

**Appendix – A**  
Reorganized Publication 14 – LMD Checklist  
(Agenda Item 12)

## Measuring Devices

# Liquid-Measuring Devices

Technical Policy • Checklists • Test Procedures



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# Liquid Measuring Devices 2005

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## Liquid-Measuring Devices

### NTEP Technical Policy for Liquid-Measuring Devices

#### A. Type Evaluation Test Location and Installations Criteria

The manufacturer has the choice of submitting a meter or liquid-measuring device to one of the following for NTEP evaluation:

- A government laboratory
- A field test
- A manufacturer's laboratory

A laboratory test alone may not be sufficient basis on which to issue a Certificate of Conformance (CC). The policies on product families, meter sizes, and flow rates listed on a CC apply regardless of where the meter is tested. Additional testing may be required based on these policies.

#### Site Requirements - General

Site requirements for tests to add new sizes to an existing CC:

For tests of a meter size not previously covered on the CC (through testing or through the guidelines outlined for meter sizes paragraph E), the installation selected for test must achieve at least 80 percent of the meter's rated maximum flow rate.

Site requirements to add new products to an existing CC:

1. If the size of meter selected for test was previously tested under the CC with another product, then there are no minimum requirements with respect to the flow rates to be achieved in the installation selected for testing.
2. If the size of meter selected for test was covered based on the guidelines outlined for meter sizes not previously tested under the CC with another product, then the installation selected for test must achieve at least 40 percent of the meter's rated maximum flow rate; otherwise, the site is inappropriate for type evaluation.

To recognize that the maximum discharge flow rate developed by the measuring system will vary with each system, NTEP accepts a maximum discharge rate developed by a system as low as 50% of the rated maximum flow rate of the device. If the maximum flow rate achieved during and NTEP evaluation is less than 50% of the maximum flow rate marked on the device, NTEP will limit the maximum flow rate listed on the Certificate of Conformance to 200% of the maximum flow rate achieved during the evaluation.

#### B. Tolerance Application

##### General

The tolerance applied during type evaluation will be listed on the Certificate of Conformance along with the product family or families covered under the Certificate for all metering devices.

A manufacturer must specify the application and consequently, the tolerance to be applied, at the time a device is submitted for evaluation. NTEP will not shift the device applications based on the results of the type evaluation because the number of devices tested are not enough to assess the performance for tighter tolerances.

If a meter is tested to the tighter tolerances for "Other Liquids" for a given product family, it can be used with that same product family in applications which would fall under "Other Liquids" OR "Agri-chemicals" because the tolerance for agri-chemical applications is larger. If, however, the meter is tested using the "Agri-chemicals" tolerance, the meter is restricted to use in agri-chemical applications until additional testing is performed.

### Normal Test Tolerances

For the purposes of calculating tolerances, normal tests conducted in an NTEP evaluation may be performed at any flow rate down to:

$$[50\% \text{ of the rated maximum flow rate} + \text{the rated minimum flow rate}]/2$$

For example: For a meter with a rated maximum flow rate of 60 gallons/minute (gpm) and a minimum flow rate of 12 gpm, the maximum discharge rate developed in an actual installation may be as low as 30 gpm. Therefore, for NTEP tests, calculate the "breakpoint" between normal and special tests as:

$$[(50\% \times 60) + 12]/2 = 21$$

Thus, in the example, NTEP test runs at flow rates between 60 and 21 gpm are considered normal tests.

### C. Product Families for Positive Displacement Meters

When submitting a positive displacement meter for evaluation, the manufacturer must specify the product family and subgroup(s) for which the meter is being submitted. From the list of liquids constituting a product family and subgroup, at least two liquids representing of the high and low key characteristics of that subgroup are to be selected for use in the test. If the meter successfully completes all accuracy and permanence tests with these products, the resulting Certificate of Conformance will cover the entire subgroup of the product family.

The product family and the specific product subgroup covered by the Certificate are to be identified on Page 1 of the Certificate of Conformance. More detailed information, including the typical product types found in the subgroup, is to be included in the application section of the Certificate.

Product Family	Product Subgroup	Typical Products <sup>1</sup>	Viscosity (Centipoise)	Specific Gravity <sup>2</sup>	% Abrasive Solids
Fuel Lubricant, Oil Products and Edible Oil Products	Refined Products	Diesel Fuel, Distillate <sup>3</sup> , Gasoline <sup>4</sup> , Fuel Oil, Kerosene, Light Oil, Spindle Oil, Lubricating Oils, SAE Grades, Bunker Oil, 6 Oil, Crude Oil, Asphalt, Vegetable Oil, etc.	0.3 to 2500	0.68 to 1.1	None
	Aviation Fuels	AVgas, Jet A, Jet A-1, Jet B, JP4, JP5, JP7, JP8, etc.	0.4 to 3.6	0.68 to 0.85	None
	Vegetable Oils	Cooking Oils, Sunflower Oil, Soy Oil, Peanut Oil, Olive Oil, etc.	20 to 300	0.8 to 1.0	None
Solvents	Solvents General	Acetates, Acetone, Esters, Ethylacetate, Hexane, MEK, Naphtha, Toluene, Xylene, etc.	0.3 to 7	0.6 to 1.6	None
	Solvents Chlorinated	Carbon Tetra-Chloride, Methylene-Chloride, Perchloro-Ethylene, Trichloro-Ethylene, etc.	0.3 to 7	0.6 to 1.6	None
Alcohol & Glycols	Alcohols, Glycols, & Water Mixes Thereof	Ethanol, Methanol, Butanol, Isopropyl, Isobutyl, Ethylene glycol, Propylene glycol, etc.	0.3 to 7	0.6 to 1.6	None

Product Family	Product Subgroup	Typical Products <sup>1</sup>	Viscosity (Centipoise)	Specific Gravity <sup>2</sup>	% Abrasive Solids
Liquefied Compressed Gases	Fuels and Refrigerants	LPG, Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, etc.	0.1 to 0.5	0.3 to 0.65	None
	NH <sup>3</sup>	Anhydrous Ammonia	0.1	0.56 to 0.68	None
Water	Water	Tap Water, Deionized, Demineralized, Potable	1.0	1.0	None
Agricultural Liquids	Clear Liquid Fertilizers	Nitrogen Solution; 28%, 30% or 32%; 20% Aqua-Ammonia; Urea; Ammonia Nitrate; N-P-K solutions; 10-34-0; 4-10-10; 9-18-9; etc.	10 to 400	1.0 to 1.45	None
	Crop Chemicals	Herbicides: Round-up, Touchdown, Banvel, Treflan, Paraquat, Prowl, etc	4 to 400	0.7 to 1.2	None
		Fungicides, Insecticides, Adjuvants, Fumigants	0.7 to 100	0.7 to 1.2	None
	Flowables Crop Chemicals	Dual, Bicep, Marksman, Broadstrike, Doubleplay, Topnotch, Gaurdsman, Harness, etc.	20 to 900	1 to 1.2	Nil to 3%
		Fungicides			
		Micronutrients			
	Suspensions Fertilizers	3-10-30; 4-4-27, etc.	20 to 900	1.0 to 1.6	Nil to 4%
Liquid Feeds	Liquid Molasses; Molasses plus Phos Acid and/or Urea; etc.	10 to 50 000	1.2 to 1.5	Nil to 4%	
Chemicals	Chemicals	Sulfuric Acid, Hydrochloric Acid, Phosphoric Acid, etc	1.0 to 296	1.1 to 1.85	None

<sup>1</sup>NOTE: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family and product subgroup.

<sup>2</sup>The specific gravity of a liquid is the ratio of its density to that of water at standard conditions, usually 4 °C (or 20 °C) and 1 atm. The density of water at standard conditions is approximately 1000 kg/m<sup>3</sup> (or 998 kg/m<sup>3</sup>)

<sup>3</sup> Diesel fuel blends (biodiesel) with up to 20% vegetable or animal fat/oil.

<sup>4</sup> Gasoline includes oxygenated fuel blends with up to 15 % oxygenate.

Source for some of the viscosity value information is in the Industry Canada - Measurement Canada "Liquid Products Group, Bulletin V-16-E (rev. 1), August 3, 1999."

## D. Product Families for Mass Flow Meters

When submitting a direct mass flow meter for evaluation, the manufacturer must specify the product or product group for which the meter is being submitted. To cover a product group, NTEP tests must be conducted with two liquids within the product group. When two liquids of different densities are tested the Certificate of Conformance (CC) for the mass flow meter will cover approved liquids with a specific gravity range from 0.1 above the highest specific gravity tested to 0.1 below the lowest specific gravity tested. The specific gravity range within the product group can be expanded by conducting an NTEP test with a liquid of higher or lower specific gravity than is covered on the existing CC.

The above does not apply to the following product groups: compressed gases, compressed liquids, and cryogenic liquids. In the case of these product groups, only one liquid within each group is required to undergo an NTEP evaluation and, upon completion, the entire product group will be covered on the existing CC.

Multi-product applications (that is, applications in which the meter will be used without a change to zero or calibration to dispense different products which vary in specific gravity by more than 0.1) must include a multi-product test. The multi-product initial test will be performed on the meter without a change to zero or calibration using multiple products having a difference in specific gravity of at least 0.2. For devices which will be used to dispense multiple products having a specific gravity range greater than 0.2, the multi-product testing must be performed over the anticipated range before multi-product applications will be included on the CC. For the multi-product testing, throughput testing will be performed on one or a combination of the products; testing for the subsequent test will be conducted on both products without a change to zero or calibration. The CC for a mass flow meter will cover multi-product applications where the specific gravity of a single product, or multiple products, varies by the amount tested throughout the entire approved specific gravity range of the meter. Example: Where a meter has been tested and a certificate issued for multi-product with one liquid having a specific gravity of 0.7 and another liquid having a specific gravity of 1.0 and the meter is subsequently tested to expand the range with a liquid having a specific gravity of 1.6 the allowed variation of densities covered by the CC will be from 0.7 through 1.6. Multi-product testing requirements do not apply to meters used to dispense a product such as propane in which the density varies in normal operation.

<b>Direct Mass Flow Product Group Table</b>			
<b>Product Groups</b>	<b>Typical Products</b>	<b>Specific Gravity</b>	<b>Minimum Test Requirements to Cover Entire Subgroup *</b>
<b>Normal Liquids</b>	Water; Alcohols; Glycols; Water Mixes thereof; Agricultural Liquids, Fertilizers, Seeds, and Herbicides; Chemicals; Petroleum Products; Solvents; Suspensions	0.7 to 2.5	Test with one liquid having a specific gravity of 0.7  Test with one liquid having a specific gravity of 2.5
<b>Compressed Liquids</b>	Propane, Butane, Ethane, Freon 11, Freon 12, Freon 22, NH <sub>3</sub> , etc.	0.3 to 0.68	Test with one product having a specific gravity at any point within the range 0.3 to 0.68
<b>Compressed Gases</b>	CNG	0.6 to 0.8	Test with one product having a specific gravity at any point with the range of 0.6 to 0.8
<b>Cryogenic Liquids (BP 152 °C) and Liquefied Natural Gas</b>	Liquefied Oxygen, Nitrogen, etc.	0.07 to 1.4	Test with one liquid having a specific gravity at any point within the range 0.07 to 1.4.

<b>Direct Mass Flow Product Group Table</b>			
<b>Product Groups</b>	<b>Typical Products</b>	<b>Specific Gravity</b>	<b>Minimum Test Requirements to Cover Entire Subgroup *</b>
<b>Heated Products (above 50 °C)</b>	Bunker C, Asphalt, etc.	0.8 to 1.2	Test with one liquid having a specific gravity of 0.8  Test with one liquid having a specific gravity of 1.2
<p>*If only a single product is selected for test, the resulting CC will cover only that product. The manufacturer may select liquids having a narrower range than that specified in the subgroup. In this case, the CC will be limited to subgroup products falling within the revised specific gravity range. The manufacturer may select liquids having a wider range than that specified in the subgroup. In this case, the CC will cover subgroup products over the wider specific gravity range.</p> <p><i>NOTE: The Typical Products listed in this table are not limiting or all-inclusive; there may be other products and product trade names, which fall into a product family and product subgroup.</i></p>			

### **E. Meter Sizes to be Included on a Certificate of Conformance**

Based upon the test of a meter (or meters), meters larger and smaller than the meter(s) tested and meeting the following criteria may be covered by the Certificate:

1. Meter sizes with rated maximum flow rates of 50 percent to 200 percent of the rated maximum flow rate of the meter tested; and
2. Meter sizes with rated minimum flow rates of 50 percent to 200 percent of the rated minimum flow rate of the meter tested.

The maximum flow rate achieved in an installation is considered to be 80% of the maximum flow rate to be listed on the Certificate of Conformance.

### **F. New Product Applications for Meters**

If a manufacturer wants to add a new product to an existing family of meters, the following criteria will be applied:

1. If the accuracy class in NIST Handbook 44 for the new product falls within the same NIST Handbook 44 accuracy class or a more strict accuracy class than the most strict accuracy class covered on the Certificate of Conformance, the entire range of meter sizes will be covered for the product tested.
2. If the accuracy class in NIST Handbook 44 for the new product falls within a less strict NIST Handbook 44 accuracy class than the most strict accuracy class covered by the Certificate, the new product will only be covered for the meters meeting the requirements of paragraph E, Meter Sizes to be Included on a Certificate of Conformance.

### **G. Range of Data Points**

The number and types of tests to be run on devices covered under this checklist are specified in the Checklist and Test Procedures section and the Field Evaluation and Permanence Tests for Metering Systems section of this checklist. However, if the NTEP laboratory feels that there is a performance or other Handbook 44 related problem and provides reasons to support this belief, the laboratory is given the latitude to require additional testing.

### **H. Listing of Stacked Sales for Electronic Cash Registers Interfaced with Retail Motor-Fuel Dispensers**

If an electronic cash register interfaced with retail motor-fuel dispensers can be programmed to accept stacked, completed sales, then the Certificate of Conformance must indicate that this option is permitted only when the electronic cash register is provided with an uninterruptible power supply or other means of recalling stacked sales information in the event of a power failure. If the cash register is equipped with the stacked sales option, but the option is not programmable, then the Certificate must limit the use of the electronic cash register to applications in which an uninterruptible power supply or other means of recalling stacked sales information in the event of a power failure is provided.

## **I. Guidelines for Requiring Serial Numbers on Devices**

A serial number is required on equipment in the following circumstances:

1. **Separate Device:** A device is capable of operating as a weighing or measuring device without interfacing with or connecting to other components.
2. **Separate Main Element:** Primary indicating elements must be marked. The device is a major element in the weighing or measuring system, which means, it is metrologically significant to the operation and/or performance of the system and interfaces with different compatible main elements. Examples: indicating elements, meter registers, and meter measuring elements (vehicle-tank meters and loading-rack meters).
3. **Component:** The device is a component in a system, may be used in different models of devices, and is sufficiently complex to warrant a separate evaluation and a separate CC (e.g., load cells and vapor recovery nozzles). Such a device may or may not be placed into an enclosure with other components of the system. When installed in an enclosure, the complete device must be marked with a serial number and the one serial number will suffice for the entire collection of components. If not placed in an enclosure with other components, the component must be marked with a serial number.

### **Examples:**

#### **Retail Motor-Fuel Dispensers:**

- Whole unit requires a serial number
- Indicating elements do not require a serial number unless it is a replacement kit with a Certificate of Conformance
- Measuring element does not require a separate serial number
- The measuring element is metrologically significant because it affects the operation of the system as a whole; however, it is always enclosed in a housing, which has a serial number for the whole device.

*Note: A conventional nozzle on a retail motor-fuel dispenser is not a sufficiently complex device to warrant a separate type evaluation or a serial number. The nozzle does not affect the accuracy of the delivery. A separate requirement addresses the anti-drain valve. A vapor recovery nozzle does warrant a separate evaluation because it is a complex device and has the potential to affect the accuracy of the device during the normal operation of the device. One model of vapor recovery nozzle can be used on many models of dispensers. Thus, it is reasonable to require a vapor recovery nozzle to be marked with a serial number.*

#### **Vehicle-Tank Meter:**

- A serial number is required on the meter; it is a major component of the system because it is required for the system to operate.
- A serial number is required on the indicating elements.

## **J. Vapor Recovery Option**

If a retail motor-fuel dispenser includes a vapor recovery option, the following statement will be included on the Certificate of Conformance: "No NTEP testing has been performed on the device equipped with vapor recovery option or equipment to determine compliance with air resources board requirements."

## **K. Policy on Remanufactured and Repaired Devices**

Refer to the Section M, Policy on Remanufactured and Repaired Devices in the NCWM Publication 14 Administrative Policy

#### **L. Cash Acceptors - Marking**

Certificates of Conformance will cover the use of the cash acceptor option at both attended and unattended stations. Cash acceptors, which are used at unattended locations, must meet the marking requirements of paragraph G-UR.3.4. Responsibility, Money-Operated Devices shall have clearly and conspicuously displayed on the device or immediately adjacent to the device information detailing the return of monies paid when the product cannot be obtained.

#### **M. Customer Display on Vehicle-Tank Meters**

Paragraph G-UR.3.3. requires the primary indicating element to be visible from a reasonable customer position. Many electronic vehicle-mounted metering/controlling systems on which transaction information is displayed are mounted inside the cab of the delivery vehicle. This location is not considered visible from a reasonable customer position. Some systems provide a remote customer display as a standard feature, and some do not. The application section of any Certificate of Conformance issued to a vehicle-mounted metering/controlling system must limit the system to installations where a customer indicator is provided and located in a reasonable customer position (e.g., at the meter on the rear of the vehicle).

#### **N. Compact Provers**

Provers other than volumetric neck-type are permitted to use in performing both field and laboratory portions of an NTEP test. If the policy of the weights and measures jurisdiction with authority over a device undergoing type evaluation does not recognize the use of compact provers for official tests, it is recommended that the weights and measures jurisdiction perform an official test following the completion of the NTEP permanence test.

#### **O. Loading Rack Meter Controllers with Blending Capabilities**

In addition to the Common and General Code Criteria and applicable sections of the Wholesale and Loading Rack Meters and other Checklists, the following applies to tests of Loading Rack Meter Controllers with Blending Capabilities:

1. For NTEP testing, it is acceptable for the sum of the total quantity printed/displayed for each component of the blend to be different from the total quantity delivered due to intermediate rounding of each component. For example, if the quantity for each component has a higher internal resolution than that displayed, the displayed/printed quantity will be a rounded value. If each component of the blend is rounded in this way, the sum of the components may be different (due to rounding) than the actual quantity delivered by the system.
2. No mathematical correction is permitted to account for growth or shrinkage due to blending of product.

#### **P. Turbine Meters with both Vertical and Horizontal Orientation**

In addition to the Common General Code Criteria, Common Specific Code Criteria, and the Field Evaluation and Permanence Tests, the Committee noted that the following applies to tests of turbine meters, which feature both vertical and horizontal orientation, and both directions of flow due to the effect on meter performance.

For NTEP testing, at least one meter must be tested in each direction (vertical and horizontal) of orientation. If the meter may be installed in this manner, it must be tested in both directions and with the meter flow in both directions.

#### **Q. New Certificate for Mass Flow Meter Indicating Only in Units of Volume or Adding Volume Measurement to Existing Mass Flow Meter Certificates**

The NTEP laboratory must test a mass flow meter with products as outlined in the family of products table to include volume units of measurement on a mass flow meter Certificate of Conformance. This policy applies regardless of whether or not the meter is covered by an existing CC for mass units. It would result in re-testing products in the volume mode that were previously tested in the mass mode.

Testing for a mass flow meter indicating only in units of volume or to add volumetric units to a MFM CC can be done volumetrically using volumetric test procedures used for other volumetric meters or gravimetrically using gravimetric test procedures outlined in Publication 14 and the minimum test criteria (kinds and number of tests) outlined for mass flow meters. The volume indication of the meter shall be based on the mass measurement and an automatic means to determine and correct for changes in product density. The method used to determine product density for gravimetric tests will be reviewed by NTEP on a case-by-case basis to allow the manufacturer flexibility in determining density for various product types and applications. Testing will not result in an approval of the density indication feature on the CC. (Note: To add volume units, the test of only one meter size is required to cover the whole family of meter sizes listed on the original CC.) Only an initial test is required for each new product. A subsequent permanence test is not required. The Certificate for a meter tested with only one measurement unit will cover only that unit of measure and will be noted in the application section of the Certificate.

#### **R. Vehicle-Mounted and Stationary Applications of the Meter**

If a meter is successfully tested in a vehicle-mounted application, both vehicle-mounted and stationary applications can be covered on the resulting NTEP Certificate of Conformance without additional testing in a stationary application provided all other suitability criteria have been met (e.g. flow rates). If a meter evaluation has only been conducted in a stationary application, testing must also be conducted on the meter in a vehicle-mounted application in order to cover both applications on the NTEP Certificate of Conformance.

#### **S. Changing the Device Category for Devices Sealed with an Audit Trail**

If a manufacturer with a Certificate for a device that uses an audit trail to meet the sealing requirements wants to change the device category for the audit trail, the CC for the device must be addended and the device will be subject to at least a partial initial evaluation. Performance testing is not required. Based on results of the initial evaluation, NTEP may determine that further evaluation is required.

