Manual of Petroleum Measurement Standards Chapter 8.2

Standard Practice for Automatic Sampling of Petroleum and Petroleum Products

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Contents

Page

1 Scope . . . 1
2 Referenced Documents . . . 2
3 Terminology . . . 2
4 Significance and Use . . . 3
5 Representative Sampling Components . . . 3
6 Design Criteria . . . 4
7 Automatic Sampling Systems . . . 5
8 Sampling Location . . . 5
9 Mixing of the Flowing Stream . . . 7
10 Proportionality . . . 9
11 Sample Extractor Grab Volume . . . 10
12 Containers . . . 10
13 Sample Handling and Mixing . . . 11
14 Control Systems . . . 11
15 Sample System Security . . . 12
16 System Proving (Performance Acceptance Tests) . . . 12
17 Performance Monitoring . . . 13
18 Crude Oil . . . 14
19 Refined Products . . . 24
20 Keywords . . . 25

Annexes (Mandatory Information)
A1 Calculation of the Margin of Error Based on Number of Sample Grabs . . . 25
A2 Theoretical Calculations for Selecting the Sampler Probe Location . . . 27
A3 Performance Criteria for Portable Sampling Units . . . 32
A4 Profile Performance Test . . . 37
A5 Sampler Acceptance Test Data . . . 39

Appendixes (Nonmandatory Information)
X1 Design Data Sheet for Automatic Sampling System . . . 42

Bibliography . . . 45

Summary of Changes . . . 45

Figures
1 In-Line Sampling System . . . 6
2 Slip Stream Sample Loop Sampling System . . . 7
3 Sample Volume Regulator . . . 7
4 Typical Portable Installation . . . 8

Contents

Page

5 Linefill . . . 8
6 Probe Design . . . 9
7 Sample Probe and Slip Stream Take-Off Probe Location for Vertical or Horizontal Pipe . . . 9
8 Sample Probe with Multiple Containers . . . 11
9 Sampling Components and Related Tests . . . 13
10 Flowchart . . . 14
11 Probe Chamfer Design . . . 16
12 Beveled Probe . . . 17
13 Sequence of Acceptance Test Activities . . . 20
A1.1 Number of Samples versus Margin of Error . . . 27
A2.1 Comparison of Mixing Devices . . . 28
A3.1 Portable Sampler Operational Data Confirmation of Mixing and Flow Sensor Velocity . . . 34
A3.2 Portable Sampler Operational Data Confirmation of Free Water Sampled . . . 35
A3.3 Typical Piping Schematic to be Recorded for Discharges . . . 36
A3.4 Typical Piping Schematic to be Recorded for Loading . . . 37
A4.1 Multi Probe for Profile Testing . . . 38
A5.1 Sampler Acceptance Test Data Sheet . . . 40
X1.1 Design Data Sheet for Automatic Sampling System . . . 43
X2.1 Comparison of Percent Sediment and Water versus Unloading Time Period . . . 44

Tables
1 Sample Frequency Variables . . . 11
2 Container Size when Used In Different Applications . . . 18
3 Allowable Deviations for the Single and Dual Sampler Water Injection Acceptance Tests (Volume by Percent) . . . 19
A1.1 Symbols . . . 25
A1.2 Samples versus Margin of Error . . . 26
A.2.1 Symbols Used in Annex A2 . . . 29
A2.2 Dispersion Factors . . . 29
A2.3 Suggested Resistance Coefficients, *K* . . . 29
A2.4 Dissipation Energy Factors (*C*) . . . 30
A2.5 Dissipation Energy Relationships . . . 30
A4.1 Typical Profile Test Data in Percent by Volume of Water . . . 38
A4.2 Calculation of Point Averages and Deviation . . . 39

Designation: D4177 – 15a

Manual of Petroleum Measurement Standards (MPMS), Chapter 8.2

Standard Practice for Automatic Sampling of Petroleum and Petroleum Products[1]

This standard is issued under the fixed designation D4177; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

INTRODUCTION

The previous version of the automatic sampling practice described the design, installation, testing, and operation of automated equipment for the extraction of representative samples from the flowing stream and storing mainly for crude oil.

This practice is a performance-based standard. It still includes the design, installation, testing, and operation of automated equipment for extraction of representative samples. It also includes the testing and proving of a sampling system in the field under actual operating conditions to ensure that the equipment, installation, and operating procedures produce representative samples. The acceptance criteria for custody transfer are covered in this practice. This practice does not address how to sample crude at temperatures below the freezing point of water. Extensive revisions have been made to the prior version of D4177 (API *MPMS* Chapter 8.2).

This practice also provides guidance for periodic verification of the sampling system.

This practice is separated into three parts:

General—Sections 5 – 17 (Part I) are currently applicable to crude oil and refined products. Review this section before designing or installing any automatic sampling system.

Crude Oil Sampling—Section 18 (Part II) contains additional information required to complete the design, testing, and monitoring of a crude oil sampling system.

Refined Product Sampling—Section 19 (Part III) contains additional information required to complete the design of a refined product sampling system.

