If you have questions or comments regarding API standards, please visit www.api.org/standards.

MANUAL OF PETROLEUM MEASUREMENT STANDARDS

API currently maintains a comprehensive *Manual of Petroleum Measurement Standards* (*MPMS*). This manual is an ongoing project, as new chapters and revisions of old chapters will be released periodically.

Manual of Petroleum Measurement Standards (Complete Set)

The price of the complete set is subject to change as new chapters and sub-chapters are released; an order for one complete set would not include the chapters released after the release date of this catalog (but before order receipt) and the binders to house the set.

NOTE Chapter 11 standards, Chapter 19 standards, and Spanish translations must be ordered separately.

Price: $9,064.00 | *Price subject to change (If purchased individually, a complete set would cost approximately $10,300.00)

Chapter 1 [Historical]
Vocabulary

Provides terms and definitions used throughout the API *Manual of Petroleum Measurement Standards* (*MPMS*). Pages: 70

2nd Edition | July 1994 | Product Number: H01002 | Price: $109.00

Current terms and definitions may be accessed through the Ch. 1 database: http://chapter1.api.org

Chapter 1 * [Historical]
Vocabulary—Spanish

Spanish translation of Ch. 1.

2nd Edition | July 1994 | Product Number: H010SP | Price: $109.00

Chapter 2
Tank Calibration

Procedures necessary for calibrating closed storage vessels larger than a drum, and methods for computing the volumes contained therein. The following API standards cover the subject of tank calibration and are included in the manual.

Chapter 2.2A
Measurement and Calibration of Upright Cylindrical Tanks by the Manual Tank Strapping Method

Procedures for calibrating upright cylindrical tanks used primarily for the storage of petroleum liquids. Ch. 2.2A addresses necessary measurement procedures to determine total and incremental tank volumes and procedures for computing volumes. Both metric and customary units are included. The metric units reflect what is available in commercial equipment. The standard also provides guidelines for recalibration and computerization of capacity tables. Ch. 2.2A should be used in conjunction with Ch. 2.2B. These two standards combined supersede the previous Std 2550. Pages: 58

1st Edition | February 1995 | Reaffirmed: August 2017
Product Number: H022A1 | Price: $125.00

Chapter 2.2B
Calibration of Upright Cylindrical Tanks Using the Optical Reference Line Method

Describes measurement and calculation procedures for determining the diameters of upright, welded (lap/butt) cylindrical tanks, or vertical cylindrical tanks, with a smooth outside surface and either floating or fixed roofs. The optical reference line method is an alternative to the manual tank strapping method for determining tank diameter. Ch. 2.2B should be used in conjunction with Ch. 2.2A. Pages: 8

1st Edition | March 1989 | Reaffirmed: January 2013
Product Number: H30023 | Price: $83.00

Chapter 2.2C/ISO 7507-3:1993
Calibration of Upright Cylindrical Tanks Using the Optical-Triangulation Method
(ANSI/API *MPMS* Ch. 2.2C-2002)

Describes the calibration of vertical cylindrical tanks by means of optical triangulation using theodolites. The method is an alternative to other methods such as strapping (Ch. 2.2A) and the optical-reference-line method (Ch. 2.2B).

This edition of Ch. 2.2C is the modified national adoption of ISO 7507-3:1993. Pages: 19

1st Edition | January 2002 | Reaffirmed: April 2013
Product Number: H022C1 | Price: $83.00

Chapter 2.2D/ISO 7507-4:1995
Calibration of Upright Cylindrical Tanks Using the Internal Electro-Optical Distance Ranging Method
(ANSI/API *MPMS* Ch. 2.2D-2003)

Specifies a method for the calibration of upright cylindrical tanks having diameters greater than 5 m by means of internal measurements using an electro-optical distance-ranging instrument, and for the subsequent compilation of tank capacity tables.

This edition of Ch. 2.2D is the modified national adoption of ISO 7507-4:1995. Pages: 13

1st Edition | August 2003 | Reaffirmed: March 2014
Product Number: H022D1 | Price: $83.00

Chapter 2.2E/ISO 12917-1:2002
Petroleum and Liquid Petroleum Products—Calibration of Horizontal Cylindrical Tanks—Part 1: Manual Methods
(includes Errata 1 dated November 2009)
(ANSI/API *MPMS* Ch. 2.2E)

Specifies manual methods for the calibration of nominally horizontal cylindrical tanks, installed at a fixed location. It is applicable to horizontal tanks up to 4 m (13 ft) in diameter and 30 m (100 ft) in length. The methods are applicable to insulated and non-insulated tanks, either when they are above-ground or underground. The methods are applicable to pressurized tanks, and to both knuckle-dish-end and flat-end cylindrical tanks as well as elliptical and spherical head tanks. This chapter is applicable to tanks inclined by up to 10 % from the horizontal provided a correction is applied for the measured tilt. For tanks over and above these dimensions and angle of tilt, appropriate corrections for tilt and appropriate volume computations should be based on the "Coats" equation.

This edition of Ch. 2.2E is the national adoption of ISO 12917-1:2002. Pages: 18

1st Edition | April 2004 | Reaffirmed: August 2014
Product Number: HX202E01 | Price: $88.00

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Chapter 2.2F/ISO 12917-2:2002
Petroleum and Liquid Petroleum Products—Calibration of Horizontal Cylindrical Tanks—Part 2: Internal Electro-Optical Distance-Ranging Method
(ANSI/API *MPMS* Ch. 2.2F)

Specifies a method for the calibration of horizontal cylindrical tanks having diameters greater than 2 m (6 ft) by means of internal measurements using an electro-optical distance-ranging instrument, and for the subsequent compilation of tank-capacity tables. This method is known as the internal electro-optical distance-ranging (EODR) method.

This edition of Ch. 2.2F is the national adoption of ISO 12917-2:2002. Pages: 14

1st Edition | April 2004 | Reaffirmed: October 2017
Product Number: HH202F01 | Price: $77.00

Chapter 2.2G
Calibration of Upright Cylindrical Tanks Using the Total Station Reference Line Method

Describes measurement and calculation procedures for determining the diameters of upright cylindrical tanks by taking vertical offset measurements externally using electro-optical distance ranging equipment rather than conventional ORLM plummet/trolley equipment. This standard is an alternate standard to Ch. 2.2B. This standard is used in conjunction with Ch. 2.2A. Calibration of insulated tanks is covered by Ch. 2.2D. Abnormally deformed tanks that are dented or have other visible signs of damage are not covered by this standard. Pages: 14

1st Edition | July 2014 | Product Number: H202G01 | Price: $80.00

Std 2552
Measurement and Calibration of Spheres and Spheroids

Describes the procedures for calibrating spheres and spheroids, which are used as liquid containers. It outlines the procedures for the measurement and calibration of spherical tanks. Pages: 17

1st Edition | October 1966 | Reaffirmed: September 2012
2-Year Extension: December 2017
Product Number: H25520 | Price: $97.00

Std 2554
Measurement and Calibration of Tank Cars

Describes the procedures for calibrating tank cars. It outlines procedures for nonpressure-type tank cars and pressure-type tank cars. Pages: 41

1st Edition | October 1966 | Reaffirmed: September 2012
2-Year Extension: December 2017
Product Number: H25540 | Price: $115.00

Std 2555
Liquid Calibration of Tanks

Describes the procedure for calibrating tanks, or portions of tanks, larger than a barrel or drum by introducing or withdrawing measured quantities of liquid. Pages: 14

1st Edition | September 1966 | Reaffirmed: May 2014
Product Number: H25550 | Price: $97.00

RP 2556
Correcting Gauge Tables for Incrustation

Incrustation is defined in this document as any material that adheres to the internal vertical sidewall surfaces of a tank when the tank is otherwise empty. The tables given in this recommended practice show the percent of error of measurement caused by varying thicknesses of uniform incrustation in tanks of various sizes. Pages: 3

2nd Edition | August 1993 | Reaffirmed: November 2013
Product Number: H25560 | Price: $76.00

Chapter 2.7
Calibration of Barge Tanks

Describes three methods for determining the total incremental volumes of liquids in barge tanks for coastal and inland waterway service that have integral hull tanks. The three methods are as follows.

- Liquids calibration.
- Calibration by linear measurement.
- Calibration from vessel drawings.

This document and Ch. 2.8A supersede the previous Std 2553. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM2 Section 5A. Pages: 25

1st Edition | March 1991 | Reaffirmed: January 2014
Product Number: H30044 | Price: $59.00

Chapter 2.8A
Calibration of Tanks on Ships and Oceangoing Barges

Three methods for determining the total and incremental volumes of liquids in tanks, oceangoing barges, and integrated tug barge units that have integral hull tanks. The three methods include liquid calibration, calibration by linear measurement, and calibration from vessel drawings. This document and Ch. 2.7 supersede the previous Std 2553. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM2 Section 5B. Pages: 22

1st Edition | March 1991 | Reaffirmed: March 2012
Product Number: H30049 | Price: $89.00

Chapter 2.8B
Recommended Practice for the Establishment of the Location of the Reference Gauge Point and the Gauge Height of Tanks on Marine Tank Vessels

Recommended practice, for use in conjunction with Ch. 2.7 and Ch. 2.8A. Establishes reference gauge heights during calibration of marine tank vessels. A reference gauge point is necessary for converting ullage to innage, and when determining the volume of the quantities remaining on board. A reference gauge point is also used for wedge formulas and establishing wedge tables. Pages: 26

1st Edition | September 1995 | Reaffirmed: December 2014
Product Number: H028B1 | Price: $97.00

Chapter 3
Tank Gauging

Standardized procedures for gauging liquid hydrocarbons in various types of tanks, containers, and carriers.

Chapter 3.1A
Standard Practice for the Manual Gauging of Petroleum and Petroleum Products

Describes the following:

- the procedures for manually gauging the liquid level of petroleum and petroleum products in non-pressure fixed-roof, floating-roof tanks and marine tank vessels,
- procedures for manually gauging the level of free water that may be found with the petroleum or petroleum products,
- methods used to verify the length of gauge tapes under field conditions and the influence of bob weights and temperature on the gauge tape length, and
- the influences that may affect the position of gauging reference point (either the datum plate or the reference gauge point).

Throughout this standard the term petroleum is used to denote petroleum, petroleum products, or the liquids normally associated with the petroleum industry.

The method used to determine the volume of tank contents determined from gauge readings is not covered in this standard. The determination of temperature, API gravity, and suspended sediment and water of the tank contents are not within the scope of this standard. Pages: 31

3rd Edition | August 2013 | Product Number: H301A03 | Price: $100.00

■ This publication is a new entry in this catalog. ◆ This publication is related to an API licensing, certification, or accreditation program.

Chapter 3.1A *
Standard Practice for the Manual Gauging of Petroleum and Petroleum Products—Spanish

Spanish translation of Ch. 3.1A.

3rd Edition | August 2013 | Product Number: H301A03S | Price: $100.00

Chapter 3.1B
Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging

Covers level measurement of liquid hydrocarbons in stationary, aboveground, atmospheric storage tanks using automatic tank gauges (ATGs). This publication discusses automatic tank gauging in general, calibration of ATGs for custody transfer and inventory control, and the requirements for data collection, transmission, and receiving. The appendices discuss the operation and installation of the most commonly used ATG equipment and of the less commonly used, electronic ATGs. Pages: 17

2nd Edition | June 2001 | Reaffirmed: February 2016
Product Number: H301B2 | Price: $97.00

Chapter 3.1B *
Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging—Spanish

Spanish translation of Ch. 3.1B.

2nd Edition | June 2001 | Product Number: H301B2SP | Price: $97.00

Chapter 3.2
Standard Practice for Gauging Petroleum and Petroleum Products in Tank Cars

Provides method for measuring liquids and liquefied gases in tank cars by liquid level measurement. Measurement of both vapor space and liquid level are covered. Gauging and temperature measurement equipment used in both open and closed measurement systems are described in this standard. These procedures reduce variability in the results of measurement and sampling operations when comparing loading terminal data to unloading terminal data. Pages: 20

1st Edition | August 1995 | Reaffirmed: May 2013
Product Number: H03021 | Price: $97.00

Chapter 3.2 *
Standard Practice for Gauging Petroleum and Petroleum Products in Tank Cars—Spanish

Spanish translation of Ch. 3.2.

1st Edition | August 1995 | Product Number: H03021S | Price: $97.00

Chapter 3.3
Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Pressurized Storage Tanks by Automatic Tank Gauging

Provides guidance on the installation, calibration, and verification of automatic tank gauges used in custody transfer for measuring the level of liquid hydrocarbons having a Reid vapor pressure of 15 psi (103 kPa) or greater, stored in stationary, pressurized storage tanks. This standard also provides guidance on the requirements for data collection, transmission, and receiving. Pages: 10

1st Edition | June 1996 | Reaffirmed: March 2017
Product Number: H03031 | Price: $83.00

Chapter 3.3 *
Standard Practice for Level Measurement of Liquid Hydrocarbons in Stationary Pressurized Storage Tanks by Automatic Tank Gauging—Spanish

Spanish translation of Ch. 3.3.

1st Edition | June 1996 | Product Number: H030316 | Price: $83.00

Chapter 3.4
Standard Practice for Level Measurement of Liquid Hydrocarbons on Marine Vessels by Automatic Tank Gauging

Provides guidance on the selection, installation, calibration, and verification of automatic tank gauges for measuring the level of liquid hydrocarbons having a Reid vapor pressure less than 15 psia (103 kPa), transported aboard marine vessels (tankers and barges). This standard also provides guidance on the requirements for data collection, transmission, and receiving. This standard supersedes all applicable sections of Std 2545. Pages: 10

1st Edition | April 1995 | Reaffirmed: May 2016
Product Number: H03041 | Price: $83.00

Chapter 3.4 *
Standard Practice for Level Measurement of Liquid Hydrocarbons on Marine Vessels by Automatic Tank Gauging—Spanish

Spanish translation of Ch. 3.4.

1st Edition | April 1995 | Product Number: H03041SP | Price: $83.00

Chapter 3.5
Standard Practice for Level Measurement of Light Hydrocarbon Liquids Onboard Marine Vessels by Automatic Tank Gauging

Covers the standard practice for level measurement of light hydrocarbon liquids onboard marine vessels by automatic tank gauges. This publication covers pressurized and refrigerated light hydrocarbon liquids. The light hydrocarbon liquids covered include: liquefied petroleum gas (LPG), natural gas liquid (NGL), and other petrochemical liquids where the storage and transportation requirements and the methods of measurement are similar to that for LPG and NGL gauging. This standard also covers the requirements for data collection, transmission, and receiving. Pages: 8

1st Edition | March 1997 | Reaffirmed: February 2013
Product Number: H03051 | Price: $83.00

Chapter 3.5 *
Standard Practice for Level Measurement of Light Hydrocarbon Liquids Onboard Marine Vessels by Automatic Tank Gauging—Spanish

Spanish translation of Ch. 3.5.

1st Edition | March 1997 | Product Number: H03051S | Price: $83.00

Chapter 3.6
Measurement of Liquid Hydrocarbons by Hybrid Tank Measurement Systems
(includes Errata 1 dated September 2005)

Covers selection, installation, commissioning, calibration, and verification of hybrid tank measurement systems for the measurement of level, static mass, observed and standard volume, and observed and reference density in tanks storing petroleum and petroleum products for custody transfer and/or inventory control purposes. Pages: 26

1st Edition | February 2001 | Reaffirmed: January 2017
Product Number: H03061 | Price: $96.00

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Chapter 4
Proving Systems

Serves as a guide for the design, installation, calibration, and operation of meter proving systems.

Chapter 4.1
Introduction

General introduction to the subject of proving. The requirements in Ch. 4 are based on customary practices that evolved for crude oils and products covered by Ch. 11.1. The prover and meter uncertainties should be appropriate for the measured fluids and should be agreeable to the parties involved. Pages: 4

3rd Edition | February 2005 | Reaffirmed: June 2014
Product Number: H04013 | Price: $82.00

Chapter 4.1 *
Introduction—Spanish

Spanish translation of Ch. 4.1.