#### **T. Testing Required To Interface Indicators and Measuring Elements With Individual CC's That Were Not Previously Tested Together**

Additional testing by an NTEP Participating Laboratory is not required if an electronic indicator is interfaced to a measuring element provided all of the following are true:

- a. The communication means for the input to the electronic indicator (pulse, frequency, serial, etc.) has been previously tested with a measuring element listed on a CC;
- b. the communication means for the output of the measuring element (pulse, frequency, serial, etc.) has been previously tested with an electronic indicator listed on a CC;
- c. the communication means to be used for the electronic indicator input is the same as the communication means to be used for the measuring element output (pulse-pulse, frequency-frequency, serial-serial, etc.) and both devices are being used within the current parameters listed on their respective CCs;
- d. the devices are communicating with each other and the system into which they are installed can be accurately calibrated; and
- e. if required, Handbook 44 compliant tickets can be printed.

*Note: NTEP may require Initial or Complete evaluation of new technologies or applications.*

#### **U. Testing Electronic Indicators for Stationary Installations Using Simulated Inputs.**

When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, etc.).

## Introduction

This checklist contains criteria that is common to the codes, which apply to retail motor-fuel devices, wholesale meters, and LP gas meters. The checklist is designed so that the user can determine and record the conformance of the device with the elements of the checklist in a logical sequence. It is suggested that the user copy the checklist to serve as worksheets, and thus, preserve the original for reference. Unless specifically requested to do so, the applicant is not required to submit a completed checklist to NTEP prior to the evaluation; however, the applicant is urged to carefully review the checklist prior to submission to ensure that the device meets the requirements of the checklist. In most cases, the results of evaluation for each element can be recorded by checking the appropriate response to the following:

In some cases, the user is required to record values, results, or comments. In those cases, space is provided. Examples are:

1.     **Yes**  **No**  **N/A**
2.      EXTERNAL  INTERNAL  N/A
3.     Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

This checklist is a guide for conducting prototype examinations to determine compliance with the requirements of NIST Handbook 44. These criteria shall apply only to type evaluation examinations, not on a retroactive basis to devices currently in service. The General Code requirements apply to all classes of devices. The specific code requirements supersede General Code requirements in all cases of conflict.

### 1.     **General**

#### **Code Reference: G-S.1. Identification**

Virtually all weighing and measuring equipment must be clearly and permanently marked with, or display, the manufacturer's name or trademark, model designation, and serial number. Service station dispensers, consoles, cash registers interfaced with dispensers, retrofit computing registers, and customer card-activated terminals must all have these markings. As a practical matter, some equipment need not have a serial number. "Satellite" modules in a modular system (e.g., keyboard module and cash drawer) need not have serial numbers because they do not have any "intelligence."

A serial number is required in the following circumstances:

**Separate Device:** A device is capable of operating as a weighing or measuring device without interfacing with or connecting to other components.

**Separate Main Element:** Primary indicating elements must be marked. The device is a major element in the weighing or measuring system, which means, it is metrologically significant to the operation and/or performance of the system and interfaces with different compatible main elements. Examples include the following: indicating elements, weighing elements, meter registers, meter measuring elements (vehicle tank meters and loading rack meters).

**Component:** The device is a component in a system, may be used in different models of devices, and is sufficiently complex to warrant a separate evaluation and a separate CC (e.g., load cells and vapor recovery nozzles). Such a device may or may not be placed into an enclosure with other components of the system. When installed in an enclosure, the complete device must be marked with a serial number, and the one serial number will suffice for the entire collection of components. If not placed in an enclosure with other components, the component must be marked with a serial number.

The following are examples of the application of these criteria:

**Retail Motor-Fuel Dispensers:**

- Whole unit requires a serial number
- Indicating elements do not require a separate serial number
- Measuring element does not require a separate serial number
- The measuring element is metrologically significant because it affects the operation of the system as a whole; however, it is always enclosed in a housing, which has a S/N for the whole device

*Note: A conventional nozzle on a retail motor-fuel dispenser is not a sufficiently complex device to warrant a special type evaluation or a serial number. The nozzle does not affect the accuracy of the delivery. A separate requirement addresses the anti-drain valve. A vapor recovery nozzle does warrant a separate evaluation because it is a complex device, and it does have the potential to affect the accuracy of the device during the normal operation of the device. One model of vapor recovery nozzle can be used on many models of dispensers. The proper operation of a vapor recovery nozzle and system is "important" as defined by federal regulations. Thus, it is reasonable to require a vapor recovery nozzle to be marked with a serial number.*

**Vehicle Tank Meters:**

- Serial number is required on the meter; it is a major component of the system since it is required for the system to operate.
- Serial number is required on the indicating elements.

Equipment must be marked on a surface that is an integral part of the device, and the marking must be visible after installation. If the required information is not positioned in a visible location after installation, a duplicate, permanent identification badge must be located in a visible location after installation. A removable cover is an acceptable location for the required information only if a permanent ID badge is located elsewhere on the device.

The information may be on a metal or plastic plate that is attached with pop rivets, adhesive, or other means, but removable bolts or screws are not permitted. A foil or vinyl badge may be used provided that it is able to survive wear and tear, remains legible, and is difficult to remove. The printing on a foil badge must be easily readable and not easily obliterated by rubbing with a relatively soft object (e.g., the wood of a pencil).

Location of the information: \_\_\_\_\_

All equipment shall be clearly and permanently marked on an exterior surface that is visible after installation with the following information (prefix lettering may be initial capitals, all capitals, or all lower case):

- |          |  |   |
|----------|--|---|
| 1.1.     | Name, initials, or trademark of the manufacturer.  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 1.1.1.   | The manufacturer's designation that positively identifies the pattern or design.   | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 1.1.2.   | The Model designation shall be prefaced by the word "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, at a minimum, begin with the letter "N" (e.g., No or No.) The abbreviation for the word "Model" shall be "Mod" or "Mod.". | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 1.1.3.   | A unique serial number. (except for not built-for-purpose, software-based devices).  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 1.1.3.1. | The current software version number for not built-for-purpose, software-based devices  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 1.1.4.   | 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.).                            | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |

**Code Reference G-S.1. (g). Effective January 1, 2003**

- 1.1.5. The NTEP Certificate of Conformance (CC) Number or a corresponding CC addendum number for devices that have a CC. The number shall be prefaced by the terms "NTEP CC", "CC", or "Approval". These terms may be followed by the word "Number" or an abbreviation for the Word "Number". The abbreviation shall as a minimum begin with the letter "N" (e.g., No or No.). **Yes**  **No**  **N/A**

The device must have an area, either on the identification plate or on the device itself, suitable for the application of the Certificate of Conformance Number. If the area for the CC Number is not part of an identification plate, note its intended location and how it will be applied.

Location of CC Number if not located with the identification:

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**Code Reference: G-S.1.1. Not Built-for-Purpose Devices, Software-Based**

- 1.2. For not built-for-purpose, software-based devices the following shall apply:
- 1.2.1. the manufacturer or distributor and the model designation shall be continuously displayed or marked on the device (see note below), or **Yes**  **No**  **N/A**
- 1.2.2. the Certificate of Conformance (CC) Number shall be continuously displayed or marked on the device (see note below), or **Yes**  **No**  **N/A**
- 1.2.3. all required information in G-S.1. Identification. (a), (b), (c), (e), and (h) shall be continuously displayed. Alternatively, a clearly identified view only System Identification, G-S.1. Identification, or Weights and Measures Identification shall be accessible through the "Help" menu. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated. **Yes**  **No**  **N/A**

*Note: Clear instructions for accessing the remaining required G-S.1. information shall be listed on the CC. Required information includes that information necessary to identify that the software in the device is the same type that was evaluated.*

- 1.3. The identification badge must be visible after installation. **Yes**  **No**  **N/A**
- 1.4. The identification badge must be permanent. **Yes**  **No**  **N/A**

**Code Reference: G-S.2. Facilitation of Fraud**

This applies to all metering systems, including retail fuel dispensers that are controlled from a remote location, vehicle tank meters, and LP gas meters. An exception is permitted if the unit price can be changed at a retail fuel dispenser only through the use of a key to gain access to the unit price mechanism, (e.g., mechanical computing registers). Such action would be obvious to a consumer and would inhibit changing the unit price during a delivery.

This requirement addresses the process of changing the unit price or unit prices set in a metering system, but not the selection of a unit price from prices among several posted on a retail motor-fuel dispensing system. Specific criteria for selecting unit prices for retail motor-fuel dispensers are given in the retail motor-fuel section of the checklist.

- 1.5. The system shall prevent a change of unit price during a delivery or, in the case of a retail fuel dispenser, while the operating mechanism is in the "on" position. **Yes**  **No**  **N/A**

**Authorization of Stacked Sales**

Service station consoles, which are capable of stacking prepaid sales, shall not be capable of automatically authorizing a stacked sale immediately upon completing the previous transaction. The console operator cannot maintain adequate control over a console with automatic authorization capability. To avoid facilitation of fraud, the console operator must maintain control over the transaction process until the customer who has paid for a prepaid, stacked sale is ready to begin dispensing the product.

For the operator to maintain control over the transaction, the operator should be required to perform some step or operation, which would give final authorization to the stacked sale after the previous sale, has been completed. For example, if the operator must press an "authorization" key before the subsequent stacked transaction can begin, the operator can maintain control over the transaction. The operator would not press the authorization key to authorize a stacked sale if the customer waiting at the dispenser is not the customer who paid for the stacked sale.

- 1.6. A service station console shall not be capable of automatically authorizing a sale immediately upon the completion of the previous transaction for that dispenser. **Yes**  **No**  **N/A**

**Code Reference: G-S.3. Permanence**

Equipment shall be of such materials, design, and construction that, under normal service conditions:

- 1.7. Accuracy will be maintained. **Yes**  **No**  **N/A**
- 1.8. Operating parts will continue to function as intended, **Yes**  **No**  **N/A**
- 1.9. Adjustments will remain reasonably permanent. **Yes**  **No**  **N/A**

**Code Reference: G-S.4. Interchange or Reversal of Parts**

If a metering system has parts that interchange or reverse in normal field assembly, the system shall either be constructed so that reversal will not affect the accuracy of the system or the parts must be marked to indicate their proper position. For most metering devices, this applies only to the reversal of connectors or cables to peripheral devices.

If a metering system has any parts that may be interchange or reverse in normal field assembly, the parts must either be:

- 1.10. Constructed so that reversal will not affect performance, or **Yes**  **No**  **N/A**
- 1.11. marked or keyed to indicate the proper position. **Yes**  **No**  **N/A**

**Code Reference: G-S.5.1. Indicating and Recording Elements**

Several requirements of a general nature facilitate the reading and interpretation of displayed values. Each display for quantity or total price must be appropriate in design and have sufficient capacity for particular applications to be suitable for the application. For example, retail fuel dispensers capable of indicating to 99.999 liters or gallons or \$99.99 are appropriate for automobiles at today's prices, but that are unsuitable for fueling trucks where deliveries may regularly exceed 100 liters or gallons and \$100. Metering devices must be capable of indicating the maximum quantity and money values that can normally be expected in a particular application.

- 1.12. The maximum money value and quantity indications and unit prices are appropriate for the intended use. **Yes**  **No**  **N/A**
- 1.13. The indications must be clear, definite, and accurate. **Yes**  **No**  **N/A**
- 1.14. The indications must be easily read under normal operating conditions. **Yes**  **No**  **N/A**
- 1.15. Totalizer values must be accurate to the nearest minimum interval with decimal points displayed or subordinate digits adequately differentiated from others, if applicable. **Yes**  **No**  **N/A**
- 1.16. Symbols for decimal points shall clearly identify the decimal position. (Generally acceptable symbols are dots, small commas, or x.) **Yes**  **No**  **N/A**
- 1.17. The zero indication must consist of at least the following minimum indications as appropriate: **Yes**  **No**  **N/A**
- 1.17.1. One digit to the left and all digits to the right of a decimal point. **Yes**  **No**  **N/A**
- 1.17.2. If a decimal point is not used, at least one active decade plus any constant zeros. **Yes**  **No**  **N/A**
- 1.17.3. A fixed or constant zero cannot appear after a decimal point, (i.e., all decades to the right of a decimal point must be active).\* **Yes**  **No**  **N/A**

\* A fixed zero may appear after a decimal point on a receipt and/or console if the system is unable to distinguish if the digit is fixed or active.

## 2. Graduations, Indications, and Recorded Representations

When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, etc.).

### Code Reference: G-S.5.2.1. Analog

- 2.1. An analog device must have graduations and a suitable indicator to provide an accurate indication of quantity and money values. Yes  No  N/A

### Code Reference: G-S.5.2.3. Size and Character

Digits used for comparable values must be uniform in size and character, but subordinate values may be displayed in different and less prominent digits than more significant values may be displayed. The latter more likely occurs on analog devices. In digital indications, the digits are usually uniform throughout a particular display. The size of digits differs for different quantities. For example, the quantity and unit price digits may be smaller than the total price digits.

- 2.2. Corresponding graduations shall be uniform in size and character. Yes  No  N/A
- 2.3. Subordinate graduations, indications, and recorded representations shall be appropriately portrayed or designated. Yes  No  N/A

### Code Reference: G-S.5.2.4. Values Defined

- 2.4. Values shall be adequately defined by a sufficient number of figures, words, symbols, or combinations and uniformly placed so that they do not interfere with the accuracy of the reading. Yes  No  N/A

### Code Reference: G-S.5.2.5. Permanence

- 2.5. Graduations, indications, or recorded representations and their defining figures, words, and symbols shall be of such character that they will not easily become obliterated or illegible. Yes  No  N/A

### Code Reference: G-S.5.3., G-S.5.3.1. Values of Graduated Intervals or Increments

- 2.6. Graduations, digital, and analog indications and recorded representations shall be uniform in size, character, and value throughout any series. Graduations must have a regular pattern, and the increments must be consistent. Quantity values shall be defined by the specific unit of measure in use. Yes  No  N/A
- 2.7. Graduations and indications shall be uniform throughout any series. Yes  No  N/A
- 2.8. Quantity values shall be identified by the unit of measure. Yes  No  N/A

### Code Reference: G-S.5.4. Repeatability of Indications

The quantity measured by a device shall be repeatable within tolerance for the same indication. One condition that may create a problem is that the value of the quantity division may be large relative to the tolerance. A delivery must be within tolerance wherever the delivery is stopped within the nominal indication of the test draft. Meters that may be at the tolerance limit may be out of tolerance at an extreme limit of the nominal quantity indication.

- 2.9. When a digital indicator is tested, the delivered quantity shall be within tolerance at any point within the quantity-value division for the test draft. Yes  No  N/A

### Code Reference: G-S.5.6. Recorded Representations

- 2.10. All recorded values shall be digital. (See also G-UR.3.3.) Yes  No  N/A

### Code Reference: G-S.5.7. Magnified Graduations and Indications

- 2.11. Magnified indications shall conform to all requirements for graduations and indications. Yes  No  N/A

### Code Reference: G-S.6. Marking, Operational Controls, Indications, and Features

All operational controls, indications, and features shall be clearly and definitely identified. Non-functional keys and annunciators shall not be marked because their marking implies that the key or annunciator is functional and should be inspected or tested by the enforcement official. Keys and operator controls that are visible to a customer in a direct sale

transaction shall be marked with words or symbols to the extent that they can aid the customer to understand and make the transaction. Keys that are visible only to the console operator need to be marked only to the extent that a trained operator can understand the function of each key.

- 2.12. All operational controls, indications, and features including switches, lights, displays, and push-buttons shall be clearly and definitely identified. The use of approved pictograms or symbols shall be acceptable. Yes  No  N/A
- 2.13. All dual function (multi-function) keys or controls shall be marked to clearly identify all functions. Yes  No  N/A
- 2.14. Non-functional controls and annunciators shall not be marked Yes  No  N/A

**Code Reference: G-S.7. Lettering, Readability**

- 2.15. Required markings and instructions shall be permanent and easy to read. Yes  No  N/A

**Code Reference: G-S.8. Sealing Electronic Adjustable Components and Provision for Metrologist Sealing of Adjustable Components or Audit Trail**

*NOTE: Also reference specific code requirements for sealing and audit trails including Liquid Measuring Devices Code paragraph S.2.2., Mass Flow Meters Code paragraph S.3.5, and other applicable specific code requirements.*

- 2.16. Electronic adjustable components that affect the performance of a device shall provide for an approved means of security (e.g. data change audit trail) or for physically applying a security seal. These components include the mechanical adjustment mechanism of meters, the electronic calibration factor and automatic temperature compensator for electronic meter registers, selection of pressure of density correction capability and correction values, and pulser setting and gallon/liter conversion switches when they may accidentally or intentionally be used to perpetrate fraud. Yes  No  N/A

The following philosophy and list of sealable parameters applies to provision for sealing all liquid-measuring devices. An electronic data audit trail is a means of allowing a weights and measures inspector to review how many times any electronic adjustment, which affects the accuracy of a weight or measurement, has been changed since the previous inspection. The information contained in the audit trail shall consist of an accumulative and non-destructible number (even if a power failure occurs) which increments each time any of the adjustments that are required to be sealed have been changed. The electronic data audit trail information shall be capable of being recalled by the official on the main display of the device.

As a minimum, devices, which use an audit trail to provide security for sealable parameters shall satisfy the following criteria and shall use the format, set forth in Appendix A, Minimum Requirements for Audit Trails for Liquid-Measuring Devices.

**Philosophy for Sealing  
Typical Features to be Sealed**

**Principles for Determining Features to be Sealed**

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 using the feature will result in fraud not being detected.

Features or functions such as setting the unit prices on gasoline dispensers and maintaining unit prices in price look-up codes stored in memory, which are routinely used by the operator as part of device operation, are not sealable parameters and shall not be sealed.

If a parameter (or set of parameters) selection would result in performance that would be obviously in error, such as the selection of parameters for different countries, then, it is not necessary to seal the selection of these features.

If individual device characteristics are selectable from a "menu" or a series of programming steps, then access to the "programming mode" must be sealable.

Note: If an audit trail is the only means of security, then the audit trail shall update only after at least one sealable parameter has been changed. Simply accessing the sealable parameters via a menu shall not update the audit trail.

If a device must undergo a physical act, such as cutting a wire and physically repairing the cut to reactivate the parameter, this physical repair process would then be considered an acceptable way to select parameters without requiring a physical seal or an audit trail.

### **Typical Features and Parameters to be Sealed**

The following provides examples of configuration and calibration parameters that are to be sealed. The examples are provided for guidance and are not intended to cover all possible parameters.

**Calibration Parameters:** Calibration parameters are those parameters whose values are expected to change as a result of accuracy adjustments. Examples include the following:

1. Measuring element adjustments where linearity corrections are used (e.g., flow rate 1 and meter factor 1, flow rate 2 and meter factor 2, etc).
2. Mass flow meter adjustments for zero adjustments (not simply setting the display to zero) and span settings.

**Configuration Parameters:** Configuration parameters are those parameters where the values are expected to be entered once only and not changed after all initial installation settings have been made. Examples include the following:

1. Octane or other blend setting ratios (optional in Canada at this time).
2. Temperature, pressure, density, and other sensor settings for zero, span, and offset values.
3. Measurement units (in Canada, only if not displayed or printed on the primary register).
4. Temperature compensation table, liquid coefficient of expansion, or compressibility factors or tables.
5. Liquid density setting (in Canada, only if not displayed or printed on the primary register) and allowable liquid density input range.
6. Vapor pressures of liquids if used in calculations to establish the quantity.
7. Meter or sensor temperature compensation factors.
8. False or missing pulse limits for dual pulse systems (Canada only).
9. On/off status of automatic temperature, pressure, or density correction.
10. Automatic or manual data input for sensors.
11. Dual pulse checking feature status on or off.
12. Flow control settings (optional in Canada).
13. Filtering constants.

<b>Liquid-Measuring Device Features and Parameters</b>	
<b>Typical Features or Parameters to be Sealed</b>	<b>Typical Features or Parameters Not Required to be Sealed</b>
Measuring element adjustment (both mechanical and electronic)	Analog-to-digital converters
Linearity correction values	Quantity division value (display resolution)
Measurement units (e.g., gallons to liters)	Double pulse counting
Octane blend setting for retail motor-fuel dispensers	Communications
Any tables or settings accessed by the software or manually entered to establish the quantity (e.g., specific gravity, pressure, etc.)	
Density ranges	
Pulsers	
Signal pick-up (magnetic or reluctance)	
Temperature probes and temperature offsets in software	
Pressure and density sensors and transducers	
Flow control settings, e.g., flow rates for slow-flow start, quantity for slow-flow start and stop	
Temperature compensating systems (on/off)	
Differential pressure valves	
As a point of clarification, the flow control settings referenced above are those controls typically incorporated into the installations of large-capacity meters (wholesale meters). The reference does not include the point at which retail motor-fuel dispensers slow product flow during a prepaid transaction to enable the dispenser to stop at the preset amount.	

