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Section 3.32. Liquefied Petroleum Gas and Anhydrous Ammonia Liquid-Measuring Devices

A. Application

A.1. General. – This code applies to devices used for the measurement of liquefied petroleum gas and anhydrous ammonia in the liquid state, whether such devices are installed in a permanent location or mounted on a vehicle. For retail motor-fuel devices, see Appendix D, definition of “liquefied petroleum gas retail motor-fuel device.”
(Amended 2022)

A.2. Devices Used to Measure Other Liquid Products not Covered in Specific Codes. – Insofar as they are clearly appropriate, the requirements and provisions of the code may be applied to devices used for the measurement of other liquids that do not remain in a liquid state at atmospheric pressures and temperatures.

A.3. Exceptions. – This code does not apply to mass flow meters. (Also see Section 3.37. Code for Mass Flow Meters.)
(Added 1994)

A.4. Additional Code Requirements. – In addition to the requirements of this code, LPG and Anhydrous Ammonia Liquid-Measuring Devices shall meet the requirements of Section 1.10. General Code.

S. Specifications

S.1. Design of Indicating and Recording Elements and of Recorded Representations.

S.1.1. Primary Elements.

S.1.1.1. General. – A device shall be equipped with a primary indicating element and may also be equipped with a primary recording element.

Note: Vehicle-mounted metering systems shall be equipped with a primary recording element as required by paragraph UR.2.6. Recorded Representations.
(Amended 2023)

S.1.1.2. Units. – A device shall indicate, and record if the device is equipped to record, its deliveries in terms of liters, gallons, quarts, pints, or binary-submultiple or decimal subdivisions of the liter or gallon.
(Amended 1987)

S.1.1.3. 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 the equivalent of:

- (a) 0.5 L (1 pt) on retail devices; or
- (b) 5 L (1 gal) on wholesale devices.

(Amended 1987)

S.1.1.4. Advancement of Indicating and Recording Elements. – Primary indicating and recording elements shall be susceptible to advancement only by the mechanical operation of the device. However, a device may be cleared by advancing its elements to zero, but only if:

- (a) the advancing movement, once started, cannot be stopped until zero is reached; or

- (b) in the case of indicating elements only, such elements are automatically obscured until the elements reach the correct zero position.

S.1.1.5. Money-Values, Mathematical Agreement. – Any digital money-value indication and any recorded money-value on a computing-type device shall be in mathematical agreement with its associated quantity indication or representation to within 1 cent of money-value; except that a stationary retail computing-type device must compute and indicate to the nearest 1 cent of money-value. (Also see Section 1.10. General Code, G-S.5.5. Money-Values, Mathematical Agreement.)

(Amended 1984 and 1988)

S.1.1.6. Recorded Representations. – Any recorded representation created by a device of the computing type which includes the total computed price, shall also include thereon the total volume of the delivery in terms of liters or gallons, and the appropriate decimal fraction of the liter or gallon, and the corresponding price per liter or gallon.

(Added 1979) (Amended 1987 and 2023)

S.1.2. Graduations.

S.1.2.1. Length. – Graduations shall be so varied in length that they may be conveniently read.

S.1.2.2. Width. – In any series of graduations:

- (a) the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations;
- (b) the width of main graduations shall be not more than 50 % greater than the width of subordinate graduations; and
- (c) graduations shall in no case be less than 0.2 mm (0.008 in) in width.

S.1.2.3. Clear Interval between Graduations. – The clear interval shall be not less than 1.0 mm (0.04 in). If the graduations are not parallel, the measurement shall be made:

- (a) along the line of relative movement between the graduations at the end of the indicator; or
- (b) if the indicator is continuous, at the point of widest separation of the graduations.

S.1.3. Indicators.

S.1.3.1. Symmetry. – The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.

S.1.3.2. Length. – The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case the distance between the end of the indicator and the ends of the graduations, measured along the line of graduations, shall be not more than 1.0 mm (0.04 in).

