



# SLOVENSKI STANDARD SIST EN ISO 3838:1998

01-maj-1998

Gi fcj UbUZU]b`HY\_c ]U]fXb]bUZb]dfc]nj cX]!'8c`c UbY[ cglcHYU]fYU]j bY  
[ cglcHY!'A YrcXUg'd]\_bca Yfca `g`\_Ud]Uf]a `nUa Uy\_ca `]b'a YrcXUn[ fUXi ]fUb]a  
V]\_Ud]Uf]a `d]\_bca Yfca `fGC" , ' , .% , ' Ł

Crude petroleum and liquid or solid petroleum products - Determination of density or relative density - Capillary-stoppered pycnometer and graduated bicapillary pycnometer methods (ISO 3838:1983)

**STANDARD PREVIEW**

Rohöl und flüssige oder feste Mineralölerzeugnisse - Bestimmung der Dichte oder der relativen Dichte - Verfahren mittels Pycnometer mit Kapillarstopfen und Bikapillar-Pycnometer mit Skale (ISO 3838:1983)

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Pétrole brut et produits pétroliers liquides ou solides - Détermination de la masse volumique ou de la densité relative - Méthodes du pycnomètre a bouchon capillaire et du pycnomètre bicapillaire gradué (ISO 3838:1983)

**Ta slovenski standard je istoveten z: EN ISO 3838:1995**

## ICS:

75.040	Surova nafta	Crude petroleum
75.080	Naftni proizvodi na splošno	Petroleum products in general

**SIST EN ISO 3838:1998**

**en**

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EUROPEAN STANDARD

EN ISO 3838

NORME EUROPÉENNE

EUROPÄISCHE NORM

October 1995

ICS 75.200

Descriptors: petroleum products, crude oil, liquids, solids, pycnometric analysis, density (mass/volume), density measurement, testing conditions, test equipment, calibration

English version

**Crude petroleum and liquid or solid petroleum products - Determination of density or relative density - Capillary-stoppered pycnometer and graduated bicapillary pycnometer methods (ISO 3838:1983)**

Pétrole brut et produits pétroliers, liquides ou solides - Détermination de la masse volumique ou de la densité relative - Méthodes du pycnomètre à bouchon capillaire et du pycnomètre bicapillaire gradué (ISO 3838:1983)

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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.

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# 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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Ref. No. EN ISO 3838:1995 E

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 April 1996, and conflicting national standards shall be withdrawn at the latest by April 1996.

According to the 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 3838:1983 has been approved by CEN as a European Standard without any modification.

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# International Standard



# 3838

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## **Crude petroleum and liquid or solid petroleum products — Determination of density or relative density — Capillary- stoppered pycnometer and graduated bicapillary pycnometer methods**

ITeH STANDARD PREVIEW

*Pétrole brut et produits pétroliers liquides ou solides — Détermination de la masse volumique ou de la densité relative —  
Méthodes du pycnomètre à bouchon capillaire et du pycnomètre bicapillaire gradué*

First edition — 1983-06-01

[SIST EN ISO 3838:1998](#)

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UDC 665.6/.7 : 531.756.4

Ref. No. ISO 3838-1983 (E)

**Descriptors :** petroleum products, crude oil, liquids, solids, pycnometric analysis, density (mass/volume), density measurement, testing conditions, test equipment, calibrating.

Price based on 11 pages

## 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 3838 was developed by Technical Committee ISO/TC 28, *Petroleum products and lubricants*, and incorporates draft International Standard ISO/DIS 3658. Both documents were circulated to the member bodies in July 1981.

They have been approved by the member bodies of the following countries:

Australia	India	Romania
Austria	Iraq	South Africa, Rep. of
Belgium	Israel	Spain
Brazil	Italy	Sweden
Canada	Japan	Switzerland
China	Netherlands	United Kingdom
France	Norway	USA
Germany, F. R.	Peru *	USSR
Hungary	Poland	

No member body expressed disapproval of the documents.

\* Peru approved DIS 3838 only.