*Note: The above examples of adjustments, parameters, and features to be sealed are to be considered "typical" or "normal." This list may not be all inclusive. Some parameters other than those listed, which affect the metrological performance of the device, must be sealed. If listed parameters or other parameters, which may affect the metrological function of the device, are not sealed, the manufacturer must demonstrate that all settings comply with the most stringent requirements for the application of the device (i.e., the parameter does not affect compliance with Handbook 44).*

**Category 1 Devices (Devices with No Remote Configuration Capability):**

- The device is sealed with a physical seal or it has an audit trail with two event counters (one for calibration, the second for configuration). **Yes**  **No**  **N/A**
- A physical seal must be applied without exposing electronics. **Yes**  **No**  **N/A**
- Event counters are non-resettable and have a capacity of at least 000 to 999. **Yes**  **No**  **N/A**
- Event counters increment appropriately. **Yes**  **No**  **N/A**
- The audit trail information must be capable of being retained in memory for at least 30 days while the device is without power, or must be retained in nonvolatile memory. **Yes**  **No**  **N/A**
- Accessing the audit trail information for review shall be separate from the calibration mode. **Yes**  **No**  **N/A**
- Accessing the audit trail information must not affect the normal operation of the device. **Yes**  **No**  **N/A**
- Accessing the audit trail information shall not require removal of any additional parts other than normal requirements to inspect the integrity of a physical security seal. (e.g., a key to open a locked panel may be required). **Yes**  **No**  **N/A**

**Category 2 Devices (Devices with Remote Configuration Capability but Controlled by Hardware):**

- Category 2 applies only to devices manufactured prior to January 1, 2005. Devices with remote configuration capability manufactured after that date must meet the sealing requirements outlined in Category 3. Devices without remote configuration capability manufactured after that date will be required to meet the minimum criteria outlined in Category 1. Yes  No  N/A

<b>Minimum Number of Counters Required</b>		
	<b>Minimum Counters Required for Devices Equipped with Event Counters</b>	<b>Minimum Event Counter(s) at System Controller</b>
Only one type of parameter accessible (calibration or configuration)	One (1) event counter	One (1) event counter for each separately controlled device, or one (1) event counter, if changes are made simultaneously.
Both calibration and configuration parameters accessible	Two (2) event counters	Two (2) event counters for each separately controlled device, or two (2) or more event counters if changes are made to all controlled devices simultaneously.

**Category 3 Devices (Devices with Unlimited Remote Configuration Capability):**

Category 3 devices have virtually unlimited access to sealable parameters or access is controlled through a password.

- For devices manufactured after January 1, 2001, the device must either: Yes  No  N/A 
  - clearly indicate when it is in the remote configuration mode, or
  - the device shall not operate while in the remote configuration mode
- The device is equipped with an event logger Yes  No  N/A
- The event logger automatically retains the identification of the parameter changed, the date and time of the change, and the new value of the parameter. Yes  No  N/A
- Event counters are nonresettable and have a capacity of at least 000 to 999. Yes  No  N/A
- The system is designed to attach a printer, which can print the contents of the audit trail. Yes  No  N/A
- The audit trail information must be capable of being retained in memory for at least 30 days while the device is without power or must be retained in nonvolatile memory. Yes  No  N/A
- The event logger must 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. Yes  No  N/A
- The event logger drops the oldest event when the memory capacity is full and a new entry is saved. Yes  No  N/A
- Describe the method used to seal the device or access the audit trail information. \_\_\_\_\_

• [NOTE: All devices with remote communication that are manufactured after January 1, 2005 must meet the requirements outlined for Category 3.]

**Code Reference: G-UR.1.1. Suitability of Equipment**

A device must be properly designed and have sufficient capacity to be suitable to use in a particular application. A device must measure the appropriate characteristics of a commodity to accurately determine the quantity, have the necessary components (e.g. vapor eliminator) to eliminate factors that may cause measurement errors during normal use, have sufficient capacity to indicate the quantity measured and the associated total price if it is a computing device. The meter must have the proper flow rate capacity to operate over the actual flow rates for the application, and the device must have a quantity division appropriate for the application. Some specific requirements for device characteristics are given in the specific codes for particular devices.

- 2.17. The equipment is suitable for its intended application. Yes  No  N/A

**Code Reference: G-UR.1.2. Environment**

- 2.18. Equipment shall be suitable for use in the environment in which it will be used. Suitability with respect to environment includes the effects of wind, weather, temperature variations, and radio frequency interference. A device must work and remain accurate under its actual conditions of use. Yes  No  N/A

**Code Reference: G-UR.3.3. Position of Equipment**

Paragraph G-UR.3.3. requires that the primary indicating element be visible from a reasonable customer position. Many electronic vehicle-mounted metering/controlling systems on which transaction information is displayed are mounted inside the cab of the delivery vehicle. This location is not considered visible from a reasonable customer position. Some systems provide a remote customer display as a standard feature and some do not. The application section of any Certificate of Conformance issued to a vehicle-mounted metering/controlling system must limit the system to installations where a customer indicator is provided and located in a reasonable customer position (e.g., at the meter on the rear of the vehicle).

### Checklist and Test Procedure for Common Specific Code Requirements

### 3. Indicating Elements, Recording Elements, and Recorded Representations

When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, etc.)

**Code Reference: S.1.1. Primary Elements - General**

- 3.1. A device shall be equipped with a primary indicating element. Yes  No  N/A
- 3.2. Is the device equipped with a primary recording element? Yes  No  N/A

**Code Reference: S.1.3. Advancement of Indicating and Recording Elements**

Primary indicating and recording elements may advance only as a result of the mechanical operation of the device. However, during the process of re-setting the indicating and recording elements to zero, the elements may advance to zero provided that once the advancing movement is started, it cannot be stopped until zero is reached, in the case of indicating elements, the indications are automatically obscured during the reset process until the correct zero position is reached.

- 3.3. Indicating and recording elements shall advance only by the mechanical operation of the device (except for clearing the device to zero). Yes  No  N/A
- 3.4. If the indicating and recording elements advance to zero during the reset operation, the advancing movement cannot be stopped until zero is reached, or in the case of indicating elements only, the elements shall automatically be obscured until the elements reach the correct zero position. Yes  No  N/A

### 4. Graduations

**Code Reference: S.1.4.1. Length**

- 4.1. Graduations shall vary in length such that they may be conveniently read. Yes  No  N/A

**Code Reference: S.1.4.2., S.1.4.3. Width, Clear Interval Between Graduations**

For the purpose of visibility and ease of reading, several requirements exist for the length and width of graduations and the clear space between graduations. Although main graduations are permitted to be wider than subordinate graduations, it is

recommended that all graduations be of uniform width. The clear interval between graduations must be at least 1.0 mm (0.04 in). If the graduations are not parallel, then the clear interval is measured at specified points depending upon the type of indicator that is used. The points of measurement are (a) along the line of movement between the graduations and the end of the indicator, or (b) if the indicator extends over the entire length of the graduations measure at the point of widest separation of the graduations.

- 4.2. Graduations shall be at least 0.2 mm (0.008 in) wide. Yes  No  N/A
- 4.3. The clear interval between graduations shall be at least 1.0 mm (0.04 in). Yes  No  N/A
- 4.4. Graduations shall not be wider than the clear interval between the graduations. Yes  No  N/A
- 4.5. Main graduations shall not be more than 50 percent wider than subordinate graduations. Yes  No  N/A

## 5. Indicators

To facilitate reading values indicated on analog indicating elements, the index of the indicator must have a shape, length, and width that promotes the accurate reading of values. The index must be properly positioned to reduce reading errors.

### Code Reference: S.1.5.1. Symmetry

- 5.1. The index shall be symmetrical with respect to the graduations. Yes  No  N/A

### Code Reference: S.1.5.2. Length

- 5.2. The index shall reach to the finest graduations with which it is used unless the indicator and graduations are in the same plane. Yes  No  N/A
- 5.3. If the indicator and graduations are in the same plane, the distance between the end of the indicator and the ends of the graduations shall not exceed 1.0 mm (0.04 in). Yes  No  N/A

### Code Reference: S.1.5.3. Width

- 5.4. Width of the index of an indicator: Yes  No  N/A
- 5.4.1. The width of the index shall not exceed the width of narrowest graduation. This requirement applies to liquid measuring devices covered in Handbook 44 Section 3.30. Liquid-Measuring Devices Yes  No  N/A
- 5.5. The width of the index shall not exceed the width of the clear interval between graduations. Yes  No  N/A
- 5.6. If the index extends along the entire length of a graduation, the portion of the index that overlays the graduation shall be of constant width throughout the length of the graduation. Yes  No  N/A

### Code Reference: S.1.5.4. Clearance

- 5.7. The clearance between the index and the graduations shall not exceed 1.5 mm (0.06 inch). Yes  No  N/A

### Code Reference: S.1.5.5. Parallax

- 5.8. Parallax effects shall be reduced to practicable minimum. Yes  No  N/A

## 6. Measuring Elements

### Code Reference: S.2.1. Vapor Elimination (LPG S.2.1.)

If air enters through a metering system or the product changes into vapor as it passes through the system, then it must be equipped with a vapor eliminator to remove the air or vapor before it passes through the meter. To prevent the vapor return lines from being pinched closed and re-opened without being detected, the vent lines shall be made of metal tubing or other rigid material. If the system is designed such that air or vapor will not enter the system, then a vapor eliminator is not required. One example is when a product is being pumped from the bottom of a tank and a low-level detector in the tank shuts off the pump before the liquid level gets to the point where air could enter the system.

- 6.1. The metering system is equipped with an effective vapor eliminator. Yes  No  N/A
- 6.2. The vent lines are made of metal tubing or some other rigid material. Yes  No  N/A

## 7. Indicating and Recording Elements

### Code Reference: G-S.5.1., G-UR.1.1. General

Indicating elements must be appropriately designed and adequate in amount. Specifically, a device must have sufficient display capacity to indicate the quantities and total prices, if it applies in the normal encountered specific application. Electronic devices shall either have sufficient display capacity to indicate the normal quantities and money values or automatically stop the delivery before exceeding the display capacity of either the quantity or total price. Analog indicating elements are required to have sufficient display capacity, or the device is not suitable for the application. This consideration may apply when evaluating a system that may be used in either a truck stop or an automobile service station.

- 7.1. Analog dispensers shall have adequate display capacity for the application. Yes  No  N/A
- 7.2. An electronic digital indicating element shall either:
- 7.2.1. have adequate display capacity for the application, or Yes  No  N/A
- 7.2.2. automatically stop the delivery before exceeding the maximum quantity or maximum total price that can be indicated. Yes  No  N/A

### Code Reference: G-S.5.2.2. Digital Indication and Representation; S.1.6.6. Agreement Between Indications

Basic operating requirements for devices are that:

- All digital values of like value in a system shall agree.
- A digital value shall agree with its analog representation to the nearest minimum graduation.
- Digital values shall round off to the nearest digital division that can be indicated or recorded.
- When a digital zero display is provided, the zero indication shall consist of at least one digit to the left and all digits to the right of the decimal point.

Due to limitations of some of the technologies used to transmit information from dispensers to service station consoles, some exceptions to these rules have been given to the indications on retail motor fuel dispensers and service station consoles. Exact agreement of digital quantity values is not required if only total price information is sent from the dispenser to the console. In these cases, the console calculates the quantity from the unit price set in the console. Consequently, the quantity indicated on the console may not agree exactly with the quantity indicated on the dispenser. However, if the console prints a customer receipt, then the quantity times unit price must equal the total price on both the dispenser and the printed receipt.

Previously, the service station console was considered an auxiliary indication and did not have to satisfy the mathematical agreement requirement for money values (G-S.5.5.). A nonretroactive requirement effective January 1, 1988 requires all service station consoles installed after January 1, 1988 (not just new models) to satisfy the mathematical agreement of money values requirement (S.1.6.6.). The money value indication for dispensers and consoles must agree for all installations, both old and new.

For those systems consisting of a console and dispensers and equipped with pre-set volume, the dispenser must deliver at least the pre-set volume; it cannot deliver less. For example, if the console sends only the money equivalent of the pre-set volume to the dispenser, the dispenser shall deliver at least the pre-set volume. It may not stop at the first quantity amount that results in mathematical agreement with the money value equivalent of the pre-set volume if the quantity indication is less than the pre-set volume. Similarly, if a money value is pre-set, the dispenser is not properly designed if it always stops at the lowest quantity value that provides mathematical agreement with the pre-set money value.

Tests for agreement of digital values shall be performed in the postpay, prepay money, and pre-set volume models. Agreement should be checked at several unit prices including the maximum unit price and with the dispenser operating at its maximum flow rate.

- 7.3. All total sale money value indications in a computing system are primary indications and must agree. Yes  No  N/A
- 7.4. Digital volume indications in a non-computing system must agree or "round off" to the nearest minimum unit that can be indicated or recorded. Yes  No  N/A
- 7.5. Manual quantity entries in invoice billing systems must be identified as such. Yes  No  N/A
- 7.6. When delivery from a computing device is based upon a pre-set volume, the quantity indicated on the dispenser and any auxiliary device must be equal to or greater than the pre-set volume and the dispenser and remote console must comply with G-S.5.5. Money Yes  No  N/A

Values, Mathematical Agreement.

- 7.7. The quantity, unit price, and total price indications on the console shall be in mathematical agreement. **Yes**  **No**  **N/A**
- 7.8. The following applies when a quantity value indicated or recorded by an auxiliary element such as a console, ticket printer, or remote customer display, is a derived or computed value based on data received from a retail motor-fuel dispenser. **Yes**  **No**  **N/A**
- 7.8.1. The quantity values indicated or recorded on a console, electronic cash register, or other auxiliary indicating or recording element may differ, however: **Yes**  **No**  **N/A**
- 7.8.2. all indicated or recorded total money values for an individual sale shall agree; and **Yes**  **No**  **N/A**
- 7.8.3. the indicated or recorded quantity, unit price, and total sales price values shall be in mathematical agreement to the closest cent (i.e., within each element, the values indicated or recorded must meet the formula [quantity x unit price = total sales price] to the closest cent). **Yes**  **No**  **N/A**
- Examples: \$1.5549 rounds to \$1.55  
\$1.5551 rounds to \$1.56  
\$1.5550 rounds to either \$1.55 or \$1.56
- 7.9. The printed ticket and dispenser must comply with G.S.5.5. Money Values, Mathematical Agreement to the nearest cent (unit price x volume = total sale  $\pm$  0.5 cent). **Yes**  **No**  **N/A**
- 7.10. Digital values agree with their associated analog value to the nearest minimum graduation. **Yes**  **No**  **N/A**

**Code Reference: G-S.5.5. Digital Money Values, Mathematical Agreement**

Any recorded money value and any digital money value indication on a primary indicator must agree mathematically with its associated quantity (volume) representation or indication to the nearest one cent.

Formula: Unit Price x Indicated Volume = Total Sale  $\pm$  0.5 cent

- 7.11. Check mathematical agreement of all primary indications (e.g., dispenser, console, printer) under the following conditions:
- 7.11.1. At various flow rates, including maximum and minimum. **Yes**  **No**  **N/A**
- 7.11.2. Snapping nozzle on and off several times during delivery. Check mathematical agreement each time flow is halted. **Yes**  **No**  **N/A**
- 7.11.3. At several unit prices including the low prices and the maximum pricing capability of the computer and when operating at the maximum flow rate. **Yes**  **No**  **N/A**
- 7.11.4. Turn the dispenser off during delivery with nozzle open. **Yes**  **No**  **N/A**

**Code Reference: G-S.5.1. Indicating and Recording Elements/General**

Discount Pricing. - Handbook 44 requires that, except for dispensers used for fleet sales, other price contract sales, truck refueling (e.g., truck stop dispensers used only to refuel trucks), when a product or grade is offered for sale at more than one unit price through a computing device, the selection of the unit price shall be made prior to delivery using controls on the device or other customer-activated controls.

Should the customer elect to use another method of payment following completion of delivery, the console may be used to recalculate the total price -- provided the dispenser complies with all applicable Handbook 44 requirements. For example, the customer selects the credit card unit price on the dispenser and dispenses product at that unit price. However, the customer discovers that he forgot his credit card and decides to pay cash. In this case, the console might be used to calculate the total price at the cash unit price. In keeping with the intent of NCWM action in 1989 to require dispensers to calculate at all unit prices for which a product is offered for sale, it is anticipated that the console would be required to recalculate the new total price using the formula (quantity x unit price = total price). Except for fleet sales and other contract sales, a receipt providing the total volume unit price, total computed price and product identity 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. (Code Reference S.1.6.7) as the transaction was completed. The recorded and displayed total volume on the receipt and dispenser, respectively, shall agree.

Selectable Unit Price Capability. - Selectable unit price capability is a design feature that permits the customer to select the unit price for a particular transaction at the time of sale. A dispenser may then allow the unit price for a delivery to be selected from two or more unit prices.

If the customer selects the unit price at the dispenser (e.g., cash or credit price), the selection may be made at any time prior to the start of product flow. The dispenser operating handle may be on when the selection is made. A system shall not permit a change to the unit price during delivery of product.

After a transaction is completed, the unit price displayed at the dispenser may be changed to a base unit price. However, the quantity and total price must be displayed on the face of the dispenser for at least 5 minutes or until the next transaction is initiated. Any display of quantity, unit price, and total price that does not mathematically agree occurs between transactions. This is permitted (in response to demands of device users) because the displayed values between "transactions" are not "significant" relative to the actual delivery process (transaction).

The displayed unit price may revert to the base unit price immediately after the completion of a transaction, defined as the time the delivery has been terminated and payment has been settled. The payment may be automatic if the delivery is to a pre-paid amount. If the sale is prepaid, the delivery is considered terminated after the "handle" is in the off position or after the nozzle has been returned to the designed hanging position. This will allow the customer adequate time to observe that the prepaid amount has been reached. If the delivery stops short or overruns a prepaid amount, settling the payment means that money is either refunded or collected from the customer and the transaction is "cashed out" by the console operator.

In the case of invoice billing systems, such as card-lock or key-lock systems which compute the total sale price, it is considered not appropriate for the displayed unit price to revert to the base unit price immediately following a transaction. Because a receipt for the transaction may not be available, the customer must be allowed an adequate period of time following the delivery to record the transaction information. The transaction unit price must be displayed for at least 30 seconds, and the total price and the quantity must be displayed for at least 5 minutes following the completion of the delivery or the start of the next transaction. The delivery is considered complete after the "handle" is off or the nozzle has been returned to its designed hanging position.

- 7.12. A dispenser may be equipped with means for selecting more than one unit price, provided that the selected unit price cannot be changed after the initial flow begins. Yes  No  N/A
- 7.13. The selected unit price must be made clearly evident on the dispenser. Yes  No  N/A
- 7.14. Once selected the unit price cannot be changed by the operator at the console prior to or during the delivery. Yes  No  N/A
- 7.15. The selected unit price displayed at the dispenser prior to the delivery of product must be continuously displayed at the conclusion of the delivery by moving the operating mechanism to the "off" position, until the start of the next transaction by:
- 7.15.1. Movement of the operating mechanism to the "on" position, or Yes  No  N/A
- 7.15.2. "Authorization/Approval" by the console operator, whichever occurs first. Yes  No  N/A
- 7.16. 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 by using controls on the device or other user-activated (i.e., customer-activated) controls.
- 7.17. In a system where a base unit price is automatically displayed on the dispenser after the completion of a transaction (i.e., product is dispensed and payment is settled), the dispenser may display the values for quantity, unit price, and total price that do not result in a mathematically correct equation. That is provided when the total price value displayed is divided by the quantity value displayed, the result is a unit price that is "posted" for a particular kind of transaction. Yes  No  N/A

**Credit Card- or Debit Card-Activated Retail Motor-Fuel Dispenser** - On card-activated retail motor fuel dispensers, the customer authorizes the dispenser by inserting the card or swiping the card through a slot. On credit card transactions, the customer is typically billed through the same methods as have been used for credit transactions handled through a station attendant. On debit card transactions, payment is made directly from the purchaser's account by electronic funds transfer.

- 7.18. A receipt must be available to the customer at the completion of the transaction. The issuance of the receipt may be initiated at the option of the customer. Yes  No  N/A
- 7.19. The customer receipt must contain the following information:

- 7.19.1 The identity (codes may be used) of the product purchased, the quantity purchased, the unit price, and the total price. **Yes**  **No**  **N/A**
- 7.20. Cash Value Card - A cash value card that is initially encoded with the purchase price, authorizing a customer to purchase products up to the current cash value of the card. The value of the card is decreased in amounts equal to individual transactions. **Yes**  **No**  **N/A**

Means shall be provided to the customer to determine the initial cash value of the card and the remaining cash value prior to and after each transaction.

- 7.21. Invoice Billing - Invoice billing is a process in which customers are billed for one or more transactions at the end of a billing period. **Yes**  **No**  **N/A**
- 7.21.1. For computing systems, the date, quantity, unit price, and total price shall be recorded and shall agree with the indications on the dispenser. **Yes**  **No**  **N/A**
- 7.21.2. When non-computing analog dispensers are used and the billing is on the basis of individual quantities for each transaction (non-cumulative), the value of the smallest unit of displayed quantity for each transaction shall be not greater than 0.1 gallon providing the "pulser" and the recorded quantity used for billing are each equal to or less than 0.01 gallon. **Yes**  **No**  **N/A**
- 7.21.3. All displayed transaction information must be shown for at least 30 seconds after completing a delivery or starting the next transaction. The delivery is considered complete after the "handle" is off or after the nozzle has been returned to its designed hanging position. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.5.2. Money-Value Divisions, Digital**

**Yes**  **No**  **N/A**

- 7.22. 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 0.05-liter intervals for devices indicating in metric units or 0.01-gallon intervals for devices indicating in inch-pound units. **Yes**  **No**  **N/A**

*Note: At least four decimal places in cents must be carried to determine the proper round off of money values.*

**Code Reference: S.1.2. Primary Elements/Units**

- 7.23. If the device is equipped to record, it will indicate and record, if equipped to record, its deliveries in terms of liters or gallons and decimal or binary submultiples of a liter or gallon. **Yes**  **No**  **N/A**

**Code Reference: S.1.2.3. Value of Smallest Unit**

- 7.24. The value of the quantity division shall not exceed the equivalent of one pint. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.1. Indication of Delivery**

- 7.25. Retail devices shall automatically show their initial zero condition and amount delivered up to the nominal capacity of the device. **Yes**  **No**  **N/A**
- 7.26. The initial indication on digital indicators may be "suppressed" or not indicated up to a maximum of 0.03 liter or 0.009 gallon. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.2.1., S.1.6.2.2. Provisions for Power Loss**

Even if power fails during a delivery, it is still necessary to correctly complete all transactions in progress at the time of the power failure. Quantity and total sales price information shall be recallable for at least 15 minutes after the power failure. The information may be recalled at the dispenser or at the console if the console indications are accessible to the customer. Operator information, such as fuel and money value totals, shall be retained in memory during a power failure. The operator information is not required to be recallable during the power failure, but shall be recallable after power is restored. Test to determine if the indications are accurate when the delivery is continued after a power failure.

