
**Petroleum and related products —
Determination of flash and fire points
— Cleveland open cup method**

*Pétrole et produits connexes — Détermination des points d'éclair et
de feu — Méthode Cleveland à vase ouvert*

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 28, *Petroleum and related products, fuels and lubricants from natural or synthetic sources*.

This third edition cancels and replaces the second edition (ISO 2592:2000), which has been technically revised and aligned with ASTM D92.

The main technical changes compared to the previous edition are as follows:

- a) [Annex D](#) on an alternative procedure for handling skin forming products has been added;
- b) the temperature measuring device requirements in [Annex B](#) has been revised;
- c) the flash point reproducibility has been changed from 17 °C to 18 °C, to align with ASTM D92 on the basis of recent precision data;
- d) a procedure to determine an approximate flash point of a sample with an unknown expected flash point has been included, to align with ASTM D92.

Petroleum and related products — Determination of flash and fire points — Cleveland open cup method

WARNING — The use of this document can involve hazardous materials, operations and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of users of this document to take appropriate measures to ensure the safety and health of personnel prior to the application of this document, and fulfil statutory and regulatory requirements for this purpose.

1 Scope

This document specifies a procedure for the determination of flash and fire points of petroleum products using the Cleveland open cup apparatus. It is applicable to petroleum products having open cup flash points between 79 °C and 400 °C, except fuel oils which are most commonly tested by the closed cup procedure described in ISO 2719.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

flash point

lowest temperature of the test portion, corrected to a standard atmospheric 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

Note 1 to entry: See [10.10](#).

3.2

fire point

lowest temperature of the test portion, 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 and sustain burning for a minimum of 5 s under the specified conditions of test

4 Principle

The test cup is filled to a specified level with the test portion. The temperature of the test portion may be increased rapidly (5 °C/min to 17 °C/min) at first and then at a slow constant rate (5 °C/min to

6 °C/min) as the flash point is approached. At specified temperature intervals, a small test flame is passed across the test cup.

The lowest temperature at which application of the test flame causes the vapour above the surface of the liquid to ignite is taken as the flash point at ambient barometric pressure. To determine the fire point, the test is continued until the application of the test flame causes the vapour above the test portion to ignite and burn for at least 5 s. The flash point and fire point obtained at ambient barometric pressure are corrected to standard atmospheric pressure using a formula.

5 Chemicals and materials

5.1 Cleaning solvent, for removal of traces of sample from the test cup and cover.

The choice of solvent depends upon the previous material tested and the tenacity of the residue. Low volatility aromatic (benzene-free) solvents may be used to remove traces of oil, and mixed solvents can be efficacious for the removal of gum type deposits.

5.2 Verification liquids, certified reference material (CRM) or secondary working standards (SWS) (see, for instance, [C.2](#)).

5.3 Steel wool, any grade capable of removing carbon deposits without damage to the test cup.

6 Apparatus

6.1 Cleveland open cup apparatus, as specified in [Annex A](#).

If automated equipment is used, ensure that it has been established that the results obtained are within the precision of this document, that the test cup and test flame applicator conform to the key dimensional and mechanical requirements specified in [Annex A](#) and the procedures described in [Clauses 7](#), [10](#) and [11](#) are followed. If automated testers are used, the user shall ensure that all the manufacturer's instructions for adjusting and operating the instrument are followed.

In cases of dispute, the flash point as determined manually shall be considered the referee test.

6.2 Shield, to cover at least three sides of the test cup.

The apparatus may include a built-in draught shield.

6.3 Temperature measuring device, which shall meet the requirements for accuracy and have the response as specified in [Annex B](#).

6.4 Barometer, reading absolute pressure accurate to 0,5 kPa with a resolution of 0,1 kPa. Barometers precorrected to give sea level readings, such as those used at weather stations and airports, shall not be used.

7 Preparation of apparatus

7.1 Location of apparatus

Place the apparatus ([6.1](#)) on a level and steady surface in a draught-free room (see below). Shield the top of the manual apparatus from strong light by any suitable means to permit detection of the flash point.

When draughts cannot be avoided, it is recommended good practice to surround the apparatus with a shield.

When testing samples which produce toxic vapours, the apparatus may be located in a fume hood with an individual control of air flow, adjusted so that vapours are withdrawn without causing air currents over the test cup.

7.2 Cleaning the test cup

Wash the test cup with an appropriate solvent (5.1) to remove any traces of gum or residue remaining from a previous test. Dry the test cup using a stream of clean air to ensure complete removal of the solvent used. If any deposits of carbon are present, remove them by rubbing with steel wool (5.3).

7.3 Preparing the test cup

7.3.1 If the alternative procedure referred to in 10.1 is used, follow the instructions in Annex D.

7.3.2 Before use, cool the test cup to at least 56 °C below the expected flash point.

7.4 Assembly of apparatus

Support the liquid in glass thermometer in a vertical position with the bottom of the bulb ($6,4 \pm 0,5$) mm from the bottom of the test cup, and located at a point halfway between the centre and side of the test cup on a diameter perpendicular to the arc (or line) of the sweep of the test flame, and on the side opposite to the test flame applicator. It is not necessary to restrict electronic temperature measuring devices to be mounted vertically, provided their performance is in accordance with the requirements in the test method.

The vertical position of the temperature measuring device may be set by lowering until it contacts the bottom of the test cup, and then raise it by ($6,4 \pm 0,5$) mm.

7.5 Verification of apparatus

7.5.1 Verify the correct functioning of the apparatus at least once a year by testing a certified reference material (CRM) (5.2). The result obtained shall be equal to or less than $R/\sqrt{2}$ from the certified value of the CRM, where R is the reproducibility of the method (see Clause 14).

It is recommended practice during verification of an automated apparatus to visually observe the detected flash point for correct operation.

It is recommended that more frequent verification checks are made using secondary working standards (SWSS) (5.2) or other verification materials with a proven value.

A recommended procedure for apparatus verification using CRMs and SWSS, and the production of SWSS, is given in Annex C.

7.5.2 The numerical values obtained during the verification check shall not be used to provide a bias statement, nor shall they be used to make any correction to the flash points subsequently determined using the apparatus.

7.5.3 It is good practice to select a CRM or SWS that has a certified value similar to the flash point of products being tested.

8 Sampling

8.1 Unless otherwise specified, obtain samples for analysis in accordance with the procedures given in ISO 3170, ISO 3171 or an equivalent national standard.