S.1.3.3. Width. – The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than:

- (a) *the width of the narrowest graduation*;* and
[*Nonretroactive as of January 1, 2002]
(Amended 2001)

- (b) the width of the minimum clear interval between graduations.

When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.

S.1.3.4. Clearance. – The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).

S.1.3.5. Parallax. – Parallax effects shall be reduced to the practicable minimum.

S.1.4. For Retail Devices Only.

S.1.4.1. Indication of Delivery. – A retail device shall automatically show on its face the initial zero condition and the quantity delivered up to the nominal capacity of the device. However, the following requirements shall apply:

- (a) For electronic devices manufactured prior to January 1, 2006, the first 0.03 L (or 0.009 gal) of a delivery and its associated total sales price need not be indicated.
- (b) *For electronic devices manufactured on or after January 1, 2006, the measurement, indication of delivered quantity, and the indication of total sales price shall be inhibited until the fueling position reaches conditions necessary to ensure that the delivery starts at zero.*

[Nonretroactive as of January 1, 2006]

(Amended 2016)

S.1.4.2. Return to Zero.

- (a) Primary indicating elements shall be readily returnable to a definite zero indication.
- (b) Primary recording elements on a stationary retail device shall be readily returnable to a definite zero indication if the device is equipped to record.
- (c) Means shall be provided to prevent the return of primary indicating elements and of primary recording elements if these are returnable to zero, beyond their correct zero position.
- (d) Primary indicating elements shall not be resettable to zero during a delivery.

(Amended 1990 and 2016)

S.1.5. For Stationary Retail Devices Only.

S.1.5.1. Display of Unit Price and Product Identity. – A device of the computing type shall display on each face the unit price at which the device is set to compute or to deliver, and there shall be conspicuously displayed on each side of the device the identity of the product that is being dispensed.

Except for dispensers used exclusively for fleet sales and other price contract sales, all of the unit prices at which that product is offered for sales shall meet the following conditions:

- (a) *For a system that applies a discount prior to the delivery, all unit prices shall be displayed or shall be capable of being displayed on the dispenser through a deliberate action of the purchaser prior to the delivery of the product. It is not necessary that all of the unit prices be simultaneously displayed prior to the delivery of the product.*

[Nonretroactive as of January 1, 2016]

- (b) For a system that offers post-delivery discounts on fuel sales, display of pre-delivery unit price information is exempt from (a) above, provided the system complies with S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided.

Note: When a product is offered at more than one unit price, display of the unit price information may be through the deliberate action of the customer: 1) using controls on the device; 2) through the customer's use of personal or vehicle-mounted electronic equipment communicating with the system; or 3) verbal instructions by the customer.

(Amended 2016)

S.1.5.2. Money-Value Computations. – A computing device shall compute the total sales price at any single-purchase unit price (excluding fleet sales and other price contract sales) for which the product is offered for sale at any delivery possible within either the measurement range of the device or the range of the computing elements, whichever is less. The analog money-value indication shall not differ from the mathematically computed money-value (quantity \times unit price = sales price), for any delivered quantity, by an amount greater than the values shown in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Amended 1995)

Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers				
Unit Price		Money- Value Division	Maximum Allowable Variation	
From	To and Including		Design Test	Field Test
0	\$0.25/liter or \$1.00/gallon	1¢	$\pm 1\text{¢}$	$\pm 1\text{¢}$
\$0.25/liter or \$1.00/gallon	\$0.75/liter or \$3.00/gallon	1¢ or 2¢	$\pm 1\text{¢}$	$\pm 2\text{¢}$
\$0.75/liter or \$3.00/gallon	\$2.50/liter or \$10.00/gallon	1¢ or 2¢	$\pm 1\text{¢}$	$\pm 2\text{¢}$
		5¢	$\pm 2\frac{1}{2}\text{¢}$	$\pm 5\text{¢}$

S.1.5.2.1. Money-Value Divisions, Analog. – The value of the graduated intervals representing money-values on a computing-type device with analog indications shall be as follows:

- (a) Not more than 1 cent at all unit prices up to and including \$0.25 per liter or \$1.00 per gallon.
- (b) Not more than 2 cents at unit prices greater than \$0.25 per liter or \$1.00 per gallon up to and including \$0.75 per liter or \$3.00 per gallon.
- (c) Not more than 5 cents at all unit prices greater than \$0.75 per liter or \$3.00 per gallon.

