

BRITISH STANDARD

**BS EN ISO
13736 : 1998
BS 2000 :
Part 170 : 1998
ISO 13736 :1997**

Methods of test for

Petroleum and its products

**Part 170. Petroleum products and other
liquids - Determination of flash point - Abel
closed cup method**

(Identical with IP 170/99)

The European Standard EN ISO 13736 : 1997 has the status of a
British Standard

National foreword

This British Standard was published under the authority of the Materials and Chemicals Sector Board and comes into effect on 18th May 1998. It is the English language version of EN ISO 13736 : 1997 *Petroleum products and other liquids - Determination of flash point - Abel closed cup method*, published by the European Committee for Standardization (CEN), which endorses ISO 13736 : 1997, published by the International Organization for Standardization (ISO).

This British Standard supersedes BS 2000 Part 170 : 1995, which will be withdrawn.

BS 2000 comprises a series of test methods for petroleum and its products that are published by the Institute of Petroleum (IP) and have been accorded the status of a British Standard. Each method should be read in conjunction with the preliminary pages of 'IP Standard methods for analysis and testing of petroleum and related products and British Standard 2000 Parts' which gives details of the BSI/IP agreement for publication of the series, provides general information on safety precautions, sampling and other matters, and lists the methods published as Parts of BS 2000.

Under the terms of the agreement between BSI and the Institute of Petroleum, BS 2000 : Part 170 / BS EN ISO 13736 will be published by the IP (in 'Standard methods for analysis and testing of petroleum and related products and British Standard 2000 Parts' and as a separate publication). The numbering of the Parts of BS 2000 follows that of the corresponding IP methods. BS 2000 : Part 170 : 1998 is thus identical with IP 170/99.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

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The following BSI references
relate to the work of this
standard:

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Descriptors: see ISO document

English version

Petroleum products and other liquids - Determination of flash point - Abel closed cup method (ISO 13736:1997)

Produits pétroliers et autres liquides - Détermination du point d'éclair - Méthode Abel en vase clos (ISO 13736:1997)

This European Standard was approved by CEN on 1 October 1997.

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.



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

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

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 month of April 1998, and conflicting national standards shall be withdrawn at the latest by April 1998.

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 13736:1997 has been approved by CEN as a European Standard without any modification.

Petroleum products and other liquids — Determination of flash point — Abel closed cup method

WARNING — The use of this International Standard may involve hazardous materials and equipment. This International Standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this International Standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a method for the determination of the closed cup flash point of petroleum products and other liquids having flash points between $-30\text{ }^{\circ}\text{C}$ and $70\text{ }^{\circ}\text{C}$ inclusive. However the precision given for the method is only valid for flash points in the range $-5\text{ }^{\circ}\text{C}$ to $66,5\text{ }^{\circ}\text{C}$.

This standard is not applicable to water borne paints which may however be tested using ISO 3679.

NOTES

- 1 This method should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions, and should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard of a particular end use.
- 2 Flash point is used in shipping, storage, and handling and safety regulations as a classification property to define "flammable" and "combustible" materials. Precise definition of the classes is given in each particular regulation.
- 3 Flash point may indicate the possible presence of highly volatile materials in a relatively non-volatile or non-flammable material.
- 4 Since the presence of small proportions of highly volatile materials need to be detected, this test should be the first determination on a received sample.
- 5 Liquids containing halogenated compounds may give anomalous results.

2 Normative references

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 3170:1988, *Petroleum liquids — Manual sampling*.

ISO 3171:1988, *Petroleum liquids — Automatic pipeline sampling*.

ISO 3679:1983, *Paints, varnishes, petroleum and related products — Determination of flash point — Rapid equilibrium method*.

3 Definition

For the purposes of this International Standard, the following definition applies.

3.1 flash point: The lowest temperature, corrected to a barometric pressure of 101,3 kPa, at which application of a test flame causes the vapour of the test portion to ignite under the specified conditions of test.

4 Principle

The test portion is placed in the test cup of an Abel apparatus and heated at specified rates. A small test flame is directed into the test cup at regular intervals and the flash point is taken as the lowest temperature at which application of the test flame causes the vapour above the test portion to ignite with a distinct flash inside the test cup.

NOTE — Separate test procedures are defined for liquids flashing between – 30 °C and 18,5 °C inclusive, and between 19 °C and 70 °C inclusive.

5 Reagents and materials

5.1 Solvent, low volatility aromatic solvent (benzene-free) for removal of traces of sample from the test cup.

NOTE — The choice of solvent will depend upon the previous sample, and the tenacity of the residue. Mixed solvents, such as toluene-acetone-methanol (TAM) may be efficacious for the removal of gum-type deposits.

5.2 Ethanediol (ethylene glycol), corrosion inhibited or **glycerol**.

5.3 Silicone lubricant.

6 Apparatus

6.1 Abel flash point apparatus

Use an Abel petroleum testing apparatus as described in annex A.

If automated testers are used, ensure that all of the manufacturer's instructions for calibrating, adjusting and operating the instrument are followed. In any cases of dispute, the flash point as determined manually shall be considered the refereeing test.

NOTE — Automated equipment may be used provided that it has been established that results obtained will not differ from those obtained by the manual procedure.

6.2 Test cup thermometer

Use a test cup thermometer conforming to the specification given in annex C. It shall be fitted into a collar as described in annex B.

6.3 Heating vessel thermometer

Use a heating vessel thermometer conforming to the specification given in annex C. It shall be fitted into a collar as described in annex B.

6.4 Low temperature thermometer

Use a low temperature thermometer conforming to the specification given in annex C or a thermocouple with similar or better precision.