3rd Edition | February 2005 | Product Number: H40101S | Price: $82.00

Chapter 4.2
Displacement Provers
(includes Addendum 1 dated February 2015)

Outlines the essential elements of provers that accumulate meter pulses as a displacing element within the prover travels between detector switches. It provides design and installation details for the types of displacement provers that are currently in use. The provers discussed are designed for proving measurement devices under dynamic operating conditions with single-phase liquid hydrocarbons. Pages: 45

3rd Edition | September 2003 | Reaffirmed: March 2011
Product Number: H04023 | Price: $123.00

Chapter 4.4
Tank Provers

Specifies the characteristics of tank provers that are in general use and the procedures for their calibration. This standard does not apply to weir-type, vapor-condensing, dual-tank water-displacement, or gas-displacement provers. Pages: 11

2nd Edition | May 1998 | Reaffirmed: May 2015
Product Number: H04042 | Price: $83.00

Chapter 4.5
Master Meter Provers

Covers the use of displacement, turbine, Coriolis, and ultrasonic meters as master meters. The requirements in this standard are intended for single-phase liquid hydrocarbons. Meter proving requirements for other fluids should be appropriate for the overall custody transfer accuracy and should be agreeable to the parties involved. This document does not cover master meters to be used for the calibration of provers. For information concerning master meter calibration of provers, see Ch. 4.9.3. Pages: 24

4th Edition | June 2016 | Product Number: H40504 | Price: $80.00

Chapter 4.6
Pulse Interpolation
(includes Errata 1 dated April 2007)

Describes how the double-chronometry method of pulse interpolation, including system operating requirements and equipment testing, is applied to meter proving. Pages: 8

2nd Edition | May 1999 | Reaffirmed: October 2013
Product Number: H04062 | Price: $65.00

Chapter 4.7
Field Standard Test Measures

Details the essential elements of field standard test measures by providing descriptions, construction requirements, as well as inspection, handling, and calibration methods. Bottom-neck scale test measures and prover tanks are not addressed in this document. The scope of this standard is limited to the certification of "delivered volumes" of test measures. Pages: 19

3rd Edition | April 2009 | Reaffirmed: June 2014
Product Number: H40703 | Price: $86.00

Chapter 4.8
Operation of Proving Systems

Provides information for operating meter provers on single-phase liquid hydrocarbons. It is intended for use as a reference manual for operating proving systems. The requirements of this chapter are based on customary practices for single-phase liquids. This standard is primarily written for hydrocarbons, but much of the information in this chapter may be applicable to other liquids. Specific requirements for other liquids should be agreeable to the parties involved. Pages: 40

2nd Edition | September 2013 | Product Number: H04082 | Price: $125.00

Chapter 4.9.1
Methods of Calibration for Displacement and Volumetric Tank Provers, Part 1—Introduction to the Determination of the Volume of Displacement and Tank Provers

Provers are precision devices, defined as volumetric standards, which are used to verify the accuracy of liquid volumetric meters used for custody transfer measurement. Both displacement and tank provers are used to prove a meter in order to obtain its meter factor, which is then used to correct for meter error caused by differences between the metered volume and the true volume. The base volume of a displacement or tank prover, determined by calibration, is an essential requirement in the determination of these meter factors. The accuracy of a meter factor is limited by several considerations:

- equipment performance,
- observation errors,
- prover volume calibration errors,
- calculation errors. Pages: 28

1st Edition | October 2005 | Reaffirmed: April 2015
Product Number: H409011 | Price: $76.00

Chapter 4.9.2
Methods of Calibration for Displacement and Volumetric Tank Provers, Part 2—Determination of the Volume of Displacement and Tank Provers by the Waterdraw Method of Calibration

All prover volumes used to calibrate meters shall be determined by calibration and not by theoretical calculation. Volumetric provers have an exact reference volume, which has been determined by a recognized method of calibration. Techniques for the determination of this reference volume include the waterdraw, master meter, and gravimetric methods of calibration. This standard describes only the waterdraw method of calibration, which is used to accurately determine the calibrated volume of both displacement and tank provers. Pages: 92

1st Edition | December 2005 | Reaffirmed: May 2015
Product Number: H409021 | Price: $182.00

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Chapter 4.9.3
Methods of Calibration for Displacement and Volumetric Tank Provers, Part 3—Determination of the Volume of Displacement Provers by the Master Meter Method of Calibration

Covers the procedures required to determine the field data necessary to calculate a base prover volume (BPV) of a field displacement prover by the master meter method for calibration. This standard applies to liquids that for all practical purposes are considered to be clean, single-phase, homogeneous, and Newtonian at metering conditions.

Detailed calculation procedures are not included in this standard: see Ch. 12.2.5. Pages: 19

1st Edition | April 2010 | Reaffirmed: March 2015
Product Number: H409031 | Price: $74.00

Chapter 4.9.4
Methods of Calibration for Displacement and Volumetric Tank Provers, Part 4—Determination of the Volume of Displacement and Tank Provers by the Gravimetric Method of Calibration
(includes Errata 1 dated August 2016)

Covers the specific procedures, equipment, and calculations required to determine the base prover volume of both tank and displacement provers by the gravimetric method of calibration. This standard presents both USC and SI units and may be implemented in either system of units. The presentation of both units is for the convenience of the user and is not necessarily the exact conversions. The system of units to be used is typically determined by contract, regulatory requirement, the manufacturer, or the user's calibration program. Throughout this document issues of traceability are addressed by references to National Institute of Standards and Technology (NIST). However, other appropriate national metrology institutes can be referenced. There is no intent to cover safety aspects of conducting the work described in this standard, and it is the duty of the user to be familiar with all applicable safe work practices. It is also the duty of the user to comply with all existing federal, state, or local regulations [e.g. the Occupational Safety and Health Administration (OSHA)] that govern the types of activities described in this standard, and to be familiar with all such safety and health regulations. Pages: 38

1st Edition | October 2010 | Reaffirmed: December 2015
Product Number: H4090401 | Price: $83.00

Chapter 5
Metering

Covers the dynamic measurement of liquid hydrocarbons, by means of meters and accessory equipment.

Chapter 5.1
General Considerations for Measurement by Meters
(includes Errata 1 dated June 2008 and Errata 2 dated June 2011)

Intended to be a guide for the proper specification, installation, and operation of meter runs designed to dynamically measure liquid hydrocarbons so that acceptable accuracy, service life, safety, reliability, and quality control can be achieved. Ch. 5 also includes information that will assist in troubleshooting and improving the performance of meters. Pages: 8

4th Edition | September 2005 | Reaffirmed: July 2016
Product Number: H05014 | Price: $94.00

Chapter 5.1 *
General Considerations for Measurement by Meters—Spanish

Spanish translation of Ch. 5.1.

4th Edition | September 2005 | Product Number: H05014SP | Price: $94.00

Chapter 5.2
Measurement of Liquid Hydrocarbons by Displacement Meters

Ch. 5.2, together with the general considerations for measurement by meters found in Ch. 5.1, describes methods for obtaining accurate quantity measurement with displacement meters in liquid hydrocarbon service. It covers the unique performance characteristics of displacement meters in liquid hydrocarbon service. It does not apply to the measurement of two-phase fluids. Pages: 3

3rd Edition | October 2005 | Reaffirmed: July 2015
Product Number: H05023 | Price: $87.00

Chapter 5.2 *
Measurement of Liquid Hydrocarbons by Displacement Meters—Spanish

Spanish translation of Ch. 5.2.

3rd Edition | October 2005 | Product Number: H50203SP | Price: $87.00

Chapter 5.3
Measurement of Liquid Hydrocarbons by Turbine Meters
(includes Addendum 1 dated July 2009)

Defines the application criteria for turbine meters and discusses appropriate considerations regarding the liquids to be measured. Discusses the installation of a turbine metering system and the performance, operation, and maintenance of turbine meters in liquid hydrocarbon service. Includes "Selecting a Meter and Accessory Equipment" and information on the recommended location for prover connections. Pages: 11

5th Edition | September 2005 | Reaffirmed: August 2014
Product Number: H05035 | Price: $106.00

Chapter 5.3 *
Measurement of Liquid Hydrocarbons by Turbine Meters—Spanish

Spanish translation of Ch. 5.3, including Addendum 1 dated July 2009.

5th Edition | September 2005 | Product Number: H50305SP | Price: $106.00

Chapter 5.4
Accessory Equipment for Liquid Meters
(includes Errata 1 dated May 2015)

Describes the characteristics of accessory equipment used with displacement and turbine meters in liquid hydrocarbon service. Includes guidance on the use of electronic flow computers. Pages: 8

4th Edition | September 2005 | Reaffirmed: August 2015
Product Number: H05044 | Price: $94.00

Chapter 5.4 *
Accessory Equipment for Liquid Meters—Spanish

Spanish translation of Ch. 5.4.

4th Edition | September 2005 | Product Number: H05044SP | Price: $94.00

Chapter 5.5
Fidelity and Security of Flow Measurement Pulsed-Data Transmission Systems

Serves as a guide for the selection, operation, and maintenance of various types of pulsed-data, cabled transmission systems for fluid metering systems to provide the desired level of fidelity and security of transmitted flow pulse data. This publication does not endorse or advocate the preferential use of any specific type of equipment or systems, nor is it intended to restrict future development of such equipment. Pages: 8

2nd Edition | July 2005 | Reaffirmed: August 2015
Product Number: H50502 | Price: $70.00

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Chapter 5.5 *
Fidelity and Security of Flow Measurement Pulsed-Data Transmission Systems—Spanish

Spanish translation of Ch. 5.5.

2nd Edition | July 2005 | Product Number: H50502SP | Price: $70.00

Chapter 5.6
Measurement of Liquid Hydrocarbons by Coriolis Meters
(ANSI/API *MPMS* Ch. 5.6-2002)

Describes methods for achieving custody transfer levels of accuracy when a Coriolis meter is used to measure liquid hydrocarbons. Topics covered include: applicable API standards used in the operation of Coriolis meters; proving and verification using both mass- and volume-based methods; and installation, operation, and maintenance. Both mass and volume-based calculation procedures for proving and quantity determination are included in Appendix E. Pages: 48

1st Edition | October 2002 | Reaffirmed: November 2013
Product Number: H05061 | Price: $139.00

Chapter 5.6 *
Measurement of Liquid Hydrocarbons by Coriolis Meters—Spanish

Spanish translation of Ch. 5.6.

1st Edition | October 2002 | Product Number: H05061S | Price: $139.00

Chapter 5.8
Measurement of Liquid Hydrocarbons by Ultrasonic Flow Meters
(includes Errata 1 dated February 2014)
(ANSI/API *MPMS* Ch. 5.8-2011)

Defines the application criteria for ultrasonic flowmeters (UFMs) and addresses the appropriate considerations regarding the liquids to be measured. This document addresses the installation, operation, and maintenance of UFMs in liquid hydrocarbon service. The field of application of this standard is the dynamic measurement of liquid hydrocarbons. While this document is specifically written for custody transfer measurement, other acceptable applications may include allocation measurement, check meter measurement, and leak detection measurement. This document only pertains to spool type, multi-path ultrasonic flow meters with permanently affixed acoustic transducer assemblies. Pages: 23

2nd Edition | November 2011 | Reaffirmed: May 2017
Product Number: H050802 | Price: $86.00

Chapter 5.8 *
Measurement of Liquid Hydrocarbons by Ultrasonic Flow Meters—Spanish

Spanish translation of Ch. 5.8.

2nd Edition | November 2011 | Product Number: H050802SP | Price: $86.00

Chapter 6
Metering Assemblies

Discussion of the design, installation, and operation of metering systems for coping with special situations in hydrocarbon measurement.

Chapter 6.1
Lease Automatic Custody Transfer (LACT) Systems

Prepared as a guide for the design, installation, calibration, and operation of a lease automatic custody transfer (LACT) system. It applies to unattended and automatic measurement by meter of hydrocarbon liquids produced in the field and transferred to a pipeline in either a scheduled or nonscheduled operation. Pages: 6

2nd Edition | May 1991 | Reaffirmed: December 2017
Product Number: H30121 | Price: $60.00

Chapter 6.2
Loading Rack Metering Systems

Serves as a guide in the selection, installation, and operation of loading rack metering systems for petroleum products, including liquefied petroleum gas. This standard does not endorse or advocate the preferential use of any specific type of metering system or meter. Pages: 30

3rd Edition | February 2004 | Reaffirmed: July 2016
Product Number: H60203 | Price: $79.00

Chapter 6.2 *
Loading Rack Metering Systems—Spanish

Spanish translation of Ch. 6.2.

3rd Edition | February 2004 | Product Number: H60203S | Price: $79.00

Chapter 6.5
Metering Systems for Loading and Unloading Marine Bulk Carriers

Deals with the operation and special arrangements of meters, provers, manifolding, instrumentation, and accessory equipment used for measurement during loading and unloading of marine bulk carriers. Pages: 6

2nd Edition | May 1991 | Reaffirmed: May 2012
Product Number: H30125 | Price: $65.00

Chapter 6.6
Pipeline Metering Systems

Provides guidelines for selection of the type and size of meters to be used to measure pipeline oil movements, as well as the relative advantages and disadvantages of the methods of proving meters by tank prover, conventional pipe prover, small volume prover, and master meter. It also includes discussion on obtaining the best operating results from a pipeline-meter station. Pages: 9

2nd Edition | May 1991 | Reaffirmed: December 2017
Product Number: H30126 | Price: $65.00

Chapter 6.7
Metering Viscous Hydrocarbons

Serves as a guide for the design, installation, operation, and proving of meters and auxiliary equipment used in metering viscous hydrocarbons. It defines viscous hydrocarbons and describes the difficulties that arise when viscous hydrocarbons are raised to high temperature. The effects of such temperatures on meters, auxiliary equipment, and fittings are discussed, and advice and warnings to overcome or mitigate difficulties are included. Pages: 6

2nd Edition | May 1991 | Reaffirmed: May 2012
2-Year Extension: December 2017
Product Number: H30127 | Price: $65.00

Chapter 7
Temperature Determination
(includes Addendum 1 dated October 2011 and Addendum 2 dated August 2017)

Describes methods and practices that may be used to obtain accurate measurements of temperature of petroleum and petroleum products in pipelines, storage tanks, gathering tanks, ships, barges, tank cars, pipe provers, tank provers, and test measures under both static and dynamic conditions using electronic temperature measuring devices or mercury-in-glass thermometers.

Describes the methods, equipment, and procedures for determining the temperature of petroleum and petroleum products under both static and dynamic conditions. This chapter discusses temperature measurement requirements in general for custody transfer, inventory control, and marine measurements. The actual method and equipment selected for temperature determination are left to the agreement of the parties involved. Pages: 38

1st Edition | June 2001 | Reaffirmed: February 2012
2-Year Extension: March 2017 | Product Number: H07001 | Price: $197.00

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Chapter 7.1 ■
Temperature Determination—Liquid-in-Glass Thermometers

Describes how to correctly use various types of liquid-in-glass thermometers to accurately determine the temperatures of hydrocarbon liquids. Other methods, equipment, and procedures for temperature determination are described in the other sub-sections of Ch. 7.

This chapter describes the methods, equipment, and procedures for manually determining the temperature of liquid petroleum and petroleum products with liquid-in-glass thermometers. This chapter discusses temperature measurement requirements in general for custody transfer, inventory control, and marine measurements. The actual method and equipment selected for temperature determination are left to the agreement of the parties involved. Pages: 37

2nd Edition | August 2017 | Product Number: H70102 | Price: $110.00

Chapter 7.3
Temperature Determination—Fixed Automatic Tank Temperature Systems

Describes the methods, equipment, and procedures for determining the temperature of petroleum and petroleum products under static conditions by the use of an automatic method. Automatic temperature measurement is discussed for custody transfer and inventory control for both onshore and marine measurement applications.

Temperatures of hydrocarbon liquids under static conditions can be determined by measuring the temperature of the liquid at specific locations. Examples of where static temperature determination is required include storage tanks, ships, and barges.

The application of this standard is restricted to automatic methods for the determination of temperature using fixed automatic tank thermometer (ATT) systems for hydrocarbons having a Reid vapor pressure at or below 101.325 kPa (14.696 psia).

