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Standard Test Method for Residues in Liquefied Petroleum (LP) Gases¹

This standard is issued under the fixed designation D2158; 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 test method covers the determination of extraneous materials weathering above ~~38°C~~ 38 °C that are present in liquefied petroleum gases. The extraneous materials will generally be dissolved in the LPG, but may have phase-separated in some instances.

1.2 Liquefied petroleum gases that contain certain anti-icing additives can give erroneous results by this test method.

1.3 Although this test method has been used to verify cleanliness and lack of heavy contaminants in propane for many years, it might not be sensitive enough to protect some equipment from operational problems or increased maintenance. A more sensitive test, able to detect lower levels of dissolved contaminants, could be required for some applications.

1.4 **WARNING**—Mercury has been designated by many regulatory agencies as a hazardous material that can cause central nervous system, kidney and liver damage. Mercury, or its vapor, may be hazardous to health and corrosive to materials. Caution should be taken when handling mercury and mercury containing products. See the applicable product Material Safety Data Sheet (MSDS) for details and EPA's website—<http://www.epa.gov/mercury/faq.htm>—for additional information. Users should be aware that selling mercury and/or mercury containing products into your state or country may be prohibited by law.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D96 Test Method for Water and Sediment in Crude Oil by Centrifuge Method \(Field Procedure\)](#) (Withdrawn 2000)³

[D1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method \(Laboratory Procedure\)](#) ~~-d2158-16~~

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

[E1137 Specification for ASTM Liquid-in-Glass Industrial Platinum Resistance Thermometers](#)

[E2251 Specification for Liquid-in-Glass ASTM Thermometers with Low-Hazard Precision Liquids](#)

[E2877 Guide for Digital Contact Thermometers](#)

2.2 *Energy Institute Document:*

[IP Test Methods – Appendix A. Specifications – IP standard thermometers](#)⁴

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *oil stain observation, n*—the volume of solvent-residue mixture required to yield an oil stain or ring that persists for ~~2 minutes~~ 2 min under specified conditions on absorbent paper.

3.1.2 *residue, n*—the volume, measured to the nearest ~~0.05 mL~~ 0.05 mL, of the residual material boiling above ~~38°C~~ 38 °C resulting from the evaporation of ~~100 mL~~ 100 mL of sample under the specified conditions of this test method.

¹ This test method is under the jurisdiction of ASTM Committee [D02](#) on Petroleum Products—Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee [D02.H0](#) on Liquefied Petroleum Gas.

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

³ The last approved version of this historical standard is referenced on www.astm.org.

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

3.1.3 *solvent-residue mixture, n*—a mixture (solution) of ~~10 mL~~ 10 mL of solvent with any residue remaining in the centrifuge tube at the conclusion of the first step in this test method.

4. Summary of Test Method

4.1 A ~~100 mL~~ 100 mL sample of liquefied petroleum gas is weathered in a ~~100 mL~~ 100 mL centrifuge tube. The volume of residue remaining after heating the tube to ~~38°C~~ 38 °C is measured and recorded.

4.2 To dissolve any residue, ~~10 mL~~ 10 mL of solvent is added to the centrifuge tube. Small, measured volumes of solvent-residue mixture are deposited on an absorbent paper in a specified manner. The appearance of the absorbent paper to which the residue solution has been added in measured increments is observed and recorded.

5. Significance and Use

5.1 Control over the residue content (required by Specification **D1835**) is of considerable importance in end-use applications of LPG. In liquid feed systems, residues can lead to troublesome deposits and, in vapor withdrawal systems, residues that are carried over can foul regulating equipment. Those that remain will accumulate, can be corrosive, and will contaminate following product. Water, particularly if alkaline, can cause failure of regulating equipment and corrosion of metals.

6. Interferences

6.1 Solid contaminants such as rust, scale or dirt can interfere with this test method, which is not intended for representative measurement of solid, undissolved contaminants.

7. Apparatus

7.1 *Centrifuge Tube*, ~~100 mL~~ 100 mL graduated, conforming to dimensions given in **Fig. 1**. The first ~~0.5 mL~~ 0.5 mL shall be graduated in ~~0.05 mL~~ 0.05 mL increments. The shape of the lower tip of the tube is especially important. The taper shall be uniform and the bottom shall be rounded as shown in **Fig. 1**. Tubes shall be made of thoroughly annealed heat-resistant glass. Volumetric graduation tolerances, based on air-free water at ~~20°C~~ 20 °C, are given in **Table 1**. Detailed requirements for centrifuge tubes appear in Test Methods **D96** and **D1796**.

7.2 *Cooling Coil and Cooling Bath*, a minimum length of ~~6 m~~ 6 m of ~~55 mm~~ 55 mm to ~~7 mm~~ 7 mm outside diameter copper tubing wound to a diameter of ~~63.5 mm~~ 63.5 mm \pm ~~1.5 mm~~ 1.5 mm outside diameter, and assembled in a suitable cooling bath. (See **Fig. 2** as an example.)

7.2.1 Mechanical refrigeration is permitted provided that the coolant temperature is below ~~-43°C~~ -43 °C. If dry ice is used, a non-glass dewar or vessel is recommended.

