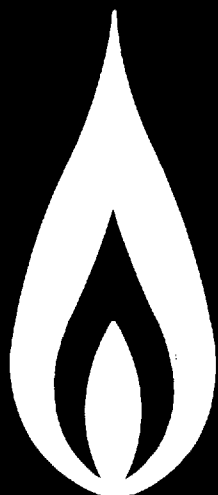


ANSI
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1992

AMERICAN
NATIONAL
STANDARD



**DIAPHRAGM TYPE
GAS DISPLACEMENT
METERS**
(Under 500 Cubic Feet Per Hour Capacity)

Secretariat



American Gas Association
1515 Wilson Boulevard
Arlington, VA. 22209

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November 12, 1992
AMERICAN NATIONAL STANDARDS INSTITUTE,
INC.

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PREFACE

This publication represents a basic standard for safe operation, substantial and durable construction, for diaphragm type gas displacement meters, having a gas flow rating of under 500 cubic feet per hour (14.2m³/h), at 0.5 inch water column (125Pa) differential pressure at standard conditions. This work is the result of years of experience, supplemented by extensive research. The Standard is designed to assure efficient performance and substantial construction of equipment.

It is recognized that during any transition period to the metric system, there will be a need for sizes and dimensions to be expressed in the metric system, or the inch-pound system, or both. In this document, both systems are used, with the inch-pound units given preference. In most cases, a soft conversion from existing inch-pound values is shown. Soft conversion implies a change in nomenclature only; in this document, the alternative nomenclatures (metric and in-pound) are shown by using parentheses and can be used interchangeably. Hard conversion is used to express metric values in (closely equivalent) round inch-pound units. Bracketed values are not to be used interchangeably with the comparable or corresponding metric values.

Nothing in this standard is to be considered as in any way indicating a measure of quality beyond compliance with the provisions it contains. It is designed to allow the construction and performance of displacement meters that may exceed the various provisions specified in any respect. In its preparation, recognition was intended to be given to the possibility of improvement through ingenuity of design. As progress takes place, revisions may become necessary. When they are believed desirable, recommendations should be forwarded to the Chairman of ANSI B109 Committee, American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209.

Users of this document should consult applicable Federal, State and local regulations. The American Gas Association does not, by the publication of this document, intend to present specifications which are not in compliance with applicable rules and this document may not be construed as doing so.

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HISTORY OF THE DEVELOPMENT OF STANDARDS FOR DIAPHRAGM TYPE GAS DISPLACEMENT METERS

In response to an expressed need within the industry for standardization of diaphragm type gas displacement meters, the American Gas Association late in 1966 requested the establishment of a project within the American National Standards Institute for development of suitable standards for such meters. At a General Conference held on January 31, 1967, at ANSI Headquarters, approval of the project scope was obtained, which was subsequently endorsed by the Mechanical Standards Board of ANSI.

The organizational meeting of ANSI Committee B109 was held on November 30, 1967, at which time five subcommittees were established to develop various sections of the standard. The first draft standard was issued in June 1970, for review and comment. This was followed by three additional drafts each incorporating modifications made in the light of comments received.

To assure that the standard as published would have wide acceptance, the fourth draft was distributed on an industry-wide basis and to all known interested parties. Comments received on the fourth draft were reviewed by the various subcommittees and indicated revisions were made in two additional drafts. Draft Six was reviewed by Committee B109 at its May 4, 1973, meeting and the standard approved for submittal to ANSI for endorsement as an American National Standard.

Throughout all stages of development of this standard, consideration has been given to the work done by the Task Committee on Standardization of Meter Purchase Specifications of the Operating Section of the American Gas Association as published in Gas Meter Specifications (OP-58-2, 1963.)

The first edition of the diaphragm type Gas Displacement standard (B109.1) was endorsed as an ANSI Standard by the American National Standards Institute, Inc., on November 27, 1973. An addendum (B109.1a) was published in 1980. Separate standards were also published in 1980 for larger gas displacement meters (500 cubic feet per hour capacity and over)—B109.2 and for rotary type gas displacement meters—B109.3

The second edition was approved by ANSI on January 9, 1987.