Although not included in the scope, requirements in this standard can be used for other fluids and other applications including petroleum liquids having Reid vapor pressures in excess of 101.325 kPa (14.696 psia) tanks with inert gas systems and cryogenic liquids. However, such applications can require different performance and installation specifications. Pages: 27

2nd Edition | October 2011 | Reaffirmed: December 2016
Product Number: H70302 | Price: $83.00

Chapter 7.3 *
Temperature Determination—Fixed Automatic Tank Temperature Systems—Spanish

Spanish translation of Ch. 7.3.

2nd Edition | October 2011 | Product Number: H70302SP | Price: $83.00

Chapter 7.5/ISO 8310:2012
Temperature Determination—Automatic Tank Temperature Measurement Onboard Marine Vessels Carrying Refrigerated Hydrocarbon and Chemical Gas Fluids
(ANSI/API *MPMS* Ch. 7.5)

Specifies the essential requirements and verification procedures for automatic tank thermometers (ATTs) consisting of platinum resistance thermometers (PRT) and an indicating device used for custody transfer measurement of liquefied natural gas, liquefied petroleum, and chemical gases on board ships. Temperature detectors other than PRT are considered acceptable for use in the custody transfer service of liquefied gases if they meet the performance requirements of this document and are approved by national regulations. Pages: 12

1st Edition | September 2014 | Product Number: HH70501 | Price: $95.00

Chapter 8
Sampling

Covers standardized procedures for sampling petroleum and petroleum products.

Chapter 8.1
Standard Practice for Manual Sampling of Petroleum and Petroleum Products
(ASTM D4057)

Covers procedures and equipment for manually obtaining samples of liquid petroleum and petroleum products, crude oils, and intermediate products from the sample point into the primary container. Procedures are also included for the sampling of free water and other heavy components associated with petroleum and petroleum products. This practice also addresses the sampling of semi-liquid or solid-state petroleum products. This practice provides additional specific information about sample container selection, preparation, and sample handling. This practice does not cover sampling of electrical insulating oils and hydraulic fluids. The procedures described in this practice may also be applicable in sampling most non-corrosive liquid industrial chemicals provided that all safety precautions specific to these chemicals are followed (also, refer to ASTM Practice E300). The procedures described in this practice are also applicable to sampling liquefied petroleum gases and chemicals. Pages: 48

4th Edition | October 2013 | Product Number: H80104 | Price: $120.00

Chapter 8.1 *■
Standard Practice for Manual Sampling of Petroleum and Petroleum Products—Spanish

Spanish translation of Ch. 8.1.

4th Edition | October 2013 | Product Number: H80104S | Price: $120.00

Chapter 8.2
Standard Practice for Automatic Sampling of Petroleum and Petroleum Products
(ASTM D4177)

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 Ch. 8.4 (ASTM Practice D5842) in conjunction with this practice. For sample mixing and handling, refer to Ch. 8.3 (ASTM Practice D5854). This practice does not cover sampling of electrical insulating oils and hydraulic fluids. Pages: 45

4th Edition | November 2016 | Product Number: H80204 | Price: $71.00

Chapter 8.3
Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products
(includes Errata 1 dated March 1996)
(ASTM D5854)

Covers the handling, mixing, and conditioning procedures required to ensure that a representative sample of the liquid petroleum or petroleum product is delivered from the primary sample container/receiver into the analytical test apparatus or into intermediate containers. For sampling procedures, refer to Ch. 8.1 and Ch. 8.2. Refer to Ch. 8.4 for the mixing and handling of light fuels for volatility measurement. Pages: 27

1st Edition | October 1995 | Reaffirmed: March 2015
Product Number: H08031 | Price: $89.00

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Chapter 8.3 *
Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and Petroleum Products—Spanish

Spanish translation of Ch. 8.3.

1st Edition | October 1995 | Product Number: H80301SP | Price: $89.00

Chapter 8.4 ■
Standard Practice for Sampling and Handling of Fuels for Volatility Measurement
(ASTM D5842)

Covers procedures and equipment for obtaining, mixing, and handling representative samples of volatile fuels for the purpose of testing for compliance with the standards set forth for volatility related measurements applicable to light fuels. The applicable dry vapor pressure equivalent range of this practice is 13 to 110 kPa (2 to 16 psia).

This practice is applicable to the sampling, mixing, and handling of reformulated fuels including those containing oxygenates. This practice is not applicable to crude oil. For the sampling of crude oil, refer to Ch. 8.1, Ch. 8.2, and Ch. 8.5. Pages: 16

4th Edition | December 2017 | Product Number: H80404 | Price: $46.00

Chapter 8.5
Standard Practice for Manual Piston Cylinder Sampling for Volatile Crude Oils, Condensates, and Liquid Petroleum Products
(ASTM D8009)

Includes the equipment and procedures for obtaining a representative sample of "live" or high vapor pressure crude oils, condensates, and/or liquid petroleum products from low pressure sample points, where there is insufficient sample point pressure to use a floating piston cylinder (FPC) as described in ASTM D3700. Pages: 20

1st Edition | December 2015 | Product Number: H80501 | Price: $50.00

Chapter 8.5 *■
Standard Practice for Manual Piston Cylinder Sampling for Volatile Crude Oils, Condensates, and Liquid Petroleum Products—Spanish

Spanish translation of Ch. 8.5.

1st Edition | December 2015 | Product Number: H80501S | Price: $50.00

Chapter 9
Density Determination

Describes the standard methods and apparatus used to determine the specific gravity of crude oil and petroleum products normally handled as liquids.

Chapter 9.1
Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
(ASTM D1298)

Covers the laboratory determination, using a glass hydrometer in conjunction with a series of calculations, of the density, relative density, or API gravity of crude petroleum, petroleum products, or mixtures of petroleum and nonpetroleum products normally handled as liquids and having a Reid vapor pressure of 101.325 kPa (14.696 psi) or less. Values are determined at existing temperatures and corrected to 15 °C or 60 °F by means of a series of calculations and international standard tables.

The initial hydrometer readings obtained are uncorrected hydrometer readings and not density measurements. Readings are measured on a hydrometer at either the reference temperature or at another convenient temperature, and readings are corrected for the meniscus effect, the thermal glass expansion effect, alternate calibration temperature effects, and to the reference temperature by means of volume correction factors; values obtained at other than the reference temperature being hydrometer readings and not density measurements.

Readings determined as density, relative density, or API gravity can be converted to equivalent values in the other units or alternate reference temperatures by means of Interconversion Procedures (Ch. 11.5) or volume correction factors (Ch. 11.1), or both, or tables, as applicable. Pages: 8

3rd Edition | December 2012 | Reaffirmed: May 2017
Product Number: H09013 | Price: $41.00

Chapter 9.2
Standard Test Method for Density or Relative Density of Light Hydrocarbons by Pressure Hydrometer
(ASTM D1657)

Covers the determination of the density or relative density of light hydrocarbons including liquefied petroleum gases (LPG) having Reid vapor pressures exceeding 101.325 kPa (14.696 psi).

The prescribed apparatus should not be used for materials having vapor pressures higher than 1.4 MPa (200 psi) at the test temperature. This pressure limit is dictated by the type of equipment. Higher pressures can apply to other equipment designs.

The initial pressure hydrometer readings obtained are uncorrected hydrometer readings and not density measurements. Readings are measured on a hydrometer at either the reference temperature or at another convenient temperature, and readings are corrected for the meniscus effect, the thermal glass expansion effect, alternate calibration temperature effects, and to the reference temperature by means of calculations and volume correction factors (Ch. 11.1) or Ch. 11.2.4 (GPA TP-27), as applicable.

Values determined as density or relative density can be converted to equivalent values in the other units or alternative reference temperatures by means of Interconversion Procedures (Ch. 11.5), or volume correction factors (Ch. 11.1) or Ch. 11.2.4 (GPA TP-27), as applicable. Pages: 6

3rd Edition | December 2012 | Reaffirmed: May 2017
Product Number: H09023 | Price: $41.00

Chapter 9.3
Standard Test Method for Density, Relative Density, and API Gravity of Crude Petroleum and Liquid Petroleum Products by Thermohydrometer Method
(ASTM D6822)

Covers the determination, using a glass thermohydrometer in conjunction with a series of calculations, of the density, relative density, or API gravity of crude petroleum, petroleum products, or mixtures of petroleum and nonpetroleum products normally handled as liquids and having a Reid vapor pressures of 101.325 kPa (14.696 psi) or less.

Values are determined at existing temperatures and corrected to 15 °C or 60 °F by means of a series of calculations and international standard tables.

The initial thermohydrometer readings obtained are uncorrected hydrometer readings and not density measurements. Readings are measured on a thermohydrometer at either the reference temperature or at another convenient temperature, and readings are corrected for the meniscus effect, the thermal glass expansion effect, alternate calibration temperature effects, and to the reference temperature by means of calculations and volume correction factors (Ch. 11.1).

Readings determined as density, relative density, or API gravity can be converted to equivalent values in the other units or alternate reference temperatures by means of Interconversion Procedures (Ch. 11.5) or volume correction factors (Ch. 11.1), or both, or tables, as applicable. Pages: 10

3rd Edition | December 2012 | Reaffirmed: May 2017
Product Number: H09033 | Price: $41.00

Chapter 10
Sediment and Water

Describes methods for determining the amount of sediment and water, either together or separately in petroleum products. Laboratory and field methods are covered.

Chapter 10.1
Standard Test Method for Sediment in Crude Oils and Fuel Oils by the Extraction Method
(ANSI/ASTM D473)

Covers the determination of sediment in crude oils and fuel oils by extraction with toluene. The precision applies to a range of sediment levels from 0.01 to 0.40 % mass, although higher levels may be determined. Pages: 6

3rd Edition | November 2007 | Reaffirmed: May 2017
Product Number: H10013 | Price: $39.00

Chapter 10.2
Standard Test Method of Water in Crude Oil by Distillation
(ASTM D4006)

Covers the determination of water in crude oil by distillation. Pages: 11

4th Edition | December 2016 | Product Number: H100204 | Price: $50.00

Chapter 10.3
Standard Test Method for Water and Sediment in Crude Oil by the Centrifuge Method (Laboratory Procedure)
(ASTM D4007)

Describes the laboratory determination of water and sediment in crude oils by means of the centrifuge procedure. This centrifuge method for determining water and sediment in crude oils is not entirely satisfactory. The amount of water detected is almost always lower than the actual water content. When a highly accurate value is required, the revised procedures for water by distillation, Ch. 10.2, and sediment by extraction, Ch. 10.1, shall be used. Pages: 13

4th Edition | August 2013 | Reaffirmed: May 2016
Product Number: H100304 | Price: $50.00

Chapter 10.4
Determination of Water and/or Sediment in Crude Oil by the Centrifuge Method (Field Procedure)
(includes Errata 1 dated March 2015)

Describes the field centrifuge method for determining both water and sediment or sediment only in crude oil. This method may not always produce the most accurate results, but it is considered the most practical method for field determination of water and sediment. This method may also be used for field determination of sediment. Pages: 23

4th Edition | October 2013 | Product Number: H100404 | Price: $85.00

Chapter 10.5
Standard Test Method for Water in Petroleum Products and Bituminous Materials by Distillation
(ASTM D95)

Covers the determination of water in the range from 0 to 25 % volume in petroleum products, tars, and other bituminous materials by the distillation method. Volatile water-soluble material, if present, may be measured as water. The specific products considered during the development of this test method were asphalt, bitumen, tar, fuel oil, lubricating oil, lubricating oil additives, and greases. For bituminous emulsions refer to ASTM Test Method D244. For crude oils, refer to Ch. 10.2. Pages: 6

5th Edition | September 2013 | Product Number: H100505 | Price: $41.00

Chapter 10.6
Standard Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)
(ASTM D1796)

Describes the laboratory determination of water and sediment in fuel oils in the range from 0 to 30 % volume by means of the centrifuge procedure. Note that with some types of fuel oils such as residual fuel oils or distillate fuel oils containing residual components, it is difficult to obtain water or sediment contents with this test method. When this situation is encountered, Ch. 10.5 or Ch. 10.1 may be used. Pages: 7

5th Edition | August 2013 | Reaffirmed: May 2016
Product Number: H100605 | Price: $41.00

Chapter 10.7
Standard Test Method for Water in Crude Oils by Potentiometric Karl Fischer Titration
(ANSI/ASTM D4377)

Describes the procedure for the determination of water in crude oils by Karl Fischer titration (potentiometric). This test method covers the determination of water in the range from 0.02 to 2 mass percent in crude oils. Mercaptan and sulfide (S^- or H_2S) sulfur are known to interfere with the method. Pages: 6

2nd Edition | December 2002 | Reaffirmed: May 2011
2-Year Extension: October 2017 | Product Number: H10072 | Price: $39.00

Chapter 10.8
Standard Test Method for Sediment in Crude Oil by Membrane Filtration
(ANSI/ASTM D4807)

Covers the determination of sediment in crude oils by membrane filtration. This test method has been validated for crude oils with sediments up to approximately 0.15 mass %. The accepted unit of measure for this test method is mass %, but an equation to convert to volume % is provided. Pages: 5

2nd Edition | November 2005 | Reaffirmed: March 2015
Product Number: H100802 | Price: $39.00

Chapter 10.9
Standard Test Method for Water in Crude Oils by Coulometric Karl Fischer Titration
(ASTM D4928)

Covers the determination of water in the range from 0.02 to 5.00 mass or volume % in crude oils. Mercaptan (RSH) and sulfide (S^- or H_2S) as sulfur are known to interfere with this test method, but at levels of less than 500 µg/g [ppm(m)], the interference from these compounds is insignificant. This test method can be used to determine water in the 0.005 to 0.02 mass % range, but the effects of the mercaptan and sulfide interference at these levels has not been determined. For the range 0.005 to 0.02 mass %, there is no precision or bias statement. This test method is intended for use with standard commercially available coulometric Karl Fischer reagent. Pages: 6

3rd Edition | May 2013 | Product Number: H10093 | Price: $41.00

Chapter 10.9 *
Standard Test Method for Water in Crude Oils by Coulometric Karl Fischer Titration—Spanish

Spanish translation of Ch. 10.9.

3rd Edition | May 2013 | Product Number: H100903SP | Price: $41.00

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TR 2570
Continuous On-Line Measurement of Water Content in Petroleum (Crude Oil and Condensate)

Provides guidance for the application, installation, operation, verification, and proving of on-line water devices (OWDs) for use in the non-custody transfer measurement of water in crude oil and condensate. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM56. Pages: 17

1st Edition | October 2010 | Reaffirmed: January 2016
Product Number: H25701 | Price: $73.00

TR 2573
Standard Guide for Sediment and Water Determination in Crude Oil (ASTM D7829)

Covers a summary of the water and sediment determination methods from Ch. 10 for crude oils. The purpose of this guide is to provide a quick reference to these methodologies such that the reader can make the appropriate decision regarding which method to use based on the associated benefits, uses, drawbacks, and limitations. Pages: 7

1st Edition | September 2013 | Product Number: H257301 | Price: $41.00

Chapter 11
Physical Properties Data (Volume Correction Factors)

Ch. 11 is the physical data that has direct application to volumetric measurement of liquid hydrocarbons. It is presented in equations relating volume to temperature and pressure, and computer subroutines. The subroutines for Ch. 11.1 are available in electronic form. These standards are not included in the complete set of measurement standards. Each element of Ch. 11 must be ordered separately.

Chapter 11.1
Standard Document and API 11.1 VCF Application
Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils (includes Addendum 1 dated September 2007)
(the 2004 edition of this standard also supersedes Ch. 11.2.1 and Ch. 11.2.1M)

Provides the algorithm and implementation procedure for the correction of temperature and pressure effects on density and volume of liquid hydrocarbons that fall within the categories of crude oil, refined products, or lubricating oils. Natural gas liquids and liquefied petroleum gases are excluded from consideration in this standard. This document is distributed electronically in Portable Document Format (PDF) or as a hard copy, printed document.

An API 11.1 VCF Application for calculating VCF is also available. This Windows-based standalone application allows users to calculate volumes and densities at observed (RHOobs), base (RHOb), and alternate (RHOtp) conditions, combined (CTPL) and independent correction factors for temperature (CTL) and pressure (CPL). The application supports both U.S. Customary (API, RD, °F and psig) and SI (kg/m^3, °C, kPag and Barg) units of measure, Thermal Expansion Factor (alpha) regression calculator and a Table Generator. The API 11.1 VCF Application is distributed on flash drive or can be electronically downloaded.

