AGA Report No. 9

Measurement of Gas by Multipath Ultrasonic Meters

Second Edition
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American Gas Association

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Transmission Measurement Committee

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FOREWORD

This report is published in the form of a performance-based specification for multipath ultrasonic meters for gas flow measurement. It is the result of a collaborative effort of users, meter manufacturers, flow measurement research organizations and independent consultants forming Task Group R-9 of AGA's Transmission Measurement Committee (TMC). In addition, comments to this report were made by the Committee on Gas Flow Measurement (COGFM) of the American Petroleum Institute (API), Gas Processor's Association (GPA), International Standard Organization's ISO/TC 30/SC 5/WG 1, Pipeline Research Council International (PRCI) and the committee members of International School of Hydrocarbon Measurement (ISHM).

This version of AGA Report No. 9 is intended to supersede all prior versions of this document. However, this document does not reference existing multipath ultrasonic meter installations. The decision to apply this document to existing installations shall be at the discretion of the parties involved.

Research conducted in support of this report and cited herein has demonstrated that multipath ultrasonic meters can accurately measure gas flow and, therefore, should be able to meet or exceed the requirements specified in this report when calibrated and installed according to the recommendations contained herein. Users should follow appropriate installation, use and maintenance of an ultrasonic meter as applicable in each case.

Various combinations of upstream fittings, valves and lengths of straight pipe can produce profile disturbances at the meter inlet that may result in flow-rate measurement errors. The amount of meter error will depend on the magnitude of the inlet velocity profile distortion produced by the upstream piping configuration and the meter's ability to compensate for this distortion. Research results and flow-meter calibration data have indicated that multipath ultrasonic flow meters can accurately measure gas flow rate when installed with upstream piping lengths and/or flow conditioning systems sufficient to maintain the integrity of the flow calibration. Other effects that may also result in flow-rate measurement errors for a given installation include levels of pulsation, range of operating pressures and ambient temperature conditions.

Flow-calibration guidelines are provided for occasions when a flow calibration is requested or required to verify the meter's accuracy or to apply a calibration factor to minimize the measurement uncertainty. (See Report text and Appendix A)

Unlike most traditional gas meters, multipath ultrasonic meters inherently have an embedded microprocessor system. Therefore, this report includes, by reference, a standardized set of international testing specifications applicable to electronic gas meters. These tests, summarized in Appendix B, are used to demonstrate the acceptable performance of the multipath ultrasonic meter's electronic system design under different influences and disturbances.

AGA Engineering Technical Note M-96-2-3, Ultrasonic Flow Measurement for Natural Gas Applications, is included in Appendix C, as a source of background information on ultrasonic gas metering. Contents of this technical note were based on the information available when the note was written in March 1996. Therefore, in case of any conflict between the information in the main report and the technical note (Appendix C), the content in the main report prevails.

The flow meter and/or flow conditioner performance verification test found in Appendix D is intended to provide a method by which an ultrasonic flow metering system can be shown to perform acceptably (i.e., within the performance specifications described in Sections 5.1, 5.1.1 and 5.1.2 of this document) under varying test flow conditions.

An example of overall measurement uncertainty calculations is provided in Appendix E with assumed numerical values for estimating measurement uncertainty for sites using ultrasonic gas flow meters.

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