# Crude petroleum and liquid or solid petroleum products — Determination of density or relative density — Capillary-stoppered pycnometer and graduated bicapillary pycnometer methods

## 1 Scope and field of application

1.1 This International Standard specifies methods for the determination of the density or relative density of crude petroleum and of petroleum products handled as liquids.

1.2 The capillary-stoppered pycnometer method is also for use with solids and this method may also be used for coal tar products, including road tars, creosote and tar pitches, or for mixtures of these with petroleum products. This method is not suitable for the determination of the density or relative density of highly volatile liquids having Reid vapour pressures greater than 50 kPa (0,5 bar) according to ISO 3007 or having an initial boiling point below 40 °C.

1.3 The graduated bicapillary pycnometer method is recommended for the accurate determination of the density or relative density of all except the more viscous products, and is particularly useful when only small amounts of samples are available. The method is restricted to liquids having Reid vapour pressures of 130 kPa (1,3 bar) or less according to ISO 3007 and having kinematic viscosities less than 50 cSt (50 mm<sup>2</sup>/s) at the test temperature.

Special precautions are specified for the determination of the density or relative density of highly volatile liquids.

## 2 References

ISO 91, *Petroleum measurement tables*.<sup>1)</sup>

ISO 653, *Long solid-stem thermometers for precision use*.

ISO 3007, *Petroleum products — Determination of vapour pressure — Reid method*.

ISO 3507, *Pycnometers*.

ISO 5024, *Petroleum liquids and gases — Measurement — Standard reference conditions*.

## 3 Definitions

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

**3.1 density** : The mass of the substance divided by its volume.

When reporting the density, the unit of density used, together with the temperature, shall be explicitly stated, for example kilograms per cubic metre, or grams per millilitre, at  $t$  °C.

**3.2 apparent mass in air** : The value obtained by weighing in air against standard masses without making correction for the effect of air buoyancy on either the standard masses or the object weighed.

**3.3 observed density** : The value required in order to enter tables 53A and 53B referred to in ISO 91/1 or given in table A in ISO/R 91 Addendum 1, determined with soda-lime glass apparatus at a test temperature which differs from the calibration temperature of the apparatus, no correction having been made for the thermal expansion or contraction of the glass.

**3.4 relative density** : The ratio of the mass of a volume of a substance at a temperature  $t_1$  to the mass of an equal volume of another substance at a temperature  $t_2$ . The temperatures  $t_1$  and  $t_2$  may be equal. For the purpose of this International Standard, the other substance is water, i.e. the relative density is the ratio of the density of the substance at a temperature  $t_1$  to the density of water at a temperature  $t_2$ .

When reporting the relative density, the temperatures  $t_1$  and  $t_2$  must be explicitly stated. ISO 91 refers only to tables for the reduction of relative density to 60/60 °F. If results are required referred to another reference temperature, the determination should be carried out at that temperature.

1) ISO 91/1 has been published, but the revision of ISO/R 91 Addendum 1 is at present at the stage of draft.

## 4 Principle

### 4.1 Capillary-stoppered pyknometer

The masses of equal volumes of the sample and of water are compared. Equal volumes are ensured by the pyknometer being filled so as to overflow when placed in a bath at the test temperature until equilibrium is reached. The calculation (clause 10) includes corrections for thermal expansion of glass and for buoyancy.

### 4.2 Graduated bicapillary pyknometer

The graduated arms of the pyknometer are calibrated, using water, in terms of the apparent mass in air of water contained in the pyknometer, and a graph prepared. The liquid sample is drawn into the dried pyknometer and, after it has reached equilibrium at the test temperature, the liquid levels are noted and the pyknometer weighed. The apparent mass in air of an equal volume of water is read from the graph and the density or relative density of the sample is calculated, with corrections being made as in 4.1.

## 5 Apparatus

**5.1 Capillary-stoppered pyknometer**, one of the three types shown in figure 1 (see 8.1.1).

The pyknometers shall conform to the relevant requirements of ISO 3507.