The PDF or hard copy, printed document are sold without the VCF application through the API websites.

The API 11.1 VCF windows based standalone application and the standard in PDF or print are available to purchase online via the Flow-Cal website (flowcal.com/api-standards/). You may also contact Flow-Cal, Inc. at +1 (281) 282-0865 or send an e-mail to APIstandards@flowcal.com.

May 2004 | Product Number: H11013 | Reaffirmed: August 2012
2-Year Extension: March 2017

11.1 Standard Document | $240.00 per document
11.1 VCF Application | $525.00 per single user license
11.1 Standard Document + 11.1 VCF Application | $650.25 (15% discount when purchased together)

See the listing for "Chapter 11.1–1980" on page 171 of this Catalog for more information on the previous edition of the standard(s).

Chapter 11.1
Add-In Program for Microsoft® Excel

A Microsoft® Windows compatible 32-bit add-in for Microsoft® Excel that provides callable functions for density, correction for temperature and pressure of a liquid (CTPL), and compressibility coefficient (Fp). These functions allow calculating density at base conditions or at alternate conditions, CTPL correction factor used to transform volume and density data to base or desired conditions, and the scaled compensation factor for transformation from alternate to base conditions or from observed to base conditions for generalized crude oils, refined products and lubricating oils. They support the following process variables: density (API gravity, relative density, and kg/m^3), temperature (°F and °C), and pressure (psig, bar, and kPa).

To order the Add-In, contact Flow-Cal, Inc. at +1 (281) 282-0865 or send an e-mail to APIstandards@flowcal.com.

XL Add-In—runs on a single standalone computer with no network access Price: $750.00

XL Add-In—installed on less than 15 standalone computers or ran on a network with less than 15 nodes | Price: $5,000.00

XL Add-In—installed on less than 50 standalone computers or ran on a network with less than 50 nodes | Price: $7,500.00

XL Add-In—installed on an unlimited number of standalone computers or ran on a network with unlimited nodes | Price: $11,000.00

Chapter 11.1
Dynamic Link Library (DLL)

The DLL is compiled from source code written in the C programming language. The DLL provides subroutines that can be called from applications written in C or other programming languages. These subroutines are subdivided into three groups (density, volume correction factors, and scaled compressibility factor) for generalized crude oils, refined products, and lubricating oils.

- The density subroutines have two sets of density functions allowing calculations at base conditions or at alternate conditions.
- The volume correction factor subroutines calculate a correction for the effect of temperature and pressure on a liquid (CTPL), correction for the effect of temperature on liquid (CTL), and correction for the effect of pressure on liquid (CPL), which are used to transform volume and density data to base or desired conditions.
- The scaled compressibility factor subroutines will convert from alternate to base conditions or from observed to base conditions.

The DLL supports the following process units, densities in API gravity, relative density, and kg/m^3, temperatures in °F and °C, and pressures in psig, bar, and kPa. This version is compatible with and can coexist with the 1980 version DLL.

To order the DLL, contact Flow-Cal, Inc. at +1 (281) 282-0865 or send an e-mail to APIstandards@flowcal.com.

DLL—installed on less than 50 standalone computers or ran on a network with less than 50 nodes | Price $15,000.00

DLL—installed on an unlimited number of standalone computers or ran on a network with unlimited nodes | Price $20,000.00

DLL—compiled as part of an application for distribution (software distributor) Price: $30,000.00

■ This publication is a new entry in this catalog. ◆ This publication is related to an API licensing, certification, or accreditation program.

Chapter 11.1
Source Code

ANSI C-Code used to compile the dynamic link libraries (DLLs). The source code may be compiled into user programs to calculate temperature and pressure volume correction factors for generalized crude oils, refined products, and lubricating oils.

NOTE An experienced C programmer will be needed to implement the C-Code subroutines. API does not directly provide technical support for the C-Code; however, a support program is available from Flow-Cal, Inc.

To order the C-Code Subroutines, contact Flow-Cal, Inc. at +1 (281) 282-0865 or send an e-mail to APIstandards@flowcal.com.

C-Code—compiled to run on a network with less than 50 nodes Price: $22,500

C-Code—compiled to run on a network with unlimited nodes Price: $30,000

C-Code—compiled as part of an application for distribution (software distributor) | Price: $45,000

Chapter 11.1
Source Code, DLL & XL Add-In—Combined

To order the C-Code Subroutines, Add-In, and DLL, contact Flow-Cal, Inc. at +1 (281) 282-0865 or send an e-mail to APIstandards@flowcal.com.

C-Code, DLL, and XL Add-In—compiled to run on a network with less than 50 nodes | Price: $27,500

C-Code, DLL, and XL Add-In—compiled to run on a network with unlimited nodes | Price: $37,000

C-Code, DLL, and XL Add-In—compiled as part of an application for distribution (software distributor) | Price: $55,000

Chapter 11.2
Data File of Chapters 11.2.2 and 11.2.2M

This package includes a data file of tables found in Ch. 11.2.2 and Ch. 11.2.2M. The tables, presented in both U.S. customary (USC) and metric (SI) units, cover compressibility factors for light hydrocarbons.

1st Edition | August 1984 | Product Number: H27320 | Price: $296.00

Chapter 11.2.2
Compressibility Factors for Hydrocarbons: 0.350–0.637 Relative Density (60 °F/60 °F) and –50 °F to 140 °F Metering Temperature

Provides tables to correct hydrocarbon volumes metered under pressure for the metered temperature. Contains compressibility factors related to the meter temperature and relative density (60 °F/60 °F) of the metered material. Pages: 246

2nd Edition | October 1986 | Reaffirmed: September 2017
Product Number: H27307 | Price: $171.00

Chapter 11.2.2M
Compressibility Factors for Hydrocarbons: 350–637 Kilograms per Cubic Meter Density (15 °C) and –46 °C to 60 °C Metering Temperature

Provides tables to correct hydrocarbon volumes metered under pressure to corresponding volumes at equilibrium pressure for the metered temperature. The standard contains compressibility factors related to the meter temperature and density (15 °C) of the metered material. Pages: 264

1st Edition | October 1986 | Reaffirmed: September 2017
Product Number: H27309 | Price: $171.00

Chapter 11.2.4
Temperature Correction for the Volume of NGL and LPG Tables 23E, 24E, 53E, 54E, 59E, 60E
(includes Errata 1 dated September 2011)

This publication is an updated version of TP-25. The actual standard represented by this report consists of the explicit implementation procedures. Sample tables, flow charts, and specific examples created from a computerized version of these implementation procedures are included. The examples are to provide guides and checkpoints for those who wish to implement a computerized procedure to represent the standard; however, these are not part of the actual standard.

This standard covers a 60 °F relative density range of 0.3500 to 0.6880, which nominally equates to a density at 15 °C of 351.7 to 687.8 kg/m^3 and a density at 20 °C of 331.7 to 686.6 kg/m^3. The temperature range of this standard is 50.8 to 199.4 °F (–46 to 93 °C). At all conditions, the pressure is assumed to be at saturation conditions (also known as bubble point or saturation vapor pressure). Pages: 149

1st Edition | September 2007 | Reaffirmed: October 2012
2-Year Extension: March 2017
Product Number: H1102041 | Price: $180.00

Chapter 11.2.5
A Simplified Vapor Pressure Correlation for Commercial NGLs
(supersedes the Addendum to Ch. 11.2.2–1994)

Methods used for calculation of the correction factor for pressure effects such as Ch. 11.2.1-1984 (now superseded by Ch. 11.1-2004) and Ch. 11.2.2-1986 require knowledge of the equilibrium bubble point pressure (vapor pressure) at the measured conditions.

However, the vapor pressure of the process liquid is generally not measured. The vapor pressure can also be calculated form compositional information, but the composition is not always measured for natural gas liquids (NGLs). Therefore, a correlation for the vapor pressure of NGLs is based upon normally measured properties is required and is documented in this publication. Pages: 27

1st Edition | September 2007 | Reaffirmed: September 2017
Product Number: H1102051 | Price: $90.00

Chapter 11.3.2.1
Ethylene Density

Identifies an equation of state (EOS) suitable for use in custody transfer measurement of pure ethylene (>99 %) in the gaseous, liquid, and super critical phases. Given flowing temperature and pressure, an EOS is capable of calculating density and other thermodynamic properties used to calculate mass and volumetric flow of ethylene to custody transfer accuracy. All accuracy and uncertainty statements in this standard are limited to the EOS results and do not include the uncertainty added by the primary and secondary measuring equipment. Pages: 4

2nd Edition | May 2013 | Product Number: H1132102 | Price: $60.00

Chapter 11.3.3
Miscellaneous Hydrocarbon Product Properties—Denatured Ethanol Density and Volume Correction Factors

Covers density and volume correction factors for denatured fuel ethanol. The actual standard consists of the explicit implementation procedures set forth in this document. Sample tables and other examples created from a computerized version of this implementation procedure are presented as examples only and do not represent the standard.

This standard is applicable at any operating temperature to bulk (e.g. tank trucks, tank cargos, barges) denatured 95 % to 99 % fuel ethanol containing D4806 allowed denaturants (natural gasoline, gasoline blend stocks, and unleaded gasoline) and denatured, 99+ % fuel ethanol containing less than 1 % denaturant. This standard does not apply to undenatured ethanol of any purity. Pages: 16

2nd Edition | November 2015
Product Number: H1103032 | Price: $145.00

Chapter 11.3.3.2
Propylene Compressibility

An electronic FORTRAN Source Code text file on CD-ROM that will produce a table of values applicable to liquid propylene in the following ranges: temperature, 30 °F to 165 °F, and saturation pressure to 1600 psia. It computes the following two values: density (pounds per cubic foot) at flowing temperature and pressure, and ratio of density at flowing conditions to density at 60 °F and saturation pressure. A documentation file is also included.

January 1974 | Reaffirmed: October 2017
Product Number: H25656 | Price: $296.00

Chapter 11.4.1
Properties of Reference Materials, Part 1—Density of Water and Water Volume Correction Factors for Calibration of Volumetric Provers
(includes Errata 1 dated September 2011)
(replaces Ch. 11.2.3 and Ch. 11.2.3M)

Specifies the density of water to be used in all applicable API *MPMS* standards. It also specifies the volume correction factor equation for water and demonstrates its use for water calibration of volumetric provers. Pages: 14

1st Edition | December 2003 | Reaffirmed: September 2013
Product Number: H11411 | Price: $53.00

Chapter 11.5
Density/Weight/Volume Intraconversion
[includes Errata 1 dated September 2011 (updated September 2013)]
[replaces Ch. 11.1–1980 Volumes XI/XII (ASTM D1250-80, IP 200/80)]

These intraconversion tables are applicable to all crude oils, petroleum products, and petrochemicals. These standards are intended for application to bulk liquid quantities. Ch. 11.5, Parts 1 to 3 are available collectively on one CD-ROM.

1st Edition | March 2009 | Reaffirmed: March 2015
Product Number: H1105CD | Price: $248.00

Chapter 11.5.1
Part 1—Conversions of API Gravity at 60 °F

Provides implementation procedures for conversion of API gravity at 60 °F to equivalent densities in both in vacuo and in air values. This standard gives the following equivalents for any value of API gravity at 60 °F:

- relative density at 60 °F (old Table 3);
- absolute density at 60 °F;
- absolute density at 15 °C (old Table 3);
- pounds per U.S. gallon at 60 °F in vacuo and in air (old Table 8);
- U.S. gallons per pound at 60 °F in vacuo and in air (old Table 8);
- short tons per 1000 U.S. gallons at 60 °F in vacuo and in air (old Table 9);
- U.S. gallons per short ton at 60 °F in vacuo and in air (old Table 10);
- short tons per barrel at 60 °F in vacuo and in air (old Table 9);
- barrels per short ton at 60 °F in vacuo and in air (old Table 10);
- long tons per 1000 U.S. gallons at 60 °F in vacuo and in air (old Table 11);
- U.S. gallons per long ton at 60 °F in vacuo and in air (old Table 12);
- long tons per barrel at 60 °F in vacuo and in air (old Table 11);
- barrels per long ton at 60 °F in vacuo and in air (old Table 12);
- metric tons per 1000 U.S. gallons at 60 °F in vacuo and in air (old Table 13);
- metric tons per barrel at 60 °F in vacuo and in air (old Table 13);
- barrels per metric ton at 60 °F in vacuo and in air;
- cubic metres per short ton at 15 °C in vacuo and in air (old Table 14);
- cubic metres per long ton at 15 °C in vacuo and in air (old Table 14).

While not related to API gravity, the following are included for user convenience:

- U.S. gallons at 60 °F to litres at 15 °C (old Table 4);
- barrels at 60 °F to litres at 15 °C (old Table 4).

Chapter 11.5.2
Part 2—Conversions for Relative Density (60/60 °F)

Provides implementation procedures for conversion of relative density (60/60 °F) to equivalent densities in both in vacuo and in air values. This standard gives the following equivalents for any value of relative density (60/60 °F):

- API gravity at 60 °F (old Table 21);
- absolute density at 60 °F;
- absolute density at 15 °F (old Table 21);
- pounds per U.S. gallon at 60 °F in and in air (old Table 26);
- U.S. gallons per pound at 60 °F in vacuo and in air (old Table 26);
- short tons per 1000 U.S. gallons at 60 °F in vacuo and in air (old Table 27);
- U.S. gallons per short ton at 60 °F in vacuo and in air (old Table 28);
- short tons per barrel at 60 °F in vacuo and in air (old Table 27);
- barrels per short ton at 60 °F in vacuo and in air (old Table 28);
- long tons per 1000 U.S. gallons at 60 °F in vacuo and in air (old Table 29);
- U.S. gallons per long ton at 60 °F in vacuo and in air (old Table 30);
- long tons per barrel at 60 °F in vacuo and in air (old Table 29);
- barrels per long ton at 60 °F in vacuo and in air (old Table 30);
- metric tons per 1000 U.S. gallons at 60 °F in vacuo and in air;
- metric tons per barrel at 60 °F in vacuo and in air;
- barrels per metric ton at 60 °F in vacuo and in air;
- cubic metres per short ton at 15 °C in vacuo and in air (old Table 31);
- cubic metres per long ton at 15 °C in vacuo and in air (old Table 31).

While not related to relative density, the following are included for user convenience:

- U.S. gallons at 60 °F to litres at 15 °C (old Table 22);
- barrels at 60 °F to litres at 15 °C (old Table 22, Table 52).

Chapter 11.5.3
Part 3—Conversions for Absolute Density at 15 °C

Provides implementation procedures for conversion of absolute density at 15 °C to equivalent densities in both in vacuo and in air values. This standard gives the following equivalents for any value of absolute density at 15 °C:

- relative density at 15 °C;
- absolute density at 60 °F;
- relative density at 60 °F (old Table 51);
- API gravity at 60 °F (old Table 51);
- density at 15 °C (similar to old Table 56);
- conversion of apparent density at 15 °C to absolute density at 15 °C;
- cubic metres per metric ton at 15 °C in vacuo and in air (similar to old Table 56);
- cubic metres per short ton at 15 °C in vacuo and in air;
- cubic metres per long ton at 15 °C in vacuo and in air;
- pounds per U.S. gallon at 60 °F in vacuo and in air;
- U.S. gallons per pound at 60 °F in vacuo and in air;
- short tons per 1000 litres (cubic metres) at 15 °C in vacuo and in air (old Table 57);
- short tons per 1000 U.S. gallons at 60 °F in vacuo and in air;
- U.S. gallons per short ton at 60 °F in vacuo and in air;
- short tons per barrel at 60 °F in vacuo and in air;
- barrels per short ton at 60 °F in vacuo and in air;
- long tons per 1000 litres (cubic metres) at 15 °C in vacuo and in air (old Table 57);
- U.S. gallons per metric ton at 60 °F in vacuo and in air (old Table 58);
- barrels per metric ton at 60 °F in vacuo and in air (old Table 58);
- long tons per 1000 U.S. gallons at 60 °F in vacuo and in air;
- U.S. gallons per long ton at 60 °F in vacuo and in air;
- long tons per barrel at 60 °F in vacuo and in air;

- barrels per long ton at 60 °F in vacuo and in air.