In the second edition, auxiliary devices relating only to larger capacity meters were deleted from this standard and added to other appropriate standards. Soft metric conversions and informative appendices on prover bell calibration and bar coding were added to this standard.

This is the third edition of this Standard B109.1, which includes minor editorial changes and a title correction. A bar (|) in the margin indicates a text change from the previous edition.

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AMERICAN NATIONAL STANDARD FOR DIAPHRAGM TYPE GAS DISPLACEMENT METERS (Under 500 Cubic Feet per Hour Capacity)

SCOPE

This standard applies to diaphragm type gas displacement meters having a flow rating of less than 500 cubic feet per hour (14.16m³/h) capacity at 0.5 inch water column (125 Pa) differential pressure at standard conditions, designed for the volumetric revenue measurement of gas.

Part I comprises a list of definitions and terms used throughout the text.

Parts II and III cover construction and performance requirements for new types of meters in the designated flow rate range, constructed entirely of new, unused parts and materials.

Part IV covers gas meter "in-service" performance requirements for diaphragm displacement meters.

Part V addresses installation requirements for these meters.

Part VI pertains to auxiliary devices used with gas meters covered by this standard.

Part VII covers test methods and equipment.

**AMERICAN NATIONAL STANDARD FOR
GAS DISPLACEMENT METERS
Under 500 Cubic Feet Per Hour
Capacity**

PART I DEFINITIONS

1.1 ACCURACY, METER. The degree to which a meter correctly measures the volume of gas passing through it, determined by comparing the volume registered by the meter with that registered by the prover. (See Appendix D for methods of expressing meter accuracy.)

1.2 ADAPTOR PLATE, INSTRUMENT. A specially designed plate mounted between a meter and an instrument to provide for a proper drive to the instrument.

1.3 AUXILIARY DEVICES. Devices used with a meter to provide an adjustment of the meter reading, permit obtaining special information, or transmit information to a remote location.

1.4 BADGE. A permanent plate, affixed in a conspicuous place on a meter, containing basic meter information.

1.5 BASE CONDITIONS. The standard base conditions of pressure and temperature for the volumetric measurement of natural gas, ANSI/API 2562-1969, has established 60°F (15.6°C) and 14.73 psi (101.56 kPa) as the base temperature and pressure to which all volumes are commonly referred.

1.6 BOTTLE, CUBIC FOOT. A specially constructed and calibrated bottle, usually immersion type, complete with an immersion tank containing a light oil of low vapor pressure, with the bottle suspended over the tank by means of a suitable cord and pulley so that the bottle may be immersed in the oil between two graduations, top and bottom. The bottle is so constructed that exactly one cubic foot of air is displaced when the bottle is immersed between the two marks. The calibration of the bottle must be traceable to the National Bureau of Standards.

1.7 CAPACITY, RATED. The capacity obtained by rounding to the nearest multiple of 5 cfh. The average readings of 10 randomly chosen production type meters representing a particular meter model.

1.8 CIRCLE(S), READING. Graduated index circles with hands which register the accumulated volume of gas passed through the meter.

1.9 CIRCLE(S), TEST. A graduated circle provided with a rotating pointer (proving hand) on the meter index, used for testing the meter and for indicating gas flow. Also referred to as index test dial or proving circle.

1.10 CONNECTIONS, METER. The integral parts of the meter designed for attachment to meter swivels, pipe, or other piping components.

1.11 CONSTANT PRESSURE COMPENSATING INDEX. An index used in conjunction with a gas meter operated at a constant pressure, other than the contract base pressure, to indicate gas volume corrected to a contract base pressure.

1.12 CUBIC FOOT, METERED. The quantity of gas that occupies one cubic foot when under pressure and temperature conditions existing in the meter.

