



CALIFORNIA DEPARTMENT OF
FOOD & AGRICULTURE

Extracts from the
CALIFORNIA CODE OF REGULATIONS
TITLE 4, DIVISION 9

WEIGHTS AND MEASURES FIELD REFERENCE MANUAL (2024)

Chapter 2
Special Equipment
Sections 4050. through 4055.

Article 1. Compressed Gas in Cylinders

Article 2. Vapor Recovery



CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE
DIVISION OF MEASUREMENT STANDARDS

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Chapter 2. Special Equipment

Article 1. Compressed Gas in Cylinders

§ 4050. Application.

This code applies to refillable cylinders used for dispensing industrial, domestic and medicinal gases. Compressed gas shall include liquefied as well as non-liquefied gases. The requirements are not in lieu of those of other codes under which a cylinder was constructed, but may be in addition thereto. The code does not apply to cylinders filled for and in the presence of a customer.

Note: Authority cited: Sections 12027 and 12107, Business and Professions Code. Reference: Section 12107, Business and Professions Code.

§ 4051. Cylinder Labeling.

(a) Tare Weight. Cylinders used for the sale of gases by weight or that are filled by weight which in turn is converted to volume shall meet the following conditions:

- (1) Cylinders shall have the tare weight legibly stamped on the cylinder.
- (2) All tare weight values required in this article shall be preceded with the letters "T.W." or the words "Tare Weight."
- (3) The tare weight shall include the weight of the cylinder, the valve and other permanent attachments. The weight of the protective cap shall not be included in either the tare weight or the gross weight.

(b) Actual Tare Weight. When acetylene cylinders are filled but are not acetoned to the stenciled tare weight, the actual tare weight must be shown on the tag with the net contents statement.

(c) Net Contents. The net contents must be expressed in terms of cubic feet, or pounds and ounces, or units of the metric system.

(d) Identity. The identity of the product must be shown.

(e) Name and Address. The name, address and zip code of the responsible company must be shown on cylinder.

(f) Liquefied Petroleum Gas Cylinder Contents. Cylinders or bottles which are prefilled with liquefied petroleum gas prior to sale, shall be labeled with the weight of the contents.

Note: Authority cited: Sections 12027, 12107 and 12609, Business and Professions Code. Reference: Sections 12107 and 12609, Business and Professions Code.

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§ 4052. Notes.

N.1. Specific Volume.

The specific volume of acetylene gas at one atmosphere and at the temperature of 70°F shall be 14.7 cubic feet per pound.

N.2. Verification of Net Quantity.

Verification of net quantity statements for cylinders of argon, helium, hydrogen, nitrogen and oxygen shall be in accordance with the Tables of Industrial Gas Container Contents and Density for Oxygen, Argon, Nitrogen, Helium and Hydrogen listed on National Bureau of Standards Technical Note issued in June 1985 and incorporated herein by reference.

N.3. Allowable Difference.

If the stamped or stenciled tare is used to determine the net contents of the cylinder, the allowable difference between the actual tare weight and the stamped (or stenciled) tare weight, or the tare weight on a tag attached to the cylinder, for a new or used cylinder shall be:

- (1) 1/2 percent for tare weights of 20 lb. or less or
- (2) 1/4 percent for tare weights of more than 20 lb.

Average Requirements. When used to determine the net contents of cylinders, the stamped or stenciled tare weights of cylinders at a single place of business found to be in error predominately in a direction favorable to the seller and near the allowable difference limit shall be considered to not be in conformance with these requirements.

Note: Authority cited: Sections 12027 and 12107, Business and Professions Code. Reference: Sections 12100 and 12107, Business and Professions Code.

§ 4053. Definitions.

(a) Cubic Foot. A standard cubic foot of gas which at a temperature of 70 °F and a pressure of 14.696 pounds per square inch absolute occupies one cubic foot.

Note: Authority cited: Sections 12027 and 12107, Business and Professions Code. Reference: Sections 12100 and 12107, Business and Professions Code.

Chapter 2. Special Equipment

Article 2. Procedures for Type Approval Certification and Field Compliance Testing of Vapor Recovery

§ 4054. A. Application.

A.1. Vapor recovery systems.

This code applies to Stage II vapor recovery systems designed to control motor vehicle fuel vapors which result from fueling operations pursuant to Sections 41954, 41956, and 41956.1 of the Health and Safety Code. This code establishes regulations to govern some design characteristics of those systems and their operation to ensure liquid recirculation is prevented.