While not related to relative density, the following are included for user convenience:

- litres at 15 °C to U.S. gallons at 60 °F;
- cubic metres at 15 °C to barrels at 60 °F (old Table 52).

Chapter 12
Calculation of Petroleum Quantities

Describes the standard procedures for calculating net standard volumes, including the application of correction factors and the importance of significant figures. The purpose of standardizing the calculation procedure is to achieve the same result regardless of which person or computer does the calculating.

Chapter 12.1.1
Calculation of Static Petroleum Quantities, Part 1—Upright Cylindrical Tanks and Marine Vessels
(includes Errata 1 dated May 2015)

Guides the user through the steps necessary to calculate static liquid quantities, at atmospheric conditions, in upright, cylindrical tanks and marine tank vessels. The standard defines terms employed in the calculation of static petroleum quantities. The standard also specifies equations that allow the values of some correction factors to be computed. Fundamental to this process is the understanding that in order for different parties to be able to reconcile volumes, they must start with the same basic information (tank capacity table, levels, temperatures, and so forth) regardless of whether the information is gathered automatically or manually. This standard does not address the calculation of clingage, nonliquid material, small quantities (such as onboard quantities, quantities remaining on board, and wedge formula, where material is not touching all bulkheads on marine vessels), and vapor space calculations. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM1 Part 1. Pages: 40

3rd Edition | April 2012 | Product Number: H1201013 | Price: $114.00

Chapter 12.1.1 *
Calculation of Static Petroleum Quantities, Part 1—Upright Cylindrical Tanks and Marine Vessels—Spanish

Spanish translation of Ch. 12.1.1.

3rd Edition | April 2012 | Product Number: H1201013SP | Price: $114.00

Chapter 12.1.2
Calculation of Static Petroleum Quantities, Part 2—Calculation Procedures for Tank Cars
(includes Ch. 12 Addendum 1 dated August 2007)

Describes the standardized method for calculating target loading quantities and actual loading quantities of liquids in tank cars. Also explained are the factors required for the calculations. This information is applicable to all crude oils, petroleum products, and petrochemicals (including LPGs and other liquefied gases) transported by rail tank car. It does not cover any products loaded or measured as solids. It defines the terms required to understand the calculations, and provides instructions for their use; includes 13 calculation examples in Appendix E. Pages: 39

1st Edition | May 2003 | Reaffirmed: May 2011
2-Year Extension: March 2016 | Product Number: H12121 | Price: $111.00

Chapter 12.1.2 *
Calculation of Static Petroleum Quantities, Part 2—Calculation Procedures for Tank Cars—Spanish

Spanish translation of Ch. 12.1.2.

1st Edition | May 2003 | Product Number: H12121S | Price: $111.00

Chapter 12.2.1
Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 1—Introduction
(includes Ch. 12 Addendum 1 dated August 2007 and Errata 1 dated July 2009)

Provides the general introduction of this standard, which is divided into five parts, each published separately. The base (reference or standard) volumetric determination of metered quantities is discussed along with the general terms required for solution of the various equations. General rules for rounding of numbers, including field data, intermediate calculations numbers, and discrimination levels, are specified. Pages: 23

2nd Edition | May 1995 | Reaffirmed: March 2014
Product Number: H12021 | Price: $109.00

Chapter 12.2.2
Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 2—Measurement Tickets
(includes Ch. 12 Addendum 1 dated August 2007)

Provides standardized calculation methods for the quantification of liquids and the determination of base prover volumes under defined conditions, regardless of the point of origin or destination or the units of measure required by governmental customs or statute. The publication rigorously specifies the equations for computing correction factors, rules for rounding, calculational sequence, and discrimination levels to be employed in the calculations. Pages: 18

3rd Edition | June 2003 | Reaffirmed: February 2016
Product Number: H12223 | Price: $101.00

Chapter 12.2.3
Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 3—Proving Reports
(includes Ch. 12 Addendum 1 dated August 2007)

Consolidates and standardizes calculations for metering petroleum liquids using turbine or displacement meters and clarifies terms and expressions by eliminating local variations among terms. This standard provides calculation methods for the determination of meter factors under defined conditions, regardless of the point of origin or destination or units of measure required by governmental customs or statute. This document specifies the equations for computing correction factors, including the calculation sequence, discrimination levels, and rules for rounding. Pages: 59

1st Edition | October 1998 | Reaffirmed: May 2014
Product Number: H12023 | Price: $119.00

Chapter 12.2.4
Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 4—Calculation of Base Prover Volumes by Waterdraw Method
(includes Ch. 12 Addendum 1 dated August 2007 and Errata 1 dated July 2009)

Provides a standardized calculation method to determine a base prover volume under defined conditions. Specifically, this standard discusses the calculation procedures for the waterdraw calibration method, which is one of several different procedures used to determine base prover volume (BPV) of a displacement prover. Pages: 58

1st Edition | December 1997 | Reaffirmed: September 2014
Product Number: H12024 | Price: $122.00

*These translated versions are provided for the convenience of our customers and are not officially endorsed by API. The translated versions shall neither replace nor supersede the English-language versions, which remain the official standards. API shall not be responsible for any discrepancies or interpretations of these translations. Translations may not include any addenda or errata to the document. Please check the English-language versions for any updates to the documents.

Chapter 12.2.5
Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, Part 5—Base Prover Volume Using Master Meter Method
(includes Ch. 12 Addendum 1 dated August 2007 and Errata 1 dated July 2009)

Provides standardized calculation methods for the quantification of liquids and the determination of base prover volumes under defined conditions, regardless of the point of origin or destination or units of measure required by governmental customs or statute. The criteria contained in this document allow different entities using various computer languages on different computer hardware (or manual calculations) to arrive at identical results using the same standardized input data. Pages: 108

1st Edition | September 2001 | Reaffirmed: August 2016
Product Number: H12025 | Price: $170.00

Chapter 12.3
Calculation of Volumetric Shrinkage from Blending Light Hydrocarbons with Crude Oils
(includes Ch. 12 Addendum 1 dated August 2007)

Provides background, theory, calculation examples, and tables to correct for volumetric shrinkage resulting when blending volatile hydrocarbons with crude oil. The tables are entered with density differentials at standard conditions and percentage light hydrocarbon in total mix. This standard supersedes and replaces Bull 2509C, 2nd Edition, 1967. Pages: 110

1st Edition | July 1996 | Reaffirmed: April 2011
Product Number: H12031 | Price: $89.00

Chapter 13
Statistical Aspects of Measuring and Sampling

The more accurate petroleum measurement becomes, the more its practitioners stand in need of statistical methods to express residual uncertainties. This chapter covers the application of statistical methods to petroleum measurement and sampling.

Chapter 13.2
Methods of Evaluating Meter Proving Data
(includes Errata 1 dated October 2015)

Addresses procedures for evaluating any meter's performance where meter proving factors are developed in accordance with Ch. 12.2. The data in examples used in this chapter are intended to be typical of custody transfer operations of low-vapor-pressure fluids using displacement or turbine meters in accordance with Ch. 4, Ch. 5, and Ch. 6. However, the procedures in Ch. 13.2 can be used for noncustody transfer metering applications and for custody transfer metering of high-vapor-pressure and gaseous fluids where meter proving data are available. Pages: 41

1st Edition | November 1994 | Reaffirmed: April 2016
Product Number: H13021 | Price: $97.00

Ch. 13.3 ■
Measurement Uncertainty

Establishes a methodology to develop uncertainty analyses for use in writing API *Manual of Petroleum Measurement Standards* (*MPMS*) documents that are consistent with the ISO GUM and NIST Technical Note 1297. This standard also supersedes Ch. 13.1, 1st Edition, 1985, which is withdrawn. Pages: 75

2nd Edition | December 2017
Product Number: H130302 | Price: $113.00

Chapter 14
Natural Gas Fluids Measurement

Standardizes practices for measuring, sampling, and testing natural gas fluids.

Chapter 14.1
Collecting and Handling of Natural Gas Samples for Custody Transfer
(includes Addendum 1 and Errata 1 dated August 2017)

Concentrates on proper sampling systems and procedures. It recognizes the critical impact of hydrocarbon dew point consideration to the overall accuracy and success of these practices and procedures. Analyses of gas samples are used for many purposes and are applied to various calculations, some of which have an impact on the accuracy of custody transfer calculations (quantity and quality). Pages: 76

7th Edition | May 2016 | Product Number: H140107 | Price: $209.00

Chapter 14.3.1
Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric Square-Edged Orifice Meters, Part 1: General Equations and Uncertainty Guidelines
(ANSI/API *MPMS* Ch. 14.3.1-2012) (AGA Report No. 3, Part 1)
(includes Errata 1 dated July 2013)

Provides a single reference for engineering equations, uncertainty estimations, construction and installation requirements, and standardized implementation recommendations for the calculation of flow rate through concentric, square-edged, flange-tapped orifice meters. Both U.S. customary (USC) and international system of units (SI) units are included. The mass flow rate and base (or standard) volumetric flow rate equations are discussed, along with the terms required for solution of the flow equation. The empirical equations for the coefficient of discharge and expansion factor are also presented. This revision includes a change to the empirical expansion factor calculation for flange-tapped orifice meters. Pages: 58

4th Edition | September 2012 | Reaffirmed: September 2017
Product Number: H1403014 | Price: $181.00

Chapter 14.3.2
Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-Edged Orifice Meters, Part 2: Specification and Installation Requirements
(ANSI/API *MPMS* Ch. 14.3.2-2016) (AGA Report No. 3, Part 2)
(includes Errata 1 dated March 2017)

Outlines the specification and installation requirements for the measurement of single-phase, homogeneous Newtonian fluids using concentric, square-edged, flange-tapped orifice meters. It provides specifications for the construction and installation of orifice plates, meter tubes, and associated fittings when designing metering facilities using orifice meters. Pages: 74

5th Edition | March 2016 | Product Number: H1403025 | Price: $188.00

Chapter 14.3.3
Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-Edged Orifice Meters, Part 3: Natural Gas Applications
(ANSI/API *MPMS* Ch. 14.3.3-2013) (AGA Report No. 3, Part 3)

Developed as an application guide for the calculation of natural gas flow through a flange-tapped, concentric orifice meter, using the U.S. customary (USC) inch-pound system of units. It also provides practical guidelines for applying Ch. 14.3, Parts 1 and 2, to the measurement of natural gas. Pages: 54

4th Edition | November 2013 | Product Number: H1403034 | Price: $220.00

Chapter 14.3.4
Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids—Concentric, Square-Edged Orifice Meters, Part 4: Background, Development, Implementation Procedures and Subroutine Documentation
(AGA Report No. 3, Part 4) (GPA 8185, 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. Pages: 138

3rd Edition | November 1992 | Reaffirmed: August 2011
2-Year Extension: March 2016 | Product Number: H30354 | Price: $164.00

Chapter 14.4 ■
Converting Mass of Natural Gas Liquids and Vapors to Equivalent Liquid Volumes
(GPA 8173-17)

Prescribes a method for calculating liquid volumes at equilibrium pressures and at temperatures of 60 °F, 15 °C, and 20 °C from the mass of a natural gas fluid (liquid or vapor) measured at operating conditions, in conjunction with a representative compositional analysis and published values for each component's molar mass and absolute density. Pages: 24

2nd Edition | June 2017 | Product Number: H140402 | Price: $65.00

Chapter 14.5
Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer
(GPA 2172-09)

Presents procedures for calculating, at base conditions from composition, the following properties of natural gas mixtures: gross heating value, relative density (real and ideal), compressibility factor, and theoretical hydrocarbon liquid content, which in the U.S. is typically expressed as GPM, the abbreviation for gallons of liquid per thousand cubic feet of gas.

Rigorous calculation of the effect of water upon these calculations is complicated. Because this document relates primarily to custody transfer, the water effect included is an acceptable contractual calculation. Annex A of this standard contains a detailed investigation of the effect of water and detailed derivations of the equations presented in the standard. Pages: 41

3rd Edition | January 2009 | Reaffirmed: February 2014
Product Number: H140503 | Price: $73.00

Chapter 14.6
Continuous Density Measurement
(includes Errata 1 dated August 1998)

Provides criteria and procedures for designing, installing, and operating continuous density measurement systems for Newtonian fluids in the petroleum, chemical, and natural gas industries. The application of this standard is limited to clean, homogeneous, single-phase liquids or supercritical fluids. The procedures and criteria in this standard have been successfully applied to fluids whose flowing density is greater than 0.3 g/cm^3 at operating conditions of 60 °F (15.6 °C) and saturation pressure. The intent of the standard is to provide the user with a density accuracy of 0.10 % for most applications. The errata provides editorial clarification regarding conversion factors and variables used in various calculation equations. Pages: 51

2nd Edition | April 1991 | Reaffirmed: February 2012
Product Number: H30346 | Price: $132.00

Chapter 14.7
Mass Measurement of Natural Gas Liquids
(GPA 8182-12)

Serves as a reference for the selection, design, installation, operation, and maintenance of single-phase dynamic liquid mass measurement systems that operate in the 350 to 688 kg/m^3 (0.350 to 0.689 relative density at 60 °F) density range. The mass measurement systems within the scope of this document include inferred mass measurement, where volume at flowing conditions is combined with density at similar conditions to result in measured mass, as well as Coriolis mass measurement. Liquids with density below 350 and above 688 kg/m^3 (below 0.350 and above 0.689 relative density at 60 °F) and cryogenic fluids (colder than approximately –50 °F) are excluded from the scope of this document, but the principles described herein may apply to such streams. Sampling equipment and techniques are covered including standards for analytical methods used to determine the composition of the sampled product. Equations of state and correlations used to calculate the density of the product are discussed. The standard used to convert mass to equivalent liquid volumes of components is also discussed. Pages: 8

4th Edition | April 2012 | Product Number: H140704 | Price: $65.00

Chapter 14.8
Liquefied Petroleum Gas Measurement

Describes dynamic and static metering systems used to measure liquefied petroleum gas in the density range of 0.30 to 0.70 g/cm^3 This edition revises the February 1983 version of the standard to incorporate the 1992 version of the Ch. 14.3 orifice meter discharge coefficient equation and revises and simplifies the mass flow rate sample calculations. Pages: 20

2nd Edition | July 1997 | Reaffirmed: October 2011
2-Year Extension: October 2016 | Product Number: H14082 | Price: $97.00

Chapter 14.9
Measurement of Natural Gas by Coriolis Meter
(AGA Report No. 11)

Developed to assist designers and users in operating, calibrating, installing, maintaining, and verifying Coriolis flow meters used for natural gas flow measurement.

2nd Edition | February 2013
Order from the American Gas Association, 500 N. Capitol Street NW, Washington, DC 20001 | 202-824-7000

Chapter 14.10
Measurement of Flow to Flares

Addresses measurement of flow to flares and includes:

- application considerations,
- selection criteria and other considerations for flare meters and related instrumentation,
- installation considerations,
- limitations of flare measurement technologies,
- calibration,
- operation,
- uncertainty and propagation of error,
- calculations.

