meter are either marked on the meter, prepaid card, or available when the card is purchased.

   $ Insert coins (preferably in the combination of coins and the amount of time stated by the complainant) or set the time, in the case of an electronic meter, and engage the meter while simultaneously starting the timing standard.

   NOTE: Some parking meters are activated automatically when coins are inserted into the slot, while other type require that a knob or handle be rotated.

   The meter immediately fails if it does not display any time when coins are inserted and the meter activated.

   The meter immediately fails if a mechanical meter points to less time or an electronic meter indicates less time than purchased.

   The meter fails if the "expired" flag or indication is activated before the time purchased has elapsed.

   The meter passes if the amount of time purchased elapses, according to the timing standard, before the "expired" flag or indication is activated.

5. Notify the complainant and the parking authority the results of the inspection.

   If the meter fails, notify the parking authority that the meter shall be repaired or removed from service within 30 days of the inspection. Failure to correct the meter or remove it from service shall cause the meter to be tagged (or bagged) indicating that parking is free for the amount of time posted.

EPO REF-U
Page Two

SUBJECT: VAPOR METER TEST LABORATORY
Requirements and Test Procedures

The following equipment and provisions are necessary for vapor meter testing:

1. Volumetric Standards

   (a) Two cubic feet bell prover or,
   (b) Five cubic feet bell prover or,
   (c) Ten cubic feet bell prover (not recommended for small capacity meters).

   Compare test standards with Division of Measurement Standards Volumetric Standards at least once in 10 years, or following alterations, accidents, or repairs.

2. Environmental temperature controls

   (a) Isolated/dedicated thermostat.
   (b) Dedicated heating and air conditioning units.
   (c) Means to prevent stratification of room air.

3. Gauges and thermometers

   (a) National Institute of Standards and Technology (NIST) traceable thermometer for bell prover oil - divisions not to exceed 1/2°F (digital not to exceed 0.2°F).

   (b) NIST traceable thermometer for bell prover air flow - divisions not to exceed 0.2°F.

   (c) NIST traceable thermometer for meter air flow - divisions not to exceed 0.2°F.

   (d) Recording/logger/hi-low thermometer(s) - for environmental monitoring (figure 11, EPO REF-V Page 18).

   (e) Two Manometers for Bell prover and Pilot flame pressure measurement (figures 12 and 13, EPO REF-V Page 18).

   (f) Pressure gauge for leak test apparatus - minimum division not to exceed 1 psi (figure 14, EPO REF-V Page 19).

   (g) Magnahelic gauge - minimum division not to exceed .2 inches of water column (figure 10, EPO REF-V Page 18).

4. Hydrostatic leak test equipment

    (a) Water tank large enough to accommodate meters during testing.

    (b) Soap and water spray (for large meters).

    (c) Pressure gauge - range 0-30 psi, minimum division not to exceed 1 psi. (figure 1, EPO REF-V Page 15 and Figure 14, EPO REF-V Page 19).

    (d) Regulator - sized to adjust from 0-30 psi (figure 3, EPO REF-V Page 15 and figure 14, EPO REF-V Page 19).

    (e) High pressure air hose and nozzle (for blowing water off meter casing after leak testing).

    (f) Hose to meter fittings:

        (1) Standard low pressure hoses - maximum working pressure 150 psi.

        (2) Hose size - 1/4" I.D. (figure 2, EPO REF-V Page 15).

        (3) Connections - swivel couplings on both ends of hoses to accommodate nozzle and regulator connection (figure 2, EPO REF-V Page 15).

5. Pilot load test equipment

    (a) Pressure regulator - adjustable to maintain 1.5 inches of water column pressure (figure 4, EPO REF-V Page 15).

    (b) Orifice sized to conduct test as outlined in California Code of Regulations Section 3.33, N.4.2.2 (figure 5, EPO REF Page 16 and Figure 8, EPO REF-V Page 17).

    (c) Automatic Timer to operate for one hour (figure 6, EPO REF-V Page 16).

    (d) Solenoid valve - 0.5 to 1 psi rating (figures 7 and 7a, EPO REF-V Page 16).

    (e) Flexible hoses (figures 8 and 8a, EPO REF-V Page 17).

    (f) Manometer - division not to exceed 0.2 inches w.c. (figure 9, EPO REF-V Page 17).

    (g) Hose to meter fittings (figures 8 and 8a, EPO REF-V Page 17).

Vapor Laboratory Equipment Specifications

Volumetric Standard:

1. NIST traceable bell prover - usually 2, 5, or 10 cu.ft.

   (a) 2 cu.ft. may test meters up to rated up to 630 cu.ft per hour.