A representative sample is "A portion extracted from the total volume that contains the constituents in the same proportions that are present in that total volume." Representative samples are required for the determination of chemical and physical properties that are used to establish standard volumes, prices, and compliance with commercial and regulatory specifications.

The process of obtaining a representative sample consists of the following: the physical equipment, the correct matching of that equipment to the application, the adherence to procedures by the operator(s) of that equipment, and the proper handling and analysis.

1. Scope*

1.1 This practice describes general procedures and equipment for automatically obtaining samples of liquid petroleum and petroleum products, crude oils, and intermediate products from the sample point into the primary container. This practice also provides additional specific information about sample container selection, preparation, and sample handling. If sampling is for the precise determination of volatility, use Practice D5842 (API *MPMS* Chapter 8.4) in conjunction with this practice. For sample mixing and handling, refer to Practice D5854 (API *MPMS* Chapter 8.3). This practice does not cover sampling of electrical insulating oils and hydraulic fluids.

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and the API Committee on Petroleum Measurement and is the direct responsibility of Subcommittee D02.02 /COMQ the joint ASTM-API Committee on Hydrocarbon Measurement for Custody Transfer (Joint ASTM-API). This practice has been approved by the sponsoring committees and accepted by the Cooperating Societies in accordance with established procedures. This practice was issued as a joint ASTM-API standard in 1982.

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***A Summary of Changes section appears at the end of this standard**

1.2 *Table of Contents:*

	Section
INTRODUCTION	
Scope	1
Referenced Documents	2
Terminology	3
Significance and Use	4
PART I–GENERAL	
Representative Sampling Components	5
Design Criteria	6
Automatic Sampling Systems	7
Sampling Location	8
Mixing of the Flowing Stream	9
Proportionality	10
Sample Extractor Grab Volume	11
Containers	12
Sample Handling and Mixing	13
Control Systems	14
Sample System Security	15
System Proving (Performance Acceptance Tests)	16
Performance Monitoring	17
PART II–CRUDE OIL	
Crude Oil	18
PART III–REFINED PRODUCTS	
Refined Products	19
KEYWORDS	
Keywords	20
ANNEXES	
Calculations of the Margin of Error based on Number of Sample Grabs	Annex A1
Theoretical Calculations for Selecting the Sampler Probe Location	Annex A2
Performance Criteria for Portable Sampling Units	Annex A3
Profile Performance Test	Annex A4
Sampler Acceptance Test Data	Annex A5
APPENDIXES	
Design Data Sheet for Automatic Sampling System	Appendix X1
Comparisons of Percent Sediment and Water versus Unloading Time Period	Appendix X2

1.3 *Units*—The values stated in either SI units or US Customary (USC) units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. Except where there is no direct SI equivalent, such as for National Pipe Threads/diameters, or tubing.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4007 Test Method for Water and Sediment in Crude Oil by the Centrifuge Method (Laboratory Procedure)

D4840 Guide for Sample Chain-of-Custody Procedures

D4928 Test Method for Water in Crude Oils by Coulometric Karl Fischer Titration

D5842 Practice for Sampling and Handling of Fuels for Volatility Measurement

D5854 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products

2.2 *API Standards:*[3]

MPMS Chapter 3 Tank Gauging

MPMS Chapter 4 Proving Systems

MPMS Chapter 5 Metering

MPMS Chapter 8.3 Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products (ASTM Practice D5854)

MPMS Chapter 8.4 Practice for Manual Sampling and Handling of Fuels for Volatility Measurement (ASTM Practice D5842)

MPMS Chapter 10 Sediment and Water

MPMS Chapter 13 Statistical Aspects of Measuring and Sampling

MPMS Chapter 20 Production Allocation Measurement for High Water Content Crude Oil Sampling

MPMS Chapter 21 Flow Measurement Using Electronic Metering Systems

2.3 *ISO Standards:*[4]

ISO 1998 Petroleum Industry – Terminology – Part 6: Measurement

NOTE 1—See the Bibliography at the end of this standard for important historical references.

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *automatic sampling system, n*—fluid sampling system that consists of: *(a)* flowing fluid stream conditioning, if required; *(b)* a means of automatically extracting a representative sample; *(c)* pacing of the sample extraction in a flow or time proportional manner; and *(d)* delivering of each extracted sample to a sample container or an analyzer.

3.1.1.1 *Discussion*—The system consists of a sample extractor with an associated controller and flow-measuring or timing device, collectively referred to as an automatic sampler or auto-sampler. In addition, the system may include a flow conditioner, slipstream, sample probe, and sample conditioning.

3.1.1.2 *Discussion*—Systems may deliver the sample directly to an analytical device or may accumulate a composite sample for offline analysis, in which case, the system includes sample mixing and handling and a primary sample container.

3.1.1.3 *Discussion*—Automatic sampling systems may be used for liquids.

3.1.2 *batch, n*—discrete shipment of commodity defined by a specified quantity, a time interval, or quality.

3.1.3 *component testing, n*—process of individually testing the components of a system.

3.1.4 *dead volume, n—in sampling*, the volume trapped between the extraction point and the primary sample container.

3.1.4.1 *Discussion*—This represents potential for contamination between batches.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, http://www.api.org.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.