



Designation: D8009 – 22



Manual of Petroleum Measurement Standards (MPMS), Chapter 8.5

Standard Practice for Manual Piston Cylinder Sampling for Volatile Crude Oils, Condensates, and Liquid Petroleum Products¹

This standard is issued under the fixed designation D8009; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This practice 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 Practice [D3700](#).

1.2 This practice is intended for use with sample types, such as UN Class 3 Flammable Liquids, that might have been collected and transported using open containers. The use of a manual piston cylinder in place of open containers is intended to prevent the loss of volatile (light end) components, which can impact subsequent test results.

1.3 This practice is suitable for sampling crude oils, condensates, and/or liquid petroleum products having true vapor pressures less than 300 kPa (43 psia nominal) at 50 °C. This practice applies to samples that will typically fall between Practices [D4057](#) (API MPMS Chapter 8.1) and [D3700](#). This practice shall not be used for materials classified as UN Class 2 Gases² (“...having a vapor pressure greater than 300 kPa at 50 °C or is completely gaseous at 20 °C at 101.3 kPa.”).

1.4 This practice allows for sampling of crude oils that flow freely at the conditions of sampling.

1.5 It is the responsibility of the user to ensure that the sampling point is located so as to obtain a representative sample.

1.6 The values stated in SI units are to be regarded as standard.

¹ This practice is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and the API Committee on Petroleum Measurement, and is the direct responsibility of Subcommittee [D02.02](#) /COMQ the joint ASTM-API Committee on Hydrocarbon Measurement for Custody Transfer (Joint ASTM-API). This practice has been approved by the sponsoring committees and accepted by the Cooperating Societies in accordance with established procedures. This practice was issued as a joint ASTM-API standard in 2015.

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² UN Recommendations of the Transportation of Dangerous Goods, Chapter 2.2.1.1.

1.6.1 *Exception*—The values given in parentheses are for information only.

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

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:³

- [D3700 Practice for Obtaining LPG Samples Using a Floating Piston Cylinder](#)
- [D4057 Practice for Manual Sampling of Petroleum and Petroleum Products](#)
- [D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants](#)
- [D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products](#)
- [D6377 Test Method for Determination of Vapor Pressure of Crude Oil: VPCR_x \(Expansion Method\)](#)
- [D6378 Test Method for Determination of Vapor Pressure \(VP_x\) of Petroleum Products, Hydrocarbons, and Hydrocarbon-Oxygenate Mixtures \(Triple Expansion Method\)](#)
- [D7975 Test Method for Determination of Vapor Pressure of Crude Oil: VPCR_x-F\(Tm°C\) \(Manual Expansion Field Method\)](#)

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

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

2.2 API Standards:⁴

MPMS Chapter 1 Terms and Definitions Database

MPMS Chapter 8.1 Manual Sampling of Petroleum and Petroleum Products

MPMS Chapter 8.2 Automatic Sampling of Petroleum and Petroleum Products

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this standard practice, refer to Terminology D4175 and the API MPMS Chapter 1 Terms and Definitions Database.

3.1.2 *dead crude oil, n*—crude oil with sufficiently low vapor pressure that, when exposed to normal atmospheric pressure at room temperature, does not result in boiling of the sample.

3.1.2.1 *Discussion*—These crudes will have vapor pressures below atmospheric pressure at room temperature.

3.1.2.2 *Discussion*—A crude oil is normally considered “live” until the vapor pressure can be established using Test Methods D6377, D6378, or D7975. Sampling and handling of dead crude oils can usually be performed without concern in open, non-pressurized sample containers, such as cans, bottles, and other atmospheric containers as described in Practice D4057 (API MPMS Chapter 8.1).

3.1.3 *live crude oil, n*—crude oil with sufficiently high vapor pressure that it would boil if exposed to normal atmospheric pressure at room temperature.

3.1.3.1 *Discussion*—Sampling and handling of samples of live crude oils will necessitate the use of the closed sample container to maintain sample integrity and preclude the use of open sample containers, such as cans, bottles, and other atmospheric containers.