A.1.1. Balance system. The balance vapor recovery system utilizes fuel delivery nozzles with a bellows and face plate designed to make an “intended tight seal” with the vehicle fill pipe opening. Liquid filling a fuel tank displaces the existing vapor space creating a positive pressure in the tank. That higher pressure achieves equilibrium with the supply tank’s vapor pressure through the vapor return line making the system “balanced”.

A.1.2. Assist system. Assist vapor recovery systems may utilize more than one type of fuel delivery nozzle. One has a bellows and face plate designed to make a “non-intended tight seal” with the vehicle fill pipe opening. Another has no bellows, uses a coaxial metal fill spout with perforations in the outer tube to remove vapors, and allows visual observation of the fill pipe opening. These systems employ a mechanism to create vacuum which “evacuates” displaced vehicle fuel tank vapors by a negative pressure in the vapor return line.

A.2. Responsibility of Director and manufacturer.

A.2.1. Director.

As specified in subsection A.1., a system submitted for type approval certification shall be evaluated by the Director applying the procedures established in this article plus any additional tests he determines necessary to assure compliance of the system with the specifications and performance requirements contained herein.

A.2.2. Manufacturer.

Prior to type approval certification testing, the applicant shall submit information to the Director pertaining to the design of the system, including schematics, blueprints, instruction manuals, brochures, components, and all other information necessary for preliminary review. If defects are found in the design, manufacture, service, repair, or any other characteristic of the system, the Director may permit the applicant to modify and resubmit the system for further review. After successful completion of preliminary review, the applicant shall be authorized to install its system of a specified number of components in a prescribed location for use in the type approval certification testing.

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A.3. Procedure.

The Secretary shall, in cooperation with the county sealer of weights and measures for the designated location, observe and examine the system in operation normally within 30 to 90 days. One or more examinations shall be conducted during the prescribed test period to determine compliance with Sections 4054.1 and 4054.2 which relate to specifications, performance, and accuracy. If, during or at the conclusion of any examination, the system fails to maintain reliability and accuracy within the tolerances specified in the submission for type approval certification, the Secretary shall so advise the applicant and may refuse further testing unless the defects are corrected. However, type approval certification shall not be issued until the applicant, following successful Division of Measurement Standards field tests, submits a report of evaluation by an independent testing laboratory as specified in Section 4054.2, N.6.

A.5. General code application.

The general code requirements for weighing and measuring devices as specified in Section 4001 shall also apply.

Note: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

§ 4054.1. S. Specifications.

S.1. Systems Components.

Systems governed by this article utilizing motor vehicle fuel 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 pipe opening.

S.1.1. Nozzles.

- (a) All nozzle types shall have a primary shut-off device which automatically activates when liquid covers the nozzle primary shut-off sensing mechanism.
- (b) Balance type nozzles shall have a secondary shut-off device or other effective means to prevent liquid recirculation. Secondary shut-off devices shall automatically activate after liquid has entered the vapor return line because the primary shut-off device has failed. (Typically, secondary shut-off devices are pressure-activated and shut off when liquid in the vapor return line blocks the return of vapors).
- (c) Assist type nozzles may have a secondary shut-off device or else some other effective means to avoid liquid overflowing a vehicle fuel tank because the primary shut-off device has failed. "Other effective means" include, but are not limited to, permitting liquid to be seen either by observing the fill pipe opening or hearing and seeing liquid overflow spillage.

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S.2. Field compliance test unit.

S.2.1. Use. The field compliance test unit shall be used to examine the proper operation of:

- (a) primary shut-off devices,
- (b) secondary shut-off devices, and
- (c) inches of H₂O column vacuum for assist systems.

S.2.2. Design.

S.2.2.1. Tank.

The test unit shall be a rigid metal vessel 13-inches high and 9-inches in diameter with a liquid capacity of 3 gallons (all measurements approximate). A commercial-sized, 30 pound Freon recharging tank is typically used.

S.2.2.2. Base support/stand. The test unit may be supported either:

- (a) on a metal base 3/16-inch thick, 6-inches wide, and 17-1/2 inches long (all measurements approximate) or,
- (b) by a stand which elevates the test unit to accommodate a bottom-inserted 3/4 inch ball valve for emptying purposes.