The scope of this standard does not include analytical instrumentation. Pages: 54

1st Edition | July 2007 | Reaffirmed: June 2012
2-Year Extension: March 2017
Product Number: H140101 | Price: $107.00

Chapter 14.12 ■
Measurement of Gas by Vortex Meters

Addresses the following: (a) provides generic information on full-bore vortex shedding flowmeters, including glossary, and sets of engineering equations useful in specifying performance; (b) describes vortex shedding flowmeters in which alternating vortices are shed from one or more bluff bodies installed in a closed conduit; (c) describes how the vortex shedding frequency is used to determine the velocity to infer the volume, mass, and/or energy flow rate and the total gas flow through the meter over a specific time interval; (d) applies only to single phase gas flows in closed conduit that are steady or vary slowly in time. For fiscal measurement, the output of the flow rate shall be within the acceptable limits of steady state flow rate; (e) describes the physical components of vortex shedding flowmeters and identifies need for inspection, certification, and material traceability; (f) addresses the effect of gas properties, installation, and process conditions that may affect the measurement uncertainty and describes guidelines for reducing or eliminating their influences; (g) defines the method for calculating uncertainty of the flow rate measurement; (h) defines the meter output requirements and necessary information pertaining to the meter output for the purpose of fiscal measurement of gas; and (i) provides calibration and/or performance verification guidance for the field application. Pages: 35

1st Edition | March 2017 | Product Number: H140121 | Price: $86.00

Chapter 15
Guidelines for the Use of the International System of Units (SI) in the Petroleum and Allied Industries

Specifies the API preferred units for quantities involved in petroleum industry measurements and indicates factors for conversion of quantities expressed in customary units to the API-preferred metric units. The quantities that comprise the tables are grouped into convenient categories related to their use. They were chosen to meet the needs of the many and varied aspects of the petroleum industry but also should be useful in similar process industries. Pages: 43

3rd Edition | December 2001 | Reaffirmed: February 2015
Product Number: H15003 | Price: $115.00

Chapter 16
Measurement of Hydrocarbon Fluids by Weight or Mass

Covers the static and dynamic measurement of hydrocarbon fluids by weight or mass.

Chapter 16.2
Mass Measurement of Liquid Hydrocarbons in Vertical Cylindrical Storage Tanks by Hydrostatic Tank Gauging

Provides guidance on the installation, commissioning, maintenance, validation, and calibration of hydrostatic tank gauging systems for the direct measurement of static mass of liquid hydrocarbons in storage tanks. This edition is applicable to hydrostatic tank gauging systems that use pressure sensors with one port open to the atmosphere. It is also applicable for use on vertical cylindrical atmospheric storage tanks with either fixed or floating roofs. Pages: 20

1st Edition | November 1994 | Reaffirmed: September 2017
Product Number: H16021 | Price: $97.00

Chapter 17
Marine Measurement

Provides guidelines for the measurement and reporting of hydrocarbons including but not limited to crude oil or petroleum product for transfers by shore terminal operators, vessel personnel, and other parties involved in cargo transfer measurement and accountability operations.

Chapter 17.1
Guidelines for Marine Inspection

Specifies the policy and minimum recommended practices for the manual and automatic measurement, sampling, and accounting for bulk quantities of crude oil (including spiked, blended, and reconstituted crude oil), petroleum products and chemicals that are transported on marine vessels. The activities described in these guidelines include actions by producers, buyers, sellers, terminal operators, vessel owners, and their crews, customs authorities, independent inspectors, and other parties with an interest in measurements.

Certain vessel or terminal configurations and cargo characteristics, particularly chemicals, may require extensive procedures and calculation methods not covered in this chapter.

These procedures are equally valid and applicable for either metric or customary units of measurement, provided that the same types of units are used consistently.

The purchase of this document includes Excel® spreadsheets of the Sample Forms in Annex A (excluding "Voyage Analysis Report," which is available in Ch. 17.5). The sample forms are designed to provide a guideline for recording and reporting essential data obtained during the marine cargo inspection procedure. Pages: 45

6th Edition | June 2014 | Product Number: H170106 | Price: $150.00

Chapter 17.2
Measurement of Cargoes On Board Tank Vessels (includes Errata 1 dated April 2000)

Covers manual portable measurement units through deck-fitted vapor control valves and fixed automatic tank gauge systems for use when a marine vessel's cargo tanks may not be open to the atmosphere. It establishes the procedures for obtaining the level measurements of cargo, free water, and onboard quantity/remaining onboard (OBQ/ROB), as well as taking the temperatures and samples required for the marine custody transfer of bulk liquid petroleum cargoes under closed or restricted system measurement conditions. This standard is not intended for use with pressurized or refrigerated cargoes such as LPG and LNG. Pages: 19

2nd Edition | May 1999 | Reaffirmed: September 2011
2-Year Extension: May 2016 | Product Number: H17022 | Price: $132.00

Chapter 17.2 *
Measurement of Cargoes On Board Tank Vessels—Spanish

Spanish translation of Ch. 17.2.

2nd Edition | May 1999 | Product Number: H1702SP | Price: $132.00

Chapter 17.3
Guidelines for Identification of the Source of Free Waters Associated with Marine Petroleum Cargo Movements

Provides guidelines for identifying the source of free waters associated with marine petroleum cargo movements. The presence of free water is a factor in marine custody transfers of bulk petroleum, especially in the case of crude oil cargoes. This standard recommends the water samples and volumes to be taken, the containers to be used, the care and distribution of the samples, and the analytical procedures of use in identifying sources of free water associated with marine petroleum cargoes. Pages: 29

2nd Edition | December 2016
Product Number: H170302 | Price: $120.00

*These translated versions are provided for the convenience of our customers and are not officially endorsed by API. The translated versions shall neither replace nor supersede the English-language versions, which remain the official standards. API shall not be responsible for any discrepancies or interpretations of these translations. Translations may not include any addenda or errata to the document. Please check the English-language versions for any updates to the documents.

Chapter 17.4
Method for Quantification of Small Volumes on Marine Vessels (OBQ/ROB)

Provides a method for determining the small volumes of on board quantity prior to loading a vessel or material remaining on board a vessel upon completion of discharge. This standard applies only to quantification by manual gauging of small volumes on marine vessels prior to loading or upon completion of discharge. It does not address clingage, hydrocarbon vapors, cargoes in transit, or cargo pumpability. Refer to Ch. 3. Pages: 25

2nd Edition | September 2016
Product Number: H170402 | Price: $110.00

Chapter 17.5
Guidelines for Voyage Analysis and Reconciliation of Cargo Quantities

Covers guidelines for the reconciliation of marine cargo quantities. These guidelines are intended to provide a basis for analyzing and reconciling the quantity differences (gains/losses) resulting from marine custody transfer movement(s) of petroleum and petroleum product cargoes. As such, the guidelines are complementary to, but do not replace, normal inspection procedures. The purchase of this document includes an Excel® spreadsheet for determining voyage analysis and reconciliation of cargo quantities. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM64. Pages: 39

3rd Edition | April 2012 | Reaffirmed: May 2017
Product Number: H170503 | Price: $145.00

Chapter 17.5 *
Guidelines for Voyage Analysis and Reconciliation of Cargo Quantities—Spanish

Spanish translation of Ch. 17.5.

3rd Edition | April 2012 | Product Number: H170503SP | Price: $145.00

Chapter 17.6
Guidelines for Determining Fullness of Pipelines Between Vessels and Shore Tanks

Describes procedures for determining or confirming the fill condition of pipeline systems used for the transfer of liquid cargoes before and/or after the liquid is loaded onto or discharged from marine vessels. It includes descriptions of methods and procedures that apply to crude oil and petroleum products. While this document includes descriptions of common line fill verification methods, it does not recommend any particular method. The responsibility for selecting a method appropriate for a given terminal, and documenting its effectiveness, rests with those responsible for operating the terminal where it is applied. Pages: 10

2nd Edition | June 2014 | Product Number: H170602 | Price: $110.00

Chapter 17.8
Guidelines for Pre-Loading Inspection of Marine Vessel Cargo Tanks and Their Cargo-Handling Systems

Specifies procedures for determining that the cargo tanks and associated cargo-handling system of marine vessels are in a suitably clean condition to receive the intended cargo. This applies to the loading of crude oil, petroleum products, and petrochemical cargoes. The extent of pre-loading inspection will vary depending on the nature of the cargo to be loaded. These guidelines recommend the extent of inspection that should be instituted for certain general types of cargoes and an example of a format that may be used for reporting the findings of tank inspections. Because of the wide variety of conditions that may exist when performing pre-loading tank inspections, this guideline is not intended to restrict the judgment of the person performing the inspection. Pages: 18

2nd Edition | August 2016 | Product Number: H170802 | Price: $108.00

Chapter 17.9
Vessel Experience Factor (VEF)
(includes Addendum 1 dated January 2014)

Provides a recommended practice for the calculation and application of a VEF and provides guidelines for data compilation, data validation, and recommendations on the appropriate use of VEF during custody transfer involving marine tank vessels. It also provides clear guidance on maintenance of quantity data on board the vessel, calculation of VEFs, and application of VEFs. The key aim is to provide a single unambiguous figure for VEFL or VEFD and to remove the possibility of any arbitrary inclusion or exclusion of data on the part of the individual(s) performing the final calculation. Also provides instruction for parcel tankers, part cargoes, compartmental VEFs, and vessel-to-vessel transfers. The methods are applicable to liquid bulk cargoes including crude oil, petroleum products, chemicals, and liquefied petroleum gases. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM49. Pages: 22

2nd Edition | May 2012 | Product Number: H170902 | Price: $165.00

Chapter 17.9 *
Vessel Experience Factor (VEF)—Spanish

Spanish translation of Ch. 17.9, including Addendum 1 dated January 2014.

2nd Edition | May 2012 | Product Number: H170902SP | Price: $165.00

Chapter 17.10.1/ISO 10976:2012
Measurement of Cargoes On Board Marine Gas Carriers, Part 1—Liquefied Natural Gas
(ANSI/API *MPMS* Ch. 17.10.1)

Establishes all of the steps needed to properly measure and account for the quantities of cargoes on liquefied natural gas (LNG) carriers. This includes, but is not limited to, the measurement of liquid volume, vapour volume, temperature and pressure, and accounting for the total quantity of the cargo on board. This document describes the use of common measurement systems used on board LNG carriers, the aim of which is to improve the general knowledge and processes in the measurement of LNG for all parties concerned. This document provides general requirements for those involved in the LNG trade on ships and onshore. Pages: 65

1st Edition | April 2014 | Product Number: HH171011 | Price: $150.00

Chapter 17.10.2
Measurement of Cargoes On Board Marine Gas Carriers, Part 2—Liquefied Petroleum and Chemical Gases

Provides guidance to vessel and shore personnel regarding accepted methods for determining quantities of liquefied petroleum and chemical gas cargoes (excluding LNG) on board refrigerated and/or pressurized carriers. This standard covers all measurement systems commonly used on refrigerated and/or pressurized gas carriers designed to carry those types of cargoes and includes recommended methods for measuring, sampling, documenting, and reporting quantities on board these vessels. Pages: 80

2nd Edition | March 2016 | Product Number: H171022 | Price: $150.00

Chapter 17.11
Measurement and Sampling of Cargoes On Board Tank Vessels Using Closed and Restricted Equipment
(includes Errata 1 dated March 2017)

Provides guidance on the use, maintenance, and calibration of restricted and closed measurement and sampling equipment. It also provides guidance on preferred size and positioning for gauging and sampling fittings on vessels. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM52. Pages:19

2nd Edition | August 2016 | Product Number: H170112 | Price: $108.00

*These translated versions are provided for the convenience of our customers and are not officially endorsed by API. The translated versions shall neither replace nor supersede the English-language versions, which remain the official standards. API shall not be responsible for any discrepancies or interpretations of these translations. Translations may not include any addenda or errata to the document. Please check the English-language versions for any updates to the documents.

Chapter 17.11 *■
Measurement and Sampling of Cargoes On Board Tank Vessels Using Closed and Restricted Equipment—Spanish

Spanish translation of Ch. 17.11.

2nd Edition | August 2016 | Product Number: H170112S | Price: $108.00

Chapter 17.12
Procedures for Bulk Liquid Chemical Cargo Inspections

Provides systematic cargo measurement procedures for use primarily by cargo inspectors and to specify procedures directed at minimizing cargo contamination and losses, in the absence of, or in conjunction with, specific client guidelines. This document should be considered a summary of best practices used within the industry. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM51. Pages: 66

2nd Edition | August 2015 | Product Number: H170122 | Price: $163.00

Chapter 17.12 *■
Procedures for Bulk Liquid Chemical Cargo Inspections—Spanish

Spanish translation of Ch. 17.12.

2nd Edition | August 2015 | Product Number: H170122S | Price: $163.00

Chapter 18
Custody Transfer

Covers application of other measurement standards to unique custody transfer situations.

Chapter 18.1
Measurement Procedures for Crude Oil Gathered from Small Tanks by Truck

Describes procedures to encourage uniform custody transfer measurement and testing practices for crude oil gathered from small tanks (1,000 barrels or less in capacity) by truck. The publication contains recommended steps for manually determining the quantity and quality of crude oil being transferred in trucks under field conditions. This publication is of interest to measurement personnel and crude oil producers and transporters. Pages: 13

2nd Edition | April 1997 | Reaffirmed: February 2012
2-Year Extension: March 2017 | Product Number: H18012 | Price: $115.00

Chapter 18.2
Custody Transfer of Crude Oil from Lease Tanks Using Alternative Measurement Methods

Defines the minimum equipment and methods used to determine the quantity and quality of crude oil being loaded from a lease tank to a truck trailer without requiring direct access to a lease tank gauge hatch. Methods and equipment described are grouped by tank zone, trailer zone, and the transition zone between the two. The equipment used for measurement is dependent on the existing design of the lease equipment, the equipment used to transport the product, or a combination of the two. Some sites may require measurements from multiple zones in order to arrive at an accurate load quantity and quality.

This publication integrates by reference the API *Manual of Petroleum Measurement Standards* (*MPMS*) for sampling, temperature determination, gauging, and quality testing into a framework that may be applied during custody transfer of crude oil from lease tanks to a tank truck without requiring direct access to the tank thief gauge hatch. Many of the individual standards have guidelines defining the frequency and tolerances for installation, verification, and calibration of the specified equipment under controlled or ideal conditions allowing for uncertainty within custody transfer requirements. However, with the conditions encountered in many of today's applications, the installation, verification, and calibration of measurement devices may have higher uncertainties due to the operational characteristics and limited access available at the lease site. In the interest of safety and environmental concerns, these higher uncertainties may still provide acceptable measurement for custody transfer of crude oil from tanks using the defined alternate methods.

The alternate measurement methods discussed in this standard are intended to minimize uncertainty and bias while encouraging consistent measurement and testing practices using existing technologies within API standards. Pages: 29

1st Edition | July 2016 | Product Number: H180201 | Price: $125.00

Chapter 19
Evaporation Loss Measurement

Covers methods for estimating hydrocarbon evaporation losses from various types of tanks.

NOTE Chapter 19 is not included in the complete set of measurement standards.

Chapter 19.1 ■
Evaporative Loss from Fixed-Roof Tanks
(previously Publ 2518)

Contains methodologies for estimating the total evaporative losses of hydrocarbons from fixed-roof tanks. The methodologies provide loss estimates for general equipment types based on laboratory, test-tank, and field-tank data.

Types of fixed-roof tanks and roof fittings described are for information only. The equations estimate average annual losses from uninsulated fixed-roof tanks for various liquid stocks, stock vapor pressures, tank sizes, meteorological conditions, and operating conditions. The following special cases are addressed.

- Horizontal tanks.
- Higher volatility stocks (true vapor pressure greater than 0.1 psia).
- Vent settings higher than 0.03 pounds (0.5 oz) per square inch.

The estimation may be improved by using detailed field information, including climatic data and operational data for the appropriate time period.

The equations are not intended to be used in the following applications.

- To estimate losses from unstable or boiling stocks or from petroleum liquids or petrochemicals for which the vapor pressure is not known or cannot readily be predicted [to calculate emissions from tanks that contain material at or above their boiling point or the point at which material starts to flash, the API model E&P Tank (Publ 4697) can be used].
- To estimate losses from fixed-roof tanks which have an internal floating roof. Ch. 19.2 and TR 2569 address these.
- To estimate losses from fixed-roof tanks which have either roof or shell insulation.
- To estimate losses from cleaning fixed-roof tanks. TR 2568 addresses this. Pages: 38

5th Edition | June 2017 | Product Number: H190105 | Price: $155.00

Chapter 19.1D
Documentation File for API Manual of Petroleum Measurement Standards Chapter 19.1—Evaporative Loss from Fixed-Roof Tanks
(previously Bulletin 2518)
(includes Errata 1 dated June 1994)

Presents information on the development of theoretical equations; comparisons with test data; a sensitivity analysis of the loss equation; and other pertinent information that was developed during the preparation of Ch. 19.1. Pages: 190

1st Edition | March 1993 | Product Number: H30553 | Price: $171.00

*These translated versions are provided for the convenience of our customers and are not officially endorsed by API. The translated versions shall neither replace nor supersede the English-language versions, which remain the official standards. API shall not be responsible for any discrepancies or interpretations of these translations. Translations may not include any addenda or errata to the document. Please check the English-language versions for any updates to the documents.