3.1.3.2 *Discussion*—Samples and bulk storage (tank) liquids may or may not appear to boil visibly (rolling) but vaporization (off-gassing) is occurring.

3.1.4 *light ends, n*—hydrocarbon components that cannot be maintained as a liquid at atmospheric pressure at temperatures greater than 0 °C.

3.1.4.1 *Discussion*—This includes any materials that have atmospheric boiling points below 0 °C including methane, ethane, propane, butane.

3.1.4.2 *Discussion*—Fixed gases, such as CO, CO₂, H₂, H₂S, N₂, and O₂, will also contribute to the composition and vapor pressure of the sample.

3.1.5 *maximum fill volume (reduced fill volume), n*—the volume of a container occupied by the sample, usually expressed as a percentage of the total capacity.

3.1.5.1 *Discussion*—Some regulatory agencies use the expressions “maximum fill density” and “reduced fill density.”

3.1.6 *open container, n*—a container designed for use with samples at atmospheric pressure conditions.

3.1.6.1 *Discussion*—This includes glass and plastic bottles. These containers are not suitable for samples expected to have vapor pressures above atmospheric pressure.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *dead volume, n*—the fixed volume required to fill the void spaces in the manual piston cylinder when the piston is pushed firmly against the sample chamber end cap.

3.2.1.1 *Discussion*—The dead volume includes the annular volume around the piston, channel volume within the end caps, and volume within the pressure relief device and valves.

3.2.2 *manual piston cylinder (MPC), n*—a pressurized sample container, with an internal piston that effectively divides the container into two separate compartments and that is attached to a rod which allows the user to manually move the piston in order to collect volatile liquid samples.

3.2.2.1 *Discussion*—A manual piston cylinder (Fig. 1) is used to collect a sample of liquid with a vapor pressure of less than 300 kPa (43 psia nominal), without the formation of a gaseous phase, which can result in changes in the composition of the liquid sample.

3.2.3 *single-phase fluid, n*—a liquid that has no separate vapor and liquid phases.

3.2.4 *true vapor pressure (TVP), n*—the total pressure generated by a fluid at a 0:1 vapor:liquid ratio at 50 °C.

3.2.4.1 *Discussion*—50 °C is the prescribed temperature for vapor pressure for distinguishing between UN Class 2 Gases and Class 3 Flammable Liquids.

3.2.4.2 *Discussion*—True vapor pressure is the sum of the

⁴ Available from American Petroleum Institute (API), 200 Massachusetts Ave. NW, Suite 1100, Washington, DC 20001, <http://www.api.org>.

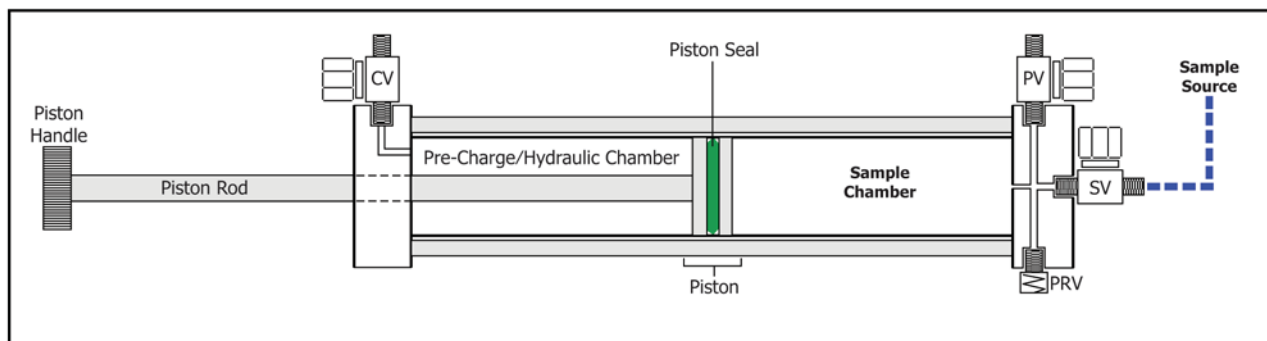


FIG. 1 Manual Piston Cylinder Schematic (Example)