

Hydrocarbon Gas Vapor-Measuring Devices

Device Description: _____

Contact Name: _____ Phone: _____

Company: _____ Address: _____

E-mail: _____ City: _____

Instructions For Completing Pre-Evaluation Checklists

You will usually need to complete **both** the “General” checklist and the specific checklist which is most applicable to your device or system type. For example, for a weighing device or weighing system the “General” checklist (which applies to all device types) and the “Scales” checklist should be completed. Both the “General” and “Watt-hour Meter” checklists should be completed and submitted with an electric watt-hour metering system application.

The exceptions are the computer software/hardware component pre-evaluation checklists which have the “General” requirements incorporated in them. Use the checklist for computer systems connected with either scales or measuring systems. Only one pre-evaluation checklist will be needed unless the software will be connected to both types of systems.

These checklists include requirements extracted from the California Code of Regulations. Though not all-encompassing, the checklists contain requirements beyond those which would apply to any single device type or accessory. It is best to think of a device type as a weighing or measuring device system or as a component of such a system whichever best describes the device(s).

When applying the requirements to your device you have three options; Check

- YES** If your device or system complies
- NO** if the device or system does not comply.
- NA** if sections appear not to apply to the device or system type(s)

If selecting “**NO**”, consider if your device or system is ready for evaluation. If the deficiency is of such a nature that it will not effect the ability to test for accuracy, such as failure to conform with marking requirements or lack of provision for sealing, the evaluation can probably begin while deficiencies are being corrected.

If you are not able to conduct accuracy testing your system or device is probably not yet ready for an evaluation.

I have reviewed the enclosed specifications, tolerances, and test notes for the device type for which we have applied for evaluation and approval. To the best of my knowledge I have determined the device meets all applicable requirements.

Signed: _____

Date: _____

Hydrocarbon Gas Vapor-Measuring Devices

| |
|---|
| <p>A. Application.</p> <p>A.1. This code applies to devices used for the measurement of hydrocarbon gas in the vapor state, such as propane, propylene, butanes, butylenes, ethane, methane, natural gas and any other hydrocarbon gas/air mix.</p> |
| <p>A.2. This code does not apply to:</p> <p>(a) Liquid-measuring devices used for dispensing liquefied petroleum gases in liquid form. (b) Natural, liquefied petroleum, and manufactured-gas-vapor meters when these are operated in a public utility system. (c) Mass flow meters.</p> |
| <p>A.3. See also General Code requirements.</p> |

| | Yes | No | NA |
|--|-----|----|----|
| <p>S. Specifications.</p> | | | |
| <p>S.1. Design of Indicating and Recording Elements and of Recorded Representations.</p> | | | |
| <p>S.1.1. Primary Elements.</p> | | | |
| <p>S.1.1.1. General. - A device shall be equipped with a primary indicating element and may also be equipped with a primary recording element.</p> | | | |
| <p>S.1.1.2. Units. - A volume-measuring device shall indicate, and record if equipped to record, its deliveries in terms of cubic meters or cubic feet, or multiple or decimal subdivisions of cubic meters or cubic feet.</p> | | | |
| <p>S.1.1.3. Value of Smallest Unit. - Volume-Measuring Devices: The value of the smallest unit of indicated delivery, and recorded delivery if the device is equipped to record, shall not exceed:</p> <p>(a) 1 m³ (1 000 dm³) (100 ft³) when the maximum rated gas capacity is less than 100 m³/h (10 000 ft³/h); (b) 10 m³ (1 000 ft³) when the maximum rated gas capacity is 280 m³/h (10 000 ft³/h) up to but not including 1 700 m³/h (60 000 ft³/h); (c) 100 m³ (10 000 ft³) when the maximum rated gas capacity is 1 700 m³/h (60 000 ft³/h) or more.</p> | | | |
| <p>S.1.1.4. Advancement of Indicating and Recording Elements. - Primary indicating and recording elements shall advance digitally or continuously and be susceptible to advancement only by the mechanical operation of the device.</p> | | | |