   (b) 5 cu.ft. may test meters up to 2400 cu.ft. per hour.

   (c) 10 cu.ft. proving indexes.

2. Inlet and outlet gate valves to restrict air flow in and out of bell prover.

3. Pressure tap on outlet side of gate valve located on the prover outlet side for manometer (figure 12, EPO REF-V Page 18).

4. Index of an indicator shall keep parallax effect to a minimal (figure 15, EPO REF-V Page 19).

5. Bell prover scaling should have graduations as follows:

   (a) major grads - one cubic foot (figure 16, EPO REF-V Page 19).

   (b) minor grads - 0.1 cu.ft. (figure 16, EPO REF-V Page 19).

   (c) proof grads - 0.02 cu.ft. (maximum smallest resolution) (figure 16, EPO REF-V Page 19).

6. Bell prover parts listing:

   (a) Tank
   (b) Bell
   (c) Top ring
   (d) Level
   (e) Columns (three)
   (f) Guides (two sets)
   (g) Tripod frame (three)
   (h) Balance wheel
   (i) Suspension
   (j) Involute
   (k) Piping
   (l) Air chamber
   (m) Air valve
   (n) Gate valve
   (o) Scale
   (p) Sealing oil
   (q) Counter weight

Prover Oil Specification:

Straw, transformer, or white oil has been found to be satisfactory. The oils should have approximately the following properties:

Pour-point	Not more than 25°F
Flash-point	Not lower than 300°F
Fire-point	Not lower than 310°F
Viscosity at 100°F	65-75 seconds, Saybolt Viscosimeter
Specific gravity at 60°F	0.848 to 0.858 (water 1.0)
Vapor pressure at 200°F	Less than 0.60 mm mercury
Color	At least +30 Saybolt

Proof Testing Apparatus Specifications:

1. Pipe connection adapters:

   (a) At least 8 pipe diameters of straight piping connecting to the meter inlet and outlet (see Appendix C, EPO REF-V Page 12).

   (b) Pressure taps - measure the pressure differential at a point between 1.5 diameters straight upstream of the integral connection on the meter inlet and a point 8 diameters straight downstream of the meter outlet (see Appendix C, EPO REF-V Page 12).

2. Orifices (rate caps) - They should be adequately sized to test flow rates from 100% down to 20% of the meter rated capacity (see figure 17, EPO REF-V Page 19 and Figure 23, EPO REF-V Page 21).

3. Involute (secondary counter weights) when bell is at its highest point, the involute should be furthest point away from the bell and the tip to be horizontal to the center of the balance wheel shaft (see Appendix A, EPO REF-V Page 10, figure 18, EPO REF-V Page 20, and figure 27, EPO REF-V Page 22).

4. Remove weights and chain from the balance wheel (leave involute on). The wheel should be able to be positioned any position (360°) and not move on it own (see Appendix A, EPO REF-V Page 10 and figure 18, EPO REF-V Page 20).

5. Bell prover hose - The flexible hose should not exceed 8 feet, hose diameter should not exceed the diameter of prover outlet connection (see figure 19, EPO REF-V Page 20).

6. Install the manometer gauge at the outlet side of prover gate valve (see figure 12, EPO REF-V Page 18).

7. Install a thermometer on the outlet air flow side of the prover (see figure 12, EPO REF-V Page 18).

8. Install a thermometer on the outlet air flow side of the meter under going proof testing (see figure 20, EPO REF-V Page 20).

Environmental and Temperature Controls Requirements:

1. When testing vapor meters, temperature has a critical effect on the accuracy of the test. A change in temperature of 1°F will result in a test error of about 0.2 percent. Thus, control of temperature is of primary concern when considering the specifications of the testing area.

   Ideally, the heating and cooling system should be capable of maintaining temperature of the testing area constant within ± 2°F.

   During the meter test, try to keep the different in airflow temperature between the prover and meter to 1°F or less (see Appendix B, EPO REF-V Page 11). If the temperature exceeds 1°F, apply the temperature correction on page 31-7.

2. Laboratory should record temperatures from at least 16 hours prior through completion of proof testing.

3. There should be at least four temperature measuring devices:

   (a) Located in the outlet air flow side of the prover (figure 12, EPO REF-V Page 18).

   (b) Submersed in the prover oil (figure 21, EPO REF-V Page 20).

   (c) Located in the outlet side of meter undergoing proof testing (figure 20, EPO REF-V Page 20).

   (d) Located adjacent to the bell prover bell (figure 21, EPO REF-V Page 20).