1.13 CUBIC FOOT, STANDARD. (See ANSI Z132). That quantity of gas which under an absolute pressure of 14.73 psi (101.56 kPa) and at a temperature of 60°F (15.6°C) occupies a volume of one cubic foot.

1.14 CUBIC METRE, STANDARD. That quantity of gas which under an absolute pressure of 101.325 kPa (14.696 lbf/in²) and a temperature of 288.15K (59°F) occupies a volume of 1 cubic metre.

1.15 FLOW RATE, PILOT. A minimum flow rate that a meter is required to register with a prescribed accuracy.

1.16 HUBS, METER. Same as 1.10, CONNECTIONS, METER.

1.17 INDEX, METER. The mechanism that displays the volume of gas that has passed through the meter.

1.18 INDEX RATE. The uncorrected flow rate calculated by dividing the registration by time.

1.19 INDEX, TEMPERATURE COMPENSATING. A meter index used to display corrected volume under flowing gas conditions to a base temperature, commonly 60°F (15.6°C).

1.20 INDEX TEST DIAL. See 1.9 CIRCLE(S), TEST.

1.21 LIFE TEST, ACCELERATED. A test under controlled conditions simulating long term operation designed to determine long term maintenance and performance characteristics within a relatively short period of time.

1.22 MAOP. Maximum Allowable Operating Pressure equivalent to manufacturer's maximum working pressure.

1.23 METER ACCURACY. The degree to which a meter correctly measures the volume of gas passing through it, determined by comparing the volume registered by the meter with that registered by prover. (See Appendix D for methods of expressing meter accuracy and 1.1 ACCURACY, METER.)

1.24 METER CLASS. A designation for different ranges of meter capacity. The class for a given type of meter is determined by its minimum capacity of 0.6 specific gravity gas at 0.5 inches of water column (125 Pa) differential pressure, under specified test conditions. The capacity so determined must equal or exceed the class designation, but be less than the next higher class.

1.25 METER, DISPLACEMENT. A meter that utilizes the principle of alternately filling and emptying compartments of known size and totals the number of times the cycle is accomplished, thereby indicating the volume of gas passing through the meter.

1.26 METER, GAS. A device for measuring a volume of flowing gas.

1.27 METER, NEW. A meter of all new materials as received from the manufacturer, never used in service.

1.28 METER, NEW TYPE. A gas meter sufficiently different in design or materials of construction (such as diaphragm material, cubic feet per tangent revolution, ratio of valve-to-diaphragm area, etc.) so affecting performance as to require qualification as a new type meter under this standard.

1.29 METER, ROTARY DISPLACEMENT. A meter that utilizes the principle of filling and emptying rotating compartments of known size and totals the number of times the cycle is accomplished, thereby indicating the volume of gas passing through the meter.

1.30 MILEAGE. See REGISTRATION.

1.31 PERCENT ACCURACY. The volume indicated by the meter (V_m) divided by the volume indicated by the standard (V_s) taken as a percentage.

1.32 PERCENT REGISTRATION. See 1.1 ACCURACY, METER and Appendix D. Same as percent accuracy.

1.33 PRESSURE, ABSOLUTE. Atmospheric pressure plus gauge pressure. Abbreviated as psia.

1.34 PRESSURE, BASE. An absolute pressure value to which measured gas volumes are corrected. If a purchase contract applies, the term is referred to as a contract base pressure.

1.35 PRESSURE DIFFERENTIAL. The difference in pressure between two points in a flowing gas system.

1.36 PRESSURE DROP. The loss in pressure between two points in a fluid flow system.

1.37 PRESSURE, GAUGE. Pressure measured relative to atmospheric pressure taken as zero. Abbreviated psig.

1.38 PRESSURE, METER. The pressure in a meter under operating conditions. (Usually considered to be the meter's inlet pressure.)

