AGA Report No. 11 API MPMS Chapter 14.9

Measurement of Natural Gas by Coriolis Meter

Prepared by

Transmission Measurement Committee

Second Edition, February 2013

American Gas Association

AMERICAN PETROLEUM INSTITUTE

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FOREWORD

This report has been written in the form of a performance-based specification. If this performance-based specification is used, Coriolis meters shall meet or exceed the function, accuracy, and testing requirements specified in this report and designers shall follow the applicable installation recommendations.

This report is split into two distinct sections – the main body of the report and a series of appendices. The main body should be considered normative as it describes working practice when applying and using Coriolis meters to measure natural gas flow. The appendices are informative and contain additional material, background and examples of how Coriolis meters are installed and operated.

Methods for verifying a meter's accuracy and/or applying a Flow Weighted Mean Error (FWME) correction factor to minimize the measurement uncertainty are contained in Appendix A, "Coriolis Gas Flow Meter Calibration Issues." Depending on the design, it may be necessary to flow-calibrate each meter on a gas similar to that expected in service.

In order to guide the designer in the specification of a Coriolis meter, Appendix B, "Coriolis Meter Data Sheet," has been provided.

As a reference for background information on Coriolis natural gas metering, Appendix C, "AGA Engineering Technical Note, XQ0112, *Coriolis Flow Measurement for Natural Gas Applications*," is provided. Due to the unique principle of operation and atypical performance characteristics of Coriolis mass flow meters, in comparison to volumetric flow meters, readers who are not familiar with the technology are encouraged to read the Appendix C prior to applying the general concepts and guidelines of this report.

This report offers general criteria for the measurement of natural gas by Coriolis meters. It is the cumulative result of years of experience of many individuals and organizations acquainted with measuring gas flow rate and/or the practical use of Coriolis meters for gas measurement. Changes to this report may become necessary from time to time.

ACKNOWLEDGEMENTS

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1 INTRODUCTION

1.1 SCOPE

This report was developed for the specification, calibration, installation, operation, maintenance and verification of Coriolis flow meters and is limited to the measurement of single phase natural gas, consisting primarily of hydrocarbon gases mixed with other associated gases usually known as “diluents.”

Although Coriolis meters are used to measure a broad range of compressible fluids, non-natural gas applications are beyond the scope of this document.

1.2 PRINCIPLE OF MEASUREMENT

Coriolis meters measure mass flow rate by measuring tube displacement resulting from the Coriolis effect. Coriolis meters operate on the principle of the bending force known as the “Coriolis force” (named after the French mathematician Gustave-Gaspard de Coriolis). When a fluid particle inside a rotating body moves in a direction toward or away from a center of rotation, that particle generates an inertial force (known as the “Coriolis force”) that acts on the body. In case of a Coriolis flow meter, the body is a tube through which fluid flows. Coriolis meters create a rotating motion by vibrating the tube or tubes through which the fluid flows. Coriolis meters have the inherent ability to measure flow in either direction with equal accuracy; i.e., they are bidirectional. The inertial force that results is proportional to the mass flow rate. The mass flow rate, thus determined, is divided by the gas base density to obtain the base volume flow rate. The flowing density of a gas as indicated by a Coriolis meter is not of sufficient accuracy to be used for the purpose of calculating flowing volume from flowing mass of the gas and shall not be used for this purpose.

2 TERMINOLOGY, UNITS, DEFINITIONS & SYMBOLS

For the purposes of this report, the following terminology, definitions and units apply.

2.1 TERMINOLOGY

Auditor	Representative of the operator or other interested party who audits the measuring system. Also referred to as the “inspector.”
Designer	Representative of the operator that designs and/or constructs metering facilities and specifies Coriolis meters.
Manufacturer	Company that designs and manufactures Coriolis meters.
Operator	Representative of the operator, that operates Coriolis meters and performs normal maintenance, also known as the “user.”
Sensor	An element of a measuring instrument (meter) or measuring chain that is directly affected by the measured quantity.
Transmitter	Part of the measuring system that receives and processes measurement signals from the Coriolis sensor and possibly other associated measuring instruments, such as from a pressure or a temperature device. It includes circuitry that receives and transmits data to the peripheral equipment. It may also be referred to as a signal processing unit (SPU).