

COMMONWEALTH OF VIRGINIA
STATE CORPORATION COMMISSION
DIVISION OF ENERGY REGULATION

**GAS MEASUREMENT AND METER TEST
STANDARDS AND PRACTICES
FOR
GAS DISTRIBUTION UTILITIES IN VIRGINIA**

Adopted By:
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GAS METERING REQUIREMENTS

SECTION I

1. *Engineering Practice and References*

1.1 **Requirement for Good Engineering Practice** - All meters and measurement equipment utilized by a utility shall be constructed, installed, maintained, and operated in accordance with accepted good, engineering practice in the gas industry to assure, as far as reasonably possible, accuracy of measurement, continuity of service, uniformity in the quality of service furnished and the safety of persons and property.

1.2 **Acceptable Standards** - Unless otherwise specified by the Commission, the utility shall use the applicable provisions in the publications listed below as standards of accepted good practice:

1.2.1 National Fuel Gas Code - ANSI 223.1 and NFPA 54

1.2.2 Gas Displacement Meters (500 CFH Capacity and Under) - ANSI B109.1 and Addenda B109.1a

1.2.3 Diaphragm Type Gas Displacement Meters (Over 500 CFH Capacity) - ANSI B109.2

1.2.4 Rotary Type Gas Displacement Meters - ANSI B109.3

1.2.5 Orifice Metering of Natural Gas - ANSI/API 2530 (formerly AGA Report #3)

1.3 **Acceptable References** - The following publications are not standards but may be used as guides to accepted good practice:

1.3.1 Measurement of Fuel Gas by Turbine Meters - AGA Transmission Measurement Committee Report No. 7

1.3.2 Standard Methods of Gas Testing - Circular No. 48, National Bureau of Standards, 1916. (The applicable portions of this circular have been substantially reproduced in the American Meter Company Handbook E-4, covering the testing of positive displacement meters).

1.3.3 Testing Large Capacity Rotary Gas Meters - Research Paper No. 1741, National Bureau of Standards Journal of Research, September 1946.

1.3.4 Reports prepared by the Practical Methods Committee of the Appalachian Gas Measurement Short Course, as follows:

- a. Report No. 1, Methods of Testing Large Capacity Displacement Meters
- b. Report No. 2, Testing Orifice Meters
- c. Report No. 3, Designing and Installing Measuring and Regulating Stations

d. Report No. 4, Useful Tables for Gas Men

e. Report No. 5, Prover Room Practices

1.3.5 A.G.A. Gas Measurement Manual

SECTION II

2. **Definitions** - The following definitions shall apply whenever the terms are used:

2.1 **Utility** - The term "utility" includes all companies distributing fuel gas under the jurisdiction of this Commission.

2.2 **Gas Meter** - The term "gas meter" shall mean any measuring device used to measure fuel gas supplied to a customer.

2.3 **Rated Capacity** - The "rated capacity" of a diaphragm gas meter is the number of cubic feet per hour of 0.60 specific gravity gas (air=1.00), at standard conditions of 14.73 pounds per square inch absolute and 60 degrees Fahrenheit, that the meter will pass when the average differential pressure between the inlet and outlet of the meter is 0.5 inch of water. The rated capacity of other types of meters will be that specified by the manufacturer of that particular meter at standard conditions.

2.4 **Check Rate Test** - A "check rate test" of a gas meter is an accuracy test made at a rate of flow not less than 20 percent nor more than 40 percent of rated capacity.

2.5 **Open Rate Test** - An "open rate test" of a gas meter is an accuracy test performed under flow rate conditions of 80 to 120% of the maximum rate of flow to which a gas meter is intended to be subjected in service.

2.6 **Request Test** - A "request test" is a test made by a utility of a gas meter as a result of a request made to the utility by a customer.

2.7 **Referee Test** - A "referee test" is a test of a meter made or witnessed by this Commission as a result of a request made to this Commission by a customer or utility.

2.8 **Out-Test** - An "out-test" is a test of a gas meter made after its assembly and prior to its installation or use at a customer's premises.

2.9 **In-Test** - An "In-test" is a test of a gas meter made within a reasonable time after its removal from a customer's premises or at said premises (if the meter is in-tested in place) and prior to any disassembly or adjustment.