(Amended 1984)

S.1.5.2.2. Money-Value Divisions, Digital. – A computing-type device with digital indications shall comply with the requirements of paragraph G.-S.5.5. Money-Values, Mathematical Agreement, and the total price computation shall be based on quantities not exceeding 0.01 gal intervals for devices indicating in U.S. customary units and 0.05 L for devices indicating in metric units.

S.1.5.2.3. Money-Value Divisions, Auxiliary Indications. – *In a system equipped with auxiliary indications, all indicated money-value divisions shall be identical.*

[Nonretroactive as of January 1, 1985.]

S.1.5.3. Agreement Between Indications.

(a) *When a quantity value indicated or recorded by an auxiliary element is a derived or computed value based on data received from a device, the value may differ from the quantity value displayed on the dispenser, provided that the following conditions are met:*

- (1) *All total values for an individual sale that are indicated or recorded by the system agree, and*
- (2) *Within each element, the values indicated or recorded meet the formula (quantity × unit price = total sale price) to the closest cent.*

(b) *When a system applies a post-delivery discount(s) to a fuel's unit price through an auxiliary element, the total volume of the delivery shall be in agreement between all elements in the system.*

[Nonretroactive as of January 1, 2016]

(Added 2016)

S.1.5.4. Recorded Representations. – Except for fleet sales and other price contract sales and for transactions where a post-delivery discount is provided, a receipt providing the following information shall be available through a built-in or separate recording element for all transactions conducted with point-of-sale systems or devices activated by debit cards, credit cards, and/or cash:

- (a) the total volume of the delivery;
- (b) the unit price;
- (c) the total computed price; and
- (d) the product identity by name, symbol, abbreviation, or code number.

(Added 2014) (Amended 2016)

S.1.5.5. Recorded Representations for Transactions Where a Post-Delivery Discount(s) is Provided.

– Except for fleet sales and other price contract sales, a recorded representation providing the following information shall be available through a built-in or separate recording element that is part of the system for transactions involving a post-delivery discount:

- (a) the product identity by name, symbol, abbreviation, or code number;
- (b) transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount(s), including the:
 - (1) total volume of the delivery;
 - (2) unit price; and
 - (3) total computed price of the fuel sale.
- (c) an itemization of the post-delivery discounts to the unit price; and
- (d) the final total price of the fuel sale after all post-delivery discounts are applied.

(Added 2016) (Amended 2023)

S.1.5.6. Transaction Information, Power Loss. – *In the event of a power loss, the information needed to complete any transaction in progress at the time of the power loss (such as the quantity and unit price, or*

sales price) shall be determinable for at least 15 minutes at the device or another on-site device accessible to the customer.

[Nonretroactive as of January 1, 2017]

(Added 2016)

S.1.5.7. Totalizers for Retail Motor-Fuel Dispensers. – *Retail motor-fuel dispensers shall be equipped with a nonresettable totalizer for the quantity delivered through the metering device.*

[Nonretroactive as of January 1, 2017]

(Added 2016)

S.1.6. For Wholesale Devices Only.

S.1.6.1. Travel of Indicator. – A wholesale device shall be readily operable to deliver accurately any quantity from 180 L (50 gal) to the capacity of the device. If the most sensitive element of the indicating system uses an indicator and graduations, the relative movement of these parts corresponding to a delivery of 4 L (1 gal) shall be not less than 5 mm (0.20 in).