4. The maximum temperature difference between prover, prover oil, ambient air, and meter undergoing proof testing should not exceed 2°F of each other.

5. Air ducts, heaters and air conditioning units should be designed to allow even distribution of conditioned air throughout the entire room.

6. Exposure to direct sunlight adversely affects meters and instruments and should be prevented in the laboratory.

7. The prover should be located away from hot or cold spots, such as radiators, steam pipes, or hot and cold air ducts.

Gauges and Thermometers:

1. Pressure differential (magnahelic) gauges should have a minimum resolution of not more than 0.2" W.C. and capacity not to exceed 2" W.C. (figure 10, EPO REF-V Page 18).

2. Manometers:

    (a) For pilot test (low Flame) the minimum resolution should be not greater than 0.1" W.C. (figure 9, EPO REF-V Page 17).

    (b) Bell prover - minimum resolution should not exceed 0.1" W.C. (figure 9, EPO REF-V Page 17).

3. Leak test pressure gauge should have a minimum resolution not to exceed 1 pound per square inch (see figure 1, EPO REF-V Page 15).

4. Thermometers - should have a minimum resolution not to exceed 1/2° F (digital not to exceed 0.2°F.)

Hydrostatic Leak Test Equipment:

1. Lock off pressure should not exceed maximum rated working pressure of meter under test.

2. Adjustable to perform leak test from four to thirty pounds per square inch.

3. Pressure gauge (at least 30 psig capacity, resolution not to exceed one psi).

4. Regulator - Range adjustable from 0 to 30 psi.

5. Orifices - Sized to a flow rate of one revolution in one minute.

Pilot Load (Low Flame)Test Equipment:

1. Manometer shall be properly sized to be able to accurately read 1.5" W.C. pressure.

    (a) Minimum resolution not to exceed 0.1" W.C. (see figure 9, EPO REF-V Page 17).

2. Liquid used in a "U" shaped manometer shall have a specific gravity of one. A "Slope" gauge manometer shall have specific gravity fluid specified by manufacturer (see figure 24, EPO REF-V Page 21).

3. Manometer should be set at zero condition when there is no pressure (figure 24, EPO REF-V Page 21).

4. Pilot test regulator shall be adjustable to maintain a 1.5" W.C. pressure when operating and manifold valves opened.

5. Manifold valves- may have as many as needed, providing pressure can maintain 1.5" W.C.

6. Each manifold should have properly sized orifices for the outlet side of meters to conduct a low flow rate of :

    (a) 0.25 cfh for meter capacities of 250 cfh or less.
    (b) 0.50 cfh for meter capacities of 250 cfh to 500 cfh.
    (c) 0.1% for capacities over 500 cfh.

7. Manifold tubing should be in good condition and shall not leak (see figure 25, EPO REF-V Page 21).

8. Regulator - Adjustable to maintain a constant 1.5" WC pressure (see figure 26, EPO REF-V Page 22).

9. Automatic one hour timer with 120 VAC plug in adapter (see figure 6, EPO REF-V Page 16).

Solenoid valve - (normally in closed position) plugged into timer (see figures. 6, 7, and 7a, EPO REF-V Page 16).

Air Pressure Systems:

1. Regulators should be properly sized to prevent pressure variation within the testing apparatus.

2. Meters being proofed should be supplied with a constant air pressure of 1.5" W.C. pressure.

3. Meters on pilot load test should be supplied with a constant air pressure of 1.5" W.C. The test duration shall not exceed one hour.

4. Pressurized air supplied by a compressor should have adequate filtration to prevent contamination (water and particlates) into the bell prover and meters.

5. Source of air - When air source is from outside of the proving room, piping into the inlet or outlet side of the first stage regulator shall be of sufficient length to permit acclimation of air to room temperature (i.e., radiator, copper tubing, secondary reserve tank and etc.).

Maintenance of Equipment:

1. Failure to maintain and verify the proving room, standards and instruments will result in invalid test results.

2. Before using proving room, inspect hoses, fittings, and gauges. Correct or replace equipment as necessary.

3. Verify the setting of regulators and manometers, readjusted as necessary.

4. When making adjustments, refer to DMS Vapor lab worksheet (see Appendix D, EPO REF-V Page 13).

5. All instruments and gauges should be maintained with current certification and verified.

6. Bell prover tank should be checked to ensure proper fluid level (figure 26, EPO REF-V Page 22).

Bell Prover - Maintenance Verification:

Step A Leaks

1. Raise bell half way up.

2. Make sure all connection outlets to prover are closed.

3. Connect a plug at the end of a hose to prevent air from escaping (see figure 32, EPO REF-V Page 23).

4. Open valve on the outlet side of prover (see figure 33, EPO REF-V Page 23).

5. Let prover stand for at least six hours.

6. If the rate of change is greater than one percent of rated prover volume in six hours, determine the cause and take corrective action.