S.2.2.3. Fuel fill pipe. The test unit shall have a metal fuel fill pipe welded to the tank at a 45 degree angle from horizontal. Placement of the fill pipe is critical. It shall enter the test unit at the middle of the curvature between the top and sides of the vessel so that a specified ullage (vapor space) is created. The fill pipe shall have no internal vent, shall be 2-1/4-inch outside diameter and 10 inches long (both measurements approximate), and shall extend inside the tank no more than 1/4 inch. A longitudinal part of the fill pipe near its fill opening shall be cut away in order to observe that the nozzle primary shut-off device sensing mechanism is immersed in liquid. The cut-away is approximately 5 inches long to a depth of 1/2 the pipe's diameter. The fill pipe shall have transparent flexible tubing slipped over its entire length. The fill opening shall be modified to accommodate nozzle spouts at least 15/16 inch outside diameter (leaded fuel). The test unit shall be airtight when the fill pipe opening is sealed.

S.2.2.4. Other Equipment. A rigid, transparent plastic tube approximately 12 inches long and 3-7/8 inches inside diameter shall be installed around the fill pipe to contain liquid overflow. A 5/16-inch valve with an outlet to attach a hose shall be installed at the top center of the vessel for obtaining pressure readings. Handles for carrying and emptying the test unit may be attached. All metal part of the test unit shall be electrically bonded together. Refer to the test unit illustrations in Figure 1.

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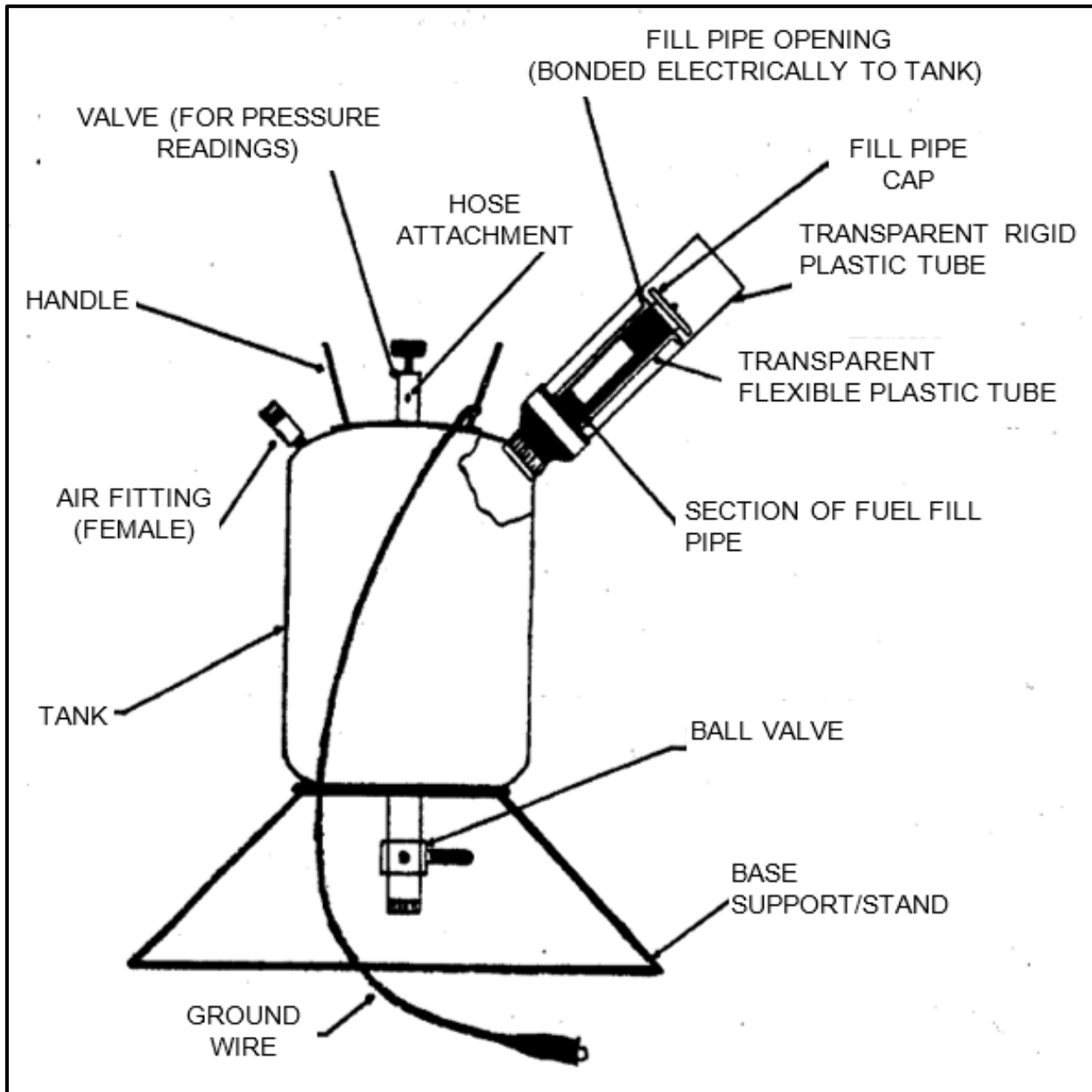


