

**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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Contents

	Page
1 Scope	1
2 Normative References	1
3 Symbols, Units, and Terminology	1
3.1 General	1
3.2 Symbols and Units	1
4 History and Development	4
4.1 Background	4
4.2 Historical Database	6
4.3 Recent Data Collection Efforts	6
4.4 Basis for Equation	12
4.5 Reader-Harris/Gallagher Equation	14
4.6 Expansion Factor Revision	21
4.7 Rigorous Method for Calculation of Mass Flow Uncertainty	24
4.8 Research on Installation Effects	26
5 Implementation Procedures	26
5.1 Introduction	26
5.2 Solution for Mass or Volume Flow Rate	27
5.3 Special Procedures and Example Calculations for Natural Gas Applications	39
5.4 Example Calculations	55
Annex A (informative) Development of Flow Equation Algorithm	97
Bibliography	104
Figures	
1 Flange Tap Data Comparison-Mean Deviation (%) versus Nominal Beta Ratio	17
2 Flange Tap Data Comparison-Mean Deviation (%) versus Nominal Pipe Diameter	18
3 Flange Tap Data Comparison-Mean Deviation (%) versus Reynolds Number Ranges	18
4 Corner Tap Data Comparison-Mean Deviation (%) versus Nominal Beta Ratio	18
5 Corner Tap Data Comparison-Mean Deviation (%) versus Reynolds Number Ranges	19
6 D-D/2 (Radius) Tap Data Comparison-Mean Deviation (%) versus Nominal Beta Ratios	19
7 D-D/2 (Radius) Tap Data Comparison-Mean Deviation (%) versus Reynolds Number Ranges	19
8 Scatter Diagram Based on Buckingham Equation	20
9 Scatter Diagram Based on Reader-Harris/Gallagher Equation	20
A.1 Number of Iterations Required to Solve for Orifice Plate Coefficient of Discharge-Direct Substitution Method	102
A.2 Number of Iterations Required to Solve for Orifice Plate Coefficient of Discharge-Newton- Raphson Method	103
Tables	
1 Nominal Tube Diameters and Beta Ratios Included in API/GPA Discharge Coefficient Research	8
2 Regression Data Points by Tapping Configuration	10
3 Regression Database Point Distribution for Flange Taps	10
4 Regression Database Point Distribution for Corner Taps	11
5 Regression Database Point Distribution for D-D/2 (Radius Taps)	11
6 Example Y_1 Calculated Values Where $k = 1.1$	22
7 Example Y_1 Calculated Values Where $k = 1.3$	23
8 Example Y_1 Calculated Values Where $k = 1.5$	23

Contents

	Page
9 Typical Values of Linear Coefficients of Thermal Expansion	29
10 Units, Conversion Constants, and Universal Constants	30
11 Example Test Case Abbreviations	31

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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.

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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