*Note: For remote controllers (e.g., cash register, console, etc.) which have the capability to retain information pertaining to a transaction (e.g., stacked completed sales). If the information cannot be recalled at the dispenser following a power outage, means (e.g., uninterruptible power supply or other means) must be provided to enable the transaction information to be recalled and verified for at least 15 minutes following a power outage.*

- 7.27. The quantity and total sales price shall be recallable for 15 minutes after the power failure. Yes  No  N/A
- 7.28. The quantity and total sales price values shall be correct if the power fails between deliveries. Yes  No  N/A
- 7.29. The quantity and total sales price values shall be correct if the delivery is continued after a power failure. Yes  No  N/A
- 7.30. The operator's information shall be retained in memory during a power failure. Yes  No  N/A
- 7.31. Remote controllers which stack completed sales must have a means to enable the transaction information to be recalled and verified for at least 15 minutes. Yes  No  N/A

**Code Reference: S.1.6.3. Return to Zero**

The primary indicating and recording elements of a retail device shall readily return to a definite zero indication. Key-lock and other self-operated devices must have a zero-return indicating element, but they are not required to have the recording element return to zero. These devices may be equipped with cumulative recording elements. The primary indicating and recording elements shall not go beyond their correct zero position.

- 7.32. Does the device have a primary recording element? Yes  No  N/A
- 7.33. The indicating and recording elements of a retail device shall readily returnable to a definite zero indication. Yes  No  N/A
- 7.34. Key-lock and self-operated devices shall have an indicating element that returns to zero. Yes  No  N/A
- 7.35. Does the device have:
- 7.35.1. a cumulative indicating element? Yes  No  N/A
- 7.35.2. a cumulative recording element? Yes  No  N/A
- 7.36. Primary indicating and recording elements shall not go beyond their correct zero position. Yes  No  N/A

**Code Reference: S.1.6.4.1. Display of Unit Price**

A computing or money-operated device shall have a means on the face of the device for displaying the unit price at which it is set to compute or deliver. If a grade, brand, blend, or mixture is offered for sale at more than one unit price from a device, then all of the unit prices at which that product is offered for sale shall be displayed or shall be capable of being displayed on the dispenser using controls available to the customer prior to the delivery of the product. The unit price shall be expressed as a decimal value in dollars.

- 7.37. Means shall be provided to display the unit price on the face of the device. Yes  No  N/A
- 7.38. If a grade, brand, blend, or mixture is offered for sale at more than one unit price from a device, then all of the unit prices at which that product is offered for sale.
- 7.38.1. shall be displayed prior to the delivery of the product, or Yes  No  N/A
- 7.38.2. shall be capable of being displayed on the dispenser using controls available to the customer. Yes  No  N/A

*Note: It is not necessary to simultaneously display all of the unit prices for all grades, brands, blends, or mixtures provided the dispenser complies with this section, S.1.6.4.1. The unit prices for each product and price level may be:*

- a. displayed simultaneously for all products;
- b. displayed simultaneously for each product separately; or
- c. displayed individually in a unit-price display only if controls permit the customer to sequence the display through the unit prices for each and every product.

*Note: Section 7.41.2[LD1] shall not apply to fleet sales, other contract sales, or truck refueling sales (e.g. sales from dispensers used to refuel trucks).*

- 7.39. The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price, (e.g., \$1.299 not \$1.29 9/10). Yes  No  N/A

**Code Reference: S.1.6.4.2., Display of Product Identity**

7.40. Means shall be provided to post the identity of the product grade, brand, blend, or mixture or dispensed product. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.5.5., Display of Quantity and Total Price**

When a delivery is completed on a computing device, 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 by using controls on the device or other customer-activated controls.

*Note: The displayed unit price may revert to a base unit price immediately after the completion of a transaction, defined as the time the delivery has been terminated and payment has been settled. Any display of quantity, unit price, and total price that does not mathematically agree occurs between transactions and is permitted (in response to demands of device users) because the displayed values between "transactions" are not "significant" relative to the actual delivery process (transaction).*

**8. Computing**

A retail computing device shall be capable of computing total sale prices for all unit prices and for all deliveries within the range of measurement or computing capacity. The maximum value of the money-value division and the maximum variation of indicated total sale price from the mathematically computed total sale price are specified for analog devices. Because analog dispensers may have different money-value divisions depending upon the unit price, the service station console must update in the same money-value division to maintain agreement of total sale price values. The maximum quantity-value divisions for digital devices are prescribed.

**Code Reference: S.1.6.5. Money-Value Computations**

8.1. A retail computing device shall compute total sale prices for all quantities and unit prices within the range of its quantity and computing capacities. **Yes**  **No**  **N/A**

*Note: For dispensers which are not capable of complying with the requirements of UR.3.2., UR.3.3., and S.1.6.5., the Certificate of Conformance must be limited to single-tier pricing applications.*

*Note: This requirement does not apply to devices for which the Certificate of Conformance is limited to installations where the devices are used for fleet sales, other price contract sales, and truck stop dispensers used only to refuel trucks.*

8.2. Analog money value indications on each side of a device shall not differ from the mathematically computed money value (Quantity x Unit Price = Sales Price), for any delivered quantity, by an amount greater than the values shown in the following table: **Yes**  **No**  **N/A**

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¢	± 1¢	± 1¢
0.25/liter or \$1.00 / gallon	0.75/liter or \$3.00 / gallon	1¢ or 2¢	± 1¢	± 2 ¢
0.75 liter or \$3.00 / gallon	2.50/liter or \$10.00/gallon	1¢ or 2¢ 5¢	± 1¢ ± 2.5 ¢	± 2 ¢ ± 5 ¢
(See H-44 N.4.3. for Test Procedures)				

8.3. Total prices indicated on the two sides of an analog register shall agree within one-half of the money value division. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.5.1. Analog Money-Value Divisions**

Analog money-value divisions shall be as follows:

8.4. Not more than 1 cent at all unit prices up to and including \$0.25 per liter or \$1.00 per gallon. **Yes**  **No**  **N/A**

8.5. Not more than 2 cents at all 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. Yes  No  N/A

8.6. Not more than 5 cents at all unit prices greater than \$0.75 per liter or \$3.00 per gallon. Yes  No  N/A

**Code Reference: S.1.6.5.2. Digital Money-Value Divisions**

8.7. Digital quantity and total price indications shall agree to the nearest cent. Yes  No  N/A

8.8. Total price indications shall be based on quantity-value divisions that are less than or equal to 0.05 liters or 0.01 gallons. Yes  No  N/A

**Code Reference: S.1.6.5.3. Money-Value Divisions, Auxiliary Indications**

8.9. Money value divisions on devices such as remote consoles and printers shall be the same as on the dispenser. Yes  No  N/A

**Code Reference: S.1.6.5.4., Selection of Unit Price**

8.10. Except for dispensers used exclusively for truck refueling (e.g., truck stop dispensers used only to refuel trucks), when a product or grade is offered for sale at more than one unit price through a computing device, the selection of the unit price shall be made:

8.10.1. prior to delivery using controls on the device, or Yes  No  N/A

8.10.2. other customer-activated controls Yes  No  N/A

A system shall not permit a change to the unit price during delivery of product.

*Note: This requirement does not apply to devices for which the Certificate of Conformance is limited to installations where the devices are used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks).*

**Code Reference: S.1.6.8. Travel of Indicator on Lubricant Devices**

8.11. If the most sensitive element of the indicating system of a lubricant device uses an indicator and graduations, the relative movement of these parts shall be at least 2.5 cm (1 in) per 0.5 L (1 pt) of delivery. Yes  No  N/A

## 9. Measuring Elements

**Code Reference: S.2.2. Provision for Sealing**

Measuring elements shall be designed with adequate provisions to prevent changes from being made to the measuring element or the flow rate control (if the flow rate control affects the accuracy of deliveries) without evidence of the change being made. These provisions can be an approved means of security (e.g., data change audit trail) or physically applying a security seal which must be broken before adjustments can be made. When applicable, the adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

9.1. A measuring element shall have provisions for either:

9.1.1. applying a physical security seal, or Yes  No  N/A

9.1.2. an approved means of security (e.g., data change audit trail) so that no changes may be made to its adjustable components. Yes  No  N/A

9.2. Any adjustable element controlling the delivery rate shall provide for sealing or other approved means of security (e.g., data audit trail) if the flow rate affects the accuracy of deliveries. Yes  No  N/A

9.3. When applicable, the adjusting mechanism shall be readily accessible for the purposes of affixing a security seal. Yes  No  N/A

9.4. Audit trails shall use the format set forth in the Common and General Code Criteria section of this checklist (Code Reference G-S.8) and in Appendix A, Audit Trail Checklist for Liquid-Measuring Devices. Yes  No  N/A

9.5. Retail motor-fuel dispensers with remote configuration capabilities shall be sealed according to Table S.2.2. in Appendix A, Minimum Requirements for Audit Trails for Liquid-Measuring Devices and under the "Common and General Code Criteria" section of this checklist. Yes  No  N/A

**Code Reference: S.2.2.1. Multiple Measuring Devices with a Single Provision for Sealing**

9.6 A change to the adjustment of any measuring element shall be individually identified. **Yes**  **No**  **N/A**

*Note: Examples of acceptable identification of a change to the adjustment of a measuring element include but are not limited to:*

- a. a broken, missing, or replaced physical seal on an individual measuring element,
- b. a change in a calibration factor for each measuring element,
- c. display of the date of or the number of days since the last calibration event for each measuring element or,
- d. a counter indicating the number of calibration events per measuring element.

**Code Reference: S.2.3. Directional Flow Valves**

9.7 Values intended to prevent the reversal of flow shall be automatic in operation. **Yes**  **No**  **N/A**

**Code Reference: S.2.4. Stop Mechanism**

If a device is hand-operated via a crank, the device is likely to have "stops" or tabs designed to stop the cranking operation at the point representing the nominal quantity to be delivered in one cycle. The stops must be held securely in place and marked with the nominal quantity represented by one cycle of the cranking process.

9.8 Stops must be held securely in position. **Yes**  **No**  **N/A**

9.9 Each stop shall be marked with the nominal quantity to be delivered by cranking to each stop. **Yes**  **No**  **N/A**

9.10 Stops shall be adjustable so deliveries will be within tolerance. **Yes**  **No**  **N/A**

**Code Reference: S.2.5. Zero-Set-Back Interlock**

The zero-set-back interlock on a dispenser is critical to prevent fraudulent practices. A retail motor-fuel device shall have an effective automatic interlock such that once the dispenser shuts off, it cannot be restarted without resetting the indicating element to zero. This requirement also applies to the recording element if one is present. The dispenser shall be designed so that the starting lever must be in the shut-off position and the interlock engaged before the discharge nozzle can be returned to its designed hanging position. If a single pump supplies more than one dispenser, then each dispenser shall have an automatic control valve that prevents product from being delivered by a dispenser until its indications have been set to zero.

9.11 After the device is turned off by moving the lever that stops the flow, a subsequent delivery shall be prevented until the indicators (and recording element if present) have returned to their correct zero positions. **Yes**  **No**  **N/A**

9.12 The starting lever shall be in shut off position and zero-set-back interlock engaged before the nozzle can 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. **Yes**  **No**  **N/A**

9.13 If more than one dispenser is connected to a single pump, an automatic control valve shall prevent fuel from being delivered until the indicating elements have been returned to their correct zero position and engaged. **Yes**  **No**  **N/A**

9.14 The use of the interlock shall be effective under all conditions when any control on the console, except a system emergency shut-off, is operating and after any momentary power failure. **Yes**  **No**  **N/A**

**Code Reference: S.2.8. Lubricant Devices, Supply Exhaustion**

A lubricant device that is not a meter type shall become inoperable or give a conspicuous and distinct warning when the level of the supply of lubricant becomes so low that it may affect the accuracy of the measurement.

**10. Discharge Lines and Discharge Line Valves****Code Reference: S.3.1. Diversion of Measured Liquid**

This paragraph does not apply to devices that comply with Paragraph S.3.2.

To prevent fraudulent practices, no means for which any measured liquid can be diverted from the measuring chamber or the discharge line of a device shall be available.

A device may have two or more delivery outlets if there are automatic means to insure that:

- a. liquid can flow from only one outlet at a time, and
- b. the direction of liquid flow is definitely and conspicuously indicated.
- 10.1. Except as identified above, it shall not be possible to divert measured liquid from the measuring chamber or the discharge line of the device. **Yes**  **No**  **N/A**
- 10.2. Two or more delivery outlets may be installed if there are automatic means to ensure that liquid can flow from only one outlet at a time, and the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated. **Yes**  **No**  **N/A**
- 10.3. Except as identified above, a manually controlled outlet may be installed to be opened for purging or draining the measuring chamber when the system is measuring food products or recirculating agri-chemical products in suspension. If suitable means are provided to ensure liquid cannot flow through any such outlet during normal operation and to prevent advancement of meter indications and recorded representations while the outlet is in use **Yes**  **No**  **N/A**

**Code Reference: S.3.2. Exceptions**

If suitable means are provided to prevent the diversion of liquid flow to other than the receiving vehicle, devices that are specifically installed for fueling trucks are exempt from the provisions of S.3.1. and may have two outlets operating simultaneously.

- 10.4. For devices that are specifically installed for fueling trucks, two outlets may be operated simultaneously only if suitable means are provided to ensure that diversion of flow to other than the receiving vehicle cannot readily be accomplished and is readily apparent. Such means include, but are not limited to, physical barriers to adjacent driveways, visible valves or lighting systems indicating which outlets are in operation, and explanatory signs. **Yes**  **No**  **N/A**

**Code Reference: S.3.3. Pump-Discharge Unit**

- 10.5. If a pump-discharge unit is equipped with a flexible discharge hose, it shall be a wet-hose type. **Yes**  **No**  **N/A**

**Code Reference: S.3.5. Discharge Hose**

- 10.6. A discharge hose shall be adequately reinforced. **Yes**  **No**  **N/A**

**Code Reference: S.3.6. Discharge Valve**

- 10.7. A discharge valve may be installed in the discharge line only if the device is of the wet-hose type. **Yes**  **No**  **N/A**

**Code Reference: S.3.7. Antidrain Valve**

- 10.8. A wet-hose, pressure-type device shall have an effective anti-drain valve incorporated in the discharge valve or adjacent thereto. **Yes**  **No**  **N/A**

**11. Marking****Code Reference: S.4.1.1. Marking Requirements; Limitation on Use**

- 11.1. If a device is intended to accurately measure only products having particular properties or under specific installation or operating conditions or when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently stated on the device. A meter may be used to measure both gasoline and diesel fuel at different times provided the meter is tested and adjusted with the product to be measured before it is used commercially. **Yes**  **No**  **N/A**

**Code Reference: S.4.4. Marking Requirements For Retail Devices Only**

- 11.2. On a retail device with a designed maximum discharge rate of 115 L/min (30 gpm) or greater, the maximum and minimum discharge rates shall be marked in accordance with NIST Handbook 44 S.4.4.2. The minimum rate shall not exceed 20 percent of the maximum discharge rate. **Yes**  **No**  **N/A**

Example: With a marked maximum discharge rate of 230 L/min (60 gpm), the marked minimum discharge rate shall be 45 L/min (12 gpm) or less (e.g., 40 L/min (10 gpm) is acceptable). A marked minimum discharge rate greater than 45 L/min (12 gpm) (e.g., 60 L/min (15 gpm)) is not acceptable.

**Code Reference: S.4.4.2. Location of Marking Information**

- 11.3. The required marking information in the General Code, paragraph G-S.1. shall be located as follows:
- a. shall be within 24 to 60 inches from the base of the dispenser; **Yes**  **No**  **N/A**
  - b. may be internal and/or external provided the information is permanent and easily read; **Yes**  **No**  **N/A**
  - c. shall be on a portion of the device that cannot be readily removed or interchanged ( i.e., not on a service access panel). **Yes**  **No**  **N/A**

*Note: the use of a dispenser key or tool to access internal marking information is permitted.*

**12. Totalizers****Code Reference: S.5.1. 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.

**13. User Requirements****Code Reference: UR.1.1. Length of Discharge Hose**

- 13.1. The length of a discharge hose shall not exceed 5.5 m (18 ft), but marinas and airports may have hoses up to 15 m (50 ft) long. **Yes**  **No**  **N/A**
- 13.2. If the length of a discharge hose in a marina or airport exceeds 8 m (26 ft), it shall be adequately protected from environmental factors. **Yes**  **No**  **N/A**

**Code Reference: UR.3. Use of Device**

*Note: For dispensers which are not capable of complying with the requirements of UR.3.2., UR.3.3., and S.1.6.5., the Certificate of Conformance must be limited to single-tier pricing applications.*

**14. Installation Requirements****Code Reference: UR.2.1. Installation**

- 14.1. A device shall be installed according to the manufacturer's instructions, and the installation shall be sufficiently secure and rigid to maintain this condition. **Yes**  **No**  **N/A**

**Code Reference: UR.2.2. Discharge Rate**

- 14.2. Actual maximum discharge rate shall not exceed the rated maximum discharge rate. **Yes**  **No**  **N/A**

**15. Card-Activated Retail Motor-Fuel Dispensers****Code Reference: G-S.2. Facilitation of Fraud**

Accidental or intentional fraud causes great concern when customers use card-activated systems in service stations, bank-card-activated systems directly access bank accounts. The following criteria and test procedures apply to card-activated retail motor-fuel dispensers.

A card-activated system shall authorize the dispensing of product for not more than three minutes for the time between authorization and "handle on" at the dispenser. It shall properly record transactions on the appropriate card account.

When a card-activated system is subjected to power loss of greater than 10 seconds, the dispenser shall de-authorize. Because systems may be installed with separate power lines to the console, card reader, and dispenser, tests should be run with power failures to different parts of the system to evaluate the potential for accidental or intentional errors. The appropriate device response depends when the power loss occurs during the delivery sequence.

- 15.1. The dispenser must de-authorize in not more than three minutes if the pump "handle" is not turned on. **Yes**  **No**  **N/A**
- 15.2. If the time limit to deactivate a dispenser is programmable, it shall not accept an entry greater than three minutes. **Yes**  **No**  **N/A**
- 15.3. When a power loss greater than 10 seconds occurs after the pump "handle" is on, the dispenser must de-authorize. **Yes**  **No**  **N/A**
- 15.4. When there is a loss of power, but the pump "handle" is not on, the dispenser must de- **Yes**  **No**  **N/A**

authorize in not more than three minutes.

## 16. Test Methods for Card-Activated Retail Motor-Fuel Dispensers

- 16.1. Authorize the dispenser and, with the pump "handle" on, interrupt power to any part (or all) of the system. The pump should deauthorize immediately. **Yes**  **No**  **N/A**   
Specifically:

- Authorize with a card and turn the "handle" on
- Power down briefly, then restore power
- Try to dispense product: the dispenser must not dispense because the power failure should have de-authorized the dispenser.

- 16.2. Authorize the dispenser using a card (leaving handle off); wait more than three minutes, and try to start the dispenser. It should not start because the authorization should have timed out. Specifically, **Yes**  **No**  **N/A**

- 16.2.1. Authorize with a card, but do not turn the "handle" on. Power down for more than three minutes, and then restore power. Try to dispense product; the dispenser should have "timed-out" and not dispense. **Yes**  **No**  **N/A**

- 16.2.2. Authorize and dispense with card #1. **Yes**  **No**  **N/A**   
Allow the system to time out and de-authorize (if it does).  
Do not turn off the "handle."  
Authorize and dispense with card #2.  
The transactions shall be properly recorded for each card.

*Note: A mechanical register may accumulate the two deliveries, but the printed record must not have accumulated values.*

- 16.2.3. Authorize with card #1. Turn the "handle" on, then off. Authorize with card #2. Dispense product and complete the delivery. Check the printed receipt to verify that the delivery has been properly charged to card #2. **Yes**  **No**  **N/A**

- 16.2.4. Turn the dispenser "handle" on, and use a card to authorize the dispenser. Turn the "handle" off. After a period of 15 seconds, turn the "handle" on. Try to deliver product; the dispenser must not dispense. **Yes**  **No**  **N/A**

- 16.2.5. Authorize with card #1 (do not turn the "handle" on) and interrupt power for at least 10 seconds. This should de-authorize the dispenser. **Yes**  **No**  **N/A**   
Resupply power; turn the "handle" on; try to dispense. The dispenser shall not deliver product.