Step B Pressure Control

1. Check the manometer gauge and verify that the gauge reads 1.5" W.C. with hose pressurized.

2. If manometer reads does not read 1.5" W.C.., adjust by adding or subtracting weights from primary counter weights on bell prover (see Appendix A, EPO REF-V Page 10).

3. Prover bell manometer reading shall not exceed 0.05" W.C. variation throughout the entire travel of bell.

4. Raise the bell to its top position, open prover outlet valve (see figure 33, EPO REF-V Page 23) and install a rate cap. Let bell drop at the rate of 7.5 to 8 inches per minute.

5. If dynamic pressure exceeds 0.05" W.C. then take corrective action.

Step C Binding

1. Lower bell all the way to bottom of tank by opening the slide valve, leave valve open (see figure 28, EPO REF-V Page 22).

2. Add weights to primary counter weights until bell reaches static balance.

3. Realign bell so scale reads a “zero”.

4. Put a 4 oz. weight (5 cu. ft. bell) or 2.5 oz. (2 cu. ft. bell) on the primary counter weight (see figure 27, EPO REF-V Page 22).

5. Bell should rise until it reaches top limit. If bell does not reach top limit, there is a binding or bell is not in complete static balance, verify and correct as necessary.

6. Repeat steps 3 and 4, except bell is aligned at top limit, remove the check weight from the primary counter weight and put it on top of the bell.

7. Bell should lower until it bottoms out. If bell does not bottom out, there is a binding or bell is not in complete static balance, verify and correct as necessary.

<u>Test Reports and Records:</u>

1. Test report (see Appendix E, EPO REF-V Page 14) should contain the following information:

   (a) Make, model, and serial number.

   (b) Flow capacity.

   (c) Meter status of density/temperature compensation (TC or NTC).

   (d) Repairperson/security seal.

   (e) Any peripheral equipment associated with the device under test.

   (f) Maximum and minimum temperature of laboratory during test period.

   (g) User/owner, address.

   (h) Open/check rate (flow rates).

   (i) Temperature of prover air/oil and meter at the time of proof test.

   (j) Compensation correction factor if applicable.

   (k) Leak test, index register condition and low flame results.

   (l) Device condition (rebuilt, new, complaint, routine, etc.).

   (m) Test results (percent accuracy, pass/fail, and action taken).

