

API Measurement Standards

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API Measurement Standards

Presentation will cover:

API's History and Mission

**API's Standards Programs and
Measurement (COPM)
Committees**

API Major Measurement Projects

**API Measurement Standards
Published and under
Development**

API Background

- API Formed in 1919 as National Trade Association
- API's mission:

API's mission is to promote safety across the industry globally and to influence public policy in support of a strong, viable U.S. oil and natural gas industry

- API engages in legislative and regulatory advocacy
- API provides statistical reports and develops standards and certification programs
- API currently represents ~600 companies

API Standards Background

- Standards Department formed in 1923 as one of three initial API foundational programs
 - Others were industry statistics and taxation
- First standard published in 1924 on pipe sizes, threads, and couplings
 - Now ~700 standards published
- All industry segments now active in standards work
 - Upstream: Exploration, Drilling & Production Operations
 - Midstream: Pipeline, Rail & Truck Transportation, and Petroleum Measurement
 - Downstream: Refining, Marketing, Process Safety, Fire Protection



API's Standards Committees

API's Standards Committees

Committee on Standardization of Oilfield Equipment and Materials, CSOEM

- Responsible for ~240 standards that form the basis of API's monogram program

Committee on Petroleum Measurement, COPM

- Responsible for ~180 standards used worldwide for custody transfer operations

Committee on Refinery Equipment, CRE

- Responsible for ~160 standards that form the basis of API's individual inspector certification program



Measurement Standards

API's Measurement Standards Program

- **Committee on Petroleum Measurement (COPM)**
 - Provides leadership in developing and maintaining cost effective, state of the art, hydrocarbon measurement standards and programs based on sound technical principles consistent with current measurement technology, recognized business accounting and engineering practices, and industry consensus.
 - This is accomplished through the committee's and API's leadership role in the national and international standardization community in the development, publication, promotion, and revision of petroleum measurement standards, through its subcommittee structure, and through elimination of duplicative efforts.

API's Measurement Standards Program

- COPM Subcommittees
 - Subcommittee on Liquid Measurement
 - Subcommittee on Gas Fluids Measurement
 - Subcommittee on Measurement Quality (Joint with ASTM D02.02)
 - Subcommittee on Measurement Accountability
 - Subcommittee on Evaporative Loss Estimation
 - Subcommittee on Production Measurement and Allocation
 - Subcommittee on Measurement Education and Training

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on Liquid Measurement**
 - Measurement, MPMS Chapter 2
 - Tank Gauging, MPMS Chapter 3
 - Proving Systems, MPMS Chapter 4
 - Metering, MPMS Chapter 5
 - Metering Assemblies, MPMS Chapter 6
 - Calculation of Petroleum Quantities, MPMS Chapter 12
 - Statistical Aspects of Measuring and Sampling, MPMS Chapter 13
 - Measurement by Weight, MPMS Chapter 16
 - Custody Transfer/Crude by Truck, MPMS Chapter 18 (Joint with COMQ)
 - Flow Measurement - Electronic Liquid Measurement, MPMS Chapter 21.2

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on Gas Fluids Measurement**
 - Natural Gas Fluids Measurement, MPMS Chapter 14
 - Electronic Gas Measurement, MPMS Chapter 21.1
 - Testing Protocols, MPMS Chapter 22

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on Measurement Quality, Joint with ASTM (D02.02)**
 - Temperature Determination, MPMS Chapter 7
 - Sampling, MPMS Chapter 8
 - Density Determination, MPMS Chapter 9
 - Sediment & Water Determination, MPMS Chapter 10
 - Physical Properties, MPMS Chapter 11
 - Use of SI Units, MPMS Chapter 15
 - Custody Transfer/Crude by Truck, MPMS Chapter 18 (Joint with COLM)

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on Measurement Accountability**
 - Marine Measurement, MPMS, Chapter 17
(12 standards)
 - Loss Control of Petroleum and Petroleum Products Involving all Modes of Transportation, MPMS Chapter 23
(2 standards)

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on
Evaporative Loss
Estimation**
- Evaporation Loss, MPMS Chapter 1
(6 standards)

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on
Production Measurement
Allocation**
- Production Measurement and Allocation, MPMS Chapter 20 (5 standards)

API's Measurement Standards Program

- COPM Subcommittees
 - **Subcommittee on Measurement Education and Training**
 - Vocabulary, MPMS Chapter 1: Terms & Definitions
 - Spanish Translation
 - Education & Training



API's COPM Major Projects

API Mercury-in-Glass Thermometer Alternatives Study

In collaboration with the U.S. Environmental Protection Agency (EPA), API undertook a project to phase out the use of Mercury Thermometers in petroleum measurement.

This effort involved 3 phases to test the viability of non-mercury alternatives, such as digital and non-mercury liquid-in-glass thermometers.

API Mercury-in-Glass Thermometer Alternatives Study

Phase I - involved testing and comparing alternatives to MIGT in tank temperature measurement completed.