NOTE — The "warden" form [see a) in figure 1] is recommended for all except viscous or solid products and should always be used for volatile products. The ground glass cap, or "warden", greatly reduces expansion and evaporation losses and this form of pyknometer may be used when the test temperature is lower than that of the laboratory.

**5.1.1** The form of pyknometer shown in b) in figure 1, known as the Gay-Lussac type, is suitable for non-volatile liquids except those of high viscosity.

**5.1.2** The wide-mouth (Hubbard) form of pyknometer [see c) in figure 1] is used for very viscous liquids and solids.

**5.1.3** As the forms of pyknometer shown in b) and c) in figure 1 have no "warden" or expansion chamber, they cannot be used when the temperature of the test is so far below that of the laboratory as to cause loss of sample by expansion through the capillary during weighing.

**5.2 Graduated bicapillary pyknometer**, capacity 1 to 10 ml, conforming to the dimensions given in figure 2, constructed of borosilicate glass or soda-lime glass, annealed after manufacture, and having a total mass not exceeding 30 g. Any pyknometer conforming with the requirements of the Lipkin pyknometer given in ISO 3507 may be used.

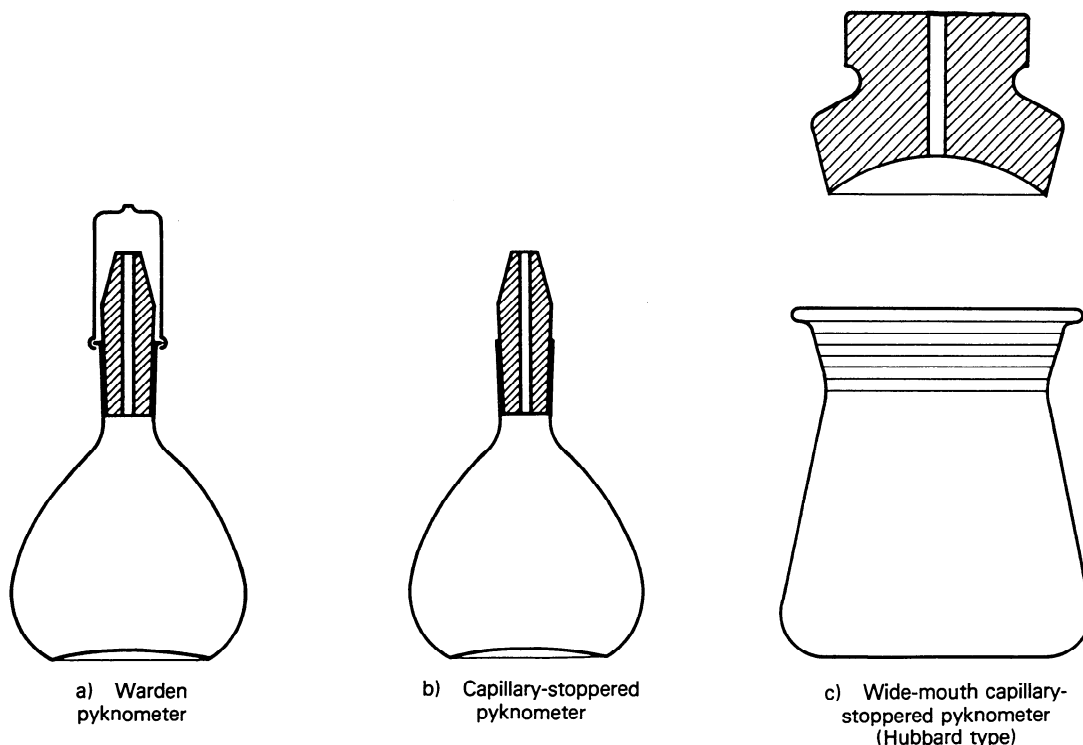


Figure 1 — Capillary-stoppered pyknometers



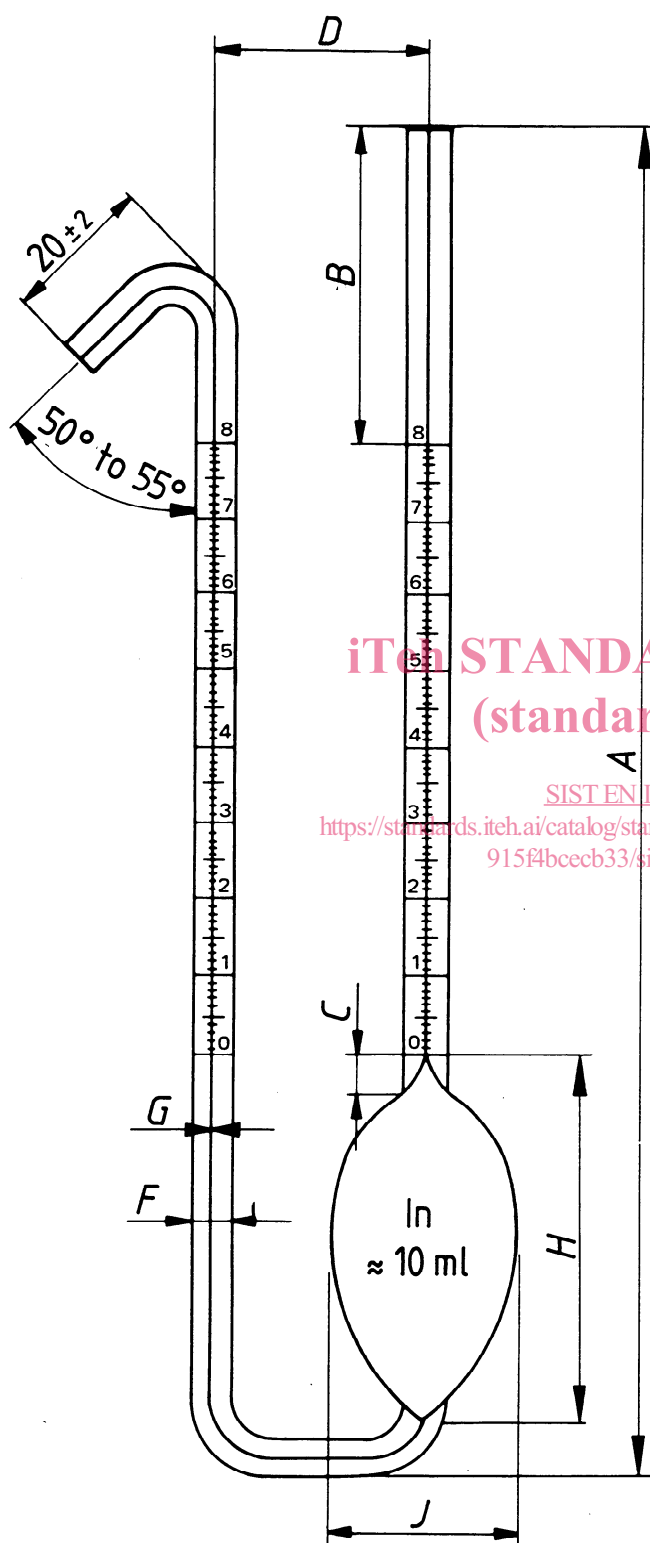


Table 1 – Characteristics of the graduated bicapillary pycnometer

Nominal capacity, ml	1	2	5	10
Difference between actual capacity and nominal capacity, max., ml	± 0,2	± 0,3	± 0,5	± 1
Maximum mass, g	30	30	30	30
Overall height, <i>A</i> , mm	175 ± 5			
Height above scale, <i>B</i> , min., mm	40			
Height from bulb to scale, <i>C</i> , min., mm	5			
Distance between centres of vertical limbs, <i>D</i> , mm	28 ± 2			
External diameter of tubing, <i>F</i> , mm	6			
Internal diameter of tubing, <i>G</i> , mm	1 ± 0,1			
Length from bottom of bulb to zero graduation line, <i>H</i> , mm	40			
External diameter of bulb, <i>J</i> , mm	11	14	20	25

Figure 2 – Graduated bicapillary pycnometer (Lipkin type)