*Note: The term "handle" generically refers to the handle, flapper, start button, on/off switch, or other mechanism used to activate or deactivate the dispenser.*

- 16.2.6. Authorize with card #1; turn the "handle" on, and then interrupt power. This should de-authorize the dispenser. **Yes**  **No**  **N/A**   
Resupply power and authorize the dispenser with card #2.  
Then, complete a delivery.  
Verify that the transaction is charged to card #2.

*Note: This test is not required if the device under test complies with paragraph 16.1.*

- 16.2.7. Authorize a dispenser with card #1, but do not turn the dispenser "handle" on. **Yes**  **No**  **N/A**   
Try to authorize the same dispenser with card #2; it should not be accepted until after the 3 minute time-out.

- 16.3. Attempt to override or confuse the card system by varying the length of time the card is in the slot, (i.e., vary the "swipe" times) and pushing all other keys on the keypad during each step of the authorization process. **Yes**  **No**  **N/A**

## 17. Checklist for Cash-Activated Retail Motor-Fuel Dispensers

The following criteria and test procedures apply to cash-activated retail motor-fuel dispensers. Tests using various denominations of bills accepted by the cash acceptor should be performed.

Certificates of Conformance will cover the use of the cash acceptor option at both attended and unattended stations. Cash Acceptors which are used at unattended locations must meet the marking requirements of paragraph G-UR.3.4. Responsibility, Money-Operated Devices shall be clearly and conspicuously displayed on the device or immediately adjacent to the device information detailing the return of monies paid when the product cannot be obtained.

**Code Reference: S.1.6.2. Provisions for Power Loss**

Even if power is interrupted during a delivery, it is still necessary to correctly complete all transactions in progress at the time of the power interruption. 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, sales price, or amount of money already inserted into the cash acceptor) shall be determinable for at least 15 minutes at the dispenser or at the console or journal printer if the console or journal printer is accessible to the customer.

All portions of the transaction must be accounted for in order to complete the transaction. This information would include the following: (1) the total amount of money that was inserted into the device prior to the power interruption, (2) the amount of product already dispensed (which should be available from the dispenser and which must comply with the requirements of S.1.6.2., (3) and any bill that has been inserted but has not yet been recognized by the cash acceptor.

*Note: For bills that have not yet been drawn into the cash acceptor to the point that the bill is no longer visible, it is assumed that the information on the bill denomination can be obtained from visual examination.*

Various methods may be used to recall specific portions of the transaction depending on how the basic system operates. For example, systems that can print a record of the amount fed into the machine as each bill is fed into the device maintain an ongoing record of bills recognized by the system. Other systems may not print a receipt until the end of the transaction, so the information is recalled on a journal printer accessible to the customer or can be recalled on the cash acceptor display

Check to see what happens when the power is interrupted at different points of the transaction. Note what occurs at the points where power is interrupted, what information is provided to the customer on the receipt, audibly and visually in the form of instructions or error messages. Because systems may be installed with separate power lines to the console, card reader, and dispenser may be installed, tests should be run with power interruptions to different parts of the system to evaluate the potential for accidental or intentional errors. The appropriate device response depends upon when the power loss occurs during the delivery sequence.

17.1. Systems with Battery Back-up or Uninterruptible Power Supply or Equivalent - Some **Yes**  **No**  **N/A**

systems are equipped with a battery back-up or an uninterruptible power supply (or equivalent) which allows a transaction to continue in the event of a power loss. For such systems, the transaction in progress at the time of a power interruption must continue as if no power interruption had occurred (or comply with the requirements for systems not equipped with a battery back-up). That is, all bills (including bills being fed into the device at the time of the power loss) must be correctly accounted for, and the quantity and total sale amounts must be mathematically correct. Check these systems by interrupting power at several points in the transaction to ensure that all information (total price, quantity, mathematical agreement, and total dollar amount inserted by the customer) is accounted for correctly.

All Other Systems - To check the operation of systems not equipped with a battery backup, uninterruptible power supply, or equivalent, interrupt power as described below. As noted earlier, if separate power lines supply different components in the system, interrupt power to different parts of the system.

17.2. When one or more bills has been accepted and registered by the device, but product has not yet been dispensed, at least one of the following criteria must be met to ensure that this information can be recalled in the event of a power interruption: **Yes**  **No**  **N/A**

17.2.1. the denomination of the bill must be printed by the printer on the device as the device recognizes the bill. (The printed receipt must be available to the customer.) **Yes**  **No**  **N/A**

17.2.2. the denomination of each bill must be printed by a journal or other printer accessible to the customer as each bill is recognized by the device **Yes**  **No**  **N/A**

17.2.3. the running total display must be capable of being recalled for at least 15 minutes. **Yes**  **No**  **N/A**

17.2.4. means provided to enable the customer to retrieve the money inserted into the **Yes**  **No**  **N/A**

device (e.g., a button which can be used during a power interruption to eject the money inserted by the customer).

- 17.2.5. other means used to provide a visual or printed record of the total amount of money accepted by the device. **Yes**  **No**  **N/A**
- 17.3. There is a brief period of time during which a bill has been accepted by the cash acceptor but has not yet been recognized by the device. The following criteria must be met to ensure completion of that this information can be recalled in the event of a power failure. **Yes**  **No**  **N/A** 
  - 17.3.1. Means provided to enable the attendant or customer to retrieve the bill (for example, a button which can be used during a power interruption to eject the bill or if the cash acceptor box can be removed by the attendant and the bill retrieved). **Yes**  **No**  **N/A**

*Note: There may be a space of time in which a bill can be caught partially in and out of the cash acceptor during a power interruption. In such a case, if the denomination of the bill is visible to the customer and attendant, this is sufficient to provide information about the bill being fed into the device at the time of the power interruption. The cash acceptor must comply with the other applicable items noted above.*

It is expected that the retail motor-fuel dispenser will comply with S.1.6.2. and the information on the product already dispensed can be recalled through this portion of the system.

- 17.4. Power should be interrupted at different points in the transaction to determine that all transaction information can be recalled in the event of a power interruption including combinations of the following:
  - 17.4.1. after one bill has been inserted **Yes**  **No**  **N/A**
  - 17.4.2. after several bills have been inserted **Yes**  **No**  **N/A**
  - 17.4.3. while a bill is being inserted **Yes**  **No**  **N/A**
  - 17.4.4. after a bill has been inserted but not yet recognized **Yes**  **No**  **N/A**
  - 17.4.5. after a bill(s) has been inserted and recognized, but the on/off handle is still in the "off" position **Yes**  **No**  **N/A**
  - 17.4.6. after a bill(s) has been inserted and recognized, the on/off handle is in the "on" position, but no product has been dispensed **Yes**  **No**  **N/A**
  - 17.4.7. after a bill(s) has been inserted and recognized, the on/off handle is in the "on" position, and product is being dispensed **Yes**  **No**  **N/A**

**Code Reference: G-S.5.1. Indicating and Recording Elements, General**

- 17.5. Total Money Display - A running display showing the amount of money fed into the machine must be provided. It is not necessary for this information to be displayed once the customer initiates delivery. **Yes**  **No**  **N/A**
- 17.6. Printed Receipt - A printed receipt must be available to the customer from the device at the completion of the transaction. The issuance of the receipt may be initiated at the option of the customer. **Yes**  **No**  **N/A** 
  - 17.6.1. The customer receipt must contain the following information: **Yes**  **No**  **N/A** 

The identity (codes may be used) of the product purchased, the quantity purchased, the unit price, and the total price.

Because the customer must be provided with the option of receiving a receipt, the system must not accept cash if sufficient paper is not available to complete the transaction.

The cash acceptor must not initiate a cash transaction if either of the following conditions are true:

- no paper is in the receipt printer of the cash acceptor **Yes**  **No**  **N/A**
- insufficient paper is available to complete a transaction **Yes**  **No**  **N/A**

**Code Reference: G-S.6. Marking Operational Controls, Indications, and Features**

- 17.7. Instructions must be marked on the device to inform the customer how to operate the cash **Yes**  **No**  **N/A**

acceptor.

**Code Reference: G-S.2., Facilitation of Fraud**

- 17.8. Means must be provided for the customer to cancel the transaction at any point. **Yes**  **No**  **N/A**
- 17.8.1. The customer has inserted cash, but has not yet dispensed product. If the customer cancels the transaction by pressing the cancel key (or equivalent key(s)) or by lowering the on/off handle, the device must either: **Yes**  **No**  **N/A**
- 17.8.1.1. be equipped with means for the customer to retrieve the cash inserted from the device AND **Yes**  **No**  **N/A**
- automatically issue a printed receipt indicating the amount tendered and the amount returned OR
- 17.8.1.2. display instructions (such as "sale terminated, see attendant," "sale terminated, get receipt" or similar wording) for the customer to see the attendant AND **Yes**  **No**  **N/A**
- automatically issue a printed receipt showing the amount of cash inserted by the customer, a statement indicating that the sale was terminated, and instructions for the customer to see the attendant.
- 17.8.2. The customer has inserted cash and has started dispensing product. If the customer cancels or discontinues the transaction by pressing the cancel key (or equivalent key(s)) or lowering the on/off handle before reaching the total money inserted into the device, the device must:
- 17.8.2.1. display instructions for the customer to obtain the receipt and to see the attendant **Yes**  **No**  **N/A**
- 17.8.2.2. automatically issue a printed receipt showing the amount of cash inserted, the amount dispensed, the balance due to the customer, a statement indicating that the sale was terminated, and instructions for the customer to see the attendant **Yes**  **No**  **N/A**

*Note: It is acceptable for different messages to be used. This depends upon whether the transaction is terminated by use of the cancel key, (e.g., "sale terminated, get receipt" or "sale terminated, see attendant") or by lowering the on/off handle, (e.g., "change due, see attendant").*

**Checklist and Test Procedures for Wholesale and Loading Rack Meters**

In addition to the Common and General Code Criteria and applicable sections of the Wholesale and Loading Rack Meters and other Checklists, the following applies to tests of Loading Rack Meter Controllers with Blending Capabilities:

1. For NTEP testing, it is acceptable for the sum of the total quantity printed/displayed for each component of the blend to be different from the total quantity delivered due to intermediate rounding of each component. For example, if the quantity for each component has a higher internal resolution than that displayed, the displayed/printed quantity will be a rounded value. If each component of the blend is rounded in this way, the sum of the components may be different (due to rounding) than the actual quantity delivered by the system.
2. No mathematical correction is permitted to account for growth or shrinkage due to blending of product.

**18. Indicating and Recording Elements**

When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, etc.)

**Code Reference: G-S.5.1., G-UR.1.1. General**

Indicating elements must be appropriate in design and adequate in amount. Specifically, a device must have sufficient display capacity to indicate the quantities and total prices, if applicable that are normally encountered in the intended application. Electronic devices shall either have sufficient display capacity to indicate the normal quantities and money

values or automatically stop the delivery before exceeding the display capacity of either the quantity or total price. Analog indicating elements must have sufficient display capacity for the device to be suitable for the application.

- 18.1. Analog dispensers shall have adequate display capacity for the application. **Yes**  **No**  **N/A**
- 18.2. An electronic digital indicating element shall either:
- 18.2.1. have adequate display capacity for the application, **Yes**  **No**  **N/A**
- 18.2.2. automatically stop the delivery before exceeding the maximum quantity or maximum total price that can be indicated. **Yes**  **No**  **N/A**

**Code Reference: G-S.5.2.2. Digital Indication and Representation**

Basic operating requirements for devices:

- 18.3. All digital values of like value in a system shall agree. **Yes**  **No**  **N/A**
- 18.4. A digital value shall agree with its analog representation to the nearest minimum graduation. **Yes**  **No**  **N/A**
- 18.5. Digital values shall round off to the nearest digital division that can be indicated or recorded. **Yes**  **No**  **N/A**
- 18.6. When a digital zero display is provided, the zero indication shall consist of at least one digit to the left and all digits to the right of the decimal point. **Yes**  **No**  **N/A**
- Agreement of indications shall be checked for several deliveries. The totalizer shall be checked for accuracy and agreement with individual deliveries and with other totalizers in the system. Indications may disagree if digital indications receive quantity pulses from a nonresettable pulser. **Yes**  **No**  **N/A**
- 18.6.1. All digital values of like values in a system agree with one another. **Yes**  **No**  **N/A**
- 18.6.2. Digital values coincide with associated analog values to the nearest minimum graduation. **Yes**  **No**  **N/A**
- 18.6.3. Digital values "round off" to the nearest minimum unit that can be indicated or recorded. **Yes**  **No**  **N/A**
- 18.6.4. The device totalizer shall agree with the total of the individual deliveries and with other totalizers in the system. **Yes**  **No**  **N/A**

**Code Reference: S.1.2. Units**

- 18.7. The device shall indicate and record if it is equipped to record its deliveries in terms of gallons, cubic meters, or liters and decimal or binary submultiples of a gallon. **Yes**  **No**  **N/A**

**Code Reference: S.1.2.3. Value of Smallest Unit**

- 18.8. The value of the smallest quantity division shall not exceed 4 liters or 1 gallon. **Yes**  **No**  **N/A**

**Code Reference: S.1.7.1. Travel of Indicator**

- 18.9. A wholesale device shall accurately deliver any quantity from 50 gallons to the capacity of the device. **Yes**  **No**  **N/A**
- 18.10. 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 liters or 1 gallon must be no less than 5 mm (0.20 in). **Yes**  **No**  **N/A**

**Code Reference: S.1.7.2. Money Values - Mathematical Agreement**

- 18.11. Any digital money value indication and any recorded money value on a computing-type device must be in mathematical agreement with its associated quantity indication or representation to within one cent of money value. (Quantity X Unit Price = Sale Price ± 1 cent). **Yes**  **No**  **N/A**

*Note: At least four decimal places in cents must be carried to determine the proper round off of money values.*

**19. Measuring Element**

**Code Reference: S.2.1.1. Vapor Elimination on Loading Rack Metering Systems**

- 19.1. A loading rack metering system shall be equipped with a vapor or air eliminator or other automatic means to prevent the passage of vapor and air through the meter. This is unless the system is designed or operationally controlled by a method that is approved by the weights and measures jurisdiction, which the device controls such that air and/or vapor cannot enter the system. (Several guidelines, not intended to be all-inclusive for evaluation of a loading rack metering system in which an air eliminator is not needed were adopted by the NCWM in July of 1995. The guidelines are intended to be incorporated in the next edition of Publication 12, EPO Number 25). **Yes**  **No**  **N/A**
- 19.2. Vent lines from the air or vapor eliminator (if present) shall be made of metal tubing or other rigid material. **Yes**  **No**  **N/A**

**Code Reference: S.2.2. Provision for Sealing**

Measuring elements shall be designed with provision for an approved means of security, (e.g., data change audit trail or physically applying security seals) such that an adjustment to the measuring element or the flow rate control (if the flow rate affects the accuracy of deliveries) cannot be made without breaking the security seal. The adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

- 19.3. A measuring element shall provide for either:
- 19.3.1. applying a physical security seal, or **Yes**  **No**  **N/A**
- 19.3.2. an approved means of security, (e.g., data change audit trail) so that no change may be made to its adjustable component. **Yes**  **No**  **N/A**
- 19.4. Any adjustable element controlling the delivery rate shall provide for sealing or other approved means of security (e.g., data change audit trail) if the flow rate affects the accuracy of deliveries. **Yes**  **No**  **N/A**
- 19.5. When applicable, the adjusting mechanism shall be readily accessible for the purpose of affixing a security seal. **Yes**  **No**  **N/A**
- 19.6. Audit trails shall use the format set forth in the Common and General Code Criteria Section of this checklist (Code Reference G-S.8) and in Appendix A, Audit Trail checklist for Liquid-Measuring Devices. [Nonreactive as of 1/1/95]. **Yes**  **No**  **N/A**

**Code Reference: S.2.3. Directional Flow Valves**

- 19.7. Values intended to prevent the reversal of flow shall be automatic in operation. **Yes**  **No**  **N/A**

**Code Reference: S.2.7.2. Provision for Deactivation - Automatic Temperature Compensator**

- 19.8. If a device is equipped with only a net indicating and/or recording element [volume compensated at 15 °C (60 °F)], provision must be made to facilitate the deactivation of the automatic temperature-compensating mechanism so the meter will indicate and/or record the uncompensated volume. **Yes**  **No**  **N/A**

**Code Reference: S.2.7.3. Provision for Sealing - Automatic Temperature Compensation**

- 19.9. Automatic temperature compensators must provide for applying security seals to prevent undetected adjustment or disconnection of the compensating system. **Yes**  **No**  **N/A**

**Code Reference: S.2.7.4. Thermometer Well**

- 19.10. If a device is equipped with an automatic compensating system, the device shall have a thermometer well either in the liquid chamber of the meter or in the meter inlet or discharge line immediately adjacent to the meter. **Yes**  **No**  **N/A**

**20. Discharge Lines and Discharge Line Valves****Code Reference: S.3.1. Diversion of Measured Liquid**

- 20.1. No means shall be provided to allow any measured liquid to be diverted from the measuring chamber. **Yes**  **No**  **N/A**
- 20.2. A manually controlled outlet that may be opened for purging or draining the measuring system or for recirculating product in suspension shall be permitted only when the system is measuring food products or agri-chemicals. Effective means shall be provided to prevent passage of liquid through any such outlet during normal operation of the **Yes**  **No**  **N/A**

measuring system and to inhibit meter indications (or advancement of indications) and recorded representations while the outlet is in operation.

**Code Reference: S.3.3. Pump-Discharge Unit**

- 20.3. If the pump-discharge unit is equipped with a flexible discharge hose, it must be a wet-hose type. **Yes**  **No**  **N/A**

**Code Reference: S.3.4. Gravity-Discharge Unit**

It is critical to accurate measurement that the gravity-discharge system be designed to drain repeatedly to the same point or condition.

- 20.4. The discharge hose or pipe must be a dry-hose type with no shut-off valve at its outlet end. It may have a shut-off valve at or near the outlet end if the line drains to the same level under all anticipated conditions of product discharge. **Yes**  **No**  **N/A**
- 20.5. A dry-hose must be stiff enough to facilitate its drainage and no longer than necessary for drainage. **Yes**  **No**  **N/A**
- 20.6. The inlet end of the hose or pipe must be high enough to provide for proper drainage. **Yes**  **No**  **N/A**
- 20.7. The system must provide an automatic vacuum breaker or equivalent means for preventing siphoning and ensuring rapid and complete drainage. **Yes**  **No**  **N/A**

**Code Reference: S.3.5. Discharge Hose**

- 20.8. A discharge hose shall be adequately reinforced. **Yes**  **No**  **N/A**

**Code Reference: S.3.6. Discharge Valve**

- 20.9. A discharge valve may be installed in the discharge line only if the device is of the wet-hose type. **Yes**  **No**  **N/A**
- 20.10. Any other shut-off valve on the discharge side of the meter must be of the automatic or semiautomatic pre-determined stop type or shall operate only:
- By means of a tool (not a pin) entirely separate from the device,
  - By mutilation of a security seal with which the valve is sealed open.

**Code Reference: S.3.7. Anti-drain Valve**

- 20.11. A wet-hose, pressure-type device shall have an effective anti-drain valve incorporated in the discharge valve or adjacent to it. **Yes**  **No**  **N/A**

**21. Marking**

**Code Reference: S.4. Marking Requirements**

- 21.1. If a device is intended to accurately measure only products that have particular properties or are under specific installation or operating conditions, or when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently marked on the device. Wholesale devices shall be marked with their designed maximum and minimum discharge rates. If a device is equipped with an automatic temperature-compensating system, the primary indicating and recording elements, and recorded representation shall be clearly and conspicuously marked to show that the volume has been adjusted to 15 °C (60 °F). A meter may be used to measure both gasoline and diesel fuel at different times provided that the meter is tested and adjusted with the product to be measured before it is used commercially. **Yes**  **No**  **N/A**

**Code Reference: S.4.1. Limitation on Use**

- 21.2. Any limitations of use shall be clearly and permanently marked on the device. **Yes**  **No**  **N/A**

**Code Reference: S.4.2. Air Pressure**

- 21.3. If the device operates using air pressure, the air pressure gauge must show the maximum and minimum working pressures recommended by the manufacturer. **Yes**  **No**  **N/A**

**Code Reference: S.4.3.1. Discharge Rates**

- 21.4. The designed maximum and minimum discharge rates must be marked on the device. **Yes**  **No**  **N/A**

minimum rate shall not exceed 20 percent of maximum rate.

**Code Reference: S.4.3.2. Temperature Compensation**

- 21.5. If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representations shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F). **Yes**  **No**  **N/A**

**Checklist and Test Procedures for Specific Criteria for Vehicle Tank Meters**

Paragraph G-UR.3.3. requires the primary indicating element to be visible from a reasonable customer position. Many electronic vehicle-mounted metering/controlling systems on which transaction information is displayed are mounted inside the cab of the delivery vehicle. This location is not considered visible from a reasonable customer position. Some systems provide a remote customer display as a standard feature, and some do not. The application section of any Certificate of Conformance issued to a vehicle-mounted metering/controlling system must limit the system to installations where a customer indicator is provided and located in a reasonable customer position (e.g., at the meter on the rear of the vehicle).