Hydrocarbon Gas Vapor-Measuring Devices

| | Yes | No | NA |
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| <p>S.1.1.5. Proving Indicator. - Devices rated less than 280 m³/h (10 000 ft³/h) gas capacity shall be equipped with a proving indicator measuring 0.025, 0.05, 0.1, 0.2, or 0.25 m³ per revolution (1, 2, 5, or 10 ft³ per revolution) for testing the meter. Devices with larger capacities shall be equipped as follows:</p> <p>(a) Devices rated 280 m³ (10 000 ft³) up to but not including 1 700 m³/h (60 000 ft³/h) gas capacity shall be equipped with a proving indicator measuring not greater than 1 m³ (100 ft³) per revolution.</p> <p>(b) Devices rated 1 700 m³/h (60 000 ft³/h) gas capacity or more shall be equipped with a proving indicator measuring not more than 10 m³ (1 000 ft³) per revolution.</p> <p>The test circle of the proving indicator shall be divided into 10 equal parts. Additional subdivisions of one or more of such equal parts may be made.</p> | | | |
| <p>S.1.2. Graduations.</p> <p>S.1.2.1. Length. - Graduations shall be so varied in length that they may be conveniently read.</p> | | | |
| <p>S.1.2.2. Width. - In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, and in no case should it exceed 1.0 mm (0.04 in) for indicating elements and 0.5 mm (0.02 in) for proving circles.</p> | | | |
| <p>S.1.2.3. Clear Interval Between Graduations. - The clear interval shall be not less than 1.0 mm (0.04 in). If the graduations are not parallel, the measurement shall be made:</p> <p>(a) along the line of relative movement between the graduations at the end of the indicator, or</p> <p>(b) if the indicator is continuous, at the point of widest separation of the graduations.</p> | | | |
| <p>S.1.3. Indicators.</p> <p>S.1.3.1. Symmetry. - The index of an indicator shall be symmetrical with respect to the graduations, at least throughout that portion of its length associated with the graduations.</p> | | | |
| <p>S.1.3.2. Length. - The index of an indicator shall reach to the finest graduations with which it is used.</p> | | | |
| <p>S.1.3.3. Width. - The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than:</p> <p>(a) the width of the widest graduation, and</p> <p>(b) the width of the minimum clear interval between graduations.</p> <p>When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.</p> | | | |

Hydrocarbon Gas Vapor-Measuring Devices

| | Yes | No | NA |
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| <p>S.1.3.4. Clearance. - The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).</p> | | | |
| <p>S.1.3.5. Parallax. - Parallax effects shall be reduced to the practicable minimum.</p> | | | |
| <p>S.2. Design of Measuring Elements.</p> <p>S.2.1. Pressure Regulation. - Except when measured as a retail motor fuel, the vapor should be measured at a normal gauge pressure (psig) of:</p> <p>(a) 2 740 Pa ± 685 Pa [11 in of water column (0.40 psig) ± 2.75 in of water column (0.10 psig)] for liquefied petroleum gas vapor; or</p> <p>(b) 1 744 Pa ± 436 Pa [7 in of water column (0.25 psig) ± 1.75 in of water column (0.06 psig)] for natural and manufactured gas.</p> <p>When vapor is measured at a pressure other than what is specified above for the specific product, a volume multiplier shall be applied within the meter or to the billing invoice based on the following equation:</p> $VPM = \frac{AAP + GP}{AAP + NGP}$ <p>Where</p> <p>VPM = Volume pressure multiplier AAP = Assumed atmospheric pressure in psia GP = Gauge pressure in pascal or psig NGP = Normal gauge pressure in pascal or psig</p> <p>The assumed atmospheric pressure is to be taken from Tables 2 and 2M (see pages 7 & 8).</p> <p>When liquefied petroleum gas vapor is measured at a pressure of 6 900 Pa (1 psig) or more, the delivery pressure shall be maintained within ± 1 725 Pa (± 0.25 psig).</p> <p>Pressure variations due to regulator lock off shall not increase the operating pressure by more than 25%.</p> | | | |
| <p>S.2.2. Provision for Sealing. - Adequate provision shall be made for applying security seals in such a manner that no adjustment or interchange may be made of any measurement element.</p> | | | |
| <p>S.2.3. Maintenance of Vapor State. - A device shall be so designed and installed that the product being measured will remain in a vapor state during passage through the meter.</p> | | | |
| <p>S.2.4. Automatic Temperature Compensation. - A device may be equipped with an adjustable automatic means for adjusting the indication and registration of the measured volume of vapor product to the volume at 15 °C (60 °F).</p> | | | |