Chapter 19.2
Evaporative Loss from Floating-Roof Tanks
(previously Publ 2517 and Publ 2519)

Contains methodologies for estimating the total evaporative losses of hydrocarbons from external floating-roof tanks (EFRTs), freely vented internal floating-roof tanks (IFRTs), and domed external floating-roof tanks (domed EFRTs). The methodologies provide loss estimates for general equipment types based on laboratory, test-tank, and field-tank data. Types of floating roofs, rim-seal systems, and deck fittings are described for information only.

The equations estimate average annual losses from floating-roof tanks for various types of tank construction, floating-roof construction, rim-seal systems, and deck fittings, as well as for various liquid stocks, stock vapor pressures, tank sizes, and wind speeds (EFRTs).

The equations were developed for:

- stocks with a true vapor pressure greater than approximately 0.1 psia,
- average wind speeds ranging from 0 miles per hour (mph) to 15 mph (EFRTs), and
- tank diameters greater than 20 ft.

The estimation techniques become more approximate when these conditions are not met.

When this standard is used to estimate losses from non-freely vented (closed vent) internal or domed external floating-roof tanks (tanks vented only through a pressure-vacuum relief vent, blanketed with an inert gas, vented to a vapor processing unit, or otherwise restricted from being freely vented), refer to the methodology in TR 2569.

The equations are not intended to be used in the following applications.

- To estimate losses from unstable or boiling stocks (i.e. stocks with a true vapor pressure greater than the atmospheric pressure at the tank location) or from petroleum liquids or petrochemicals for which the vapor pressure is not known or cannot readily be predicted.
- To estimate losses from tanks in which the materials used in the rim seal, deck fittings, or deck seams have either deteriorated or been significantly permeated by the stored stock.
- To estimate losses from storage tanks that do not have a floating roof.
- To estimate losses from landing floating roofs (TR 2567 addresses this).
- To estimate losses from cleaning storage tanks (TR 2568 addresses this).

The 3rd Edition of Ch. 19.4 was published following a revision that was carried out concurrently with revisions to Ch. 19.1, published as the 4th Edition, and Ch. 19.2, published as the 3rd Edition. Primary changes are as follows.

- Consolidation of common material in Ch. 19.4. Material that had previously been included in both Ch. 19.1 and Ch. 19.2 has been moved to Ch. 19.4. Ch. 19.4, which was previously *Recommended Practice for Speciation of Evaporative Losses*, now has the title *Evaporative Loss Reference Information and Speciation Methodology*. This chapter had already contained reference information on the properties of chemicals and typical petroleum liquids, and this information has now been removed from Ch. 19.1 and Ch. 19.2. In addition, meteorological data have been moved from Ch. 19.1 and Ch. 19.2 to Ch. 19.4. In the revised documents:
  - meteorological data are found in Ch. 19.4;
  - calculation of storage tank temperatures is found in Ch. 19.1 and Ch. 19.2 (in that fixed-roof tanks involve calculation of the vapor space temperature in order to determine vapor density, whereas this step is not involved in estimating emissions from floating-roof tanks); and
  - calculation of true vapor pressure is found in Ch. 19.4 (in that this is now calculated in the same manner for both fixed- and floating-roof tanks). Pages: 85

3rd Edition | October 2012 | 2-Year Extension: March 2017
Product Number: H190203 | Price: $176.00

Chapter 19.3, Part A
Wind Tunnel Test Method for the Measurement of Deck-Fitting Loss Factors for External Floating-Roof Tanks

Describes the procedures to establish evaporative loss factors for deck fittings on external floating-roof tanks. The test method involves measuring the weight loss of a test assembly over time. The standard specifies the test apparatus, instruments, test procedures, and calculation procedures to be used. It also addresses the variables to be measured, format for reporting the test values, and their associated uncertainty. Pages: 27

1st Edition | June 1997 | Reaffirmed: September 2017
Product Number: H1903A | Price: $122.00

Chapter 19.3, Part B
Air Concentration Test Method—Rim-Seal Loss Factors for Floating-Roof Tanks

Describes the procedures to establish evaporative rim-seal loss factors for rim seals used on external floating-roof tanks. The test method involves passing a controlled flow rate of air through a test chamber that contains a test liquid and a test rim seal, and measuring the concentration of the test liquid vapor in the air streams entering and leaving the test chamber. The standard specifies the test apparatus, instruments, test procedures, and calculation procedures to be used. It also addresses the variables to be measured, format for reporting the test values, and their associated uncertainty. Pages: 30

1st Edition | August 1997 | Reaffirmed: September 2017
Product Number: H1903B | Price: $122.00

Chapter 19.3, Part C
Weight Loss Test Method for the Measurement of Rim-Seal Loss Factors for Internal Floating-Roof Tanks

Provides a uniform method for measuring evaporative loss from rim seals used on aboveground storage tanks. This information can be utilized to establish product specific loss factors in terms of loss rate and seal gap area. Pages: 29

1st Edition | July 1998 | Reaffirmed: November 2012
Product Number: H1903C | Price: $122.00

Chapter 19.3, Part D
Fugitive Emission Test Method for the Measurement of Deck-Seam Loss Factors for Internal Floating-Roof Tanks

Establishes a uniform method for measuring evaporative deck-seam loss factors and deck-joint loss factors of mechanically joined deck seams that are used on internal floating-roof tanks. These deck-seam loss factors and deck-joint loss factors are to be determined in terms of their loss rate at specified pressure differences across the deck seam or deck joint for certification purposes. Pages: 31

1st Edition | June 2001 | Reaffirmed: December 2012
Product Number: H1903D | Price: $122.00

Chapter 19.3, Part E
Weight Loss Test Method for the Measurement of Deck-Fitting Loss Factors for Internal Floating-Roof Tanks

Describes the test methods to be used to establish evaporative loss factors for deck fittings on internal floating-roof tanks. This chapter specifies the test apparatus, instruments, test procedures, and calculation procedures to be used. The standard also addresses the requirements for reporting test report values. Pages: 30

1st Edition | May 1997 | Reaffirmed: October 2017
Product Number: H1903E | Price: $122.00

Chapter 19.3, Part H
Tank Seals and Fittings Certification—Administration

Provides guidance for the administration of the former API Tank Seals and Fittings Certification Program. The document includes detailed methods for monitoring and analysis of tests conducted on individual devices and describes the steps in the certification process. Pages: 53

1st Edition | March 1998 | Reaffirmed: August 2016
Product Number: H1903H | Price: $122.00

Chapter 19.4
Evaporative Loss Reference Information and Speciation Methodology (includes Addendum 1 dated November 2013 and Addendum 2 dated June 2017)

Provides methodology to estimate emissions of individual hydrocarbon species using the total emissions of multicomponent hydrocarbon mixtures (such as crude oils and gasoline) estimated from Ch. 19.1 for fixed-roof tanks, Ch. 19.2 for floating-roof tanks, Ch. 19.5 for marine vessels, and other methods used for total hydrocarbon emission estimates. This process is referred to as speciation.

Speciation of emissions from hydrocarbon mixtures accounts for the higher evaporation rate of the more volatile components, resulting in a different composition of the mixture in the vapor phase than in the liquid phase. The methodology presented in this standard assumes that there is sufficient liquid present such that the chemical composition at the liquid surface may be considered to not change as a result of the evaporative loss.

This standard also contains reference information used for estimating emissions in accordance with Ch. 19.1, Ch. 19.2, and Ch. 19.5.

The methodology in this standard applies to:

- liquids with vapor pressure that has reached equilibrium with ambient conditions at a true vapor pressure less than the ambient atmospheric pressure (i.e. not boiling);
- liquids for which the vapor pressure is known or for which sufficient data are available to determine the vapor pressure; and
- liquid mixtures where Raoult's Law can be used to describe the vapor phase equilibria.

This methodology does not apply to:

- emissions that result from leaks from piping components (e.g. valves, flanges, pumps, connectors etc.);
- liquid mixtures where Raoult's Law cannot be used to describe the vapor phase equilibria (e.g. mixtures in which hydrocarbons are dissolved in water, or mixtures of hydrocarbons with alcohols).

This 3rd Edition of Ch. 19.4 was published following a revision that was carried out concurrently with revisions to Ch. 19.1, published as the 4th Edition, and Ch. 19.2, published as the 3rd Edition. Primary changes are as follows.

- Consolidation of common material in Ch. 19.4. Material that had previously been included in both Ch. 19.1 and Ch. 19.2 has been moved to Ch. 19.4. Ch. 19.4, which was previously *Recommended Practice for Speciation of Evaporative Losses*, now has the title *Evaporative Loss Reference Information and Speciation Methodology*. This chapter had already contained reference information on the properties of chemicals and typical petroleum liquids, and this information has now been removed from Ch. 19.1 and Ch. 19.2. In addition, meteorological data have been moved from Ch. 19.1 and Ch. 19.2 to Ch. 19.4. In the revised documents:
  - meteorological data are found in Ch. 19.4;
  - calculation of storage tank temperatures is found in Ch. 19.1 and Ch. 19.2 (in that fixed-roof tanks involve calculation of the vapor space temperature in order to determine vapor density, whereas this step is not involved in estimating emissions from floating-roof tanks); and
  - calculation of true vapor pressure is found in Ch. 19.4 (in that this is now calculated in the same manner for both fixed- and floating-roof tanks). Pages: 136

3rd Edition | October 2012 | Product Number: H190403 | Price: $196.00

Chapter 19.5
Atmospheric Hydrocarbon Emissions from Marine Vessel Transfer Operations (formerly Publ 2514A)

Provides methods for estimating evaporative loss from marine vessel transfer operations. Specifically, this standard addresses:

- loading stock into:
  - ship or ocean barges, or
  - shallow draft barges; and
- loading ballast water into ship or ocean barges from which crude oil has been unloaded.

The emission estimates are for uncontrolled loading operations and do not apply to operations using vapor balance or vapor control systems or ballasting of ships with segregated ballast tanks. This standard does not address evaporative loss for:

- very large crude carriers (VLCCs) or ultra large crude carriers (ULCCs) (unless the saturation factor KS is determined);
- marine vessels employing crude oil washing;
- marine vessel transit loss;
- loading ballast water into marine vessels that, prior to dockside unloading, held anything other than crude oil (unless the saturation factor KS is determined); or
- unloading marine vessels.

This standard supersedes Publ 2514A, 2nd Edition, September 1981, which is withdrawn. A joint API/Energy Institute (EI) standard, it also carries the EI designation Hydrocarbon Management, HM65. Pages: 31

1st Edition | September 2009 | Reaffirmed: October 2014
Product Number: H19051 | Price: $124.00

Chapter 19.6.1 ■
Evaporative Loss from Storage Tank Floating-Roof Landings (formerly TR 2567)

Investigates storage tank emissions that may result from landing and subsequently refloating a floating roof. The existing emission factors for floating-roof tanks are based on the assumption that the floating roof is continuously floating on the stored stock liquid. Additional emissions may occur, however, if the tank is emptied such that the floating roof is no longer floating. This study sought to quantify these floating-roof landing loss emissions. Pages: 38

1st Edition | February 2017 | Product Number: H1906011 | Price: $125.00

Publ 2524
Impact Assessment of New Data on the Validity of American Petroleum Institute Marine Transfer Operation Emission Factors

Consultant CH2M Hill confirmed the validity of the model used in Publ 2514A by comparing emission test data with predictive emission models developed by API, ARCO, and Exxon. The study found that the API model adequately predicts emissions for tanks ranging in size from 17,000 to 35,000 dead weight tons and for tanks being loaded within the lower-48 states. The model does not appear to apply to crude oil loading of tankers in Valdez, Alaska, because of unique local operating conditions. However, no known test data invalidates the model for predicting crude oil loading emissions from carriers smaller than very large crude carriers in the lower-48 states. Pages: 194

July 1992 | Product Number: H25240 | Price: $157.00

Publ 2558
Wind Tunnel Testing of External Floating-Roof Storage Tanks

Presents the results of a wind tunnel study to determine the local wind velocities, wind directions, and roof pressures on external floating roof tanks. Pages: 13

1st Edition | June 1993 | Product Number: H25580 | Price: $195.00

TR 2568
Evaporative Loss from the Cleaning of Storage Tanks

Provides guidance for estimating emissions that result from removing the liquid heel (free-standing stock liquid) and cleaning the remaining deposits of stock liquid mixed with residue and water (sludge) from the bottoms of aboveground storage tanks. The emissions addressed in this report are those that leave the tank during the tank cleaning process. This report does not address:

- the fate of vapors after the have left the tank (other accounting for the efficiency of the control device),
- the fate of sludge after it has left the tank (or emissions that may occur during sludge treatment or disposal), or
- emissions that may be expelled by the vacuum pump of a vacuum truck or suction pump, if such devices are used in the tank cleaning process.

In other words, this report addresses the estimation of the mass of volatile organic compounds that leave the tank as vapor during the tank cleaning process. It does not address emissions that may result from the handling of liquids or sludge after such materials have been removed from the tank. This report is intended to reduce the effort required to generate a good faith estimate of tank cleaning emissions, and to result in more uniformity in the resulting emissions estimates. Pages: 47

1st Edition | November 2007 | Product Number: H25680 | Price: $107.00

TR 2569
Evaporative Loss from Closed-Vent Internal Floating-Roof Storage Tanks

Addresses evaporative loss from internal floating-roof tanks (IFRTs) with closed vents. When the vents in the fixed roof of an IFRT are closed, rather than open, estimation of emissions is shown to be highly complex. This subject is not covered in other API standards such as Ch. 19.1, which specifically excludes fixed-roof tanks that have an internal floating roof, and Ch. 19.2, which specifically excludes closed internal floating-roof tanks (that is, tanks vented only through a pressure-vacuum relief vent, blanketed with an inert gas, vented to a vapor processing unit, or otherwise restricted from being freely vented). Pages: 26

1st Edition | August 2008 | Product Number: H25690 | Price: $107.00

TR 2574
Field Testing Protocol for Characterization of Total Gaseous Nonmethane Organics (TGNMO), Methane, and Ethane in Air-Vapor Mixture During Filling of a Cargo Vessel with Crude Oil

Provides a standardized testing methodology for quantifying total gaseous nonmethane organics (TGNMO), methane, and ethane, in the air-vapor mixture that is expelled from cargo compartments during filing with crude oil. It utilizes a modified version of Federal Reference Method 25 (FRM 25) to characterize the concentration of TGNMO, methane, and ethane. While the field testing in support of this protocol was performed only for the loading of crude oil into barges, the method could be suitable for loading of any volatile organic liquid into any type of vessel or compartment from which vapors are exhausted through a single vent opening where the field sampling can take place. Pages: 56

1st Edition | August 2016 | Product Number: H257401 | Price: $105.00

TR 2576
Short-Term Evaporative Loss Estimation from Atmospheric Storage Tanks

Provides methodology on how to estimate short-term individual tank and facility-wide emissions. The methodology in this technical report can be used for purposes such as preparing permit applications and air dispersion modeling. The technical report does not provide guidance on how to run the actual air dispersion model. Pages: 18

1st Edition | July 2016 | Product Number: H257601 | Price: $110.00

Chapter 20
Allocation Measurement of Oil and Natural Gas

Chapter 20.1
Allocation Measurement
(includes Addendum 1 dated January 2013, Addendum 2 dated November 2016, and Addendum 3 dated December 2017)

Provides design and operating guidelines for liquid and gas allocation measurement systems. Included are recommendations for metering, static measurement, sampling, proving, calibrating, and calculating procedures. Pages: 67

1st Edition | September 1993 | Reaffirmed: October 2016
Product Number: H30701 | Price: $109.00

Chapter 20.2
Production Allocation Measurement Using Single-Phase Devices

Covers the application of production allocation (determination of flow quantities and rates of oil, gas, water, and other constituents) using single-phase measurement devices in combination with a two- or three-phase production separator.

This standard is applicable to single-phase measurement techniques upstream of the custody transfer points where custody transfer conditions are not possible. The standard presents single-phase flow measurement used in the allocation process and located downstream of the first stage of separation on a production facility.

