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Standard Specification for Liquefied Petroleum (LP) Gases¹

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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 standard. The values given in parentheses are provided 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:²

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

[D1267 Test Method for Gage Vapor Pressure of Liquefied Petroleum \(LP\) Gases \(LP-Gas Method\)](#)

[D1657 Test Method for Density or Relative Density of Light Hydrocarbons by Pressure Hydrometer](#)

[D1837 Test Method for Volatility of Liquefied Petroleum \(LP\) Gases](#)

[D1838 Test Method for Copper Strip Corrosion by Liquefied Petroleum \(LP\) Gases](#)

[D2158 Test Method for Residues in Liquefied Petroleum \(LP\) Gases](#)

[D2163 Test Method for Analysis of Liquefied Petroleum \(LP\) Gases and Propene Concentrates by Gas Chromatography](#)

[D2420 Test Method for Hydrogen Sulfide in Liquefied Petroleum \(LP\) Gases \(Lead Acetate Method\)](#)

[D2598 Practice for Calculation of Certain Physical Properties of Liquefied Petroleum \(LP\) Gases from Compositional Analysis](#)

[D2713 Test Method for Dryness of Propane \(Valve Freeze Method\)](#)

[D2784 Test Method for Sulfur in Liquefied Petroleum Gases \(Oxy-Hydrogen Burner or Lamp\)](#)

[D3700 Practice for Obtaining LPG Samples Using a Floating Piston Cylinder](#)

[D5504 Test Method for Determination of Sulfur Compounds in Natural Gas and Gaseous Fuels by Gas Chromatography and Chemiluminescence](#)

[D5623 Test Method for Sulfur Compounds in Light Petroleum Liquids by Gas Chromatography and Sulfur Selective Detection](#)

[D6667 Test Method for Determination of Total Volatile Sulfur in Gaseous Hydrocarbons and Liquefied Petroleum Gases by Ultraviolet Fluorescence](#)

[D6897 Test Method for Vapor Pressure of Liquefied Petroleum Gases \(LPG\) \(Expansion Method\)](#)

[D7756 Test Method for Residues in Liquefied Petroleum \(LP\) Gases by Gas Chromatography with Liquid, On-Column Injection](#)

2.2 Gas Processors Association Standard:³

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

¹ This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products 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 Available from Gas Processors Association, 6526 E. 60th St., Tulsa, OK 74145. www.gasprocessors.com

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

3. Terminology

3.1 Definitions:

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

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

3.1.3 *commercial propane, n*—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, n*—a product composed chiefly of propane which exhibits superior antiknock characteristics and was specifically developed for use as fuel in spark ignition internal combustion engines.

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 ^A	
Vapor pressure at 37.8°C (100°F), max kPa	1434	483	^B	1434	D1267 or D2598 or D6897 ^C
psig	208	70	^B	208	D1267 or D2598 or D6897 ^C
Volatile residue:					
evaporated temperature, 95 %, max °C	−38.3	2.2	2.2	−38.3	
°F	−37	36	36	−37	D1837
or					
Butane and heavier, max, vol %	2.5	...	...	2.5	D2163
Pentane and heavier, max, vol %	...	2.0	2.0	...	D2163
Propylene content, max, vol %	...	...	...	5.0	D2163
Residual matter: ^D					
Residue on evaporation of 100 mL, max, mL	0.05	0.05	0.05	0.05	D2158
Oil stain observation	pass ^E	pass ^E	pass ^E	pass ^E	D2158
Density at 15°C or relative density at 15.6/15.6°C (60/60°F)	^F	^F	^F	...	D1657 or D2598
Corrosion, copper, strip	No. 1	No. 1	No. 1	No. 1	D1838 ^G
Sulfur, mg/kg (ppm mass)	185 ^H	140 ^H	140 ^H	123 ^H	D2784 or D6667 ^I
Hydrogen sulfide	pass	pass	pass	pass	D2420
Moisture content	pass	...	...	pass	D2713
Free water content	...	none ^J	none ^J	...	...

^A Equivalent to Propane HD-5 of GPA Standard 2140.

^B The permissible vapor pressures of products classified as PB mixtures shall not exceed 1430 kPa (208 psig) 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.

^C In case of dispute about the vapor pressure of a product, the value actually determined by Test Method D1267 shall prevail over the value calculated by Practice D2598 or measured by Test Method D6897.

^D See X1.2.3+X1.2.4 for information about residues in LPG and for information about a gas chromatographic test for residues in LPG.

^E 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 D2158.

^F Although not a specific requirement, the density or relative density can be needed 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).

^G This method may not accurately determine the presence of reactive materials (for example, H₂S, S^o) in liquefied petroleum gas if the product contains corrosion inhibitors or other chemicals which diminish the reaction with the copper strip.

^H The total sulfur limits in these specifications do include sulfur compounds used for stenching purposes.

^I Test Method D6667 may be used as an alternative means of sulfur measurement for LPG samples within the range that has been validated in Test Method D6667.

^J The presence or absence of water shall may be determined by visual inspection of the samples on which the density or relative density is determined.

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 D1265 or Practice D3700. In the event of a dispute involving sample integrity when sampling for testing against D1835 requirements, Practice D3700 shall be used as the referee sampling procedure.

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; LPG; propane; special duty propane

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 other than the ones for which they were designed. The following can be accepted as a general guide in the more common use applications of the four types of fuels:

X1.1.3.1 *Commercial Propane*—This fuel type is adequate for domestic, commercial, and industrial use, particularly in geographical areas and in seasons where low ambient temperatures are common, and where uniformity of fuel is an important consideration. Commercial propane can be suitable for certain low severity internal combustion engine applications.

X1.1.3.2 *Commercial PB Mixtures*—This fuel type, since it covers a broad range of mixtures, permits the tailoring of fuels to specific needs. The various mixtures find application as domestic, commercial, and industrial fuel in areas and at times when low ambient temperature conditions are not encountered. This fuel type is not suitable for vapor withdrawal applications in cool or cold climates.

X1.1.3.3 *Commercial Butane*—This fuel type finds limited application as a domestic fuel in areas of warmer climates. It is similarly used in industrial applications where problems of fuel vaporization are not present, such as direct liquid injection.

X1.1.3.4 *Special-Duty Propane*—This fuel type, equivalent to HD-5 propane, is a product tailored to meet the restrictive needs of internal combustion engines operating under moderate to high engine severity (that is, normal automotive applications). Fuel products of this type will be less variable in composition and combustion characteristics than the other products covered by this specification. Special-Duty Propane can be used as a substitute for Commercial Propane.

X1.2 Significance and Use

X1.2.1 This specification addresses commercial liquefied petroleum gases consisting of either propane or butane or mixtures thereof. Consequently, the important characteristics of these products can be defined and controlled by a relatively few simple measurements. The specification test methods provided achieve the desired results. The significance of the various tests as they can apply to consumer problems is summarized here.

X1.2.2 *Vapor Pressure, Volatility, and [Relative] Density:*