



# SLOVENSKI STANDARD

## SIST EN ISO 3993:1998

01-maj-1998

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### Utekočinjeni naftni plin in lahki ogljikovodiki - Določanje gostote ali relativne gostote - Metoda z areometrom pod tlakom (ISO 3993:1984)

Liquefied petroleum gas and light hydrocarbons - Determination of density or relative density - Pressure hydrometer method (ISO 3993:1984)

Flüssiggas und leichte Kohlenwasserstoffe - Bestimmung der Dichte oder der relativen Dichte - Verfahren mittels Druck-Areometer (ISO 3993:1984)

Gaz de pétrole liquéfiés et hydrocarbures légers - Détermination de la masse volumique ou de la densité relative - Méthode de l'aréometre sous pression (ISO 3993:1984)

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Ta slovenski standard je istoveten z: EN ISO 3993:1995

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#### ICS:

75.160.30 Plinska goriva Gaseous fuels

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EUROPEAN STANDARD

EN ISO 3993

NORME EUROPÉENNE

EUROPÄISCHE NORM

August 1995

ICS 75.200

Descriptors: petroleum products, liquefied petroleum gases, hydrocarbons, tests, physical tests, determination, density(mass/volume), hydrometers, test equipment

English version

**Liquefied petroleum gas and light hydrocarbons -  
Determination of density or relative density -  
Pressure hydrometer method (ISO 3993:1984)**

Gaz de pétrole liquéfiés et hydrocarbures légers - Détermination de la masse volumique ou de la densité relative - Méthode de l'aréomètre sous pression (ISO 3993:1984)

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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.

The European Standards exist 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, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

# CEN

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 ISO/TC 28 "Petroleum products and lubricants" of the International Organization for Standardization (ISO) has been taken over as a European Standard by the Technical Committee CEN/TC 19 "Petroleum products, lubricants and related products".

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 February 1996, and conflicting national standards shall be withdrawn at the latest by February 1996.

According to CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, 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 3993:1984 has been approved by CEN as a European Standard without any modification.

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# International Standard



# 3993

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## Liquefied petroleum gas and light hydrocarbons — Determination of density or relative density — Pressure hydrometer method

*Gaz de pétrole liquéfiés et hydrocarbures légers — Détermination de la masse volumique ou de la densité relative — Méthode de l'aréomètre sous pression*

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UDC 665.725 : 531.754.3

Ref. No. ISO 3993-1984 (E)

**Descriptors** : petroleum products, liquefied petroleum gases, hydrocarbons, tests, physical tests, determination, density (mass/volume), hydrometers, test equipment.

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been authorized 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 3993 was developed by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, and was circulated to the member bodies in March 1983.

It has been approved by the member bodies of the following countries:

Austria	Iran	Sri Lanka
Australia	Iraq	Sweden
Belgium	Israel	Switzerland
Brazil	Italy	Turkey
Canada	Japan	United Kingdom
China	Netherlands	USA
Egypt, Arab Rep. of	Norway	USSR
Germany, F. R.	Peru	Venezuela
Hungary	Romania	
India	South Africa, Rep. of	

The member body of the following country expressed disapproval of the document on technical grounds :

France

# Liquefied petroleum gas and light hydrocarbons — Determination of density or relative density — Pressure hydrometer method

## 1 Scope and field of application

1.1 This International Standard specifies a method for the determination of density or relative density of liquefied petroleum gases and other light hydrocarbons. The prescribed apparatus shall not be used for materials having gauge vapour pressures higher than 1,4 MPa<sup>1)</sup> (14 bar) (absolute vapour pressure 1,5 MPa) at the test temperature.

**CAUTION — Attention is drawn to the hazards encountered when working with liquefied petroleum gas or light hydrocarbons. The requirements of any national, local or domestic safety code should always be strictly observed.**

1.2 Alternative calibration procedures are described, but only the one using a certified hydrometer is suitable for the determination of density to be used in calculations of quantities for custody transfer or fiscal purposes.

NOTE — An alternative method for calculating the density of liquefied petroleum gases from gas chromatographic analysis is described in ISO 6578<sup>2)</sup>.

1.3 Provision is made in the annex for the use of thermohydrometers.

## 2 Definitions

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

2.1 **density** : The mass of the liquid divided by its volume.

When reporting the density, the unit of density used, together with the temperature, shall be explicitly stated, for example kilogram per metre cubed or gram per millilitre at  $t$  °C (see the note). The standard reference temperature for international trade in petroleum and its products is 15 °C (see ISO 5024); but other reference temperatures may be required for legal metrology or other special purposes.