This standard addresses common allocation single-phase flow measurement devices for liquid hydrocarbons, water, and gas including ancillary flow measurement systems such as fuel, flare, and recirculation.

This standard discusses configuration and operation of flow measurement equipment, fluid properties, production processing, associated flow conditions, and their effects on the quality of the flow measurement results. This standard discusses the possible impacts on these devices during inefficient and/or ineffective separation.

This document provides guidance with respect to the major factors that could contribute to measurement uncertainty for single-phase devices used in production allocation. It is not intended to prescribe a particular meter type or allocation method. Allocation methodologies are addressed in Ch. 20.1. Pages: 33

1st Edition | November 2016 | Product Number H200201 | Price: $124.00

Chapter 20.3
Measurement of Multiphase Flow
(supersedes RP 86)

Addresses multiphase flow measurement in the production environment, upstream of the custody transfer (single-phase) measurement point, where allocation measurement for onshore, offshore, or subsea is applied. For other multiphase flow measurement applications such as reservoir management, well tests, and flow assurance, the standard can be used as a reference or guide. However, the focus of this standard is on those applications where the accuracy of multiphase flow measurement for allocation systems is required.

This document refers to existing standards and recommended practices to supplement the guidance it provides in this subject area. The document addresses principles used in multiphase flow measurement, multiphase metering types and classifications, assessment of expected performance, and selecting and operating multiphase measurement systems. Operational requirements or constraints are addressed, including expectations for flow meter acceptance, calibration criteria, flow loop and in situ verifications, and other guidance specific to different multiphase flow metering applications. The document does not address specific meter configurations. Pages: 72

1st Edition | January 2013 | Product Number: H200301 | Price: $180.00

Chapter 20.5 ■
Recommended Practice for Application of Production Well Testing in Measurement and Allocation

Establishes a framework to conduct and apply production well testing for well rate determination in measurement and allocation. Production well testing addressed in this document refers to measurement of gas, oil, and water quantities from a single well during a specified length of time under controlled operational conditions. The intent of this document is to provide operators with a consistent and transparent approach for conducting, applying, and managing production well testing within an upstream measurement and allocation system. It is not intended to prescribe a particular production well test method, or particular application of production well test data use in allocation.

This document provides recommendations and guidelines for the application of production well testing in production measurement and allocation. The recommendations and guidelines apply to conducting a production well test, calculating production well test volumes and rates, and the application of production well test data for use in measurement and allocation. This includes production well testing preparation, initiation, measurement, validation, and volume and rate calculations for separator, multiphase flow meter, and tank production well test systems. Additionally, this document addresses the proration of production well test results for use in allocation, the application of production well tests for validation and update of well flow models and virtual flow metering, and the adjustment of gas well continuous measurement results with production well test data.

This document also provides recommendations and guidelines for the application of well flow modeling and virtual flow metering in production measurement and allocation.

Allocation methodologies are addressed in Ch. 20.1. Pages: 123

1st Edition | December 2017 | Product Number: H200501 | Price: $186.00

Draft Standard
Application of Hydrocarbon Phase Behavior Modeling in Upstream Measurement and Allocation Systems

Provides requirements and guidelines for the application of hydrocarbon phase behavior modeling in upstream measurement and allocation systems. The requirements and guidelines apply to the development, implementation, and performance management of a process simulation model (PSM) incorporating an equation of state (EOS) description of phase behavior. This includes functional specifications, validation, and maintenance of the PSM, EOS specification and implementation, and fluid compositional specification and validation.

This document establishes a framework to develop, implement, and manage the application of hydrocarbon phase behavior modeling. The applied phase behavior modeling addressed in this document refers to PSM incorporating EOS description of the phase behavior, or pressure, volume, temperature (PVT) properties, of the fluids within the modeled process. The intent of this document is to provide operators with a consistent and transparent approach for applying and managing an EOS-based PSM within an upstream measurement and allocation system. It is not intended to prescribe a particular mathematical phase estimation (i.e. EOS), process simulation (i.e. PSM), or allocation method. Allocation methodologies are addressed in Ch. 20.1. Pages: 47

1st Edition | August 2016 | Product Number: H200401D | Price: $90.00

RP 85
Use of Subsea Wet-Gas Flowmeters in Allocation Measurement Systems
(includes Addendum 1 dated January 2013)

Presents a recommended allocation methodology that best fits the application and that equitably accommodates variances in the uncertainty level between meters in the system. It is intended to advise the user on various aspects of the use of subsea wet-gas flowmeters in allocation measurement systems. Marinization, operation, abnormal operation, and meter testing are important topics included here, but foremost, this document proposes techniques to be used in the allocation of total production to individual contributing streams. Pages: 64

1st Edition | March 2003 | Reaffirmed: October 2013
Product Number: G08501 | Price: $123.00

RP 87
Recommended Practice for Field Analysis of Crude Oil Samples Containing from Two to Fifty Percent Water by Volume

Provides the user with recommended "field" methods of sampling, sample handling, and analysis for high water content streams up to 50 % water on a volumetric basis. In particular, this RP was developed giving consideration to offshore installations (both floating and fixed platforms). These installations are generally subject to motion and vibrations, have minimal laboratory equipment, and perform S&W analysis with multi-skilled operations personnel as opposed to laboratory chemists. The techniques described, however, are applicable to onshore locations.

Provides design and operating guidelines for sampling, sample handling, and analysis for high water content streams, up to 50 % water on a volumetric basis. As a guide, this RP targets a relative accuracy of 5 % of reading up to a maximum of 50 % water content as a qualifier for various methods described herein. For example, the corresponding absolute accuracy for a 10 % water content stream is ±0.5 % and for 20 % water content is ±1.0 %. Pages: 19

1st Edition | August 2007 | Reaffirmed: October 2017
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Chapter 21
Flow Measurement Using Electronic Metering Systems

Describes standard practices and minimum specifications for electronic measurement systems used in the measurement and recording of flow parameters. This chapter covers natural gas fluid and petroleum and petroleum product custody transfer applications using industry-recognized primary measurement devices.

Chapter 21.1
Flow Measurement Using Electronic Metering Systems—Electronic Gas Measurement
(ANSI/API *MPMS* Ch. 21.1-2011) (AGA Report No. 3)

Describes the minimum specifications for electronic gas measurement systems used in the measurement and recording of flow parameters of gaseous phase hydrocarbon and other related fluids for custody transfer applications utilizing industry recognized primary measurement devices. This standard provides the minimum reporting and change management requirements of the various intelligent components required for accurate and auditable measurement. The requirements can be met by a combination of electronically and/or manually recorded configuration, test reports, change record reporting of the electronic gas measurement system components, and flow parameters. It is recognized that diagnostic capabilities of the newer meter and transmitter technologies are important but due to the device specific complexity, intelligent device diagnostics are out of scope for this standard. Pages: 94

2nd Edition | February 2013 | Product Number: H210102 | Price: $165.00

Chapter 21.2
Electronic Liquid Volume Measurement Using Positive Displacement and Turbine Meters

Provides guidance for the effective use of electronic liquid measurement systems for custody transfer measurement of liquid hydrocarbons under the following conditions. Use of the measurement systems must fall within the scope and field of application of Ch. 12.2. Guidance applies to systems using turbine or positive displacement meters. Guidance applies to systems using on-line correction for the effect of temperature on liquid (CTL) and correction for the effect of pressure on liquid (CPL) compensation. The procedures and techniques in Ch. 21.2 are recommended for new measurement applications. This standard provides custody transfer measurement procedures for pipeline and other electronic liquid metering systems including design, selection, use, auditing, reporting, calibration, verification, and security. Pages: 60

1st Edition | June 1998 | Reaffirmed: October 2016
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Chapter 21.2-A1
Addendum 1 to Flow Measurement Using Electronic Metering Systems, Inferred Mass

This addendum specifically covers inferred mass measurement systems utilizing flow computers as the tertiary flow calculation device and either turbine or displacement type meters, working with on-line density meters, as the primary measurement devices. The scope does not include systems using calculated flowing densities, i.e. Equations of State. The hardware is essentially identical to that referenced in Ch. 21.2 and the methods and procedures are as described in Ch. 14.4, 14.6, 14.7, and 14.8. Audit, record-keeping, collection and calculation interval, security, and most other requirements for systems covered in Ch. 21.2 will apply to this addendum. As in Ch. 21.2, the hydrocarbon liquid streams covered in the scope must be single phase liquids at measurement conditions.

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Chapter 22
Testing Protocols

Testing protocols for devices used in the measurement of hydrocarbon fluids. Testing protocols define appropriate methods for measuring and reporting the performance characteristics of similar equipment in a comparable manner, thus providing a means to highlight the relative performance advantages and disadvantages of similar devices.

Chapter 22.1
General Guidelines for Developing Testing Protocols for Devices Used in the Measurement of Hydrocarbon Fluids
(ANSI/API *MPMS* Ch. 22.1-2015)

Intended for the development of testing protocols and to serve as a guideline to document performance characteristics of hydrocarbon fluid measurement related devices. Pages: 7

2nd Edition | August 2015 | Product Number: H220102 | Price: $87.00

Chapter 22.2 ■
Testing Protocols—Differential Pressure Flow Measurement Devices

Defines the testing and reporting protocols for flow measurement devices based on the detection of a pressure differential that is created by the device in a flowing stream. This protocol is designed to supply industry with a comparable description of the capabilities of these devices for the measurement of single-phase fluid flow when they are used under similar operating conditions. The objectives of this Testing Protocol are to:

- ensure that the user of any differential pressure flow meter knows the performance characteristics of the meter over a range of Reynolds numbers as applicable or defined by tests,
- facilitate both the understanding and the introduction of new technologies,
- provide a standardized vehicle for validating manufacturer's performance specifications,
- provide information about relative performance characteristics of the primary elements of the differential pressure metering devices under standardized testing protocol,
- quantify the uncertainty of these devices and define the operating and installation conditions for which the stated uncertainties apply. Pages: 52

2nd Edition | April 2017 | Product Number: H220202 | Price: $104.00

Chapter 22.3
Testing Protocol for Flare Gas Metering
(ANSI/API *MPMS* Ch. 22.3-2015)

Describes a testing protocol for flare gas meters. This includes a discussion of the testing to be performed, how the test data should be analyzed, and how an uncertainty is determined from the testing of the meter. The scope does not include the general guidelines to flare gas metering that are covered under Ch. 14.10. Pages: 21

1st Edition | August 2015 | Product Number: H220301 | Price: $98.00

Chapter 22.6
Testing Protocol for Gas Chromatographs

A general gas chromatograph (GC) performance test protocol that specifies the scope and reporting requirements of GC tests for repeatability, reproducibility, and response linearity. The protocol specifies requirements for tests over a range of gas compositions, tests over a range of environmental conditions, and long-term performance tests. Pages: 50

1st Edition | August 2015 | Product Number: H220601 | Price: $98.00

Chapter 23
Reconciliation of Hydrocarbon Quantities

Provides practical methodologies for monitoring hydrocarbon transportation loss and gain for non-marine systems i.e. pipeline, tank cars (rail tank cars, tank trucks, etc.). For Marine Reconciliation, refer to Ch. 17.

Chapter 23.1
Reconciliation of Liquid Pipeline Quantities
(supersedes Std 2560)

Provides methodologies for monitoring liquid pipeline loss/gain and for determining the normal loss/gain level for any given pipeline system. Troubleshooting suggestions are also presented. This document does not establish industry standards for loss/gain level because each system is individual and exhibits its own loss/gain level and/or patterns under normal operating conditions. The document provides operational and statistically based tools for identifying when a system has deviated from normal, the magnitude of the deviation, and guidelines for identifying the causes of deviation from normal.

The primary application of this publication is in custody transfer liquid pipeline systems in which there is provision for measuring all liquids that enter the system and exit the system, as well as liquid inventory within the system. The application is not intended for nonliquid or mixed-phase systems. The applications and examples in this document are intended primarily for custody transfer pipeline systems, but the principles may be applied to any system that involves the measurement of liquids into and out of the system and, possibly, inventory of liquids within the system. Such systems may include pipelines, marine terminals, marine voyages, bulk loading or storage terminals, tank farms, and rail and trucking systems. Pages: 35

1st Edition | June 2016 | Product Number: H230101 | Price: $95.00

Publ 2566
State of the Art Multiphase Flow Metering

Provides information on multiphase flow metering systems gleaned from more than 150 published documents that are in the public domain. The documentation was prepared from information obtained through mid-2002. It should be noted that the indicated performances data stated in these published documents have not necessarily been verified by an independent body. The listing of these references in the Appendix 2 is intended to provide a comprehensive source of data and information on multiphase metering; the reader needs to carefully review the source of the data in the documents when utilizing the information. Pages: 80

1st Edition | May 2004 | Product Number: H25661 | Price: $127.00

TR 2571
Fuel Gas Measurement

Provides a performance-based methodology for the measurement and reporting of fuel gas consumption. The document provides guidance in the following areas to allow the user to achieve a targeted uncertainty of measurement:

- selection of flow meter type; differential pressure (DP), displacement, ultrasonic, Coriolis, vortex, turbine, thermal, and others;
- associated instrumentation for measuring fluid properties and flowing conditions, such as pressure and temperature transmitters, densitometers, gas chromatographs;
- obtaining and use of gas composition or other analytical data;

- design and installation requirements of the measurement system;
- inspection, verification, and calibration practices of flow meters and their associated accessory instrumentation; and
- simplified uncertainty calculations with examples to illustrate the methodology.

Techniques are described to assess the uncertainty contribution of individual components of fuel gas measurement systems and overall facility fuel gas measurement uncertainty. Pages: 67

1st Edition | March 2011 | Product Number: H257101 | Price: $124.00

TR 2572
Carbon Content, Sampling, and Calculation

Carbon emission quantities can be calculated from either the volume/mass of fuel or feedstock fed to a process (as applicable) and carbon content of the process or fuel supply, or by directly measuring volume/mass emissions. This technical report (TR) provides guidance on the sampling and calculation of carbon content of process or fuel supplies. The API companion technical report, TR 2571, can be referenced for guidance on measuring the volume/mass of process fuel gas or feedstock, and the *API Compendium of Greenhouse Gas Emissions Estimation Methodologies for the Oil and Natural Gas Industry* can be reference for guidance on the calculation of emissions.

TR 2572 provides guidance and a methodology for the determination of carbon content from hydrocarbon-based petroleum and petrochemical products, and the uncertainty of the average carbon content as calculated from multiple samples taken during a reporting period. This method is intended to make use of industry-accepted mixture property data and test methods with no new or modified test methods introduced in this document. The method is applicable to carbon-content-based reporting or trading for all gaseous and liquid hydrocarbons.

This TR provides references and supplemental information on applicable industry practices based on the published resources, existing industry standards, industry-accepted physical constants, or properties of hydrocarbons for measurement, sampling, sampling frequency, and analysis of hydrocarbon samples. Pages: 24

1st Edition | May 2013 | Product Number: H257201 | Price: $100.00

TR 2575
Measurement of Thermally Cracked Gas

Presents a method to compute the density, compressibility factor, and supercompressibility factor for thermally cracked gas (TCG) for custody transfer using orifice meters. It provides equations, parameters, computation flow diagrams, and example spreadsheet calculations. This technical report applies to TCG mixtures after treatment. It applies for temperature from 90 °F to 120 °F (305 K to 322 K) at pressures up to 300 psig (2 MPa). It is limited to a specific operating region. The method is for the single gas phase only. Pages: 17

1st Edition | September 2014 | Product Number: H257501 | Price: $65.00

TR 2578 ■
Flow Conditioner Installation and Effects on Turbine Meters

Provides a summary of flow conditioning testing performed on turbine meters in liquid hydrocarbons. Initial testing was conducted in water and those findings were included as an addendum to Ch. 5.3 in 2009, subsequent testing in hydrocarbon liquids was carried out through July 2016.

Phase II testing focused on operational effects, specifically the relationship of strainer design, strainer basket disturbances, flow conditioning, and their effects on the flow meter deviations in hydrocarbon applications (viscosities, densities, and Reynolds number). Pages: 16

1st Edition | October 2017 | Product Number: H257801 | Price: $65.00