6.5 Timer

Use one of the following:

- a) metronome, that beats at a frequency of 75 beats per min to 80 beats per min;
- b) pendulum, of 610 mm effective length, counting one beat from one extremity of the swing to the other;
- c) electric/electronic timing device, which can measure intervals of 0,75 s to 0,80 s or 1 s.

6.6 Barometer

Use either a Fortin type or other suitable type of barometer, readable to, and with an accuracy of 1 hPa (0,1 kPa). Do not use aneroid barometers pre-corrected to give sea level readings, such as those used at weather stations and airports.

6.7 Cooling bath

Use either liquid or metal block or a recirculating cooler.

6.8 Test cup thermal insulator

Use either a cover made of foam plastics or woollen material.

7 Sampling

7.1 Obtain samples according to the procedures given in ISO 3170, ISO 3171 or an equivalent National Standard, and place in tightly sealed containers appropriate to the material being sampled.

7.2 Samples shall not be taken or stored in plastic containers, since volatile materials may diffuse through the walls, and/or react with the container.

8 Apparatus preparation

Support the Abel apparatus on a level steady table. Unless tests are made in a draught-free room or compartment, surround the tester on three sides with a shield, each section of which shall be approximately 450 mm wide and 600 mm high.

9 Apparatus verification

The correct functioning of the apparatus shall be verified in accordance with annex D.

10 Procedure

10.1 Procedure for liquids flashing between – 30 °C and 18,5 °C

10.1.1 Note the ambient pressure of the laboratory at the time of test by recording the barometric pressure and the temperature of the barometer used or its immediate surroundings.

10.1.2 Fill the heating vessel completely and the air chamber which surrounds the test cup to a depth of at least 38 mm with either a mixture of equal volumes of ethanediol (5.2) and water or a higher ratio of glycerol (5.2) and water.

10.1.3 Adjust the temperature of the heating vessel, using either a cooling bath or recirculating cooler (6.7), to $-35\text{ }^{\circ}\text{C}$, or to at least $9\text{ }^{\circ}\text{C}$ below the expected flash point of the material being tested, whichever is the higher, measuring the temperature with a low temperature thermometer (6.4). Carry out a trial flash point determination if necessary.

While cooling, mix the water-ethanediol or water-glycerol mixture in the heating vessel either by stirring manually or mechanically, or by means of a gentle stream of air introduced into the heating vessel by a tube inserted through the thermometer socket and reaching to the bottom of the heating vessel.

CAUTION — Eye protection shall be worn to guard against the possible risk from drops splashed or liquid thrown off whilst mixing.

10.1.4 Cool the sample in its container, in a cooling bath or refrigerator to below $-35\text{ }^{\circ}\text{C}$, or to at least $17\text{ }^{\circ}\text{C}$ below the expected flash point, whichever is the higher, before opening. Replace the closure with a vapour tight closure carrying a low temperature thermometer or suitable thermocouple (6.4) to check the temperature. After reaching the required temperature remove the cover carrying the thermometer and replace the original closure. Maintain the sample at this temperature, or lower, until all flash point tests on the sample are completed.

Cool liquids which crystallise on cooling to just above their crystallising points.

10.1.5 Wash the test cup with an appropriate solvent (5.1) to remove any traces of gum or residue remaining from a previous test. Dry using a stream of clean air. Place a low temperature thermometer (6.4) in position in the cover of the test cup. Loosely assemble the cover and test cup. Cover with the thermal insulator (6.8), and cool the assembly in a cooling bath or refrigerator until the thermometer registers $-35\text{ }^{\circ}\text{C}$ or at least $17\text{ }^{\circ}\text{C}$ below the expected flash point, whichever is the higher.

If a liquid cooling bath is used, ensure that neither cooling liquid nor vapour which could affect the flash point of the product under test enters the test cup.

NOTES

1 A low temperature thermometer filled with alcohol or toluene is used when cooling the test cup and cover to avoid the risk of freezing the mercury in the flash point thermometer and the consequent rupture of the thread.

2 Cooling a cover or test cup that is wet with water to below $0\text{ }^{\circ}\text{C}$ can cause sticking due to ice (e.g. sticking of the slide). Wiping the apparatus dry with a duster or a piece of absorbent paper before cooling to below $0\text{ }^{\circ}\text{C}$ is usually sufficient to prevent icing, but, alternatively, icing can be minimized by the use of a thermal insulating cover (6.8) and by lubricating the outer face of the lip of the test cup and the slide with a silicone lubricant (5.3).

10.1.6 Position the heating vessel on a firm level surface. Place the test cup in position in the apparatus (see clause A.2) and replace the low temperature thermometer by a test cup thermometer (6.2). Remove the cover and pour in the test portion without undue agitation, avoiding as far as possible the formation of air bubbles, until the level just reaches the point of the index gauge on the wall of the test cup. Do not move the apparatus after filling. Place the cover on the test cup and push it down into position. Ignite the test flame, adjust its size to approximately 3,8 mm in diameter, and maintain it at that size throughout the test, comparing it frequently with the projecting white bead mounted on the cover of the test cup.

10.1.7 Remove the low temperature thermometer from the heating vessel and insert the heating vessel thermometer (6.3).

10.1.8 Apply heat to the heating vessel in such a manner that the temperature of the test portion in the test cup rises at a rate of $1\text{ }^{\circ}\text{C}/\text{min}$.

Stir the test portion in a clockwise direction (i.e. to give a downward thrust) at approximately $0,5\text{ s}^{-1}$ (30 r/min) or as close to this rate as the viscosity of the material permits. When testing viscous products ensure that the stirring action does not push the test portion above the filling mark. Continue stirring in a steady manner for the duration of the test but do not stir during the application of the test flame.