2.10 **Statistical Sampling** - A recognized statistical method that is acceptable to this Commission of selecting a reduced number of meters whose test results will represent the performance of a larger group of meters.

2.11 **Prover** - A device used to determine the accuracy of a gas meter.

2.12 **Standards:**

2.12.1 **Primary** - A principal calibration reference as used by the National Bureau of Standards.

2.12.2 **Secondary** - A calibration device whose accuracy is directly traceable to a primary standard.

2.12.3 **Working** - A calibration device used primarily to test the accuracy of meters or instruments and whose accuracy is directly traceable to a secondary standard.

SECTION III

3. **Meter Qualifications/Requirements**

3.1 New Meters - New diaphragm, rotary and orifice meters will be constructed, installed and operated in accordance with the applicable standard listed in Section 1.2 and applicable reference listed in Section 1.3. New turbine meters will be constructed, installed and operated in accordance with the applicable reference listed in Section 1.3.

SECTION IV

4. **Meter Shop and Working Standards**

4.1 **Meter Shop** - Each utility shall maintain or designate a meter shop for the purpose of inspecting, testing, and repairing meters. The shop, including the facilities, equipment, and the methods of measurements and testing employed, shall be open for inspection by authorized representatives of the Commission at all reasonable times.

The area within the meter shop used for testing of meters shall be designed so that the meters and meter testing equipment are protected from drafts and excessive changes of temperature.

The meters to be tested shall be stored in such manner that the temperature of the meters is substantially the same as the temperature of the prover.

4.2 **Working Standards** - Each utility shall own and maintain, or have access

to, at least one prover and all other equipment necessary to test meters. The prover shall be maintained in good condition and correct adjustment so that it shall be capable of determining the accuracy of any in-service gas meter to within plus or minus one-half percent (± 0.5).

Working standards must be checked periodically with a secondary standard, at least once every five (5) years. More frequent calibration shall be made if test results are inconsistent or damage to the working standard is suspected.

Extreme care must be exercised in the use and handling of standards to assure that their accuracy is not disturbed. Each standard shall be accompanied at all times by a calibration card on which are recorded the corrections required to compensate for errors found at the customary test points.

Working standards of sufficient flow capacity to test turbine and rotary meters at the check flow rate must be maintained to an accuracy of plus or minus one-half percent (± 0.5).

SECTION V

5. Test Methods and Procedures - The test of any meter and/or associated device shall consist of a comparison of its accuracy with the accuracy of a working standard or may consist of other methods specified in these rules.

SECTION VI

6. Pre-Installation Inspection Tests - Every meter and associated device shall be inspected and tested before being placed in service, except where an acceptable statistical sampling program for new meters is in use by the utility.

6.1 Out-Test - A diaphragm meter, whether new or repaired, shall be in good working order and adjusted to an accuracy of 100% within the limits of plus or minus one percent (± 1.0) at its check rate and at the open rate.

The difference between these, test values shall not exceed one percent (1.0).

6.2 A Rotary or Turbine Meter, whether new or repaired, shall be in good working order and adjusted to an accuracy of 100% within the limits of plus or minus one percent (± 1.0) at its check rate.

6.3 Orifice meter measurements shall be in accordance with those measurements specified in the standard named in Section 1.2.5. Recording gauges (pressure, temperature) shall be calibrated in accordance with the reference named in Section 1.3.5.

6.4 No meter, whether new or repaired, shall be placed in service unless it has been tested for case leaks at a pressure of 1.5 times its anticipated operating pressure or two (2) PSIG, whichever is greater.

6.5 **New Meter Sampling** - Newly purchased meters may be sample tested in accordance with a utility's sample plan of testing acceptable to the Commission.

SECTION VII

7. **As Found Tests - Acceptable Accuracy** - Meters and/or associated measurement equipment shall be tested in place or as soon as possible after they are removed from service. Such tests shall be made before the meters and/or associated equipment are adjusted, repaired, or retired. Meters changed or tested should be within an accuracy of plus or minus two percent (± 2.0) at check rate test.

