



## Standard Specification for Liquefied Petroleum (LP) Gases<sup>1</sup>

This standard is issued under the fixed designation D 1835; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification covers those products commonly referred to as liquefied petroleum gases, consisting of propane, propene (propylene), butane, and mixtures of these materials. Four basic types of liquefied petroleum gases are provided to cover the common use applications.

1.2 This specification is applicable to products intended for use as domestic, commercial and industrial heating, and engine fuels.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *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:

- D 1265 Practice for Sampling Liquefied Petroleum (LP) Gases (Manual Method)<sup>2</sup>
- D 1267 Test Method for Gage Vapor Pressure of Liquefied Petroleum (LP) Gases (LP-Gas Method)<sup>2</sup>
- D 1657 Test Method for Density or Relative Density of Light Hydrocarbons by Pressure Thermohydrometer<sup>2</sup>
- D 1837 Test Method for Volatility of Liquefied Petroleum (LP) Gases<sup>2</sup>
- D 1838 Test Method for Copper Strip Corrosion by Liquefied Petroleum (LP) Gases<sup>2</sup>
- D 2158 Test Method for Residues in Liquefied Petroleum (LP) Gases<sup>2</sup>
- D 2163 Test Method for Analysis of Liquefied Petroleum (LP) Gases and Propene Concentrates by Gas Chromatography<sup>2</sup>
- D 2420 Test Method for Hydrogen Sulfide in Liquefied Petroleum (LP) Gases (Lead Acetate Method)<sup>2</sup>

D 2598 Practice for Calculation of Certain Physical Properties of Liquefied Petroleum (LP) Gases from Compositional Analysis<sup>2</sup>

D 2713 Test Method for Dryness of Propane (Valve Freeze Method)<sup>2</sup>

D 2784 Test Method for Sulfur in Liquefied Petroleum Gases (Oxy-Hydrogen Burner or Lamp)<sup>2</sup>

D 3700 Practice for Obtaining LPG Samples Using a Floating Piston Cylinder<sup>3</sup>

#### 2.2 Other Document:

GPA Standard 2140<sup>4</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 *commercial butane*—a hydrocarbon product for use where low volatility is required.

3.1.2 *commercial PB mixtures*—mixtures of propane and butane for use where intermediate volatility is required.

3.1.3 *commercial propane*—a hydrocarbon product for use where high volatility is required. Commercial propane is suitable for certain low severity internal combustion engine applications.

3.1.4 *special-duty propane*—a high-quality product composed chiefly of propane, which exhibits superior antiknock characteristics when used as an internal combustion engine fuel.

### 4. Sampling

4.1 Proper sampling of liquefied gases is extremely important if the test results are to be significant. Obtain representative samples in accordance with Practice D 1265 or Practice D 3700.

### 5. Detailed Requirements

5.1 The four types of liquefied petroleum gases shall conform to the requirements prescribed in Table 1.

### 6. Keywords

6.1 butane; HD-5 propane; liquefied petroleum (LP) gases specifications; propane

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 05.02.

<sup>4</sup> Available from Gas Processors Assn., 6526 E. 60th St., Tulsa, OK 74145. www.gasprocessors.com

**TABLE 1 Detailed Requirements for Liquefied Petroleum Gases**

	Product Type				ASTM Test Methods (see Section 2)
	Commercial Propane	Commercial Butane	Commercial PB Mixtures	Special-Duty Propane <sup>A</sup>	
Vapor pressure at 37.8°C (100°F), max, kPa	1434	483	<sup>B</sup>	1434	D 1267 or D 2598 <sup>C</sup>
psig	208	70	<sup>B</sup>	208	D 1267 or D 2598 <sup>C</sup>
Volatile residue:					
evaporated temperature, 95 %, max, °C	-38.3	2.2	2.2	-38.3	D 1837
°F	-37	36	36	-37	
or					
butane and heavier, max, vol %	2.5	...	...	2.5	D 2163
pentane and heavier, max, vol %	...	2.0	2.0	...	D 2163
Propylene content, max, vol %	...	...	...	5.0	D 2163
Residual matter:					
residue on evaporation 100 mL, max, mL	0.05	0.05	0.05	0.05	D 2158
oil stain observation	pass <sup>D</sup>	pass <sup>D</sup>	pass <sup>D</sup>	pass <sup>D</sup>	D 2158
Relative density at 15.6/15.6°C (60/60°F)	<sup>E</sup>	<sup>E</sup>	<sup>E</sup>	...	D 1657 or D 2598
Corrosion, copper, strip	No. 1	No. 1	No. 1	No. 1	D 1838 <sup>F</sup>
Sulfur, ppmw	185 <sup>G</sup>	140 <sup>G</sup>	140 <sup>G</sup>	123 <sup>G</sup>	D 2784
Hydrogen sulfide	pass	pass	pass	pass	D 2420
Moisture content	pass <sup>H</sup>	...	...	pass <sup>H</sup>	D 2713
Free water content	...	none <sup>I</sup>	none <sup>I</sup>	...	