(Amended 1987)

S.2. Design of Measuring Elements.

S.2.1. Air/Vapor Elimination. – A measuring system shall be equipped with an effective air/vapor eliminator or other automatic means to prevent the passage of air/vapor through the meter. Vent lines from the air/vapor eliminator shall be made of appropriate non-collapsible material.

(Amended 2016 and 2018)

S.2.2. Provision for Sealing. – For devices and systems in which the configuration or calibration parameters can be changed by use of a removable digital storage device, security shall be provided for those parameters as specified in G-S.8.2. Devices and Systems Adjusted Using Removable Digital Storage Devices. For parameters adjusted using other means, the following applies.

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

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

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

*Audit trails shall use the format set forth in Table S.2.2. Categories of Device and Methods of Sealing.**

*[*Nonretroactive as of January 1, 1995]*

(Amended 2006 and 2019)

Table S.2.2.
Categories of Device and Methods of Sealing

Categories of Device	Methods 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. <i>The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i>	<i>The hardware enabling access for remote communication must be on-site. The hardware must be sealed using a physical seal or an event counter for calibration parameters and an event counter for configuration parameters. The event counters may be located either at the individual measuring device or at the system controller; however, an adequate number of counters must be provided to monitor the calibration and configuration parameters of the individual devices at a location. If the counters are located in the system controller rather than at the individual device, means must be provided to generate a hard copy of the information through an on-site device.</i>
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password). <i>The device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode or shall not operate while in this mode.</i>	<i>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 on demand through the device or through another on-site device. The information may also be available electronically. The event logger shall have a capacity to retain records equal to 10 times the number of sealable parameters in the device, but not more than 1 000 records are required. (Note: Does not require 1 000 changes to be stored for each parameter.)</i>

[Nonretroactive as of January 1, 1995]

(Table Added 2006) (Amended 2016)

S.2.3. Directional Flow Valves. – A measuring system shall be equipped with a valve or other effective means, automatic in operation and installed in or adjacent to the measuring element, to prevent reversal of flow of the product being measured.

(Amended 1982)

S.2.4. Maintenance of Liquid State. – A device shall be so designed and installed that the product being measured will remain in a liquid state during the passage through the meter.

S.2.5. Zero-Set-Back Interlock.

S.2.5.1. Zero-Set-Back Interlock, Electronic Stationary Meters (Other than Electronic Stationary Retail Motor-Fuel Dispensers) and Electronic Vehicle-Mounted Meters. – A device shall be constructed so that after an individual delivery or multiple deliveries at one location have been completed, an automatic interlock system shall engage to prevent a subsequent delivery until the indicating element and, if equipped, recording element have been returned to their zero positions.

[Nonretroactive as January 1, 2021]

(Added 2019) (Amended 2021 and 2024)

S.2.5.2. Zero-Set-Back Interlock for Electronic Stationary Retail Motor-Fuel Devices. – A device shall be constructed so that:

- (a) after a delivery cycle has been completed by moving the starting lever to any position that shuts off the device, an automatic interlock prevents a subsequent delivery until the indicating elements and recording elements, if the device is equipped and activated to record, have been returned to their zero positions;
- (b) the discharge nozzle cannot be returned to its designed hanging position (that is, any position where the tip of the nozzle is placed in its designed receptacle and the lock can be inserted) until the starting lever is in its designed shut-off position and the zero-set-back interlock has been engaged; and
- (c) in a system with more than one dispenser supplied by a single pump, an effective automatic control valve in each dispenser prevents product from being delivered until the indicating elements on that dispenser are in a correct zero position.

[Nonretroactive as of January 1, 2017]

(Added 2016) (Amended 2024)

S.2.6. Automatic Timeout.

S.2.6.1. Electronic Stationary (Other than Stationary Retail Motor-Fuel Dispensers). – For individual deliveries, if there is no product flow for three minutes the transaction must be completed before additional product flow is allowed. The three-minute timeout shall be a sealable feature on an indicator.

