

This document is not an ASTM standard and is intended only to provide the user of an ASTM standard an indication of what changes have been made to the previous version. Because it may not be technically possible to adequately depict all changes accurately, ASTM recommends that users consult prior editions as appropriate. In all cases only the current version of the standard as published by ASTM is to be considered the official document.



---

**Designation: D 2598 – 96 (Reapproved 2001)**



# Standard Practice for Calculation of Certain Physical Properties of Liquefied Petroleum (LP) Gases from Compositional Analysis<sup>1</sup>

This standard is issued under the fixed designation D 2598; 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.

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.H on Liquefied Petroleum Gas.

Current edition approved Nov. April 10, 1996; 2002. Published January 1997; June 2002. Originally published as D 2598 – 67. Last previous edition D 2598 – 96 (2001).

## 1. Scope

1.1 This practice covers, by compositional analysis, the approximate determination of the following physical characteristics of commercial propane and special-duty propane (covered by Specification D 1835): vapor pressure, relative density, and motor octane number (MON).

1.2 This practice is not applicable to any product exceeding specifications for nonvolatile residues. (See Test Method D 2158.)

1.3 For calculating motor octane number, this practice is applicable only to mixtures containing 20 % or less of propene.

1.4 For calculated motor octane number in method, this practice is based on mixtures containing only components shown in Table 1.

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

## 2. Referenced Documents

### 2.1 ASTM Standards:

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 Liquid Hydrocarbons by Pressure Thermohydrometer<sup>2</sup>

D 1835 Specification for 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 Propane Concentrates by Gas Chromatography<sup>2</sup>

D 2421 Practice for Interconversion of Analysis of C<sub>5</sub> and Lighter Hydrocarbons to Gas-Volume, Liquid-Volume, or Weight Basis<sup>2</sup>

## 3. Summary of Practice

3.1 The composition of a sample of LP-gas is obtained by using Test Method D 2163 or other acceptable method. From the

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

TABLE 1 Factors for Determining the Physical Characteristics of LP-Gases<sup>A</sup>

Component	Vapor Pressure Blend Factor, kPa (psig) at 37.8°C (100°F)	Relative Density at 15.6°C (60°F)	MON Blend Value
Ethane	4826 (700)	0.35618	...
Ethane	17547 (2545)	0.3	...
Ethane	4213 (611)	0.35639	100.7
Propane	1200 (174)	0.50699	-97.4
Propane	1200 (174)	0.50736	97.1
Propene	1469 (213)	0.52095	-84.9
Propene	1469 (213)	0.52264	84.9
n-Butane	255 (37)	0.58404	-89.6
n-Butane	255 (37)	0.58407	89.6
i-Butane	400 (58)	0.56287	-97.6
i-Butane	400 (58)	0.56293	97.6

<sup>A</sup> Constants for vapor pressure and motor octanes are empirical values to be used only in the calculation procedures described in this test method.

analysis (expressed in liquid volume percent), the vapor pressure, relative density, and motor octane number of the sample may be determined.

3.2 Conversion of a compositional analysis from mole, gas-volume, or weight basis to liquid-volume is obtained by using **Test Method Practice D 2421** or other suitable method.

#### 4. Significance and Use

4.1 Vapor pressure is an important specification property of commercial propane and special duty propane that assures adequate vaporization, safety, and compatibility with commercial appliances. Relative density, while not a specification criterion, is necessary for determination of filling densities and custody transfer. The motor octane number (MON) is useful in determining the products' suitability as a fuel for internal combustion engines.

#### 5. Calculation

5.1 *Calculated LP-Gas Vapor Pressure* (see Test Method D 1267):

5.1.1 Calculate the partial gage vapor pressure due to each component in the mixture as follows:

$$\text{Partial gage vapor pressure} = (vp' \times C)/100 \quad (1)$$

where:

$vp'$  = vapor pressure factor of specific component at 37.8°C (100°F) (see Table 1), and

$C$  = liquid volume percent of component in the mixture.

5.1.2 Add the partial gage vapor pressures due to all components, rounding to the nearest 7kPa (1psi). The total is reported as the LP-gas vapor pressure of the sample, kPa gage at 37.8°C (100°F).

5.2 *Calculated Relative Density* (see Test Method D 1657):

5.2.1 Calculate the relative mass of each component in the mixture as follows:

$$\text{Relative mass of component} = (sg' \times C)/100 \quad (2)$$

where:

$sg'$  = relative density of the pure component at 15.6°C (60°F) (see Table 1), and

$C$  = liquid volume percent of component in the mixture.

5.2.2 Add the relative mass of all components, rounding the total to three decimal places. The total is reported as the relative density of the mixture.

5.3 *Calculated Motor Octane Number* (see ASTM Data Series DS 4B, Physical Constants of Hydrocarbons and Nonhydrocarbon Compounds).<sup>3</sup>

5.3.1 Calculate the partial motor octane number of each component in the mixture to the nearest 0.1 MON as follows:

$$\text{Partial motor octane number of component} = (m \times C)/100 \quad (3)$$

where:

$m$  = motor octane number of component (see Table 1), and

$C$  = liquid volume percent of component in mixture.

5.3.2 Add the partial motor octane numbers of all components and round the total to the nearest one-half number. The total is reported as the calculated motor octane number of the mixture.

#### 6. Keywords

6.1 liquified petroleum gases; motor octane; relative density; vapor pressure

<sup>3</sup> Available from ASTM International Headquarters.

*ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.*

*This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.*

*This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org).*