NOTE — In this International Standard, the preferred unit is the kilogram per metre cubed, but provision is also made for the use of the gram per millilitre.

2.2 **relative density** (this term now replaces the former term specific gravity) : The ratio of the mass of a volume of the liquid at a temperature  $t_1$  to the mass of an equal volume of pure water at a temperature  $t_2$ , i.e. the ratio of the density of the liquid at a temperature  $t_1$  to the density of pure water at a temperature  $t_2$ .

When reporting the relative density, the temperatures  $t_1$  and  $t_2$  shall be explicitly stated, for example relative density 60/60 °F. The standard reference temperature is 15 °C, but 20 °C and 60 °F are also in general use for  $t_1$  and  $t_2$  and other temperatures may be employed for  $t_1$ .

## 3 Principle

The apparatus is purged with a portion of the sample before filling with the portion to be used for testing. The pressure cylinder is filled to a level at which the enclosed hydrometer floats freely. The hydrometer reading and the temperature of the sample are noted.

1) The SI unit of pressure is the pascal : 1 Pa = 1 N/m<sup>2</sup>; 10<sup>5</sup> Pa = 1 bar = 1,019 72 kgf/cm<sup>2</sup>

2) At present at the stage of draft.

## ISO 3993-1984 (E)

## 4 Apparatus

**4.1 Hydrometers**, made of glass, graduated in density or relative density, with the appropriate range and conforming to the dimensions given in table 1.

NOTE — For the use of thermohydrometers see the annex.

Use a certified hydrometer, or calibrate the hydrometers in accordance with clause 7. Calibration corrections should be applied if the scale errors are in excess of 0,5 of a subdivision of the scale.

**4.2 Thermometer**, having a sensitivity of at least 2,7 mm/1 °C (1,5 mm/1 °F) calibrated for total immersion and of suitable dimensions to fit inside the hydrometer cylinder (4.3).

A thermometer conforming to ISO/R 653, STL/0.2/ – 15/ + 45 is recommended.

The thermometer shall be held firmly inside the hydrometer cylinder by means of a suitable clip in such a position as not to interfere with the free motion of the hydrometer.

**4.3 Hydrometer cylinder**, constructed of glass or transparent plastics, for example polymethylmethacrylate or equivalent material, conforming to the design and dimensions given in the figure. The ends shall be tightly sealed by means of chloroprene gaskets and metal end-plates as shown.

**CAUTION — As a precautionary measure a protective shield shall be placed around the plastics or glass cylinder. Replace any cylinders that show any fogging, crazing, cracking, or etching.**

NOTE — Certain compounds attack plastics and cloud the inner surface of the cylinder, making it difficult or impossible to read the hydrometer. Tests have shown no attack by ethane, ethylene, propane, propylene, butane, isobutane, normal butylenes, isobutylene, pentane and isopentane and no attack is expected from butadiene.

Users are cautioned, however, always to clean the cylinder thoroughly after each determination. Ketones and alcohols must not be used for cleaning as they attack and weaken plastics whilst aromatics also tend to attack the surface of plastics and should similarly not be used.

The liquid inlet valve and the liquid outlet valve shall be tightly connected to a base plate which shall be so bored as to give both valves a common inlet to the cylinder. The vapour vent valve shall be similarly connected to the top plate. All valves shall be 6 mm or equivalent needle valves.

**The cylinder shall not be operated at a gauge pressure greater than 1,4 MPa (14 bar).**

**4.4 Water bath**, fitted with a thermostat or other means of maintaining the bath at a constant temperature of  $15 \pm 0,2$  °C or  $20 \pm 0,2$  °C or  $60 \pm 0,5$  °F, and of such dimensions that the hydrometer cylinder (4.3) can be completely immersed.

## 5 Reference liquids

The following reference liquids are required for calibration of the hydrometer if a certified hydrometer is not available.

**5.1 Pure propane**, having a certified density or relative density.

NOTE — Propane of density 507,6 kg/m<sup>3</sup> (0,507 6 g/ml) at 15 °C or 500,0 kg/m<sup>3</sup> (0,500 0 g/ml) at 20 °C or a relative density 60/60 °F of 0,507 3 is suitable.

**5.2 Pure butane**, having a certified density or relative density.

NOTE — Butane of density 584,5 kg/m<sup>3</sup> (0,584 5 g/ml) at 15 °C or 578,8 kg/m<sup>3</sup> (0,578 8 g/ml) at 20 °C or a relative density 60/60 °F of 0,584 4 is suitable.