[Nonretroactive as of January 1, 2021]

(Added 2021) (Amended 2023)

S.2.6.2. Automatic Timeout Pay-at-Pump Retail Motor-Fuel Devices. – Once a device has been authorized, it must deauthorize within three minutes if not activated. Reauthorization of the device must be performed before any product can be dispensed. If the time limit to deauthorize the device is programmable, it shall not accept an entry greater than three minutes.

[Nonretroactive as of January 1, 2022]

(Added 2021)

S.2.6.3. Electronic Vehicle-Mounted Meters. – For individual deliveries, if there is no product flow for five minutes the transaction must be completed before additional product flow is allowed. The five-minute timeout shall be a sealable feature on the indicator.

(Added 2023)

S.2.7. Thermometer Well. – For test purposes, means shall be provided to determine the temperature of the liquid either:

- (a) in the liquid chamber of the meter; or
- (b) in the meter inlet or discharge line and immediately adjacent to the meter.

(Amended 1987)

S.2.8. Automatic Temperature Compensation. – A device may be equipped with an adjustable automatic means for adjusting the indication and registration of the measured volume of product to the volume at 15 °C (60 °F).

S.2.8.1. Provision for Deactivating. – On a device equipped with an automatic temperature-compensating mechanism that will indicate or record only in terms of liters or gallons adjusted to 15 °C (60 °F), provision

shall be made to facilitate the deactivation of the automatic temperature-compensating mechanism so that the meter may indicate, and record if it is equipped to record, in terms of the uncompensated volume.

(Amended 1972)

S.2.8.2. Provision for Sealing. – Provision shall be made for applying security seals in such a manner that an automatic temperature-compensating system cannot be disconnected and that no adjustment may be made to the system.

S.3. Design of Discharge Lines and Discharge Line Valves.

S.3.1. Diversion of Measured Liquid. – No means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or the discharge line therefrom. However, two or more delivery outlets may be permanently installed if means are provided to ensure that:

- (a) liquid can flow from only one such outlet at one time; and
- (b) the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated.

In addition, a manually controlled outlet that may be opened for the purpose of emptying a portion of the system to allow for repair and maintenance operations shall be permitted. Effective means shall be provided to prevent the passage of liquid through any such outlet during normal operation of the device and to indicate clearly and unmistakably when the valve controls are so set as to permit passage of liquid through such outlet.

(Amended 1975)

S.3.2. Delivery Hose. – The delivery hose of a retail device shall be of the wet-hose type with a shutoff valve at its outlet end.

S.4. Marking Requirements.

S.4.1. Limitation of Use. – If a device is intended to measure accurately only products having particular properties, or to measure accurately only under specific installation or operating conditions, or to measure accurately only when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently stated on the device.

S.4.2. Discharge Rates. – A device shall be marked to show its designed maximum and minimum discharge rates. The marked minimum discharge rate shall not exceed:

- (a) 20 L (5 gal) per minute for stationary retail devices; or
- (b) 20 % of the marked maximum discharge rate for other retail devices and for wholesale devices.

(Amended 1987)

Note: Also see example in Section 3.30. Liquid-Measuring Devices Code, paragraph S.4.4.1. Discharge Rates.

(Added 2003)

S.4.3. Location of Marking Information; Retail Motor-Fuel Dispensers. – *The marking information required in General Code, paragraph G-S.1. Identification shall appear as follows:*

- (a) *within 60 cm (24 in) to 150 cm (60 in) from the base of the dispenser;*
- (b) *either internally and/or externally provided the information is permanent and easily read; and*

- (c) on a portion of the device that cannot be readily removed or interchanged (i.e., not on a service access panel).

The use of a dispenser key or tool to access internal marking information is permitted for retail motor-fuel dispensers.

[Nonretroactive as of January 1, 2003]

(Added 2006)

S.4.4. Temperature Compensation. – If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representation shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

N. Notes

N.1. Test Liquid. – A device shall be tested with the liquid to be commercially measured or with a liquid of the same general physical characteristics.