**22. Indicating and Recording Elements**

**Code Reference: G-S.5.1. General/Tax Computation**

Digital electronic vehicle tank meters frequently have the capability to compute the taxes applicable to the sale of fuel oil and gasoline. There may be more than one tax on a delivery. Unless the round-off method for a tax to be applied to a sale is specified, the dollar amount of each tax is to be computed separately, rounded to the nearest cent, and then summed to obtain the total price of the sale. A vehicle-tank-meter register must demonstrate that it is capable of rounding the tax money values to the nearest cent (even if the jurisdiction in which the test is conducted specifies another form of round off) because most jurisdictions require round-off to the nearest cent.

- 22.1. Each tax shall be computed separately, rounded to the nearest cent, and summed to obtain the total price of the sale. **Yes**  **No**  **N/A**

**23. Digital**

**Code Reference: G-S.5.2.2. Digital Indication and Representation**

Basic operating requirements for devices:

- 23.1. All digital values of like value in a system shall agree. **Yes**  **No**  **N/A**
- 23.2. A digital value shall agree with its analog representation to the nearest minimum graduation. **Yes**  **No**  **N/A**
- 23.3. Digital values shall round off to the nearest digital division that can be indicated or recorded. **Yes**  **No**  **N/A**
- 23.4. When a digital zero display is provided, the zero indication shall consist of at least one digit to the left and all digits to the right of the decimal point. **Yes**  **No**  **N/A**

Agreement of indications shall be checked for several deliveries. The totalizer shall be checked for accuracy and agreement with individual deliveries and with other totalizers in the system. Indications may disagree if digital indications receive quantity pulses from a nonresettable pulser.

- 23.5. All digital values of like values in a system agree with one another. **Yes**  **No**  **N/A**
- 23.6. Digital values coincide with associated analog values to the nearest minimum graduation. **Yes**  **No**  **N/A**
- 23.7. Digital values "round off" to the nearest minimum unit that can be indicated or recorded. **Yes**  **No**  **N/A**
- 23.8. The device totalizer shall agree with the total of the individual deliveries and with other totalizers in the system. **Yes**  **No**  **N/A**

**24. Primary Elements**

**Code Reference: S.1.1.2. (a) Units**

- 24.1. If the device is equipped to record, it shall indicate and record its deliveries in terms of gallons and decimal or binary subdivisions except as noted in S.1.1.2.(b) and S.1.1.2.(c) below. **Yes**  **No**  **N/A**

**Code Reference: S.1.1.2. (b) Units for Meters Used to Sell Milk**

24.2. When it is an industry practice to purchase and sell milk by weight based upon 1.03 kg/L (8.6 lb/gal), the primary indicating element may indicate in pounds. Fractional parts of the pound shall be in decimal subdivisions. **Yes**  **No**  **N/A**

24.3. The weight value division shall be a decimal multiple or submultiple of 1, 2, or 5. **Yes**  **No**  **N/A**

*Note: The mass shall be expressed as apparent mass versus 8.0 g/cm<sup>3</sup>.*

**Code Reference: S.1.1.3. Value of Smallest Unit**

If the meter is equipped to record, the value of the smallest unit of indicated delivery and recorded delivery shall not exceed the equivalent of:

24.4. 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk-metering systems and on meters with a rated maximum flow rate of 500 L/min (100 gal/min) or less used for retail deliveries of liquid fuel, or **Yes**  **No**  **N/A**

24.5. 5 L (1 gal) on other meters. **Yes**  **No**  **N/A**

**Code Reference: S.1.1.5. Return to Zero**

The primary indicating elements on a vehicle tank meter must be returnable to zero before a delivery. If the register has a printer, it is not required that the printer be returnable to zero. If it is returnable to zero, then neither the indicating nor the recording element shall go beyond their correct zero position. Due to the manner in which vehicle tank meters are operated, the outlet side of the meter shall be automatically or manually pressurized before the indicating and recording elements are set to zero.

24.6. Primary indicating elements shall be readily returnable to a definite zero indication. Means shall be provided to prevent the return of the primary indicating or recording elements beyond their correct zero position. **Yes**  **No**  **N/A**

24.7. Automatic or manual means shall be provided to assure that the system on the outlet side of the meter is pressurized before recording an initial zero condition as required by UR.2.1. **Yes**  **No**  **N/A**

24.8. A printer shall be so designed that the recording of zero shall reflect the actual initial condition of the meter prior to deliver. **Yes**  **No**  **N/A**

**Code Reference: S.1.3.6. Travel of Indicator**

24.9. If the most sensitive element of the indicating system uses an indicator and graduations, the relative movement of these parts corresponding to the smallest indicated value must be no less than 5 mm (0.2 in). **Yes**  **No**  **N/A**

**25. Computing-Type Devices****Code Reference: S.1.4. Computing-Type Device**

If a vehicle tank meter can compute the total sales price of a delivery, then the unit price at which the meter is set to compute must be displayed on the outside of the device. The unit price must be displayed in a manner that is clear to both the operator and an observer. The primary indicating element must be visible from a reasonable customer position. Many electronic vehicle-mounted metering/controlling systems on which transaction information is displayed are mounted inside the cab of the delivery vehicle. This location is not considered visible from a reasonable customer position. Some systems provide a remote customer display as a standard feature and some do not. The application section of any Certificate of Conformance issued to a vehicle-mounted metering/controlling system must limit the system to installations where a customer indicator is provided and located in a reasonable customer position (e.g., at the meter on the rear of the vehicle.) The printed ticket must state the quantity delivered and the unit price if the total price is printed on the ticket.

A computing-type meter shall compute the total sale price for all unit prices and quantities for all deliveries. The money value division for analog meters shall be one cent, and the graduations shall be accurately positioned; however, the accuracy of the total price is not specified. On devices with digital indications, the total price shall be computed on the basis of a quantity-value division of 0.2 L (0.1 gal) or less. The total price indication on a digital device shall be accurate to within one cent.

**Code Reference: S.1.4.1. Display of Unit Price**

25.1. Means must be provided to display the unit price at which the device is set to compute in **Yes**  **No**  **N/A**

proximity to the total computed price display.

- 25.2. The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price (e.g., \$1.299 not \$1.29 9/10). **Yes**  **No**  **N/A**

**Code Reference: S.1.4.2. Printed Ticket**

- 25.3. Any printed ticket with the total computed price indicated must also have clearly printed the total quantity delivered in terms of liters, gallons or kilograms, pounds and the appropriate fraction, and the unit price. **Yes**  **No**  **N/A**

**Code Reference: S.1.4.3. Money Value Computations**

- 25.4. The device shall be of the full computing type. **Yes**  **No**  **N/A**
- 25.5. Money-value graduations shall be supplied and accurately positioned. **Yes**  **No**  **N/A**
- 25.6. The value of each graduated interval shall be one cent. **Yes**  **No**  **N/A**
- 25.7. On electronic devices with digital indications, the total price may be computed on the basis of the quantity indicated when the value of the smallest division indicated is equal to or less than 0.2 L (0.1 gal), or 0.2 kg (1 lb). **Yes**  **No**  **N/A**

**Code Reference: S.1.4.4. Money Values - Mathematical Agreement**

Any digital money value indication and any recorded money value on a computing type device must mathematically agree with its associated quantity indication or representation to within one cent of money value (Quantity X Unit Price = Sale Price  $\pm$  1 Cent). Check mathematical agreement:

- 25.8. At various flow rates, including the maximum and minimum. **Yes**  **No**  **N/A**
- 25.9. At several unit prices including low prices and the maximum pricing capability of the computer. **Yes**  **No**  **N/A**

*Note: At least four decimal places in cents must be carried to determine the proper round off of money values.*

**26. Measuring Element**

**Code Reference: S.2.2. Provision for Sealing**

Measuring elements shall be designed with a provision for sealing such that an adjustment to the measuring element or the flow rate control (if the flow rate affects the accuracy of deliveries) cannot be made without breaking the security seal. Milk meters are exempt from this requirement. The adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

- 26.1. A measuring element shall have provision for sealing its adjustable components. **Yes**  **No**  **N/A**
- 26.2. Any adjustable element controlling the delivery rate shall provide for sealing if the flow rate affects the accuracy of deliveries. **Yes**  **No**  **N/A**
- 26.3. The adjusting mechanism shall be readily accessible to affix a security seal. **Yes**  **No**  **N/A**

**Code Reference: S.2.3. Directional Flow Valves**

- 26.4. Directional flow valves shall automatically operate, except that valves on equipment used for fueling aircraft may be manual. **Yes**  **No**  **N/A**

**27. Discharge Lines and Discharge Valves**

**Code Reference: S.3.1. Diversion of Measured Liquid**

Except on equipment used only for fueling aircraft, no means shall be provided to allow any measured liquid to be diverted from the measuring chamber or from the discharge line. However, two or more delivery outlets may be installed if means are provided to ensure that liquid can flow from only one outlet at a time and the setting for the direction of flow is conspicuously and definitely indicated.

- 27.1. Is the equipment used only to fuel aircraft? **Yes**  **No**  **N/A**
- 27.2. It shall not be possible to divert measured liquid from the measuring chamber or the discharge line. **Yes**  **No**  **N/A**
- 27.3. If two or more delivery outlets are installed, then liquid shall flow from only one outlet at a time and the direction of flow shall be conspicuously indicated. **Yes**  **No**  **N/A**

**Code Reference: S.3.2. Pump-Discharge Unit**

- 27.4. A pump-discharge unit must have wet-hose type discharge hose with the shut-off valve at outlet end. **Yes**  **No**  **N/A**
- 27.5. A pump-discharge unit may also have dry-hose type without a shut-off valve at the outlet end if:
- 27.5.1. the dry-hose is as short as practicable, and **Yes**  **No**  **N/A**
- 27.5.2. an effective means in the discharge piping immediately adjacent to the meter permits flow through only one of the discharge hoses at any one time, and the meter and wet-hose remain full of liquid at all times. **Yes**  **No**  **N/A**

**Code Reference: S.3.3. Gravity-Discharge Unit**

It is critical to accurate measurement that a gravity-discharge system be designed to drain repeatedly to the same point or condition.

- 27.6. The discharge hose or pipe must be a dry-hose type with no shut-off valve at its outlet end. **Yes**  **No**  **N/A**
- 27.7. A dry hose must be stiff enough to facilitate its drainage and no longer than necessary for drainage. **Yes**  **No**  **N/A**
- 27.8. The inlet end of the hose or pipe must be high enough to provide for proper drainage. **Yes**  **No**  **N/A**
- 27.9. The system must provide an automatic vacuum breaker or equivalent means for preventing siphoning and ensuring rapid and complete drainage. **Yes**  **No**  **N/A**

**Code Reference: S.3.4. Discharge Hose**

- 27.10. The discharge hose must be adequately reinforced. **Yes**  **No**  **N/A**

**Code Reference: S.3.5. Discharge Valve**

- 27.11. A discharge valve may be installed in the discharge line only if the device is of the wet-hose type in which case the valve must be at the discharge end of the line. **Yes**  **No**  **N/A**
- 27.12. Any other shut-off valve on the discharge side of the meter must be of the automatic or semiautomatic predetermined stop type or shall be operable only:
- 27.12.1. By means of a tool (not a pin) entirely separate from the device, or **Yes**  **No**  **N/A**
- 27.12.2. by mutilation of a security seal with which the valve is sealed open. **Yes**  **No**  **N/A**

**Code Reference: S.3.6. Anti-drain Valve**

- 27.13. A wet-hose, pressure-type device shall have an effective anti-drain valve incorporated in the discharge valve or adjacent thereto to prevent drainage of the discharge hose. Devices used only for fueling and de-fueling aircraft may be of the pressure-type without an anti-drain valve. **Yes**  **No**  **N/A**

**28. Marking Requirements****Code Reference: S.5. Marking Requirements**

If a device is intended to accurately measure only products with the following: having particular properties, under specific installation, operating conditions, or when used in conjunction with specific accessory equipment. These limitations shall be clearly and permanently marked on the device. Wholesale devices shall be marked with their designed maximum and minimum discharge rates.

**Code Reference: S.5.1. Limitation of Use**

- 28.1. Any limitations of use shall be clearly and permanently marked on the device. **Yes**  **No**  **N/A**

**Code Reference: S.5.2. Discharge Rates**

- 28.2. The designed maximum and minimum discharge rates must be marked on the device. **Yes**  **No**  **N/A**
- The minimum rate shall not exceed 20 percent of maximum rate.

**Code Reference: S.5.5. Conversion Factor**

When the conversion factor of 8.6 pounds per gallon is used to convert the volume of milk to weight, the conversion factor shall be clearly marked on the primary indicating element and recorded on the delivery ticket.

## Checklist and Test Procedures for LPG Liquid Measuring Devices

### 29. General - LPG Liquid Measuring Devices

When evaluating electronic indicators for stationary installations, submitted separate from a measuring element, indicators may be evaluated using simulated inputs (i.e., meter pulse, temperature, pressure, density, etc.)

#### Code Reference: G-S.5.1., G-UR.1.1. General

Indicating elements must be appropriately designed and adequate in amount. Specifically, if applicable, a device must have sufficient display capacity to indicate the quantities and total prices normally encountered in the specific application. Electronic devices shall either have sufficient display capacity to indicate the normal quantities and money values or automatically stop the delivery before exceeding the display capacity for the device to be suitable for the application.

- 29.1. Analog dispensers shall have adequate display capacity for the application. Yes  No  N/A
- 29.2. An electronic digital indicating element shall either:
- 29.2.1. have adequate display capacity for the application, Yes  No  N/A
- 29.2.2. automatically stop the delivery before exceeding the maximum quantity or maximum total price that can be indicated. Yes  No  N/A

#### Code Reference: G-S.5.2.2. Digital Indication and Representation

Basic operating requirements:

- 29.3. All digital values of like value in a system shall agree. Yes  No  N/A
- 29.4. A digital value shall agree with its analog representation to the nearest minimum graduation. Yes  No  N/A
- 29.5. Digital values shall round off to the nearest digital division that can be indicated or recorded. Yes  No  N/A
- 29.6. When a digital zero display is provided, the zero indication shall consist of at least one digit to the left and all digits to the right of the decimal point. Yes  No  N/A

Agreement of indications shall be checked for several deliveries. Check the totalizer for accuracy and agreement with individual deliveries and with other totalizers in the system. Indications may disagree if digital indicators receive quantity pulses from a nonresettable pulsar.

- 29.7. All digital values of like values in a system agree with one another. Yes  No  N/A
- 29.8. Digital values coincide with associated analog values to the nearest minimum graduation. Yes  No  N/A
- 29.9. Digital values "round off" to the nearest minimum unit that can be indicated or recorded. Yes  No  N/A
- 29.10. The device totalizer shall agree with the total of the individual deliveries and with other totalizers in the system. Yes  No  N/A

#### Code Reference: S.1.1.2. Units

- 29.11. The device shall indicate, and record if equipped to record, its deliveries in terms of gallons, cubic meters, or liters and decimal or binary-submultiples of a gallon. Yes  No  N/A

#### Code Reference: S.1.1.3. Value of Smallest Unit

- 29.12. The value of the smallest quantity division shall not exceed:
- 29.12.1. 0.5 L (1 pt) on retail devices, or Yes  No  N/A
- 29.12.2. 5 L (1 gal) on wholesale devices. Yes  No  N/A

#### Code Reference: S.1.1.5. Money Values - Mathematical Agreement

Any recorded money value and any digital money value indication on a primary indicator must be in mathematical agreement with its associated quantity (volume) representation or indication to:

- 29.13. The nearest one cent for a motor-fuel device. Yes  No  N/A
- 29.14. Within one cent for all other LPG liquid meters. Yes  No  N/A

**Code Reference: S.1.1.6. Printed Ticket**

Any printed ticket with the total computed price must also have clearly printed the total volume delivered in terms of gallons, cubic meters, or liters, and the appropriate fractions, and unit price.

*Note: Vehicle-mounted metering systems must be equipped with a ticket printer. If the device submitted for type evaluation is equipped with a ticket printer, this should be listed as a standard feature. If the device submitted is not equipped with a ticket printer, the application section of the Certificate of Conformance must indicate that the device is suitable for installation only in applications where an appropriate and compatible ticket printer is provided. (Code Reference UR.2.6., Ticket Printer)*

**Code Reference: S.1.4. For Retail Devices Only**

Retail LPG devices are used for single deliveries of liquified petroleum gas for domestic or non-resale use. A retail device may be mounted on a vehicle for home deliveries or it may be stationary, used primarily as a motor-fuel dispenser or for filling LPG cylinders. The requirements of Section S.1.4. apply to both stationary and vehicle-mounted retail devices, but additional specifications are given in Section S.1.5. for stationary retail devices.

**Code Reference: S.1.4.1. Indication of Delivery**

29.15. A retail device shall automatically show its initial zero condition and the amount delivered up to normal capacity of the device. **Yes**  **No**  **N/A**

**Code Reference: S.1.4.2. Return to Zero**

The primary indicating element on any retail device shall be returnable to zero before a delivery. However, unless the retail device is a retail motor-fuel device (or a stationary retail device), the recording element need not be returnable to zero before a delivery. Consequently, a vehicle-mounted LPG retail meter is not required to have a recording element that is returnable to zero before a delivery.

29.16. Is the device equipped with a recording element? **Yes**  **No**  **N/A**

29.17. The primary indicating element shall be capable of being reset to zero before a delivery. **Yes**  **No**  **N/A**

29.18. If the device is a retail motor-fuel device and includes a printer, it shall be possible to reset the printer to zero before a delivery. **Yes**  **No**  **N/A**

29.19. Indicating and recording elements shall not go beyond their correct zero position. **Yes**  **No**  **N/A**

**30. Stationary Retail Devices****Code Reference: S.1.5.1. Display of Unit Price and Product Identity**

A computing or money-operated device shall have a means for displaying on its face the unit price at which it is set to compute or deliver, expressed as a decimal value in dollars. Means shall be provided to post the identity of the product grade, blend, or mixture of product being dispensed.

30.1. Means shall be provided to display the unit price on the face of the device. **Yes**  **No**  **N/A**

30.2. The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price, (e.g., \$1.299 not \$1.29 9/10). **Yes**  **No**  **N/A**

30.3. The unit price cannot be changed while the dispenser is activated. **Yes**  **No**  **N/A**

30.4. Means shall be provided to post on the side of the device the product identity, grade, brand, blend, or mixture of product being dispensed. **Yes**  **No**  **N/A**

**Code Reference: 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 x unit price = sales price) for any delivered quantity by an amount greater than the values shown in Table 1 on the next page. The maximum value of the money-value division and the maximum variation of indicated total sale price from the mathematically computed total sale price are specified for analog devices.

30.5. A retail computing device shall compute total sale prices for all quantities and unit prices within the range of its quantity and computing capacities. **Yes**  **No**  **N/A**

30.6. For any delivered quantity, analog money value indications on each side of a device shall **Yes**  **No**  **N/A**

not differ by an amount greater than the values shown in Table 1 from the mathematically computed money value (Quantity x Unit Price = Sales Price).

- 30.7. Total prices indicated on the two sides of an analog register shall agree within one-half of the money value division. **Yes**  **No**  **N/A**

(See H-44 N.4.3. for Test Procedures)

**Code Reference: S.1.5.2.1. Analog Money-Value Divisions**

Analog money-value divisions shall be as follows:

- 30.8. Not more than 1 cent at all unit prices up to and including \$0.25 per liter or \$1.00 per gallon. **Yes**  **No**  **N/A**
- 30.9. Not more than 2 cents at all unit prices greater than \$1.00 up to and including \$0.75 per liter or \$3.00 per gallon. **Yes**  **No**  **N/A**

<b>Table 1.                      Money-Value Divisions and Maximum Allowable Variations                      for Money-Value Computations on Mechanical Analog Computers</b>				
<b>Unit Price</b>		<b>Money Value                      Division</b>	<b>Maximum                      Allowable Variation</b>	
<b>From</b>	<b>To and                      including</b>		<b>Design                      Test</b>	<b>Field                      Test</b>
0	0.25/liter or \$1.00/gallon	1¢	± 1¢	± 1¢
0.25/liter or \$1.00/gallon	0.75/liter or \$3.00/gallon	1¢ or 2¢	± 1¢	± 2 ¢
0.75/liter or \$3.00/gallon	2.50/liter or \$10.00/gallon	1¢ or 2¢	± 1¢	± 2 ¢
0.75/liter or \$3.00/gallon	2.50/liter or \$10.00/gallon	5¢	± 2 1/2 ¢	± 5 ¢

- 30.10 Not more than 5 cents at all unit prices greater than \$0.75 per liter or \$3.00 per gallon. **Yes**  **No**  **N/A**

**Code Reference: S.1.5.2.2. Digital Money-Value Divisions**

- 30.11. Digital quantity and total price indications shall agree to the nearest cent. **Yes**  **No**  **N/A**
- 30.12. Total price indications shall be based on quantity-value divisions that are less than or equal to 0.05 L (0.01 gal). **Yes**  **No**  **N/A**

**Code Reference: S.1.5.2.3. Money-Value Divisions, Auxiliary Indications**

- 30.13. Money value divisions on devices such as remote consoles and printers shall be the same as on the dispenser. **Yes**  **No**  **N/A**

**Code Reference: S.1.6.1. Travel of Indicator**

- 30.14. A wholesale device shall accurately deliver any quantity from 180 L (50 gal) to the capacity of the device. **Yes**  **No**  **N/A**
- 30.15. 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 5 kg (10 lb) or 5 L (1 gal) must be no less than 5 mm (0.20 in). **Yes**  **No**  **N/A**

**31. Measuring Element**

**Code Reference: S.2.2. Provision for Sealing**

Measuring elements shall be designed with a provision for sealing such that an adjustment to the measuring element or the

flow rate control (if the flow rate affects the accuracy of deliveries) cannot be made without breaking the security seal. The adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

31.1. A measuring element shall provide for sealing its adjustable components. Yes  No  N/A

31.2. Any adjustable element controlling the delivery rate shall provide for sealing if the flow rate affects the accuracy of deliveries. Yes  No  N/A

31.3. The adjusting mechanism shall be readily accessible to affix a security seal. Yes  No  N/A

**Code Reference: S.2.3. Directional Flow Valves**

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

**Code Reference: S.2.4. Maintenance of Liquid State**

31.4. Because LPG liquid is susceptible to cavitation and is measured under pressure, a device shall be designed and installed so that the product will remain in liquid state while passing through the meter. Yes  No  N/A

**Code Reference: S.2.5. Thermometer Well**

31.5. For test purposes, means shall be provided for inserting a thermometer in the meter chamber or immediately adjacent to the meter. Yes  No  N/A

**Code Reference: S.2.6. Automatic Temperature Compensator**

31.6. An LPG meter may be equipped with an automatic temperature compensator. If so equipped, the meter shall be provided with a means for automatically adjusting the indication and registration of the measured volume of the product to the volume at 15 °C (60 °F). Yes  No  N/A

**Code Reference: S.2.6.1. Provision for Deactivation**

31.7. If a device is equipped with only a net indicating and/or recording element (volume compensated to 15 °C (60 °F) provisions must be made to facilitate the deactivation of the automatic temperature-compensating mechanism so that the meter will indicate and/or record the uncompensated volume. Yes  No  N/A

**Code Reference: S.2.6.2. Provision for Sealing**

31.8. Automatic temperature compensators must provide for applying security seals to prevent undetected adjustment or disconnection of the compensating system. Yes  No  N/A

**32. Discharge Lines and Discharge Line Valves**

**Code Reference: S.3.1. Design of Discharge Lines and Discharge Line Valves**

To deter fraudulent practices, it shall not be possible to divert measured liquid from the measuring chamber or the discharge line of a device. The following exceptions to this requirement are permitted.

