# GAS MEASUREMENT MANUAL

## PART SEVENTEEN
## CORIOLIS METERING

Prepared by the
Transmission Measurement Committee




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# Acknowledgements

Gas Measurement Manual – Part 17: Coriolis Metering was revised by a Transmission Measurement Committee (TMC) task group under the chairmanship of Angela Floyd of BP America

This document references AGA Report 11 – Measurement of Natural Gas by Coriolis Meters (2006) extensively. Key members of the Manual - Part 17 Task Group included:

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# CORIOLIS METERING

A.G.A. Gas Measurement Manual
Part 17

## Table of Contents

# 1 Introduction

## 1.1 Scope

This manual provides instructions related to the principle of operation, typical operating characteristics and applications of Coriolis meters as well as installation, calibration, testing, and maintenance procedures, and computations used in the calculations of flow for the measurement of natural gas. Typical applications include measuring single-phase gas flow found in production, process, transmission, storage, distribution, and end-use gas measurement systems.

This manual also 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 Coriolis meter measurement. It is intended for use in conjunction with AGA Report No.11 - Measurement of Natural Gas by Coriolis Meters and technical manuals produced by meter manufacturers. The general guidance provided in this manual is not intended to replace or supersede the meter design-specific information provided by the manufacturer. This manual is not intended for use as a standard and is not intended for reference in a tariff or other regulatory documents.

## 1.2 History of Coriolis

THE ORIGIN AND HISTORY OF CORIOLIS MASS FLOW MEASUREMENT [1]

In 1835, Gustave-Gaspard Coriolis published a paper (original version in French, its title translated as) On the Equations of Relative Motion of Systems of Bodies. He showed that a supplementary inertial force acts on a moving body if viewed from a rotating frame of reference. In early 20th century, this force was coined as “Coriolis force”. [2]

In rather general terms, we can define “Coriolis acceleration” as the acceleration related to the cross product of a rotating body’s angular velocity ‘ω’ and a moving body’s linear velocity ‘v’ from the rotational center, i.e. “Coriolis force” can therefore be used to refer to any forces related to the Coriolis acceleration, which includes the force to create it, a reactive force, or an inertial force. [3]

The theory and principle of Coriolis forces extends back to the 19th century and serious attempts at industrial development of Coriolis flowmeters have been around since the mid-20th century (see detailed timeline following).

Coriolis mass flow measurement as an industrial flow measurement technology is well accepted in all industries as an extremely accurate method of directly measuring mass flow and density and in the inferred measurement of volumetric flow and concentration.

This technology is suitable for the measurement of liquids and gasses and recent innovations have allowed it to be more readily used in two phase processes such as liquids with entrained gases and wet gas/steam applications.

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[1] For a detailed discussion of the origin and history of Coriolis mass flow measurement, see Coriolis Flowmeters: A Review of Developments Over the Past 20 Years, and an Assessment of the State of the Art and Likely Future Directions, Flow Measurement an Instrumentation Vol 40, pp 99-123 April 2, 2014, R. C. Baker and T. Wang.

[2] Edwin B. Wilson (1920). James McKeen Cattell (ed.). "Space, Time, and Gravitation". The Scientific Monthly.

[3] https://www.britannica.com/science/Coriolis-force