N.2. Vaporization and Volume Change. – Care shall be exercised to reduce to a minimum, vaporization and volume changes.

N.3. Test Drafts.

N.3.1. Minimum Test. – Test drafts shall be equal to at least the amount delivered by the device in one minute at its normal discharge rate.

(Amended 2023)

N.3.2. Transfer Standard Meter Test. – When comparing a meter with a calibrated transfer standard meter, the minimum quantity for any test draft shall be equal to or greater than the amount delivered in one minute at the flow rate being tested.

(Added 2023) (Amended 2024)

(Amended 1982, 2023, and 2024)

N.4. Testing Procedures.

N.4.1. Normal Tests. – The “normal” test of a device shall be made at the maximum discharge flow rate developed under the conditions of the installation. Any additional tests conducted at flow rates down to and including one-half the sum of the maximum discharge flow rate and the rated minimum discharge flow rate shall be considered normal tests.

(Amended 1998)

N.4.1.1. Automatic Temperature Compensation. – On devices equipped with automatic temperature-compensating systems, normal tests shall be conducted as follows:

- (a) by comparing the compensated volume indicated or recorded to the actual delivered volume adjusted to 15 °C (60 °F); and
- (b) with the temperature-compensating system deactivated, comparing the uncompensated volume indicated or recorded to the actual delivered volume.

The first test shall be performed with the automatic temperature-compensating system operating in the “as found” condition. On devices that indicate or record both the compensated and uncompensated volume for each delivery, the tests in (a) and (b) may be performed as a single test.

(Amended 1987)

N.4.2. Special Tests. – “Special” tests shall be made to develop the operating characteristics of a device and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. Normal Tests shall be considered a special test.

N.4.2.1. For Motor-Fuel Devices. – A motor-fuel device shall be so tested at a minimum discharge rate of:

- (a) 20 L (5 gal) per minute; or
- (b) the minimum discharge rate marked on the device, whichever is less.

N.4.2.2. For Other Retail Devices. – A retail device other than a motor-fuel device shall be tested at a minimum discharge rate of the:

- (a) minimum discharge rate that can be developed under the conditions of installation; or
- (b) minimum discharge rate marked on the device, whichever is greater.

(Amended 1973)

N.4.2.3. For Wholesale Devices. – “Special” tests on a wholesale device shall include a test at, or slightly above, the minimum discharge rate marked on the device. In no case shall the test be performed at a flow rate less than the minimum discharge rate marked on the device.

(Amended 1987 and 2017)

N.4.3. Money-Value Computation Tests.

N.4.3.1. Laboratory Design Evaluation Tests. – In the conduct of laboratory design evaluation tests, compliance with paragraph S.1.5.2. Money-Value Computations shall be determined by using the cone gear as a reference for the total quantity delivered. The indicated delivered quantity shall agree with the cone gear representation with the index of the indicator within the width of the graduation. The maximum allowable variation of the indicated sales price shall be as shown in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

N.4.3.2. Field Tests. – In the conduct of field tests to determine compliance with paragraph S.1.5.2. Money-Value Computations the maximum allowable variation in the indicated sales price shall be as shown in Table 1. Money-Value Divisions and Maximum Allowable Variations for Money-Value Computations on Mechanical Analog Computers.

(Added 1984)

N.4.4. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors such as temperature, pressure, and flow rate are reduced to the extent that they will not affect the results obtained. When conducting the tests, the discharge rates shall be within the minimum and maximum discharge rates as marked by the manufacturer. For devices equipped with an automatic temperature compensator, results shall be based on the uncompensated (gross) volume (e.g., with the temperature compensator deactivated).

(Amended 2019)

N.5. Temperature Correction. – Adjustments shall be made for any changes in volume resulting from the differences in liquid temperatures between time of passage through the meter and time of volumetric determination in the prover. When adjustments are necessary, appropriate petroleum measurement tables should be used.