SECTION VIII

8. **Meter Test Schedule** - Each utility shall file with the Commission a meter test schedule based on one or more of the following types of meter test plans:

8.1 A periodic test program may be elected with meters and instruments being tested on a regular basis.

8.2 A mileage test schedule may be elected with meters and instruments being tested based on the index registration.

8.3 The percentage of meters in service to be tested each year shall be determined by the previous year's test results.

8.4 Quantities of meters to be tested in any year may be determined by a statistical sampling plan acceptable to the Commission.

SECTION IX

9. **Meter Handling**

9.1 **Capping Meters** - All incoming meters must be capped when removed from service and awaiting test. All meters which have been out-tested, or are ready for installation, must be capped and remain capped until installed.

9.2 **Transporting Meters** - While being transported, meters should be secured and remain in an upright position. To assure that the accuracy has not been impaired, any meter which has been dropped or has received a sudden jar shall be returned to the Meter Shop to be retested.

SECTION X

10. **Meter Records** - Each utility shall maintain a record of each gas meter and associated metering device containing the following data as appropriate: (1) manufacturer, (2) identification number, (3) type, (4) capacity, (5) multiplier, (6) constants, (7) pressure rating, (8) date of installation, (9) date of removal from service, and (10) meter location.

10.1 **Test Records** - Each utility shall maintain records of the latest test for each meter which shall include the following:

10.1.1 The date and reason for the test

10.1.2 The index reading of the meter prior to making the test

10.1.3 The in-test accuracy (as found) at check rate test

10.1.4 The out-test accuracy (as left) at check and open rate test

10.2 **Records Retention** - Records shall be retained for a period of one (1) year following meter retirement.

SECTION XI

11. **State Corporation Commission Inspections and Tests**

The Meter Shop shall be open for inspection by an authorized representative of the Commission at all reasonable times. The facilities and equipment, as well as the methods of measurement and testing employed, shall be subject to the approval of the Commission.

SECTION XII

12. **Instrumentation - Measurement at Other Than Base Conditions**

12.1 **Pressure Recording and Correcting Equipment** - If gas is measured to a customer through a meter(s) at a pressure greater than standard service pressure, such meter(s) may be equipped with reliable pressure recording gauges, or pressure correcting devices for accurately determining the quantity of gas.

12.2 **Temperature Recording and Correcting Equipment** - If gas is measured to a customer through meter(s) at a temperature other than standard temperature (60°F), such meters may be equipped with reliable temperature recording gauges, or temperature correcting devices for accurately determining the quantity of gas.

12.3 **Determination of Multiplier** - In computing the volume of gas at a given

pressure base from a pressure-volume chart, the multiplier shall be obtained by a weighted average method, which consists of determining the average pressure for each indicated unit volume on the chart.

12.4 Fixed Pressure Factor Metering - If the gas metering pressure can be maintained at a constant level such that it will not vary by more than plus or minus one percent (± 1.0) of the absolute metering pressure, the quantity of gas corrected for pressure for billing purposes may be determined by multiplying the uncorrected volume by the factor of Meter Pressure + Atmospheric Pressure + Base Pressure. This equation for clarity purposes would be:

$$\frac{\text{Metering Pressure} + \text{Atmospheric Pressure}}{\text{Base Pressure}}$$

A special index with gearing to perform this calculation may be used. The special index shall meet the specifications of ANSI Standard B109.1, Section 6.9. The ability of the regulator to maintain the constant metering pressure may be verified by the installation of a pressure recording gauge for an initial period adequate to ascertain that the installation has been subjected to both high and low flow conditions. The metering pressure shall then be verified at least every two (2) years.

12.5 Determination of Static and Differential Pressure - In computing the volume of gas at a given pressure base from an orifice meter chart or charts, the average static pressure and the average differential pressure shall be determined for periods not exceeding one (1) hour. If pressure variations are extreme during the hour, such average shall be determined at more frequent intervals.

12.6 Mechanical or Electronic Devices - Mechanical or electronic devices may be substituted for the method of computing orifice meter charts set forth in this section.

SECTION XIII

13. Meter Testing Employees - Each utility shall have in its employ, or shall have access to, personnel who are able to perform those tests necessary to determine the accuracy of the utility's meters.