Manual of Petroleum Measurement Standards Chapter 14.3—Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-edged Orifice Meters

Part 4—Background, Development, Implementation Procedure, and Example Calculations

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Introduction

This part of the standard for Concentric, Square-edged Orifice Meters provides the background and history of the development of the standard and recommends a method to solve the flow equations for mass and volumetric flow.

Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-edged Orifice Meters Part 4—Background, Development, Implementation Procedures, and Example Calculations

1 Scope

Chapter 14.3, Part 4 describes the background and development of the equation for the coefficient of discharge of flange-tapped, square-edged, concentric orifice meters, and recommends a flow rate calculation procedure. The recommended procedures provide consistent computational results for the quantification of fluid flow under defined conditions, regardless of the point of origin or destination, or the units of measure required by governmental customs or statute. The procedures allow different users with different computer languages on different computing hardware to arrive at almost identical results using the same standardized input data.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API *Manual of Petroleum Measurement Standards*

Chapter 12.2.1, *Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volume Correction Factors*, *Part 1—Introduction*

Chapter 14.2/AGA Report No. 8, *Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases*

Chapter 14.3.1/AGA Report No. 3, Part 1, *Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-edged Orifice Meters, Part 1—General Equations and Uncertainty Guidelines*

Chapter 14.3.2/AGA Report No. 3, Part 2, *Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-edged Orifice Meters, Part 2—Specification and Installation Requirements*

Chapter 14.3.3/AGA Report No. 3, Part 3, *Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-edged Orifice Meters, Part 3—Natural Gas Applications*

3 Symbols, Units, and Terminology

3.1 General

The symbols and units used are specific to API *MPMS* Chapter 14.3.3/AGA Report No. 3, Part 3 and were developed based on the USC inch—pound system of units. Regular conversion factors can be used where applicable; however, if SI units are used, the more generic equations in API *MPMS* Chapter 14.3.1/AGA Report No. 3, Part 1 should be used for consistent results.

3.2 Symbols and Units

C_d	orifice plate coefficient of discharge
$C_d(FT)$	coefficient of discharge at a specified pipe Reynolds number for flange-tapped orifice meter
C_{d_o}	first flange-tapped orifice meter coefficient of discharge constant within iteration scheme
C_{d_1}	second flange-tapped orifice meter coefficient of discharge constant within iteration scheme