<sup>A</sup> Equivalent to Propane HD-5 of GPA Standard 2140.

<sup>B</sup> The permissible vapor pressures of products classified as PB mixtures shall not exceed 208 psig (1430 kPa) and additionally shall not exceed that calculated from the following relationship between the observed vapor pressure and the observed relative density:

$$\text{Vapor pressure, max} = 1167 - 1880 (\text{relative density at } 60/60^\circ\text{F}) \text{ or } 1167 - 1880 (\text{relative density at } 15.6/15.6^\circ\text{C})$$

A specific mixture shall be designated by the vapor pressure at 100°F in pounds per square inch gage. To comply with the designation, the vapor pressure of the mixture shall be within +0 to -10 psi of the vapor pressure specified.

<sup>C</sup> In case of dispute about the vapor pressure of a product, the value actually determined by Test Method D 1267 shall prevail over the value calculated by Practice D 2598.

<sup>D</sup> An acceptable product shall not yield a persistent oil ring when 0.3 mL of solvent residue mixture is added to a filter paper, in 0.1-mL increments and examined in daylight after 2 min as described in Test Method D 2158.

<sup>E</sup> Although not a specific requirement, the relative density must be determined for other purposes and should be reported. Additionally, the relative density of PB mixture is needed to establish the permissible maximum vapor pressure (see Footnote B).

<sup>F</sup> This method may not accurately determine the presence of reactive materials (for example, H<sub>2</sub>S, S<sup>o</sup>) in liquefied petroleum gas if the product contains corrosion inhibitors or other chemicals which diminish the reaction with the copper strip.

<sup>G</sup> The total sulfur limits in these specifications *do include* sulfur compounds used for stenching purposes.

<sup>H</sup> Commercial propane and Special duty propane should be produced to comply with the moisture content requirement, and de-icer additives should not routinely be used to pass dryness test requirements. That is, these products must be so dry that they are sub-saturated with water at most ambient temperatures. They should be maintained dry during storage and distribution. A de-icer such as methyl alcohol (methanol) should not be added to these products without specific agreement and approval of the purchaser. During short-term upsets in production, or inadvertent contamination by trace water during storage or distribution, addition of 50 ppm methyl alcohol has proven to be acceptable to prevent valve freezing in normal applications. For guidance, based on historical experience and phase separation data, the maximum cumulative addition of methyl alcohol should not exceed 200 ppm by volume.

<sup>I</sup> The presence or absence of water shall be determined by visual inspection of the samples on which the relative density is determined.

## APPENDIX

### (Nonmandatory Information)

#### X1. SIGNIFICANCE OF ASTM SPECIFICATIONS FOR LIQUEFIED PETROLEUM (LP) GASES

##### X1.1 General

X1.1.1 Liquefied petroleum gas products are composed of those readily liquefiable hydrocarbon compounds that are produced in the course of processing natural gas and also in the course of the conventional refining of crude oil. The composition of liquefied gases can vary widely depending upon the source and the nature of the treatment to which the products have been subjected.

X1.1.2 There are many uses for liquefied petroleum gases. Important uses include, (1) as domestic, commercial, and industrial fuels, (2) as a carbon source material in metal

treating operations, (3) as refinery raw materials for synthesis of gasoline components, and (4) as petrochemical raw materials. The nature of the needs dictates the required composition characteristics in these various applications. Since the last three uses of those listed are in the category of specialty applications, which involve special requirements, they are excluded from consideration in the specifications.

X1.1.3 In substance, this specification is designed to properly define acceptable products for domestic, commercial, and industrial uses. In many cases it will be found that products meeting the specifications will also be usable in applications