Hydrocarbon Gas Vapor-Measuring Devices

| | Yes | No | NA |
|--|-----|----|----|
| <p>S.3. Design of Discharge Lines.</p> <p>S.3.1. Diversion of Measured Vapor. - No means shall be provided by which any measured vapor can be diverted from the measuring chamber of the meter or the discharge line therefrom.</p> | | | |
| <p>S.4. Marking Requirements.</p> <p>S.4.1. Limitations of Use. - If a device is intended to measure accurately only products having particular properties, or to measure accurately only under specific installation or operating conditions, or to measure accurately only when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently stated on the device.</p> | | | |
| <p>S.4.2. Discharge Rates. - A volume-measuring device shall be marked to show its rated gas capacity in cubic meters per hour or cubic feet per hour.</p> | | | |
| <p>S.4.3. Temperature Compensation. [NOT ADOPTED]</p> <p>S.4.4. Badge. - A badge affixed in a prominent position on the front of the device shall show the manufacturer's name, serial number and model number of the device, and capacity rate of the device for the particular products that it was designed to meter as recommended by the manufacturer.</p> | | | |
| <p>N. Notes.</p> <p>N.1. Test Medium. - The device shall be tested with air or the product to be measured.</p> | | | |
| <p>N.2. Temperature and Volume Change. - Care should be exercised to reduce to a minimum any volume changes. The temperature of the air, bell-prover oil, and the meters under test should be within 1 °C (2 °F) of one another. The devices should remain in the proving room for at least 16 hours before starting any proving operations to allow the device temperature to approximate the temperature of the proving device.</p> | | | |
| <p>N.3. Test Drafts. - Except for low-flame tests, test drafts shall be at least equal to one complete revolution of the largest capacity proving indicator, and shall in no case be less than 0.05 m³ or 2 ft³. All flow rates shall be controlled by suitable outlet orifices.</p> | | | |
| <p>N.4. Test Procedures. - If a device is equipped with an automatic temperature compensator, the proving device reading shall be corrected to 15 °C (60 °F), using an approved table.</p> | | | |
| <p>N.4.1. Normal Tests. - The normal test of a device shall be made at a rate not to exceed the capacity rate given on the badge of the meter.</p> | | | |
| <p>N.4.1.1. Automatic Temperature Compensation. - If a device is equipped with an automatic temperature compensator, the quantity of the test draft indication of the standard shall be corrected to 15°C (60 °F).</p> | | | |
| <p>N.4.1.2. Repeatability Tests. – Tests for repeatability should include a minimum of three consecutive test drafts of approximately the same size and be conducted under controlled conditions where variations in factors, such as temperature pressure, and flow rate are reduced to the extent that they will not affect the results obtained.</p> | | | |