T. Tolerances

T.1. Application.

T.1.1. To Underregistration and to Overregistration. – The tolerances hereinafter prescribed shall be applied to errors of underregistration and errors of overregistration, whether or not a device is equipped with an automatic temperature compensator.

T.2. Tolerance Values. – The maintenance and acceptance tolerances for normal and special tests shall be as shown in Table T.2. Accuracy Classes and Tolerances for LPG and Anhydrous Ammonia Liquid-Measuring Devices. (Amended 2003)

Table T.2. Accuracy Classes and Tolerances for LPG and Anhydrous Ammonia Liquid-Measuring Devices				
Accuracy Class	Application	Acceptance Tolerance	Maintenance Tolerance	Special Test Tolerance
1.0	Anhydrous ammonia, LPG (including vehicle-mounted meters)	0.6 %	1.0 %	1.0 %

(Added 2003)

T.3. Repeatability. – When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 40 % of the absolute value of the maintenance tolerance and the results of each test shall be within applicable tolerance. (Also see N.4.4. Repeatability Tests)

(Added 1992) (Amended 1997, 2001, and 2019)

T.4. Automatic Temperature-Compensating Systems. – The difference between the meter errors (expressed as a percentage) determined with and without the automatic temperature-compensating system activated shall not exceed:

- (a) 1.0 % for mechanical automatic temperature-compensating systems; and
- (b) 0.5 % for electronic automatic temperature-compensating systems.

The delivered quantities for each test shall be approximately the same size. The results of each test shall be within the applicable acceptance or maintenance tolerance.

(Added 1991) (Amended 1992, 1996, and 1997)

UR. User Requirements

UR.1. Installation Requirements.

UR.1.1. Discharge Rate. – A device shall be so installed that the actual maximum discharge rate will not exceed the rated maximum discharge rate. If necessary, means for flow regulation shall be incorporated in the installation, in which case this shall be fully effective and automatic in operation.

UR.1.2. Length of Discharge Hose. – The length of the discharge hose on a stationary motor-fuel device shall not exceed 5.5 m (18 ft), measured from the outside of the housing of the device to the inlet end of the discharge nozzle, unless it can be demonstrated that a longer hose is essential to permit deliveries to be made to receiving vehicles or vessels. Unnecessarily remote location of a device shall not be accepted as justification for an abnormally long hose.

(Amended 1991)

UR.2. Use Requirements.

UR.2.1. Return of Indication and Recording Elements to Zero. – The primary indicating elements (visual), and the primary recording elements when these are returnable to zero, shall be returned to zero before each delivery.

UR.2.2. Condition of Fill of Discharge Hose. – The discharge hose shall be completely filled with liquid before the “zero” condition is established prior to the start of a commercial delivery, whether this condition is established by resetting the primary indicating elements to zero indication or by recording the indications of the primary indicating elements. (Also see UR.2.1. Return of Indication and Recording Elements to Zero.)

UR.2.3. Vapor-Return Line. – During any metered delivery of liquefied petroleum gas from a supplier’s tank to a receiving container, a vapor-return line from the receiving container to the supplier’s tank is prohibited except:

- (a) in the case of any receiving container to which normal deliveries cannot be made without the use of such vapor-return line; or
- (b) in the case of any top spray-fill receiving container when the ambient temperature is at or above 32 °C (90 °F).

(Amended 2016)

UR.2.4. Temperature Compensation.

UR.2.4.1. Use of Automatic Temperature Compensators. – If a device is equipped with an automatic temperature compensator, this shall be connected, operable, and in use at all times. Such automatic temperature compensator may not be removed, nor may a compensated device be replaced with an uncompensated device, without the written approval of the weights and measures authority having jurisdiction over the device.