Phase II - involved testing of alternatives, such as digital and non-mercury liquid-in-glass thermometers for use in calibration (daily checks) of non-mercury thermometers. The protocol involved testing the devices in three environments at two different laboratories:

1. Outdoor Ambient Bath; 2. Indoor Laboratory Bath; 3. Indoor Thermal Block.

Phase III - involved comparing the Mercury-in-Glass Thermometers (MIG), Portable Electronic Thermometers (PET) and Digital Contact Thermometers (DCT) response time to temperature change while performing temperature readings at test measures per clause 6.1.3 in API *MPMS* Ch. 4.9.2, 1st Ed.

RESULTING STANDARDS PUBLISHED

- API *MPMS* Chapter 7.1, Temperature Determination, Part 1- Liquid in Glass Thermometers
- API *MPMS* Chapter 7.2, Temperature Determination, Part 2- Portable Electronic Thermometers
- API *MPMS* Chapter 7.4, Temperature Determination, Part 4- Dynamic Temperature Measurement

API Project for Determining VCF for Gasoline/Ethanol Blends

The purpose of this study was to:

- 1) measure temperature and volume changes resulting from blending various denatured ethanols and gasolines, and
- 2) measure the density of the various blends at specific temperatures and pressures.

The data is the basis for blend volume growth and temperature/pressure volume expansion equations.

RESULTING STANDARDS PUBLISHED - 2019

- API *MPMS* Chapter 11.1, Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils, Addendum 2 to 2nd Ed.
- API *MPMS* Chapter 11.3.3, Miscellaneous Hydrocarbon Properties – Denatured Ethanol and Volume Correction Factors, 3rd Ed.
- API *MPMS* Chapter 11.3.4, Miscellaneous Hydrocarbon Properties – Denatured Ethanol and Gasoline Component Blend Densities and Volume Correction Factors, 1st Ed.
- API Technical Report 2580, Documentation Report and Data Files for API *MPMS* Chapter 11.3.3 and API *MPMS* Chapter 11.3.4
- API *MPMS* Chapter 11.2.4, Temperature Correction for NGL & LPG, 2nd Ed. (joint Standard with GPA 8217)

Continuous Density Measurement under Dynamic (flowing) Conditions: Determination of Alternate Performance Verification Method(s) and Density Meter High Performance Calibration Coefficients (HPC)

Project Objectives:

- Improve density measurement precision by determining the calibration constants within the operating range of light liquid hydrocarbons at the pressure, temperature and composition ranges expected for the density meter installation.
- Develop a master density meter proving method as an alternative to the pycnometer method while reaching the same performance level as the pycnometer proving while reducing the complexity and time required of the proving

Results will be incorporated into API *MPMS* Chapter 9.4 (see next).

Related Standard Published – 2018

- API *MPMS* Chapter 9.4, Continuous Density Measurement Under Dynamic (Flowing) Conditions, 1st ed.

API Project for Wet Gas Sampling – Objective

- Current industry guidance documents for the collection of custody-quality natural gas samples:
 - written and evaluated for “dry” gas
 - many field applications require sample extraction & collection from gas streams at or below the hydrocarbon dew point (“wet” gas).
- API WG established to evaluate if data can be established which will either:
 - a) support techniques that provide:
 - representative samples
 - establish uncertainties of those techniques, and
 - the limitations of those techniques where they fail to meet the established uncertainty expectations

or

 - b) determine that:
 - no proven techniques exist for the collection of a representative hydrocarbon wet gas sample, and
 - current techniques provide the best available analytical data
- Data from the study could be collated into an API Technical Report with a view to subsequent development of an API Standard on this subject



API Standards Published in 2019

COPM STANDARDS PUBLISHED - 2019

- API *MPMS* Chapter 11.1, Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils, Addendum 2 to 2nd Ed.
- API *MPMS* Chapter 11.3.3, Miscellaneous Hydrocarbon Properties – Denatured Ethanol and Volume Correction Factors, 3rd Ed.
- API *MPMS* Chapter 11.3.4, Miscellaneous Hydrocarbon Properties – Denatured Ethanol and Gasoline Component Blend Densities and Volume Correction Factors, 1st Ed.
- API Technical Report 2580, Documentation Report and Data Files for API *MPMS* Chapter 11.3.3 and API *MPMS* Chapter 11.3.4
- API *MPMS* Chapter 11.2.4, Temperature Correction for NGL & LPG, 2nd Ed. (joint Standard with GPA 8217)

COPM STANDARDS PUBLISHED - 2019

- API *MPMS* Chapter 15, Guidelines for the Use of Petroleum Industry – Specific International System (SI) Units, 4th Ed.
- API *MPMS* Chapter 8.3, Standard Practice for Mixing and Handling of Liquid Samples of Petroleum and petroleum Products, 2nd Ed. (joint Standard with ASTM D5854)
- API *MPMS* Chapter 19.6.2, Evaporative Loss from the Cleaning of Storage Tanks, 1st Ed.
- API *MPMS* Chapter 12.1.1, Calculation of Static Petroleum Quantities, Part 1 – Upright Cylindrical Tanks and Marine Vessels