**Table 1 — Ranges and dimensional specification for pressure hydrometers**

Alternative ranges	500 to 580 kg/m <sup>3</sup> 570 to 650 kg/m <sup>3</sup>	0,500 to 0,580 g/ml 0,570 to 0,650 g/ml	0,500 to 0,580 0,570 to 0,650
Subdivisions	1 kg/m <sup>3</sup>	0,001 g/ml	0,001
Figured every	5 or 10 kg/m <sup>3</sup>	0,005 or 0,010 g/ml	0,005 or 0,010
Overall length	330 mm max.		
Bulb diameter	18 to 20 mm		
Bulb wall thickness	0,4 to 0,6 mm		
Stem diameter	8 to 9 mm		
Stem wall thickness	0,3 to 0,35 mm		
Scale length	110 to 130 mm		



Dimensions in millimetres

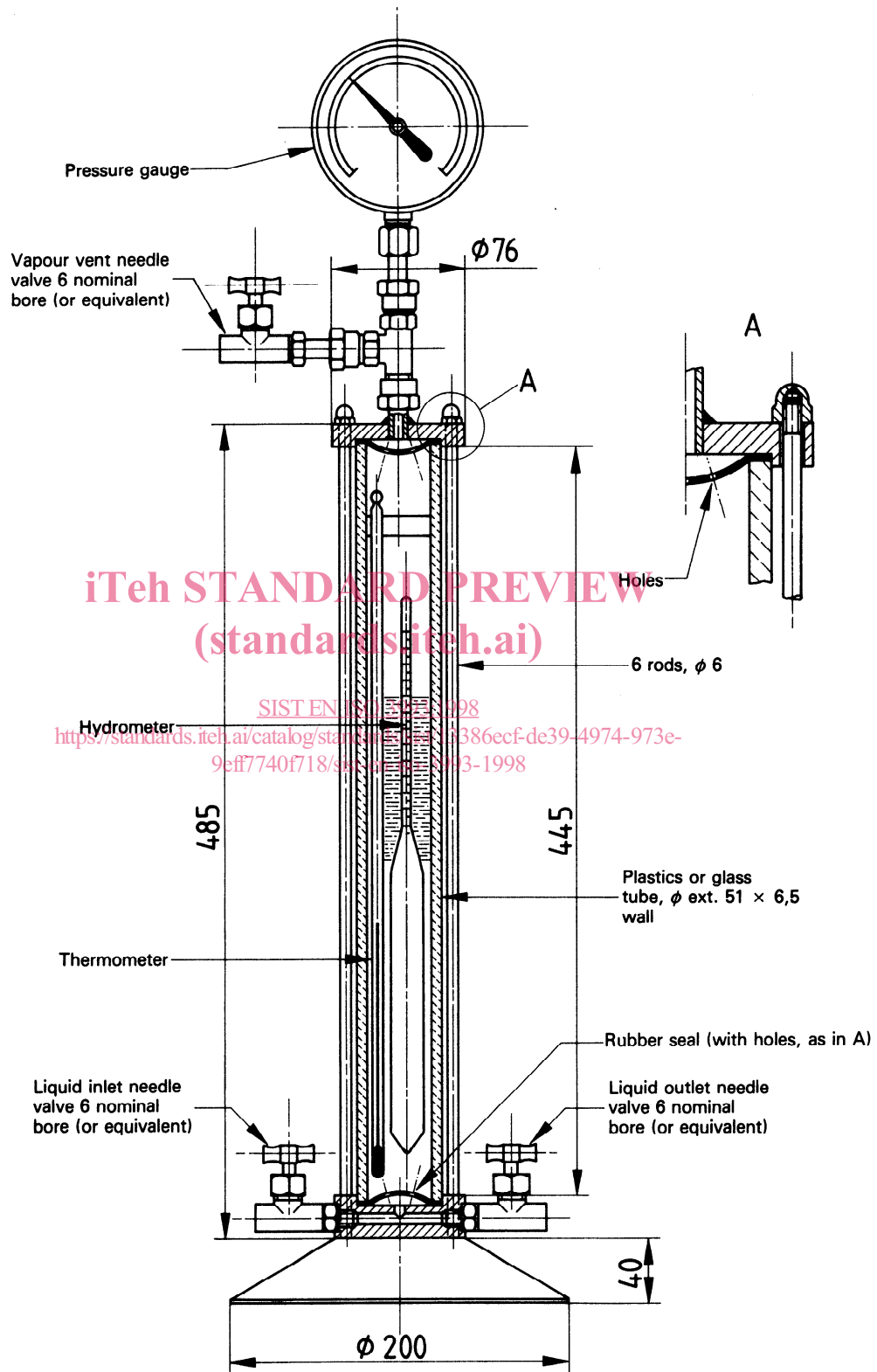


Figure — Pressure hydrometer cylinder