Appendix A

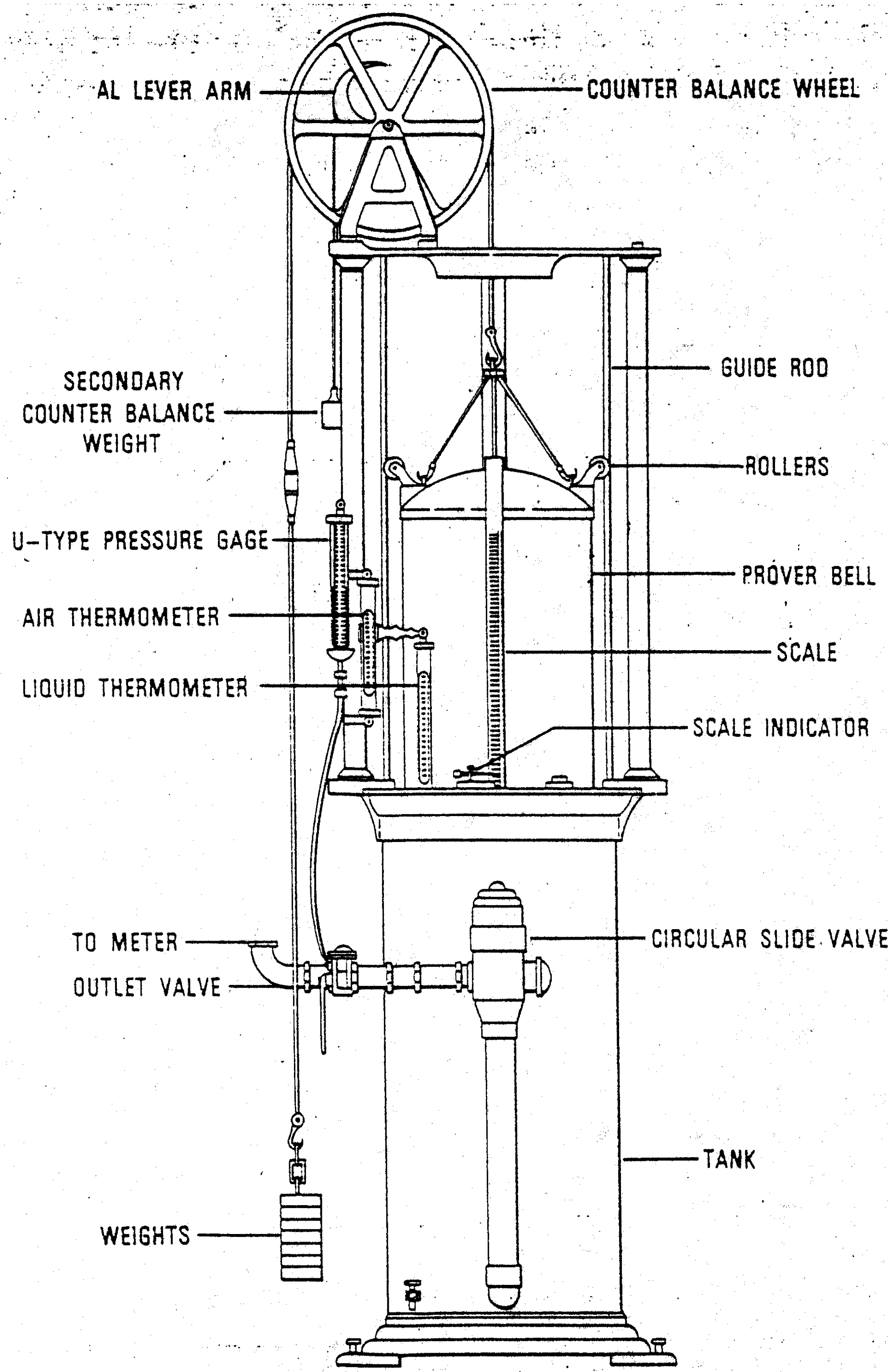