Figure 1 - Field Compliance Vapor Recovery Test Unit

S.3. Assist system inches of H₂O column vacuum.

Assist vapor recovery systems with booted nozzle spouts that can form a closed seal around the vehicle filler neck shall be designed to operate at not more than -10 inches H₂O column vacuum as measured at the nozzle or test unit during a delivery typical of customer usage.

Note: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

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§ 4054.2. N. Notes -Type Approval Certification Evaluation.

N.1. System installation.

A minimum of 6 nozzles shall be installed in a test location for evaluation purposes. Hoses shall be selected to anticipate maximum customer usage and efficient observer interaction. The test nozzles shall not fail to operate as designed for the duration of the evaluation.

N.2. Dispenser measurement accuracy.

Prior to the field examination of a vapor recovery system, the dispenser meters for the test nozzles shall be tested and adjusted, if necessary, to be within maintenance tolerance.

N.3. Performance accuracy - primary and secondary shut-off devices.

N.3.1. Test method. Examination of the test nozzles shall be performed with a field compliance test unit as specified in subsection S.2.

Note: Two or more test units will expedite the examination significantly.

N.3.1.1. Test procedure - primary shut-off device.

N.3.1.1.1. Initial test. Dispense fuel into the test unit with each nozzle. All nozzles shall shut off automatically at any delivery flow rate as the test unit becomes full as specified in subsection S.1.1.(a).

N.3.1.1.2. Override test. 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. Record the dispenser indicator gallons.

Make 10 additional consecutive override attempts duplicating a range of customer usage and record the new indicated gallons. All 10 attempts shall result in automatic nozzle shut off before the dispenser volume indicator increases more than the 1/10 gallon limit as specified in subsection T.1.1. The 10 override attempts shall be performed on a minimum of 6 nozzles, each tested a minimum of 3 times during this examination.

N.3.1.2. Test procedures - secondary shut-off device (if equipped). Introduce sufficient fuel into the vapor return line (approximately 1/10 gallon or 375 milliliter) to block the return of vapors through the line. Hold in place a "U-shaped" configuration of the fuel discharge hose at a level lower than the nozzle to concentrate the liquid. Make a minimum of 10 attempts to dispense fuel into an empty test unit. Record the dispenser indicator gallons before and after each attempt. (Balance-type nozzles must make their intended tight seal at the fill pipe opening.) The nozzle shall shut off automatically before the dispenser volume indicator increases more than the 3/10 gallon limit for each attempt as specified in subsection T.1.2. This procedure shall be performed on a minimum of 6 nozzles.

Notes: (1) The test unit must be empty initially to insure liquid does NOT interact with the primary shut-off device sensing mechanism. (2) For some hose configurations,

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introducing additional fuel into the vapor return line during the test procedure may be necessary. Introduced liquid can be returned to storage by building vapor line pressure produced by this procedure.

N.4. Delivery accuracy - 150 vehicle test.

N.4.1. Test method. Compliance with delivery accuracy requirements shall be based upon data recorded for at least 150 vehicles while observing customers fueling (self-serve) with the test nozzles under normal field conditions.

N.4.2. Test procedure. Install a transparent trap, or other suitable means, between each nozzle and dispenser outlet connection for the hose. Any liquid entering a vapor return line will be collected while observing the fueling operations. Then after each fueling, the liquid shall be drained into the trap, removed, and measured. Trap placement and observer actions shall produce the least possible interference with normal operations at the test location.

The liquid collected from both one individual delivery and the total of all individual deliveries shall not exceed the tolerances as specified in subsections T.3.(a) and T.3.(b), respectively.