7.3 *Syringe*, ~~2 mL~~ 2 mL graduated in 0.1 mL and equipped with a needle ~~200 mm~~ 200 mm \pm ~~5 mm~~ 5 mm long. The needle may be either a sharp needle (ordinary medical syringe needle) or a safe, non-sharp syringe needle to avoid a puncture hazard. Alternatively, an equivalent liquid dispensing device capable of delivering ~~0.1 mL~~ 0.1 mL increments may be used, such as a ~~0.1 mL~~ 0.1 mL pipette or ~~0.1 mL~~ 0.1 mL pipet.

7.4 *Temperature Measuring Device*, that is intrinsically safe, with accuracy equal to or better than liquid-in-glass thermometer ASTM S5C described in Specification E4E2251 or IP, Guide E2877 Test Methods – Appendix A shall be used. Thermometers conforming to and Specification E4E1137 or IP Appendix A have been found to be satisfactory. may be useful for selecting a digital contact thermometer.

Low Range	-38°C to +50°C	IP-1G/ASTM-5G or IP-2G/ASTM-6G
High Range	-20°C to +50°C	ASTM-57G

7.4.1 For routine testing, a general purpose thermometer or a digital contact thermometer with 0.5 °C subdivisions or display resolution and a maximum error of 0.5 °C may be used.

NOTE 1—When a thermometer or a water bath, or both, are not available, for example when conducting a field test, a satisfactory alternative for screening purposes is to warm the tip of the centrifuge tube with the hand.

7.4.1 For routine testing, a general purpose thermometer with 0.5°C subdivisions and a maximum scale error of 0.5°C may be used.

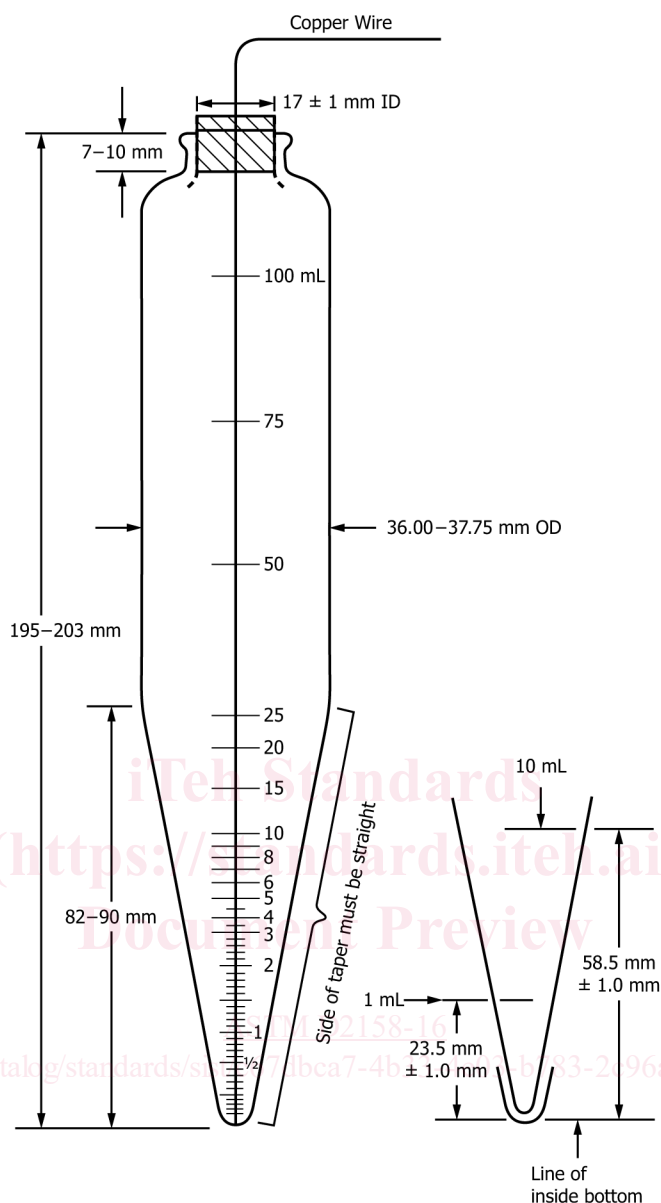
7.5 *Absorbent Paper*, white, at least ~~100 mm~~ 100 mm diameter. Medium grade or rapid filter paper has been found to be satisfactory. In this test method, the paper will be referred to as “filter paper.”

7.6 *Solvent Wash Bottle*, typically polyethylene.

7.7 *Water Bath*, controlled at ~~38°C~~ 38 °C \pm ~~2°C~~ 2 °C.

7.8 *Copper Wire*, ~~1 mm~~ 1 mm to ~~2 mm~~ 2 mm diameter, at least ~~10 mm~~ 10 mm longer than the centrifuge tube’s height.

7.9 *Clamp*, suitable for holding the centrifuge tube during weathering.



INSIDE TAPER SHAPE

FIG. 1 Cone-Shaped Centrifuge Tube, 203-mm²⁰³ mm

TABLE 1 Centrifuge Tube Graduation Tolerances

Range, mL	Scale, Division, mL	Limit of Error, mL
0.0 to 0.1	0.05	0.02
0.1 to 0.3	0.05	0.03
0.3 to 0.5	0.05	0.05
0.5 to 1.0	0.1	0.05
1.0 to 3.0	0.1	0.1
3.0 to 5.0	0.5	0.2
5.0 to 25.0	1.0	0.5
25.0 to 100.0	1.0	1.0

8. Reagents and Materials

8.1 *Solvent*—HPLC-grade pentane or cyclopentane. Another grade of solvent may be used provided that it meets the requirements of 10.2.