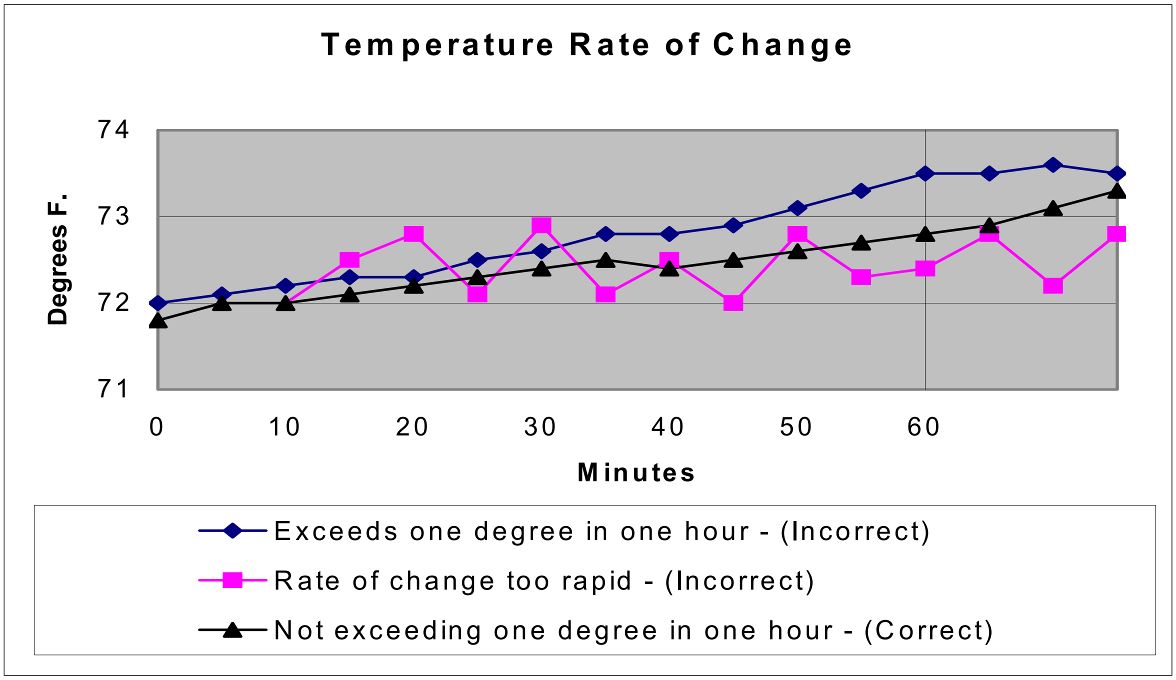
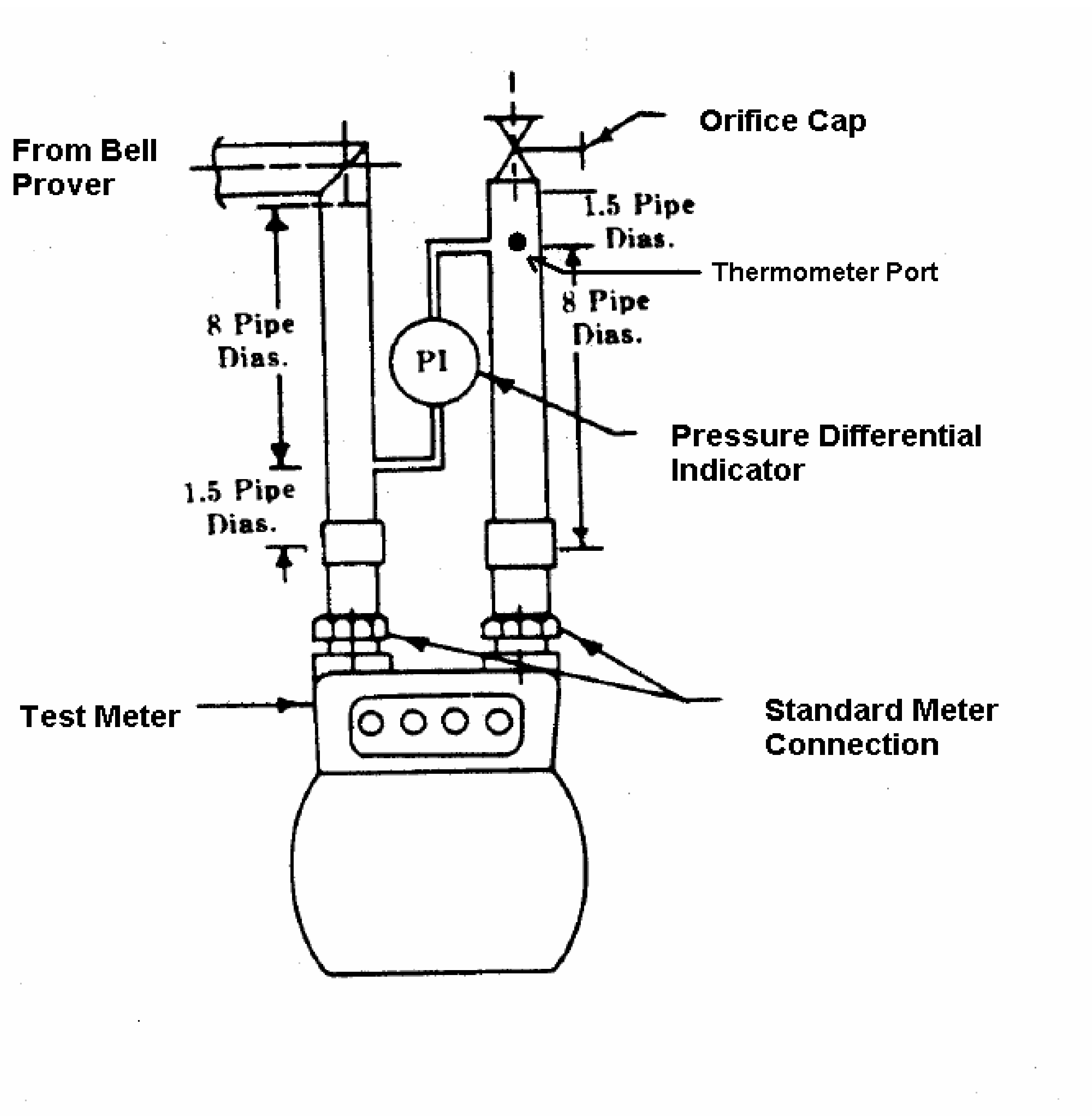