Hydrocarbon Gas Vapor-Measuring Devices

| | Yes | No | NA |
|---|-----|----|----|
| N.4.2. Special Tests. - "Special" tests shall be made to develop the operating characteristics of a device, and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. shall be considered a special test. | | | |
| N.4.2.1. Slow Test. - The device shall be tested at a rate not less than 20 percent of the marked capacity rate, or (at the check rate) not less than the minimum flow rate if marked on the device, whichever is less. | | | |
| N.4.2.2. Low-Flame Test. - The device shall be tested at an extremely low-flow rate as given in Table 1 (see page 7). The test shall consist of passing air at a pressure of 375 Pa (1.5 in water column) through the meter for not less than 60 minutes. The meter shall continue to advance at the conclusion of the test period. | | | |
| N.4.2.3. Pressure Regulation Test. - On devices operating at a pressure of 6 900 Pa (1 psig) or more, a pressure regulation test shall be made at both the minimum and maximum use load to determine the proper operation of the regulator and the proper sizing of the piping and dispensing equipment. These tests may include a test of 24 hours during which the pressure is recorded. | | | |
| N.5. Temperature Correction. - Corrections shall be made for any changes in volume resulting from the difference in air temperatures between time of passage through the device and time of volumetric determination in the proving device. | | | |
| N.6. Frequency of Test. - A hydrocarbon gas vapor-measuring device shall be tested before installation and allowed to remain in service for 10 years from the time last tested without being retested, unless a test is requested by: (a) the purchaser of the product being metered, (b) the seller of the product being metered, or (c) the weights and measures official. | | | |
| T. Tolerances. | | | |
| T.1. Tolerance Values on Normal Tests and on Special Tests Other Than Low-Flame Tests. - Maintenance and acceptance tolerances for normal and special tests for hydrocarbon gas vapor-measuring devices shall be as shown in Table T.1. (see below) | | | |
| T.2. Repeatability – When multiple tests are conducted at approximately the same flow rate and draft size, the range of the test results for the flow rate shall not exceed 0.9% and the results of each test shall be within the applicable tolerance. | | | |

| Accuracy Class | Application | Acceptance Tolerance | Maintenance Tolerance |
|----------------|---|----------------------|-----------------------|
| 3.0 | Gases at low pressure (for example, LPG vapor) | Overregistration | 1.5% |
| | | Underregistration | 3.0% |

Hydrocarbon Gas Vapor-Measuring Devices

| Table 1 Capacity of Low-Flow Test Rate Orifices With Respect to Device Capacity | | | |
|--|-------------------------|--|-------------------------|
| Metric Units | | Inch-Pound Units | |
| Rated Capacity | Low-Flow Test Rate | Rated Capacity | Low-Flow Test Rate |
| Up to and including 7 m ³ /h | 0.007 m ³ /h | Up to and including 250 ft ³ /h | 0.25 ft ³ /h |
| Over 7 m ³ /h up to and including 14 m ³ /h | 0.014 m ³ /h | Over 250 ft ³ /h up to and including 500 ft ³ /h | 0.50 ft ³ /h |
| Over 14 m ³ /h | 0.1% of capacity rate | Over 500 ft ³ /h | 0.1% of capacity rate |

| Table 2 Corrections for Altitude, Inch-Pound Units | | | | | | | |
|--|-----------|--------|----------------------------|-----------|------------------------------|--|------------------|
| Elevation (feet) | | | Altitude Correction Factor | | Assumed Atmospheric Pressure | Assumed Atmospheric Pressure Plus Gauge Pressure | |
| | | | 11 inch WC | 7 inch WC | (psia) | 11 inch WC (psia) | 7 inch WC (psia) |
| | -150 to | 400 | 1.02 | 1.01 | 14.64 | 15.04 | 14.89 |
| above | 400 to | 950 | 1.00 | 0.99 | 14.35 | 14.74 | 14.60 |
| above | 950 to | 1550 | 0.98 | 0.97 | 14.05 | 14.45 | 14.30 |
| above | 1550 to | 2100 | 0.96 | 0.95 | 13.76 | 14.15 | 14.01 |
| above | 2100 to | 2700 | 0.94 | 0.93 | 13.46 | 13.86 | 13.71 |
| above | 2700 to | 3300 | 0.92 | 0.91 | 13.17 | 13.56 | 13.42 |
| above | 3300 to | 3950 | 0.90 | 0.89 | 12.87 | 13.27 | 13.12 |
| above | 3950 to | 4550 | 0.88 | 0.87 | 12.58 | 12.97 | 12.83 |
| above | 4550 to | 5200 | 0.86 | 0.85 | 12.28 | 12.68 | 12.53 |
| above | 5200 to | 5850 | 0.84 | 0.83 | 11.99 | 12.38 | 12.24 |
| above | 5850 to | 6500 | 0.82 | 0.81 | 11.69 | 12.09 | 11.94 |
| above | 6500 to | 7200 | 0.80 | 0.79 | 11.40 | 11.79 | 11.65 |
| above | 7200 to | 7900 | 0.78 | 0.77 | 11.10 | 11.50 | 11.35 |
| above | 7900 to | 8600 | 0.76 | 0.75 | 10.81 | 11.20 | 11.06 |
| above | 8600 to | 9350 | 0.74 | 0.73 | 10.51 | 10.91 | 10.76 |
| above | 9350 to | 10 100 | 0.72 | 0.71 | 10.22 | 10.61 | 10.47 |
| above | 10 100 to | 10 850 | 0.70 | 0.69 | 9.92 | 10.32 | 10.17 |
| above | 10 850 to | 11 650 | 0.68 | 0.67 | 9.63 | 10.03 | 9.88 |
| above | 11 650 to | 12 450 | 0.66 | 0.65 | 9.33 | 9.73 | 9.58 |
| above | 12 450 to | 13 250 | 0.64 | 0.63 | 9.04 | 9.44 | 9.29 |
| above | 13 250 to | 14 100 | 0.62 | 0.61 | 8.75 | 9.14 | 9.00 |
| above | 14 100 to | 14 950 | 0.60 | 0.59 | 8.45 | 8.85 | 8.70 |

