



Designation: D3700 – 26

Standard Practice for Obtaining LPG Samples Using a Floating Piston Cylinder¹

This standard is issued under the fixed designation D3700; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope*

1.1 This practice covers the equipment and procedures for obtaining a representative sample of liquefied petroleum gas (LPG), such as specified in ASTM Specification [D1835](#), GPA 2140, and comparable international standards. It may also be used for other natural gas liquid (NGL) products that are normally single phase (for example, NGL mix, field butane, and so forth), defined in other industry specifications or contractual agreements, and for volatile (higher vapor pressure) crude oils.

NOTE 1—Some floating piston cylinders have such tight piston seals that the vapor pressure of some high vapor pressure crude oils may not be sufficient to allow sampling without a handle to move the piston. An alternative sampling practice for UN Class 3 liquids (under 300 kPa at 52 °C) is Practice [D8009](#), which utilizes a Manual Piston Cylinder (MPC) sampler.

1.2 This practice is not intended for non-specification products that contain significant quantities of undissolved gases (N_2 , CO_2), free water or other separated phases, such as raw or unprocessed gas/liquids mixtures and related materials. The same equipment can be used for these purposes, but additional precautions are generally needed to obtain representative samples of multi-phase products (see [Appendix X1](#)).

1.3 This practice includes recommendations for the location of a sample point in a line or vessel. It is the responsibility of the user to ensure that the sampling point is located so as to obtain a representative sample.

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

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

1.5 *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 This practice is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.H0](#) on Liquefied Petroleum Gas.

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1.6 *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:²

[D1265](#) Practice for Sampling Liquefied Petroleum (LP) Gases, Manual Method

[D1835](#) Specification for Liquefied Petroleum (LP) Gases

[D4175](#) Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

[D8009](#) Practice for Manual Piston Cylinder Sampling for Volatile Crude Oils, Condensates, and Liquid Petroleum Products

2.2 GPA Midstream Association Standards:³

[GPA 2140](#) Liquefied Petroleum Gas Specifications and Test Methods

[GPA 2174](#) Obtaining Liquid Hydrocarbon Samples for Analysis by Gas Chromatography

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this practice, refer to Terminology [D4175](#).

3.1.2 *floating piston cylinder (FPC)*, *n*—a high pressure sample container, with a free floating internal piston that effectively divides the container into two separate compartments.

3.1.2.1 *Discussion*—A floating piston cylinder is used to collect a sample of liquid under pressure without the formation of a gaseous phase which can result in changes in the composition of the liquid sample.

3.1.3 *maximum fill volume (reduced fill volume)*, *n*—the volume of a container that may be safely occupied by the liquid sample, usually expressed as a percentage of the total capacity.

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

³ Available from GPA Midstream Association, 6526 E. 60th St., Tulsa, OK 74145, www.gpaglobal.org

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

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

4. Summary of Practice

4.1 A liquid petroleum gas (LPG) sample is transferred as a liquid under pressure from a sample point to a floating piston cylinder. The floating piston cylinder (FPC) is designed to collect liquid samples with no vaporization by displacing a piston against a pressurizing fluid (preferably an inert gas). The piston serves as a physical barrier between the sample and the pressurizing fluid, at the sampling pressure. The position of the piston at the end of sampling indicates the percent fill of the sample cylinder.

4.2 It is the responsibility of the user of this practice to locate the sample point at a suitable location and orientation where the product being sampled is a representative, single phase, homogeneous liquid.

5. Significance and Use

5.1 This practice allows the collection of a representative sample of LPG that may contain trace volatile dissolved components such as methane, ethane, and nitrogen. Sampling by Practice D1265 can result in a small, but predictable, loss of these lighter components. Practice D1265 is suitable for collecting samples for routine specification testing, as the small loss of light components is not significant under Specification D1835 specification requirements. Practice D3700 is recommended whenever highly accurate determination of light components is required. For example, compositions determined on samples collected according to Practice D3700 may be used to establish the product value of NGL mixtures (see Appendix X1).

6. Interferences

6.1 An interference in a sampling procedure is anything which compromises the integrity of the sample.

6.2 Incorrect choice of a sample point location can result in a non-representative sample due to solid or liquid contaminants, two phases, storage tank stratification, and so forth.

6.3 Reactivity of steel surfaces can remove or chemically alter trace reactive components such as H₂S, COS, and mercaptan (see 6.9).

6.4 A lubricant used on the floating piston or other internal wetted parts that is soluble in LPG can contaminate the sample.

6.5 Pre-charge (inert) gas can leak into the sample due to worn or damaged piston seals or poor surface finish (see 8.1).

6.5.1 Consult the manufacturer’s guidelines for suitable procedures to verify a leak-free cylinder, such as pressure testing each side of the cylinder. It is also possible to analyze the sample for inert gas, or the inert gas for hydrocarbon, to detect leakage in either direction.

6.6 Failure to flush sample lines and *dead volumes* can result in contaminants in samples.

6.7 Sampling from stratified tanks, *dead zones* in flowing systems, or inappropriate time periods in composite sampling systems can result in non-representative samples.

6.8 Any material that can create carryover contamination from one sample to the next has to be removed from the cylinder and the cylinder shall be thoroughly cleaned. In addition to cleaning the interior metal surfaces and cleaning the soft parts (O-rings, for example), consideration should be given to replacing the soft parts if they might have absorbed any contamination. Examples of contaminants include glycol, amine, lubricants, sulfur species, solvents, methanol, etc.

6.9 Certain properties of interest can be affected by the material making up the sampling system and sample cylinder assembly. Two examples of analytes commonly associated with adsorption (and desorption) at lower concentrations (for example, <100 ppm by mass) are active sulfur compounds and water. Without the use of properly treated equipment, there is potential for lower response from analytes than actually present in the sample due to adsorption (or, in the case of desorption, higher response).

6.9.1 Adsorption and desorption can result from physical attraction or chemical attraction.⁴ Due to adsorption, tubing and cylinder components exposed to a sample may need surface treatment (that is, with an inert surface material) in order to collect a representative sample to be analyzed for the property of interest.

6.9.2 Surfaces that are rough can result in a larger surface area than expected. In order to reduce the surface area, the interior surface needs to be smooth (typically honed). Additionally, a surface treatment on the internal wall is needed to reduce the potential for polar molecules to adsorb. For stainless steel cylinders (which have a high potential for adsorption of polar molecules), this treatment may be achieved with amorphous silicon or other coating designed to reduce the potential for adsorption by the molecules of interest.

6.9.3 Samples to be tested for the presence of corrosive compounds or sulfur compounds should be taken in containers made inert to such compounds and equipped with valves compatible with chemical, pressure, and temperature requirements; otherwise, determinations of mercaptans and hydrogen sulfide, for example, can be misleading. Internal surfaces of sample containers, valves, and associated lines and fittings may be surface coated to reduce bare metal surfaces reacting with trace reactive components.

NOTE 2—Adsorption is not passivation. With adsorption, molecules are both adsorbing and desorbing. Since each individual action can occur at any time, there is potential for an analysis to see less or more of an analyte than actually present in the sample. Passivation is a permanent or long-term surface treatment that minimizes adsorption of polar compounds.

7. Apparatus

7.1 Floating Piston Cylinder (FPC):

7.1.1 *Construction*, typically fabricated from corrosion resistant 316 stainless steel, in accordance with the pressure

⁴ Waters, T., *Industrial Sampling Systems, Reliable Design & Maintenance for Process Analyzers*, Swagelok Company, 2013.