FIGURE 2. *Exterior view of a conventional bell prover.*

Appendix B


Temperature Rate of Change
74
73
72
71
Degrees F.
0
10
20
30
40
50
60
Minutes
Exceeds one degree in one hour - (Incorrect)
Rate of change too rapid - (Incorrect)
Not exceeding one degree in one hour - (Correct)

Appendix C


Orifice Cap
From Bell Prover
1.5 Pipe Dias.
Thermometer Port
8 Pipe Dias.
8 Pipe Dias.
PI
Pressure Differential Indicator
1.5 Pipe Dias.
Test Meter
Standard Meter Connection

Appendix D

DEPARTMENT OF FOOD AND AGRICULTURE
Division of Measurement Standards
8500 Fruitridge Road
Sacramento, CA. 95826
(916) 229-3000

Vapor Laboratory Maintenance Checklist

NIST Traceable Doc. No:

Bell Prover		Thermometers (Assigned DMS ID Numbers XX-XX-XXX)					
Make:		DMS ID.		ID No.		ID No.	
Size:		Certification Date:					
Serial No:		DMS ID.		ID No.		ID No.	
		Certification Date:					

Test Apparatus					
Enter date of maintenace inspection only if correct or corrected and initials					
Pilot manometer (1.5"W.C.)					
Pilot hoses					
Timer and solonoid valve functioning					
Pilot connection leaks					
Leak test gauge/regulator functioning					
Bell Prover					
Enter date of maintenace inspection only if correct or corrected and initials					
Oil level (1/4") from tank to rim					
Manometer setting (1.5"W.C.)					
Leak check					
Binding (2oz for $2ft^3$, 4oz for $5ft^3$)					
Hose condition					
Enviromental					
Enter date of maintenace inspection only if correct or corrected and initials					
Temperature monitor					
Heating/cooling unit					

Remarks:

46-012c rev.42202

Appendix E

Vapor Meter Test Report

Owner: Phone No.: Date Received:

Address: Date Test Started:

City/Zip: Date Completed:

Lab Temperature: Max. Min.

Note: Temperature monitored at least 16 hours prior to proof testing. Accuracy is based on actual volume measured.

	Make & Model Number	Index Drive	Leak Test	Low Flame	Open Rate / Check Rate	Metered Volume FT^3	Prover Volume FT^3	% Uncorr. Error	Prover Air Temp F.	Prover Oil Temp F.	Meter Air Temp F.	Air Temp Differences Prover vs Meter Correction Factor	Temp Comp to 60 F: Meter TC ? Y =Yes Blank = N	Percent Error Corrected %	Test Invalid
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															

Acceptance and Maintenance Over-Registration (-) 1.5% Under-Registration (+) 3.0%

Remarks:

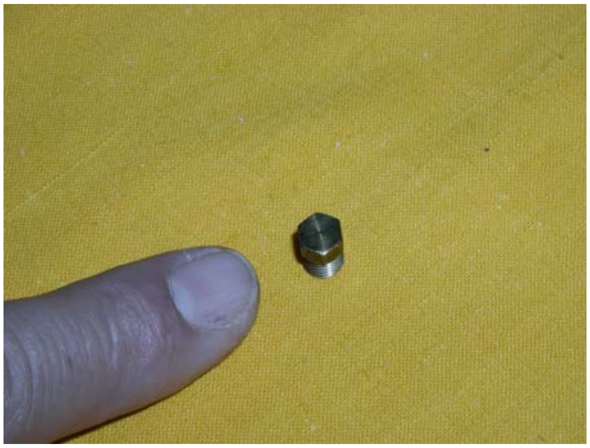
Rev.41502 Inspector: Date:

01

02

03

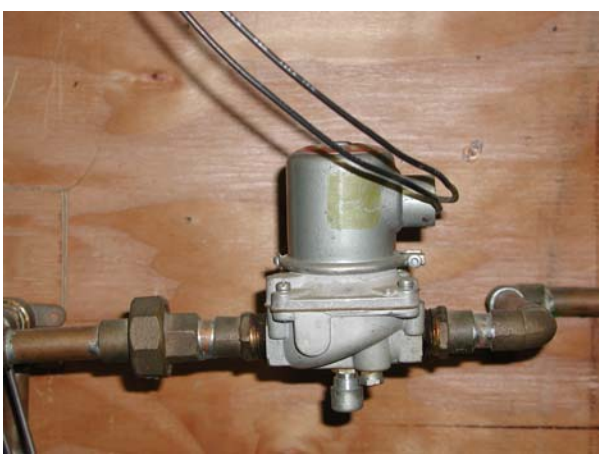
04



05


UNIVERSAL TIMER

06

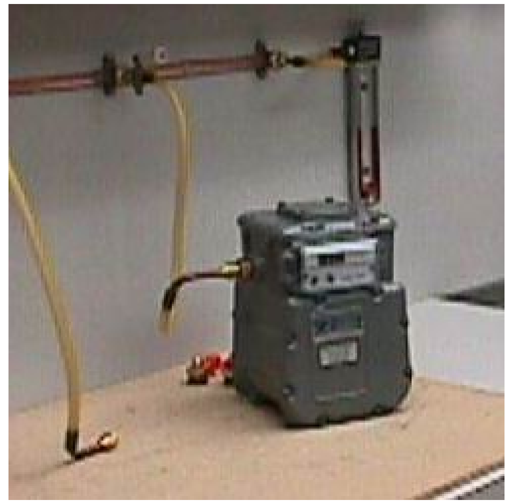


07


GENERAL CONTROLS
MAGNETIC VALVE
TYPE
CAT NO
VOLTS
115
SERIAL NO
CYCLES
60-50
WATTS
SOLENOID SIZE
180

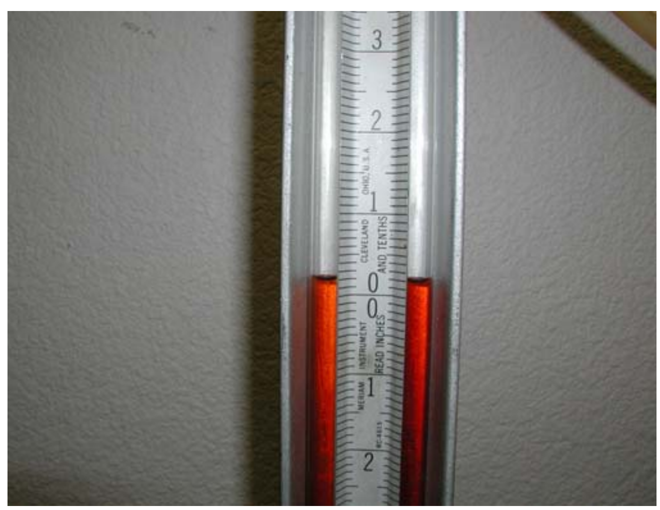
07a

08



08a

08b



09

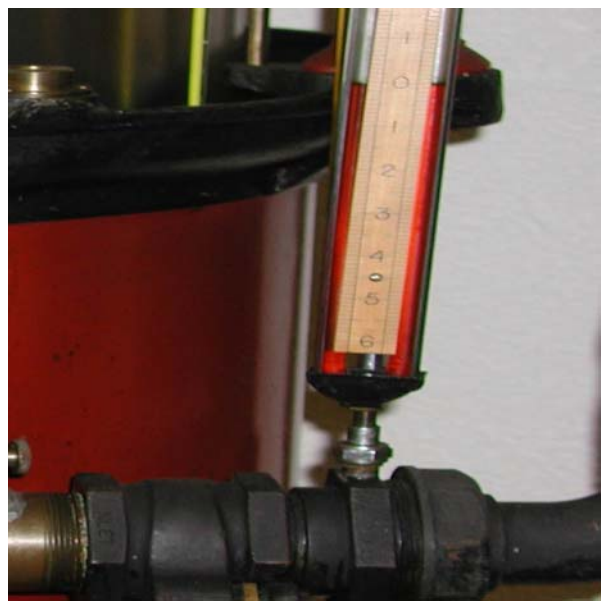

0
.20
.60
.80
1.0
MAGNEHELIC

10


69.7 °F
70.3 °F
CH1
CH2
TIME
REC/STOP
INT
CALL/OUT
SATO

11

12



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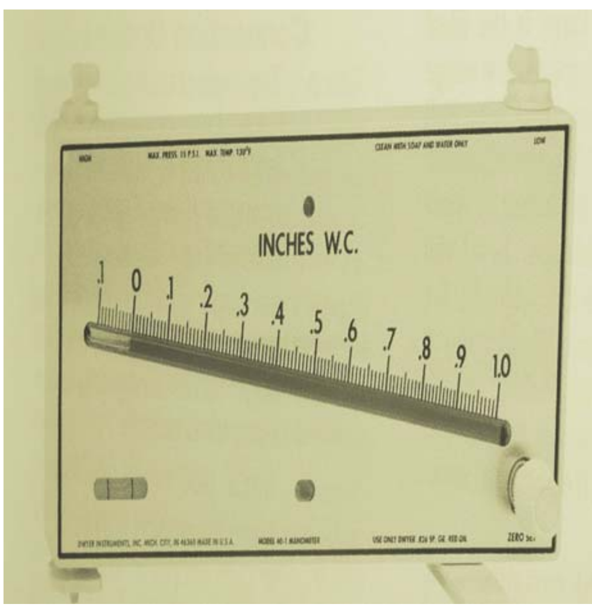

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33