32.1. A device may have two or more delivery outlets if there are automatic means to ensure that:

- liquid can flow from only one outlet at a time, and
- the direction of liquid flow is definitely and conspicuously indicated.

32.2. A manually controlled outlet may be opened to empty a portion of the system to allow for repair and maintenance operations. Yes  No  N/A

32.3. Except as identified above, it shall not be possible to divert measured liquid from the measuring chamber or the discharge line of the device. Yes  No  N/A

32.4. Two or more delivery outlets may be installed if there are automatic means to ensure that liquid can flow from only one outlet at a time and the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated. Yes  No  N/A

32.5. If the device is equipped with a manually-controlled valve to empty a portion of the system, the passage of liquid through the outlet during normal operation shall be prevented. The device shall clearly indicate whenever the valve controls are set to allow liquid through the valve. Yes  No  N/A

**Code Reference: S.3.2. Delivery Hose**

- 32.6. The delivery hose of a retail device shall be of the wet-hose type with a shut-off valve at its outlet end. **Yes**  **No**  **N/A**

**33. Marking****Code Reference: S.4. Marking Requirements**

- 33.1. If a device is intended to accurately measure only products having particular properties, or under specific installation or operating conditions, or when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently marked on the device. Devices shall be marked with their designed maximum and minimum discharge rates. If the device is equipped with an automatic temperature-compensating system, the primary indicating and recording elements, and recorded representation shall be clearly and conspicuously marked to show that the volume has been adjusted to 15 °C (60 °F). **Yes**  **No**  **N/A**

**Code Reference: S.4.1. Limitation of Use**

- 33.2. Any limitations for use shall be clearly and permanently marked on the device. **Yes**  **No**  **N/A**

**Code Reference: S.4.2. Discharge Rates**

- 33.3. Maximum and minimum discharge rates must be marked on the device. The marked minimum shall not exceed 20 liters (5 gal) per minute on motor-fuel devices or 20 percent of the maximum rate for other devices. **Yes**  **No**  **N/A**

**Code Reference: S.4.3. Temperature Compensation**

- 33.4. If a device is equipped with an automatic temperature compensator, the primary indicating elements, recording elements, and recorded representations shall be clearly and conspicuously marked to show that the volume delivered has been adjusted to the volume at 15 °C (60 °F). **Yes**  **No**  **N/A**

**Additional Checklist and Test Procedures for Mass Flow Meters****34. Indicating and Recording Elements****Code Reference: S.2.8., G-S.5.1., G-UR.1.1. General**

Indicating elements must be appropriately designed and adequate in amount. If applicable specifically, a device must have sufficient display capacity to indicate the quantities and total prices that are normally encountered in the specific application. Electronic devices shall have either sufficient display capacity to indicate the normal quantities and money values or automatically stop the delivery before exceeding the display capacity of either the quantity or total price.

- 34.1. The device shall automatically show on its face the initial zero condition; however, the first 0.03 L (0.009 gal.) of a delivery and its associated total sales price does not need to be indicated. **Yes**  **No**  **N/A**
- 34.2. The device shall automatically show on its face the quantity delivered up to the nominal capacity. **Yes**  **No**  **N/A**

**Code Reference: S.7. Totalizers for Retail Motor-Fuel Devices**

- 34.3. Retail motor-fuel dispensers shall be equipped with a non-resettable totalizer. **Yes**  **No**  **N/A**

**Code Reference: G-S.5.2.2., G-S.5.2.3., Digital Indication and Representation**

Basic operating requirements for devices are that:

- All digital values of like value in a system shall agree. **Yes**  **No**  **N/A**
- A digital value shall agree with its analog representation to the nearest minimum graduation. **Yes**  **No**  **N/A**

- Digital values shall round off to the nearest digital division that can be indicated or recorded. **Yes**  **No**  **N/A**
- When a digital zero display is provided, the zero indication shall consist of at least one digit to the left and all digits to the right of the decimal point. **Yes**  **No**  **N/A**

Due to limitations of some of the technologies used to transmit information from dispensers to service station consoles, some exceptions to these rules have been given to the indications on retail motor-fuel dispensers and service station consoles. Exact agreement of digital quantity values is not required if only total price information is sent from the dispenser to the console. In these cases, the console calculates the quantity from the unit price set in the console. Consequently, the quantity indicated on the console may not exactly agree with the quantity indicated on the dispenser. However, if the console prints a customer receipt, then the quantity times unit price must equal the total price on both the dispenser and the printed receipt.

Previously, the service station console was considered an auxiliary indication and did not have to satisfy the mathematical agreement requirement for money values (G-S.5.5.). The money value indication for dispensers and consoles must agree for all installations, both old and new.

For those systems consisting of a console, dispensers, and equipped with pre-set volume, the dispenser must deliver at least the pre-set volume; it cannot deliver less. For example, if the console sends only the money equivalent of the pre-set volume to the dispenser, the dispenser shall deliver at least the pre-set volume. It may not stop at the first quantity amount that results in mathematical agreement with the money value equivalent of the pre-set volume if the quantity indication is less than the pre-set volume. Similarly, if a money value is pre-set, the dispenser is not properly designed if it always stops at the lowest quantity value that provides mathematical agreement with the pre-set money value.

Tests for agreement of digital values shall be performed in the post-pay, prepay money, and pre-set volume models. Agreement should be checked at several unit prices including the maximum unit price and with the dispenser operating at its maximum flow rate.

- 34.4. All total sale money value indications in a computing system are primary indications and must agree. **Yes**  **No**  **N/A**
- 34.5. Digital volume indications in a non-computing system must agree or "round off" to the nearest minimum unit that can be indicated or recorded. **Yes**  **No**  **N/A**
- 34.6. Manual quantity entries in invoice billing systems must be identified as such. **Yes**  **No**  **N/A**
- 34.7. When delivery from a computing device is based upon a pre-set volume, the quantity indicated on the dispenser and any auxiliary device must be equal to or greater than the pre-set volume and the dispenser and remote console must comply with G-S.5.5. Money Values, Mathematical Agreement. **Yes**  **No**  **N/A**
- 34.8. Ticket printers and remote customer read-outs used in conjunction with retail dispensers may print or display a volume that is not in exact agreement with the dispenser or remote console, but the total sale amounts must agree. The printed ticket and dispenser must comply with G.S.5.5. Money Values, Mathematical Agreement to the nearest cent (unit price x volume = total sale  $\pm$  0.5 cent.) **Yes**  **No**  **N/A**
- 34.9. Digital values agree with their associated analog value to the nearest minimum graduation. **Yes**  **No**  **N/A**

#### **Code Reference: G-S.5.5. Digital Money Values, Mathematical Agreement**

Any recorded money value and any digital money value indication on a primary indicator must mathematically agree with its associated quantity (volume) representation or indication to the nearest one cent.

Formula: Unit Price x Indicated Volume = Total Sale  $\pm$  0.5 cent

Check mathematical agreement of all primary indications (e.g., dispenser, console, printer) under the following conditions:

- 34.10. At various flow rates, including maximum and minimum. **Yes**  **No**  **N/A**
- 34.11. After shutting off the dispenser by turning lever or button to 'off' position while pumping gas into cylinder. **Yes**  **No**  **N/A**
- 34.12. At several unit prices including the low prices and the maximum pricing capability of the computer and when operating at the maximum flow rate. **Yes**  **No**  **N/A**

#### **Code Reference: G-S.5.1. Indicating and Recording Elements**

After a transaction is completed, the unit price displayed at the dispenser may be changed to a base unit price. Any display of quantity, unit price, and total price that does not mathematically agree occurs between transactions. This is permitted (in response to demands of device users) because the displayed values between "transactions" are not "significant" relative to the actual delivery process (transaction).

The displayed unit price may revert to the base unit price immediately after the completion of a transaction. This is defined as the time the delivery has been terminated and payment has been settled. The payment may be automatic if the delivery is to a prepaid amount. If the sale is prepaid, the delivery is considered terminated after the "handle" is in the off position or after the nozzle has been returned to the designed hanging position. This allows the customer adequate time to observe that the prepaid amount has been reached. If the delivery stops short or overruns a prepaid amount, settling the payment means that money is either refunded or collected from the customer and the transaction is "cashed out" by the console operator.

In the case of invoice billing systems such as card-lock or key-lock systems which compute the total sale price, it is not considered appropriate for the displayed unit price to revert to the base unit price immediately following a transaction. Because a receipt for the transaction may not be available, the customer must be allowed an adequate period of time following the delivery to record the transaction information. All information for a transaction, including the transaction unit price, must be displayed for at least 30 seconds following the completion of the delivery and the total price and the quantity must be displayed for at least 5 minutes following the completion of the delivery or the start of the next transaction. The delivery is considered complete after the "handle" is off or the nozzle has been returned to its designed hanging position.

- 34.13. In a system where a base unit price is automatically displayed on the dispenser after the completion of a transaction (i.e., product is dispensed and payment is settled), the dispenser may display the values for quantity, unit price, and total price that do not result in a mathematically correct equation, provided that when the total price value displayed is divided by the quantity value displayed, the result is a unit price that is "posted" for a particular kind of transaction. **Yes**  **No**  **N/A**

*Note: The mass shall be expressed as apparent mass versus a density of 8.0 g/cm<sup>3</sup>.*

**Code Reference: S.1.3. Units for Mass Flow Meters**

- 34.14. The primary indicating element may indicate in pounds. Fractional parts of the pound shall be expressed in decimal subdivisions. **Yes**  **No**  **N/A**

Credit Card- or Debit Card-Activated Retail Motor-Fuel Dispenser - On card-activated retail motor fuel dispensers, the customer authorizes the dispenser by inserting the card or swiping the card through a slot. On credit card transactions, the customer is typically billed through the same methods as have been used for credit transactions handled through a station attendant. On debit card transactions, payment is made directly from the purchaser's account by electronic funds transfer.

- 34.15. A receipt must be available to the customer at the completion of the transaction. The customer may request a receipt. **Yes**  **No**  **N/A**

- 34.16. The customer receipt must contain the following information: **Yes**  **No**  **N/A**

The identity (codes may be used) of the product purchased, the quantity purchased, the unit price, and the total price.

- 34.17. Cash Value Card - A cash value card initially encoded with the purchase price, authorizing a customer to purchase products up to the current cash value of the card. The value of the card decreases in amounts equal to individual transactions. **Yes**  **No**  **N/A**

Means shall be provided to the customer to determine the initial cash value of the card and the remaining cash value prior to and after each transaction.

- 34.18. Invoice Billing - Invoice billing is a process in which customers are billed for one or more transactions at the end of a billing period. **Yes**  **No**  **N/A**

- 34.18.1. For computing systems, quantity, unit price, and total price shall be recorded and shall agree with the indications on the dispenser. **Yes**  **No**  **N/A**

- 34.18.2. All displayed transaction information must be shown for at least 30 seconds after the completion of a delivery or the start of the next transaction. The delivery is considered complete after the "handle" is off or after the nozzle has been returned to its designed hanging position. **Yes**  **No**  **N/A**

**Code Reference: S.1.2. Compressed Natural Gas Dispensers -- Mass Flow Meters**

Except for fleet sales and other price contract sales, a compressed natural gas dispenser used to refuel vehicles, shall be of the

computing type and shall indicate the quantity, the unit price, and the total price of each delivery. The mass measured for each transaction shall be displayed on the dispenser either continuously on an external or internal display accessible during the inspection and test of the dispenser, or display the quantity in mass units by using controls on the device. Code Reference:

#### S.1.3.1.1. Compressed Natural Gas Used as an Engine Fuel - Mass Flow Meters

When compressed natural gas is dispensed as an engine fuel, the delivered quantity shall be indicated in "gasoline liter equivalent (GLE) units" or "gasoline gallon equivalent (GGE) units" (See Handbook 44 definitions below).

**Gasoline Gallon Equivalent (GGE).** Gasoline gallon equivalent (GGE) means 5.660 pounds of natural gas. [3.37] (Added 1994)

**Gasoline Liter Equivalent (GLE).** Gasoline liter equivalent (GLE) means 0.678 kilograms of natural gas. [3.37] (Added 1994)

- 34.19. An electronic digital indicating element shall either:
- 34.19.1. have adequate display capacity for the application, or **Yes**  **No**  **N/A**
- 34.19.2. automatically stop the delivery before exceeding the maximum quantity or maximum total price that can be indicated. **Yes**  **No**  **N/A**

#### Code Reference: S.1.3.3. Money-Value Divisions, Digital

- 34.20. The maximum value of the quantity-value division for liquids shall not be greater than 0.2 percent of the minimum measured quantity. **Yes**  **No**  **N/A**
- 34.20.1. 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 gasoline liter equivalent (GLE) for devices indicating in metric units or 0.001 gasoline gallons equivalent intervals for devices indicating in inch-pound units. The maximum value of the mass division shall not exceed 0.001 kg or 0.001 lb. **Yes**  **No**  **N/A**

*Note: At least four decimal places in cents must be carried to determine the proper round off of money values.*

#### Code Reference: S.1.3.1. Units of Measurement

- 34.21. The primary indicating element may indicate in grams, kilograms, metric tons, pounds, tons, liters, gallons, quarts, and/or pints. Fractional parts of each unit must be expressed in decimal subdivisions. **Yes**  **No**  **N/A**

*Note: The mass shall be expressed as apparent mass versus a density of 8.0 g/cm<sup>3</sup>.*

- 34.22. Volume indications may be based upon mass measurements as long as an automatic means to determine and correct for changes in product density is included in the system. **Yes**  **No**  **N/A**

#### Code Reference: S.1.3.3. Value of Smallest Unit

- 34.23. The value of the quantity division shall not exceed the equivalent of 0.001 units mass and 0.01 GLE or 0.001 GGE. **Yes**  **No**  **N/A**

#### Code Reference: S.2.4.1., S.2.4.2. Provisions for Power Loss

Even if power fails during a delivery, it is still necessary to correctly complete all transactions in progress at the time of the power failure. Quantity and total sales price information shall be recallable for at least 15 minutes after the power failure. The information may be recalled at the dispenser or at the console if the console indications are accessible to the customer. Operator information, such as fuel and money value totals, shall be retained in memory during a power failure. The operator information is not required to be recallable during the power failure, but shall be recallable after power is restored. Test to determine if the indications are accurate when the delivery is continued after a power failure.

- 34.24. The quantity and total sales price shall be recallable for 15 minutes after the power failure. **Yes**  **No**  **N/A**
- 34.25. The quantity and total sales price values shall be correct if the power fails between deliveries. **Yes**  **No**  **N/A**
- 34.26. The quantity and total sales price values shall be correct if the delivery is continued after a power failure. **Yes**  **No**  **N/A**
- 34.27. The operator's information shall be retained in memory during a power failure. **Yes**  **No**  **N/A**

**Code Reference: UR.3.8., S.2.1. Return to Zero**

The primary indicating and recording elements of a retail device shall be readily returnable to a definite zero indication. Key-lock and other self-operated devices must have a zero-return indicating element, but are not required to have the recording element return to zero. These devices may be equipped with cumulative recording elements. The primary indicating and recording elements shall not go beyond their correct zero position.

- 34.28. Does the device have a primary recording element? **Yes**  **No**  **N/A**
- 34.29. The indicating and recording elements of a retail device shall be readily returnable to a definite zero indication. **Yes**  **No**  **N/A**
- 34.30. Key-lock and self-operated devices shall have an indicating element that returns to zero. **Yes**  **No**  **N/A**
- 34.31. Does the device have:
- 34.31.1. a cumulative indicating element? **Yes**  **No**  **N/A**
- 34.31.2. a cumulative recording element? **Yes**  **No**  **N/A**
- 34.32. Primary indicating and recording elements shall not go beyond their correct zero position. **Yes**  **No**  **N/A**
- 34.33. Does the device return to zero after each delivery if the device is not key-lock or self operated? **Yes**  **No**  **N/A**

**Code Reference: S.2.5.1. Display of Unit Price**

A computing or money-operated device shall have a means for displaying on each face of the device the unit price at which it is set to compute or deliver. The unit price shall be expressed as a decimal value in dollars.

- 34.34. Means shall be provided to display the unit price on the face of the device. **Yes**  **No**  **N/A**
- 34.35. The unit price shall be expressed in dollars and decimals of dollars using a dollar sign. A common fraction shall not appear in the unit price; e.g., \$1.199 not \$1.29 9/10. **Yes**  **No**  **N/A**

**Code Reference: S.2.5.2. Display of Product Identity**

- 34.36. Means shall be provided to post the identity of the dispensed product. **Yes**  **No**  **N/A**

**Code Reference: S.2.5.3. Selection of Unit Price**

- 34.37. Unless the dispenser is used exclusively for fleet sales or other contract sales, means shall be available to select the unit price prior to delivering product using customer-activated controls. **Yes**  **No**  **N/A**
- 34.38. The dispenser shall not permit a change to the unit price during the delivery of a product. **Yes**  **No**  **N/A**

**Code Reference: S.2.6.2. Display of Quantity and Total Price**

When a delivery is completed on a computing device, 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 customer uses controls on the device or other user-activated controls to initiate the next transaction.

*Note: The displayed unit price may revert to a base unit price immediately after the completion of a transaction, defined as the time the delivery has been terminated and payment has been settled. Any display of quantity, unit price, and total price that is not in mathematical agreement occurs between transactions and is permitted (in response to demands of device users) because the displayed values between "transactions" are not "significant" relative to the actual delivery process (transaction).*

**35. Computing**

A retail computing device shall be capable of computing total sale prices for all unit prices and for all deliveries within the range of measurement or computing capacity. The maximum value of the money-value division and the maximum variation of indicated total sale price from the mathematically computed total sale price are specified for analog devices. Because analog dispensers may have different money-value divisions depending upon the unit price, the service station console must update in the same money-value division to maintain agreement of total sale price values. The maximum quantity-value divisions for digital devices are prescribed.

**Code Reference: S.2.6. Money-Value Computations**

- 35.1. A retail computing device shall compute total sale prices for all quantities and unit prices within the range of its quantity and computing capacities. **Yes**  **No**  **N/A**

*Note: This requirement does not apply to devices for which the Certificate of Conformance is limited to installations where the devices are used for fleet sales, other price contract sales, and truck stop dispensers used only to refuel trucks.*

**Code Reference: G-S.5.5. Digital Money-Value Divisions**

- 35.2. Digital quantity and total price indications shall agree to the nearest cent. Yes  No  N/A
- 35.3. Total price indications shall be based on quantity-value divisions that are less than or equal to 0.01 gasoline liters equivalent or 0.001 gasoline gallons equivalent. Yes  No  N/A

**Code Reference: S.2.6.1. Money-Value Divisions, Auxiliary Indications**

- 35.4. Money value divisions on devices such as remote consoles and printers shall be the same as on the dispenser. Yes  No  N/A

*Note: This requirement does not apply to devices for which the Certificate of Conformance is limited to installations where the devices are used exclusively for fleet sales, other price contract sales, and truck refueling (e.g., truck stop dispensers used only to refuel trucks).*

**Code Reference: S.2.5.4. Agreement Between Indications**

- 35.5. The quantity values indicated on a console and a dispenser may differ, however:
- 35.5.1. all indicated or recorded total money values for an individual sale shall agree; and Yes  No  N/A
- 35.5.2. the indicated or recorded quantity of each element, unit price, and total sales price values shall meet the formula (quantity x unit price=total sales price) to the closest one cent. Yes  No  N/A

**36. Measuring Elements**

**Code Reference: S.3.5. Provision for Sealing; S.3.3. Vapor Elimination**

Measuring elements shall be designed with adequate provisions to prevent changes from being made to the measuring element or the flow rate control (if the flow rate control affects the accuracy of deliveries) without evidence of the change being made. These provisions can be an approved means of security (e.g., data change audit trail) or physically applying a security seal which must be broken before adjustments can be made. When applicable, the adjusting mechanism shall be readily accessible for the purposes of affixing a security seal.