The 150 or more vehicles shall be representative of California vehicles, including various sizes of passenger vehicles, vans, and trucks. This examination shall include varied fuel delivery rates and nozzle orientations plus complete and partial fills. The system may be retested if the Director by his own initiative, or at the request of the applicant, determines the test was not representative of field conditions.

N.5. Performance accuracy - assist system evaporation and volume change.

N.5.1. Test method. An appropriate means (manometer, column gauge, etc.) shall be used to determine the inches of H₂O column vacuum for nozzles where the spout is booted and can form a closed seal around the vehicle filler neck. Excessive vacuum may result in artificial evaporation of customer fuel which would decrease the measured volume and also cause possible implosion of vehicle fuel tanks.

N.5.2. Test procedure. Install the vacuum indicator at the nozzle or test unit. Record the value of the reading while the system is operating in a normal manner to determine if it is functioning within the -10 inches H₂O column vacuum limit as specified in subsection T.2.

N.6. Independent laboratory evaluation.

Pursuant to Section 41958 of the Health and Safety Code, type approval certification regarding recirculation shall include evaluations by Underwriters Laboratories (U.L.) or a similar independent laboratory selected by the Secretary. Reports required by other State agencies may be used to determine compliance with this section. The laboratory evaluation shall determine but is not limited to, proper secondary shut-off device operation for nozzles where the spout is booted and can form a closed seal around the vehicle filler neck with the primary shut-off device inoperable.

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Note: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

§ 4054.3. T. Tolerances.

T.1. Performance accuracy - primary and secondary shut-off devices.

T.1.1. 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.

T.1.2. Secondary shut-off device. With the vapor return line blocked by fuel (simulating recirculation due to primary shut-off device failure), each attempt to dispense fuel shall result in automatic nozzle shut off before the dispenser volume indication increases more than 3/10 gallon.

T.2. Assist system inches of H₂O column vacuum.

Assist vapor recovery systems shall operate at the inches of H₂O column vacuum recommended by the manufacturer, but shall not exceed -10 inches of H₂O column vacuum for nozzles where the spout is booted and can form a closed seal around the vehicle filler neck.

T.3. Delivery accuracy - 150 vehicle test.

The quantity of measured liquid collected in the vapor return line/lines shall not exceed both:

- (a) 0.2 percent of any one individual vehicle fuel delivery, and
- (b) 0.02 percent of the sum of the fuel deliveries to all vehicles observed (150 or more) during the delivery accuracy tests.

Note: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.

§ 4055. N. Notes-Field Compliance Testing.

N.1. Test methods - primary and secondary shut-off devices.

Examination of primary and secondary shut-off devices to determine the acceptability of an individual nozzle shall be performed using motor vehicles with fuel tanks and fill pipes representative of California vehicles and/or a field compliance test unit as specified in subsection S.2.

N.2. Test procedure - primary and secondary shut-off devices.

N.2.1 Initial test - primary shut-off device. Dispense fuel into the fill pipe opening of a vehicle fuel tank or test unit in accordance with the instructions for the vapor recovery

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device, if any, and common public usage. The nozzle shall shut off automatically when the nozzle primary shut-off sensing mechanism is covered by the liquid. Automatic nozzle shut off shall occur with the dispenser operating at discharge rates both greater than and equal to the minimum rate allowed by the slowest hold-open clip setting, if any, or 3 gallons per minute, whichever is less.

N.2.2. Override test - primary shut-off device. 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. Record the dispenser indicator gallons. 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 as specified in subsection T.1.1.

Note: A test unit must be used for this procedure so the primary shut-off device sensing mechanism can be seen immersed in liquid.

N.2.3. Secondary shut-off device (if equipped). Introduce sufficient fuel into the vapor return line (approximately 1/10 gallon or 375 milliliter) to block the return of vapors through the line. 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 test unit or vehicle fuel tank that is within 3 gallons of being full, including the fill pipe. (Balance-type nozzles must make their intended tight seal at the fill pipe opening.) The nozzles shall shut off automatically before the dispenser volume indicator increases more than the 3/10 gallon limit for each attempt as specified in subsection T.1.2.

N.3. Assist systems.

To test assist systems for proper operation at the specified inches of H₂O column vacuum, refer to Section 4054.2, N.5.

NOTE: Authority cited: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a), and 41956(c), Health and Safety Code. Reference: Sections 12107 and 12500.5, Business and Professions Code; and Sections 41956(a) and 41956(c), Health and Safety Code.