AGA

Gas Measurement Manual

(Revised)

PART TWO
DISPLACEMENT METERING

Prepared by the Customer Field Services and Measurement
And Transmission Measurement Committees
Of the Operating Section

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1 Introduction

1.1 Scope

This document is intended to describe the theory of operation, typical operating characteristics, and applications of diaphragm and rotary positive displacement meters. This document covers sizing meters, accuracy, rangeability (turndown), installation specifications, proof testing, maintenance procedures, and computations used in the calculation of displacement meter flow for the measurement of natural gas.

Applications include measuring single-phase gas flow found in production, processing, distribution, and end-use gas measurement systems. Typical use is the measurement of fuel-grade natural gas and associated hydrocarbon gases, either as pure hydrocarbons or as a mixture of pure hydrocarbons and diluents.

Refer to manufacturers' accessory equipment used to measure pressure, temperature, and density of the flowing gas, or for other mechanical or electronic instruments that convert meter outputs from line conditions to base conditions. This document does not cover characteristics of electronic pulse signal generating devices within or attached to the meter, although it does address the use of their outputs.

In addition to providing guidance on the use of gas displacement meters, this section provides practical formulas for reference and training of new entrants to the industry as well as back office and non-technical individuals unfamiliar with natural gas displacement meter measurement.

This section is intended for use in conjunction with ANSI B109.1, B109.2, and B109.3 (B109.1: Diaphragm-Type Gas Displacement Meters (Under 500-Cubic-Feet-per-hour Capacity), B109.2: Diaphragm-Type Gas Displacement Meters (500-Cubic-Feet-per-hour Capacity and over), & B109.3: Rotary Type Gas Displacement Meters) and manuals produced by positive displacement meter manufacturers. Consult with the specific meter's manufacturer for guidance in cases where manufacturer-supplied information is not consistent with information presented in this section or other AGA documents. This section is not intended for use as a standard and is not intended for reference in a tariff or other regulatory documents.

1.2 History

Initially, gas companies typically did not measure the amount of gas consumers used: most consumers were charged a flat rate. Wet type positive displacement meters were developed in 1815 (Clegg) to measure actual gas volume used by each customer. The dry type diaphragm positive displacement meter was developed in 1844 (Richards and Croll). Thomas Glover improved this design, and the meter became known as the Glover two diaphragm slide valve type meter. Meter connections sizes (5 light, 10 light, etc.) were used to indicate the number of gas lights that the meter could accurately measure. This basic meter design is still in use today and is available in four-chamber and three-chamber configurations.

Over the ensuing years, new materials and manufacturing techniques have been developed to make diaphragm meters lighter, longer lasting, more accurate, and more reliable. For example, meter bodies formerly made of ductile iron are now made from lightweight aluminum. Diaphragm materials have advanced from leather, which required periodic lubrication to stay flexible, to synthetic rubber which has a maintenance free service life. Slide valve materials have also