- 36.1. A mass flow metering system shall be equipped with a vapor or air eliminator or other automatic means to prevent the passage of vapor or air through the meter. Yes  No  N/A
- 36.2. Vent lines from the air or vapor eliminator (if present) shall be made of metal tubing or other rigid material to prevent the lines from being pinched closed and re-opened without being detected. Yes  No  N/A
- 36.3. A measuring element shall have provisions for either:
- 36.3.1. applying a physical security seal, or Yes  No  N/A
- 36.3.2. an approved means of security (e.g., data change audit trail) so that no changes may be made to its adjustable components. Yes  No  N/A
- 36.4. Any adjustable element controlling the delivery rate shall provide for sealing or other approved means of security (e.g., data audit trail) if the flow rate affects the accuracy of deliveries. Yes  No  N/A
- 36.5. When applicable, the adjusting mechanism shall be readily accessible for the purposes of affixing a security seal. Yes  No  N/A
- 36.6. Audit trails shall use the format set forth in the Common and General Code Criteria section of this checklist (Code Reference G-S.8) and in Appendix A, Audit Trail Checklist for Liquid-Measuring Devices. [Nonretroactive and enforceable as of January 1, 1995] Yes  No  N/A
- 36.7. Adequate provision must be made for an approved means of security (e.g., data change audit trail) or physically applying security seals in such a manner that an adjustment on any device that affects the measurement result cannot be made without breaking the security seal. Provision shall be made for the zero adjustment mechanism to meet this requirement. Yes  No  N/A

*Note: See also Common General Code Criteria Code Reference G-S.8 and Appendix A for audit trail criteria*

- 36.8. Retail motor-fuel dispensers with remote configuration capabilities shall be sealed as specified in Table S.3.5. and according to Appendix A, Audit Trail Checklist for Liquid-Measuring Devices and under the "Common and General Code Criteria" sections of this checklist. **Yes**  **No**  **N/A**

**Code Reference: S.3.6. Mass Flow Meters Only**

- 36.9. An automatic means to determine and correct for changes in product density due to changes in temperature, pressure, and composition, shall be incorporated in any mass flow metering system that is affected by changes in the density of the product being measured. **Yes**  **No**  **N/A**

**Code Reference: S.3.8. Zero-Set-Back Interlock**

The zero-set-back interlock on a dispenser is critical to prevent fraudulent practices. A retail motor-fuel device shall have an effective automatic interlock such that once the dispenser is shut off, it cannot be restarted without resetting the indicating element to zero. This requirement also applies to the recording element if one is present. The dispenser shall be designed so that the starting mechanism must be in the shut-off position and the interlock engaged before the discharge nozzle can be returned to its designed hanging position. If a single pump supplies more than one dispenser, then each dispenser shall have an automatic control valve that prevents product from being delivered by a dispenser until its indications have been set to zero.

- 36.10. After the device is turned off by movement of the mechanism that stops the flow, a subsequent delivery shall be prevented until the indicators (and recording element if present) have returned to their correct zero positions. **Yes**  **No**  **N/A**
- 36.11. The starting mechanism shall be in shut off position and zero-set-back interlock engaged before the nozzle can 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. **Yes**  **No**  **N/A**
- 36.12. If more than one dispenser is connected to a single compressor station, an automatic control valve shall prevent fuel from being delivered until the indicating elements have been returned to their correct zero position and engaged. **Yes**  **No**  **N/A**
- 36.13. Use of the interlock shall be effective under all conditions when any control on the console, except a system emergency shut-off, is operated and after any momentary power failure. **Yes**  **No**  **N/A**

**Code Reference: S.4.3. Directional Flow Valves**

- 36.14. Valves intended to prevent the reversal of flow shall be automatic in operation. **Yes**  **No**  **N/A**

**37. Discharge Lines and Discharge Line Valves**

**Code Reference: S.4.1. Diversion of Measured Vapor**

To prevent fraudulent practices, it shall not be possible to divert measured vapor from the measuring chamber or the discharge line of a device.

A device may have two or more delivery outlets if there are automatic means to insure that:

- a. vapor can flow from only one outlet at a time, and **Yes**  **No**  **N/A**
- b. the direction of vapor flow is definitely and conspicuously indicated. **Yes**  **No**  **N/A**
- 37.1. Except as identified above, it shall not be possible to divert measured vapor from the measuring chamber or the discharge line of the device. **Yes**  **No**  **N/A**

**Code Reference: S.3.7. Pressurizing the Discharge Hose**

- 37.2. The discharge hose for compressed natural gas shall automatically pressurize prior to the advancement of the register. **Yes**  **No**  **N/A**

**Code Reference: S.4.4. Discharge Valve**

- 37.3. A discharge valve installed in the discharge side of the instrument shall be of the automatic or semi-automatic predetermined-stop type or shall be operable only:
- 37.3.1. by means of a tool (but not by a pin) entirely separate from the device, or **Yes**  **No**  **N/A**

37.3.2. by means of a security seal with which the valve is sealed open. Yes  No  N/A

**Code Reference: S.4.5. Anti-drain Valve**

37.4. There shall be effective means provided to prevent hose drainage between transactions or: Yes  No  N/A

37.4.1. The device shall automatically correct for loss of product in the hose before a subsequent delivery. Yes  No  N/A

37.4.2. If the hose is designed to be bled back to the storage tank, then there shall be automatic means to correct for these conditions so that the customer is not charged for the hose fill or portion of product not received. Yes  No  N/A

**38. Marking**

**Code Reference: S.5. Marking Requirements**

38.1. The dispenser shall have the following information on the identification plate:

a. pattern approval mark (i.e., type approval number); Yes  No  N/A

b. name and address of the manufacturer or his trademark and, required by the weights and measures authority, the manufacturer's identification mark in addition to the trademark; Yes  No  N/A

c. model designation or product name selected by the manufacturer; Yes  No  N/A

d. non-repetitive serial number; Yes  No  N/A

e. accuracy class of the meter as specified by the manufacturer consistent with Table T.2; Yes  No  N/A

f. maximum and minimum flow rates in pounds per unit of time; Yes  No  N/A

g. maximum working pressure; Yes  No  N/A

h. applicable temperature range if other than - 10 °C to +50 °C; Yes  No  N/A

i. minimum measured quantity (MMQ); Yes  No  N/A

j. product limitations if applicable. Yes  No  N/A

**Code Reference: S.5.1. Marking of Gasoline Volume Equivalent Conversion Factor**

A device dispensing compressed natural gas shall have either the statement "1 Gasoline Liter Equivalent (GLE) is Equal to 0.678 kg of Natural Gas" or "1 Gasoline Gallon Equivalent (GGE) is Equal to 5.660 lb of Natural Gas" permanently and conspicuously marked on the face of the dispenser according to the method of sale used.

**39. Installation Requirements**

**Code Reference: UR.2. Low-Flow Cut-Off Valve**

39.1. The low-flow cut-off valve shall not be set at flow rates lower than the minimum operating flow rate specified by the manufacturer. The system shall be equipped with a flow control valve, which prevents the flow of product and stops the indicator from registering whenever the product flow rate is less than the low-flow cut-off. Yes  No  N/A

**Additional Checklist and Procedures for CNG Retail Motor-Fuel Dispensers**

**40. Card-Activated Retail Motor-Fuel Dispensers**

**Code Reference: G-S.2. Facilitation of Fraud**

There is great concern regarding the potential for accidental or intentional fraud when card-activated systems are used in service stations, especially because bank-card-activated systems give direct access to bank accounts. The following criteria and test procedures apply to card-activated retail motor-fuel dispensers.

A card-activated system shall authorize the dispensing of product for not more than three minutes of the time between authorization and "handle on" at the dispenser. It shall properly record transactions on the appropriate card account.

When a card-activated system is subjected to power loss of greater than 10 seconds, the dispenser shall deauthorize. Because systems may be installed with separate power lines to the console, card reader, and dispenser, to different parts of the system should be tested with power failures to evaluate the potential for accidental or intentional errors. The appropriate device response depends upon when the power loss occurs during the delivery sequence.

- 40.1. The dispenser must de-authorize in not more than three minutes if the pump "handle" is not turned on. **Yes**  **No**   
N/A
- 40.2. If the time limit to deactivate a dispenser is programmable, it shall not accept an entry greater than three minutes. **Yes**  **No**   
N/A
- 40.3. When a power loss greater than 10 seconds occurs after the pump "handle" is on, the dispenser must de-authorize. **Yes**  **No**   
N/A
- 40.4. When there is a loss of power, but the pump "handle" is not on, the dispenser must de-authorize in not more than three minutes. **Yes**  **No**   
N/A

**41. Test Methods**

- 41.1. Authorize the dispenser and, with the pump "handle" on, interrupt power to any part (or all) of the system. The pump should de-authorize immediately. **Yes**  **No**   
N/A   
Specifically,  
  - Authorize with a card and turn the "handle" on.
  - Power down briefly, then restore power.
  - Try to dispense product: the dispenser must not dispense since the power failure should have de-authorized the dispenser.
- 41.2. Authorize the dispenser using a card (leaving handle off), wait more than three minutes, and try to start the dispenser. It should not start because the authorization should have timed out. Specifically,
  - 41.2.1. Authorize with a card, but do not turn the "handle" on. **Yes**  **No**   
Power down for more than three minutes, and then restore power. **N/A**   
Try to dispense product: the dispenser should have "timed-out" and not dispense.
  - 41.2.2. Authorize and dispense with card #1. **Yes**  **No**   
Allow the system to time out and de-authorize (if it does). **N/A**   
Do not turn off the "handle".  
Authorize and dispense with card #2.  
The transactions shall be properly recorded for each card.

*Note: A mechanical register may accumulate the two deliveries, but the printed record must not have accumulated values.*

- 41.2.3. Authorize with card #1. Turn the "handle" on, then off. **Yes**  **No**   
 Authorize with card #2. Dispense product and complete the **N/A**

delivery.

Check the printed receipt to verify that the delivery has been properly charged to card #2.

- 41.2.4. Turn the dispenser "handle" on and use a card to authorize the dispenser. **Yes**  **No**   
Turn the "handle" off, then on. **N/A**   
Try to deliver product: the dispenser must not dispense.

For multi-hose dispensers:

- 41.2.5. Turn the dispenser "handle" on and use a card to authorize the dispenser. **Yes**  **No**   
Turn the "handle" off. After a period of 15 seconds, turn the "handle" on. **N/A**   
Try to deliver product; the dispenser must not dispense.

- 41.2.6. Authorize with card #1 (do not turn the "handle" on) and interrupt power for at least 10 seconds. This should de-authorize the dispenser. **Yes**  **No**   
Resupply power, turn "handle" on, and try to dispense. The dispenser shall **N/A**   
not deliver product.

- 41.2.7. Authorize with card #1, turn the "handle" on, and then interrupt power. This should de-authorize the dispenser. **Yes**  **No**   
Resupply power and authorize the dispenser with card #2, then complete a delivery. **N/A**   
Verify that the transaction is charged to card #2.

- 41.2.8. Authorize a dispenser with card #1, but do not turn the dispenser "handle" on. **Yes**  **No**   
Try to authorize the same dispenser with card #2, it should not be accepted **N/A**   
until after the three minute time-out

- 41.3. Attempt to override or confuse the card system by: varying the length of time the card is in the slot, i.e., vary the "swipe" times, and pushing all other keys on the keypad during each step of the authorization process. **Yes**  **No**   
**N/A**

## 42. Checklist for Cash-Activated CNG Retail Motor-Fuel Dispensers

The following criteria and test procedures apply to cash-activated retail motor-fuel dispensers. Tests should be performed using various denominations of bills accepted by the cash acceptor

Cash acceptors must meet the marking requirements of paragraph G-UR.3.4. Responsibility, Money-Operated Devices.

### Code Reference: S.2.4. Provisions for Power Loss

Even if power is interrupted during a delivery, it is still necessary to correctly complete all transactions in progress at the time of the power interruption. 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, sales price, or amount of money already inserted into the cash acceptor) shall be determinable for at least 15 minutes at the dispenser or at the console or journal printer if the console or journal printer is accessible to the customer.

All portions of the transaction must be accounted for in order to complete the transaction. This information would include the following: (1) the total amount of money that was inserted into the device prior to the power interruption; (2) the amount of product already dispensed (this should be available from the dispenser which must itself comply with the requirements of S.2.4.1.); and (3) any bill that has been inserted, but has not yet been recognized by the cash acceptor. (Note: For bills that have not yet been drawn into the cash acceptor to the point that the bill is no longer visible, it is assumed that the information

on the bill denomination can be obtained from visual examination.)

Various methods may be used to recall specific portions of the transaction depending on how the basic system operates. For example, systems that can print a record of the amount fed into the machine as each bill is fed into the device maintain an ongoing record of bills recognized by the system. Other systems may not print a receipt until the end of the transaction, so the information is recalled on a journal printer that is accessible to the customer or can be recalled on the cash acceptor display.

Check to see what happens when power is interrupted at different points of the transaction. Note what occurs at the points where power is interrupted and what information in the form of audible and visual instructions or error messages is provided on the customer's receipt. Because systems may be installed with separate power lines to the console, card reader, and dispenser, tests should be run with power interruptions to different parts of the system to evaluate the potential for accidental or intentional errors. The appropriate device response depends upon when the power loss occurs during the delivery sequence.

- 42.1. Systems with Battery Back-up or Uninterruptible Power Supply or Equivalent - Some systems are equipped with a battery back-up or an uninterruptible power supply (or equivalent) which allows a transaction to continue in the event of a power loss. For such systems, the transaction in progress at the time of a power interruption must continue as if no power interruption had occurred (or comply with the requirements for systems not equipped with a battery back-up). That is, all bills must be correctly accounted for (including bills being fed into the device at the time of the power loss) and the quantity and total sale amounts must be mathematically correct. Check these systems by interrupting power at several points in the transaction to ensure that all information (total price, quantity, mathematical agreement, and total dollar amount inserted by the customer) is accounted for correctly.
- Yes  No   
N/A

**All Other Systems** - To check the operation of systems not equipped with a battery back-up, uninterruptible power supply, or equivalent, interrupt power as described below. As noted earlier, if separate power lines supply different components in the system, interrupt power to different parts of the system.

- 42.2. When the device has accepted and requested one or more bills, but product has not yet been dispensed, at least one of the following criteria must be met to ensure that this information can be recalled in the event of a power interruption:
- 42.2.1. The printer must print the denomination of the bill on the device as the device recognizes the bill. (The printed receipt must be available to the customer.)
- Yes  No   
N/A
- 42.2.2. The denomination of each bill must be printed by a journal or other printer accessible to the customer as each bill is recognized by the device.
- Yes  No   
N/A
- 42.2.3. The running total display must be capable of being recalled for at least 15 minutes.
- Yes  No   
N/A
- 42.2.4. Means provided to enable the customer to retrieve the money inserted into the device (e.g., a button which can be used during a power interruption to eject the money inserted by the customer).
- Yes  No   
N/A
- 42.2.5. Other means used to provide a visual or printed record of the total amount of money accepted by the device.
- Yes  No   
N/A
- 42.3. There is a brief period of time during which a bill has been accepted by the cash acceptor, but has not yet been recognized by the device. In the case of a power interruption during that time period, the following criteria must be met to ensure that this information can be recalled in the event of a power interruption:
- Yes  No   
N/A

- 42.3.1. Means provided to enable the attendant or customer to retrieve the bill (for example, a button which can be used during a power interruption to eject the bill or if the cash acceptor box can be removed by the attendant and the bill retrieved). **Yes**  **No**   
**N/A**

*Notes: There may be a space of time in which a bill can be caught partially in and partially out of the cash acceptor during a power interruption. In such a case, if the denomination of the bill is visible to the customer and attendant, this is sufficient to provide information about the bill being fed into the device at the time of the power interruption. The cash acceptor must comply with the other applicable items noted above.*

It is expected that the retail motor-fuel dispenser will comply with S.2.4. and the information on the product already dispensed can be recalled through this portion of the system.

- 42.4. Power should be interrupted at different points in the transaction to determine that all transaction information can be recalled in the event of a power interruption, including combinations of:
- 42.4.1. after one bill has been inserted **Yes**  **No**   
**N/A**
- 42.4.2. after several bills have been inserted **Yes**  **No**   
**N/A**
- 42.4.3. while a bill is being inserted **Yes**  **No**   
**N/A**
- 42.4.4. after a bill has been inserted but not yet recognized **Yes**  **No**   
**N/A**
- 42.4.5. after a bill(s) has been inserted and recognized, but the on/off handle is still in the "off" position **Yes**  **No**   
**N/A**
- 42.4.6. after a bill(s) has been inserted and recognized, the on/off handle is in the "on" position, but no product has been dispensed **Yes**  **No**   
**N/A**
- 42.4.7. after a bill(s) has been inserted and recognized, the on/off handle is in the "on" position, and product is being dispensed **Yes**  **No**   
**N/A**

**Code Reference: G-S.5.1. Indicating and Recording Elements, General**

- 42.5. Total Money Display - A running display showing the amount of money fed into the machine must be provided. It is not necessary for this information to be displayed once the customer initiates delivery. **Yes**  **No**   
**N/A**
- 42.6. Printed Receipt - A printed receipt must be available to the customer from the device at the completion of the transaction. The issuance of the receipt may be initiated at the option of the customer. **Yes**  **No**   
**N/A**

Because the customer must be provided with the option of receiving a receipt, the system must not accept cash if sufficient paper is not available to complete the transaction.

The cash acceptor must not initiate a cash transaction if either of the following conditions are true:

- no paper is in the receipt printer of the cash acceptor **Yes**  **No**   
**N/A**
- insufficient paper is available to complete a transaction **Yes**  **No**   
**N/A**

**Code Reference: G-S.6. Marking Operational Controls, Indications, and Features**

- 42.7. Instructions to inform the customer how to operate the cash acceptor must be marked on the device. **Yes**  **No**   
**N/A**  **Yes**  **No**

N/A

**Code Reference: G-S.2., Facilitation of Fraud**

- 42.8. Means must be provided for the customer to cancel the transaction at any point.
- 42.8.1. The customer has inserted cash, but has not yet dispensed product. If the customer cancels the transaction by pressing the cancel key (or equivalent key(s)) or by lowering the on/off handle, the device must either:
- 42.8.1.1. be equipped with means for the customer to retrieve the cash inserted from the device **AND** **Yes**  **No**   
N/A
- 42.8.1.2. automatically issue a printed receipt indicating the amount tendered and the amount returned **OR** **Yes**  **No**   
N/A
- 42.8.1.3. display instructions (such as "sale terminated, see attendant", "sale terminated, get receipt" or similar wording) for the customer to see the attendant **AND** **Yes**  **No**   
N/A
- 42.8.1.4. automatically issue a printed receipt showing the amount of cash inserted by the customer, a statement indicating that the sale was terminated, and instructions for the customer to see the attendant **Yes**  **No**   
N/A
- 42.8.2. The customer has inserted cash and has started dispensing product. If the customer cancels or discontinues the transaction by pressing the cancel key (or equivalent key(s)) or lowering the on/off handle before reaching the total money inserted into the device, the device must:
- 42.8.2.1. display instructions for the customer to obtain the receipt and to see the attendant **Yes**  **No**   
N/A
- 42.8.2.2. automatically issue a printed receipt showing the amount of cash inserted, the amount dispensed, the balance due to the customer, a statement indicating that the sale was terminated, and instructions for the customer to see the attendant **Yes**  **No**   
N/A

*Note: It is acceptable for different messages to be used depending upon whether the transaction is terminated by use of the cancel key (e.g., "sale terminated, get receipt" or "sale terminated, see attendant") or by lowering the on/off handle (e.g., "change due, see attendant").*

**43. Additional Checklist and Test Procedures for Milk Meters**

**Code Reference: S.3.1. Diversion of Liquid to be Measured -- Milk Meters Code (Milk Meters Code Reference)**

There will be no means provided by which any liquid can be diverted from the supply tank to the receiving tank without being measured by the device. A manually controlled outlet that may be opened for purging or draining the measuring system shall be permitted. Effective means shall be provided to prevent passage of liquid through any such outlet during normal operation of the measuring system.

**44. Additional Checklist and Test Procedures for Interfacing Components**

When examining the interface between Electronic Indicator and a Measuring Element, the following must be considered:

- |       |  |   |
|-------|--|---|
| 44.1. | Does the electronic indicator have a CC?   | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.2. | Is the electronic indicator being used within the application limits of the CC?  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.3. | Does the measuring element have a CC?  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.4. | Is the measuring element being used within the application limits of the CC?   | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.5. | Can the system into which both devices are installed be accurately calibrated?   | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.6. | Can a ticket (if required) be properly printed?  | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |
| 44.7. | Are interfaces, other than mechanical or pulse interfaces (e.g. 4-20 mA or frequency interfaces), being used as defined by the appropriate CC? | Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> |