UR.2.4.2. Temperature Compensated Sale. – All sales of liquefied petroleum gas in a liquid state, when the quantity is determined by an approved measuring system equipped with a temperature-compensating mechanism, or by weight and converted to liters or gallons, or by a calibrated container, shall be in terms of liters or the U.S. gallon of 231 in³ at 15 °C (60 °F).

(Added 1984)

UR.2.4.3. Invoices. – Any invoice based on a reading of a device that is equipped with an automatic temperature compensator or based on a weight converted to gallons, or based on the volume of a calibrated container, shall have shown thereon that the volume delivered has been adjusted to the volume at 15 °C (60 °F).

(Amended 1984)

UR.2.4.4. Automated Temperature-Compensating Systems. – Means for determining the temperature of measured liquid in an automatic temperature-compensating system shall be so designed and located that, in any “usual and customary” use of the system, the resulting indications and/or recorded representations are within applicable tolerances.

(Added 1987)

UR.2.5. Ticket in Printing Device. – A ticket shall not be inserted into a device equipped with a ticket printer until immediately before a delivery is begun, and in no case shall a ticket be in the device when the vehicle is in motion while on a public street, highway, or thoroughfare.

UR.2.6. Recorded Representations. – Vehicle-mounted metering systems shall be equipped with a means to record all sales where product is delivered through the meter and shall comply with G-S.5.6. Recorded

Representations. A copy of the recorded representation issued by the device shall be provided to the customer at the time of delivery or as otherwise specified by the customer.

(Added 1992) (Amended 2023)

UR.2.7. For Stationary Retail Computing-Type Systems Only, Installed After January 1, 2017.

UR.2.7.1. Unit Price and Product Identity.

- (a) The following information shall be conspicuously displayed or posted on the face of a retail dispenser used in a direct sale:
 - (1) except for unit prices resulting from any post-delivery discount and dispensers used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks), all of the unit prices at which the product is offered for sale; and
 - (2) in the case of a computing-type device or money-operated type device, the unit price at which the dispenser is set to compute.

Provided that the dispenser complies with S.1.5.1. Display of Unit Price and Product Identity, it is not necessary that all the unit prices be simultaneously displayed or posted.

- (b) The following information shall be conspicuously displayed or posted on each side of a retail dispenser used in a direct sale:
 - (1) The identity of the product in descriptive commercial terms; and
 - (2) The identity of the grade, brand, blend, or mixture that a multi-product dispenser is set to deliver.

(Added 2016)

UR.2.7.2. Computing Device. – Any computing device used in an application where a product or grade is offered for sale at one or more unit prices shall be used only for sales for which the device computes and displays the sales price for the selected transaction. The following exceptions apply:

- (a) Fleet sales and other price contract sales are exempt from this requirement.
- (b) A truck stop dispenser used exclusively for refueling trucks is exempt from this requirement, provided that:
 - (1) all purchases of fuel are accompanied by a recorded representation of the transaction containing the applicable price per unit of measure, the total quantity delivered, and the total price of the sale; and
 - (2) unless a dispenser complies with S.1.5.1. Display of Unit Price, the price posted on the dispenser and the price at which the dispenser is set to compute shall be the highest price for any transaction which may be conducted.
- (c) A dispenser used in an application where a price per unit discount is offered following the delivery is exempt from this requirement, provided the following conditions are satisfied:
 - (1) the unit price posted on the dispenser and the unit price at which the dispenser is set to compute shall be the highest unit price for any transaction;
 - (2) all purchases of fuel are accompanied by a receipt recorded by the system for the transaction containing:

- a. the product identity by name, symbol, abbreviation, or code number;
 - b. transaction information as shown on the dispenser at the end of the delivery and prior to any post-delivery discount including the:
 - 1. total volume of the delivery;
 - 2. unit price; and
 - 3. total computed price of the fuel sale prior to post-delivery discounts being applied.
 - c. an itemization of the post-delivery discounts to the unit price; and
 - d. the final total price of the fuel sale after all post-delivery discounts are applied.
- (Added 2016) (Amended 2023)

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