Hydrocarbon Gas Vapor-Measuring Devices

| <p align="center">Table 2M Corrections for Altitude, Metric Units</p> | | | | | | | |
|--|----------------------------------|-------------------------------|------------------------------------|--|-------------------------------|--|--|
| Elevation (meters) | Altitude Correction Factor | | Assumed Atmospheric Pressure | Assumed Atmospheric Pressure Plus Gauge Pressure | | | |
| | 2.74 kPa Gauge Pressure | 1.74 kPa Gauge Pressure | (kPa) | 2.74 kPa Gauge Pressure | 1.74 kPa Gauge Pressure | | |
| above -50 to 120 | 1.02 | 1.01 | 100.85 | 103.59 | 102.58 | | |
| above 120 to 300 | 1.00 | 0.99 | 98.82 | 101.56 | 100.54 | | |
| above 300 to 470 | 0.98 | 0.97 | 96.79 | 99.53 | 98.51 | | |
| above 470 to 650 | 0.96 | 0.95 | 94.76 | 97.50 | 96.48 | | |
| above 650 to 830 | 0.94 | 0.93 | 92.73 | 95.47 | 94.45 | | |
| above 830 to 1020 | 0.92 | 0.91 | 90.70 | 93.44 | 92.42 | | |
| above 1020 to 1210 | 0.90 | 0.89 | 88.66 | 91.40 | 90.39 | | |
| above 1210 to 1400 | 0.88 | 0.87 | 86.63 | 89.37 | 88.36 | | |
| above 1400 to 1590 | 0.86 | 0.85 | 84.60 | 87.34 | 86.33 | | |
| above 1590 to 1790 | 0.84 | 0.83 | 82.57 | 85.31 | 84.29 | | |
| above 1790 to 2000 | 0.82 | 0.81 | 80.54 | 83.28 | 82.26 | | |
| above 2000 to 2210 | 0.80 | 0.79 | 78.51 | 81.25 | 80.23 | | |
| above 2210 to 2420 | 0.78 | 0.77 | 76.48 | 79.22 | 78.20 | | |
| above 2420 to 2640 | 0.76 | 0.75 | 74.45 | 77.19 | 76.17 | | |
| above 2640 to 2860 | 0.74 | 0.73 | 72.41 | 75.15 | 74.15 | | |
| above 2860 to 3080 | 0.72 | 0.71 | 70.38 | 73.12 | 72.12 | | |
| above 3080 to 3320 | 0.70 | 0.69 | 68.35 | 71.09 | 70.08 | | |
| above 3320 to 3560 | 0.68 | 0.67 | 66.32 | 69.06 | 68.05 | | |
| above 3560 to 3800 | 0.66 | 0.65 | 64.29 | 67.03 | 66.01 | | |
| above 3800 to 4050 | 0.64 | 0.63 | 62.26 | 65.00 | 63.98 | | |
| above 4050 to 4310 | 0.62 | 0.61 | 60.23 | 62.97 | 61.95 | | |
| above 4310 to 4580 | 0.60 | 0.59 | 58.20 | 60.94 | 59.92 | | |