1.39 PROVER. Device for measuring the accuracy of gas meter registration.

1.40 PROVER, BELL. A calibrated cylindrical bell in which a quantity of air is collected over an oil seal. The prover bell is connected to a meter under test and the quantity of air that passed through the meter as measured on the meter index is compared with the change in the quantity of air entrapped within the bell to determine meter accuracy. In pressure proving, the prover pressure is greater than the atmospheric pressure and passes out of the bell through the meter. In vacuum proving, the prover pressure is below atmospheric pressure and the air is drawn through the meter into the bell.

1.41 PROVER, LOW PRESSURE FLOW. An apparatus utilizing an orifice for testing meters at low pressures by passing gas or air through both the orifice and meter and finally discharging it to the atmosphere. The time for a given quantity of gas to pass through the meter compared to the orifice standard time corrected for test conditions provides a measure of meter accuracy.

1.42 PROVER, SONIC FLOW. See SONIC FLOW NOZZLE.

1.43 PROVER, TRANSFER. A device for determining the accuracy of a meter under test by comparing its reading against the reading obtained from a calibrated reference meter connected in series with the meter under test.

1.44 PROVING CIRCLE. See 1.9 CIRCLE(S), TEST.

1.45 READING CIRCLES. Those circles that indicate the volume of gas passed through the meter and are commonly used for billing purposes.

1.46 RECORDER, DEMAND. An instrument that records gas flow rate as a function of time.

1.47 RECORDER-PRESSURE, CIRCULAR CHART. An auxiliary device designed to record variations of pressure relative to time by means of a clock driven circular chart.

1.48 RECORDER, PRESSURE AND TEMPERATURE, CLOCK DRIVEN CIRCULAR CHART. An auxiliary device designed to record variations in pressure and temperature relative to time by means of a clock driven chart.

1.49 REGISTRATION. The indicated volume of gas passed through a meter.

1.50 REMOTE METER READING DEVICE. A device for a gas meter that continuously provides or reproduces a reading of the meter index, at a point remote from the meter. The reading may be displayed for visual observation, recorded in a portable device, or transmitted to a distant point.

1.51 SEAL. A device designed to give evidence of tampering with a meter.

1.52 SONIC FLOW NOZZLE. Also referred to as **SONIC FLOW PROVER** or **CRITICAL FLOW PROVER**. A device employing either venturis, orifices or sonic nozzles as restrictions that is used for testing meters, usually at elevated pressures, by passing gas or air through both the meter and restriction and finally discharging it at a lower pressure that maintains sonic velocity (critical flow) through the restriction. The time for a given quantity of gas or air to pass through the meter compared to the restriction standard time corrected for test conditions provides a measure of meter accuracy.

1.53 STANDARD CONDITIONS. The standard conditions of pressure and temperature for the volumetric measurement of natural gas. See also 1.5 **BASE CONDITIONS**

1.54 STANDARD STILLMAN. A portable, one-cubic foot, liquid sealed, bell type transfer device used in the calibration of bell provers.

1.55 STRAPPING. A method of checking a bell prover by determining the relations between displaced volume and linear movement of a bell prover by means of measuring scale length, bell circumference and displacement of the sealing liquid.

1.56 SUPERCOMPRESSIBILITY. Deviation of a gas from the ideal gas laws.

1.57 TAPE, STRAPPING. A metal tape calibrated to give a direct reading of diameter when applied to the circumference of a circular surface.

1.58 TEMPERATURE, ABSOLUTE. That temperature obtained in degrees Rankine by adding 459.67 degrees to a reading of a Fahrenheit thermometer or in degrees Kelvin by adding 273.15 degrees to that of a Celsius thermometer reading.

1.59 TEMPERATURE, BASE. A reference temperature to which measured gas volumes are corrected.

1.60 TEMPERATURE, FLOWING. The temperature of the gas at flowing conditions.

1.61 TEMPERATURE, METERING. The temperature of the gas in a meter at operating conditions. (Defined as the meter's outlet temperature.)

1.62 TEST, ACCELERATED LIFE. Same as 1.21, **LIFE TEST, ACCELERATED**.