



SLOVENSKI STANDARD SIST EN ISO 8973:1999

01-november-1999

Utekočinjeni naftni plini – Računska metoda za gostoto in parni tlak (ISO 8973:1997)

Liquefied petroleum gases - Calculation method for density and vapour pressure (ISO 8973:1997)

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Gaz de pétrole liquéfiés - Méthode de calcul de masse volumique et de la pression de vapeur (ISO 8973:1997)

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75.160.30 Plinska goriva Gaseous fuels

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN ISO 8973

March 1999

ICS 75.160.30

English version

Liquefied petroleum gases - Calculation method for density and vapour pressure (ISO 8973:1997)

Gaz de pétrole liquéfiés - Méthode de calcul de masse volumique et de la pression de vapeur (ISO 8973:1997)

This European Standard was approved by CEN on 18 February 1999.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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Foreword

The text of the International Standard from Technical Committee ISO/TC 28 "Petroleum products and lubricants" of the International Organization for Standardization (ISO) has been taken over as an European Standard by Technical Committee CEN/TC 19 "Petroleum products, lubricants and related products", the secretariat of which is held by NNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 1999, and conflicting national standards shall be withdrawn at the latest by September 1999.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of the International Standard ISO 8973:1997 has been approved by CEN as a European Standard without any modification.

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INTERNATIONAL STANDARD

**ISO
8973**

First edition
1997-07-15

Liquefied petroleum gases — Calculation method for density and vapour pressure

*Gaz de pétrole liquéfiés — Méthode de calcul de la masse volumique et de
la pression de vapeur*

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Reference number
ISO 8973:1997(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 8973 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

Annex A forms an integral part of this International Standard. Annex B is for information only.

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International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
X.400 c=ch; a=400net; p=iso; o=isocs; s=central

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Liquefied petroleum gases — Calculation method for density and vapour pressure

1 Scope

This International Standard describes a simplified method for the calculation of density and vapour pressure of liquefied petroleum gases (LPG) based on compositional data and density and vapour pressure factors for individual LPG components. A list of factors is provided in this International Standard. This method is intended for application in specifications of product quality and is not intended for application to quantity measurement in custody transfer (see ISO 6578).

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2 Normative references (standards.iteh.ai)

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 6578:1991, *Refrigerated hydrocarbon liquids — Static measurement — Calculation procedure*.

ISO 7941:1988, *Commercial propane and butane — Analysis by gas chromatography*.

3 Definitions

For the purpose of this International Standard the following definitions apply.

3.1 liquefied petroleum gas (LPG): Hydrocarbon gas that can be stored and/or handled in the liquid phase under moderate conditions of pressure and at ambient temperature. It consists essentially of C₃ and C₄ alkanes or alkenes, or a mixture of these, contains generally less than 5 % by liquid volume of material of higher carbon number, and has a gauge vapour pressure not exceeding approximately 1 600 kPa at 40 °C.

3.2 density factor: Density, expressed in kilograms per cubic metre, of a component in the liquid phase under its own vapour pressure at a temperature of 15 °C.

3.3 vapour pressure: Vapour pressure, expressed in kilopascals on an absolute basis, i.e. the gauge pressure plus local ambient pressure.

3.4 vapour pressure factor: Absolute vapour pressure, expressed in kilopascals, of a component of the liquid at temperature of 37,8 °C, 40 °C, 50 °C or 70 °C.

4 Principle

The molar composition of the LPG is determined by gas chromatography in accordance with ISO 7941. This analysis is used to calculate the liquid density and vapour pressure by using, for each component, the liquid density and vapour pressure factors provided in this International Standard.

5 Procedure

Determine the molar composition in accordance with ISO 7941.

6 Calculation

6.1 Use the LPG component relative molecular mass, density and pressure factors given in table A.1 in the equations shown below.

6.2 Density

6.2.1 Calculate the mass fraction, W , of each component of the mixture as follows:

$$W_i = \frac{X_i M_i}{\sum_1^n X_i M_i}$$

where

i is the number of the specific component;

n is the total number of components;

W_i is the mass fraction of component i in the mixture;

X_i is the mole fraction of component i in the mixture;

M_i is the relative molecular mass of component i in the mixture;

$\sum_1^n X_i M_i$ is the sum of the products of X and M for each component.

6.2.2 Calculate the density of the LPG, ρ , in kilograms per cubic metre at 15 °C, as follows:

$$\rho = \frac{1}{\sum_1^n \frac{W_i}{\rho_i}}$$

where

ρ_i is the density factor of component i in the mixture, expressed in kilograms per cubic metre at 15 °C;

$\sum_1^n \frac{W_i}{\rho_i}$ is the sum of $\frac{W_i}{\rho_i}$ for each component in the mixture.

6.3 Vapour pressure

6.3.1 Calculate the partial vapour pressure, p_{vp} , due to each component of the mixture as follows:

$$p_{vp,i} = X_i p_{v,i}$$

where

$p_{vp,i}$ is the partial absolute vapour pressure of component i in the mixture, expressed in kilopascals at 37,8 °C, 40 °C, 50 °C or 70 °C;

X_i is the mole fraction of component i in the mixture;

$p_{v,i}$ is the vapour pressure factor of component i in the mixture, expressed in kilopascals at 37,8 °C, 40 °C, 50 °C or 70 °C.

6.3.2 Calculate the absolute vapour of the LPG, p_v , in kilopascals at 37,8 °C, 40 °C, 50 °C or 70 °C, as follows:

$$p_v = \sum_{i=1}^n p_{vp,i}$$

where $\sum_{i=1}^n p_{vp,i}$ is the sum of the $p_{vp,i}$ due to each component in the mixture.

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6.3.3 Calculate the gauge vapour pressure, p_{ve} , as follows:
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$$p_{ve} = p_v - \text{local atmospheric pressure (101,325 kPa)}$$

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7 Expression of results

Report the calculated density to the nearest 0,1 kg/m³ and the calculated vapour pressure to the nearest 1 kPa.

8 Precision

The precision of this method is dependent on the precision of the original gas chromatography determination of the LPG composition and the accuracy of the factors which are entered into the calculation.

9 Test report

The test report shall contain at least the following information:

- a) reference to this International Standard;
- b) the type and complete identification of the product tested;
- c) the result of the test (see clause 7);
- d) any deviation, by agreement or otherwise, from the procedure specified;
- e) the date of the test.