**COPM STANDARDS CURRENTLY
UNDER DEVELOPMENT/REVISION**

Liquid Measurement

- API *MPMS* Chapter 2.2A, Measurement and Calibration of Upright Cylindrical Tanks by Manual Strapping Method, 2nd Ed. (updating Annex A, Tank Calibration Frequency and Re-computation of Calibration Tables)
- API Standard 2552, Calibration of Spheres and Spheroids (will actually be re-designated as *MPMS* Chapter 2.3, 1st Ed.)
- API Standard 2554, Measurement and Calibration of Tank Cars (will actually be re-designated as *MPMS* Chapter 2.4, 1st Ed.)
- API *MPMS* Chapter 3.1B, Level Measurement of Liquid Hydrocarbons in Stationary Tanks by Automatic Tank Gauging, 4th Ed.
- API *MPMS* Chapter 4.2, Displacement Provers, 4th Ed.
- API *MPMS* Chapter 4.6, Pulse Interpolation. 3rd Ed.
- API *MPMS* Chapter 4.8, Operation of Proving Meters, 3rd Ed.
- API *MPMS* Chapter 4.9.1, Introduction to Determination of the Volume of Displacement and Tank Provers, 2nd Ed.

NOTE Those documents listed in red are under publication.

Liquid Measurement

- API *MPMS* Chapter 5.6, Measurement of Liquid Hydrocarbons by Coriolis Meters, 2nd Ed.
- API *MPMS* Chapter 5.8, Measurement of Liquid Hydrocarbons by Ultrasonic Flowmeters, 3rd Ed.
- API *MPMS* Chapter 6.1A, Metering Assemblies—General Considerations, 1st Ed.
- API *MPMS* Chapter 6.2A, Truck and Rail Loading and Unloading Measurement Systems, 1st Ed.
- API *MPMS* Chapter 6.3A, Pipeline and Marine Loading/Unloading Measurement Systems, 1st Ed.
- API *MPMS* Chapter 6.4A, Lease Automatic Custody Transfer (LACT) Systems, 1st Ed.

Liquid Measurement

- API *MPMS* Chapter 12.2, Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors, 2nd Ed.
- API *MPMS* Chapter 12.4.1, Calculation of Petroleum – Base Prover Quantity Calibration – Waterdraw Method, 1st Ed. (formerly Ch. 12.2.4)
- API *MPMS* Chapter 12.4.2, Calculation of Petroleum – Base Prover Quantity Calibration – Master Meter Method, 1st Ed. (formerly Ch. 12.2.5)
- API *MPMS* Chapter 12.4.3, Calculation of Petroleum – Base Prover Quantity Calibration – Gravimetric Method, 1st Ed.
- API *MPMS* Chapter 21.2, Electronic Liquid Volume Measurement Using Positive Displacement and Turbine Meters, 2nd Ed.

Gas Fluids Measurement

- API *MPMS* Chapter 14.1, Collecting and Handling of Natural Gas Samples for Custody Transfer, 8th Ed. (revision and jointing of the API Standard with GPA 2166)
- *API MPMS Chapter 14.3.4, Concentric, Square-Edged Orifice Meters – Background Development, Implementation Procedures & Subroutine Documentation (AGA Report No. 3 Part 4), 4th Ed.*
- API *MPMS* Chapter 14.10, Measurement of Flow to Flares, 2nd Ed.
- API *MPMS* Chapter 14.13, Recommended Practice for Fuel Gas Measurement and Meter Selection in Non-Custody Applications, 1st Ed. (revision and re-designation of TR 2571)
- API *MPMS* Chapter 14.XX, Venturi Metering of Natural Gas and Other Related Hydrocarbon Fluids, 1st Ed.

NOTE Those documents listed in **red** are under publication.

Gas Fluids Measurement

- API *MPMS* Chapter 21.1, Electronic Gas Measurement, 3rd Ed.
- API *MPMS* Chapter 22.5, Testing Protocol for Electronic Flow Computers for Gas Flows, 1st Ed.

Production Measurement and Allocation

- API *MPMS* Chapter 20.1, Production Measurement and Allocation, 2nd Ed.
- API *MPMS* Chapter 20.3, Measurement of Multiphase Flow, 2nd Ed.
- API *MPMS* Chapter 20.4, Phase Behavior Applications in Upstream Measurement, 1st Ed. (revision and re-designation of Draft Standard)

Measurement Quality

- *API MPMS Chapter 8.1, Standard Practice for Manual Sampling of Petroleum and Petroleum Products, 5th Ed. (joint Standard with ASTM D4057)*
- *API MPMS Chapter 8.2 (ASTM D4177), Standard Practice for Automatic Sampling of Petroleum and Petroleum Products, 5th Ed.*
- *API MPMS Chapter 8.6, Continuous and Intermittent Sampling and Handling of Liquefied Natural Gas, 1st Ed. (New Standard, modified National adoption of ISO 8943)*
- *API MPMS Chapter 10.10, On-Line Measurement of Water Content in Petroleum and Petroleum Products, 1st Ed. (New Standard)*
- *API MPMS Chapter 10.4, Determination of Water and/or Sediment in Crude Oil by the Centrifuge Method (Field Procedure), 5th Ed.*

NOTE Those documents listed in **red** are under publication.

API Measurement Standards

Thank You for Your Attention!

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[API Standards](#)
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