
**Determination of sustained
combustibility of liquids**

Détermination de la combustion entretenue des liquides

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Contents

Page

Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Principle.....	2
5 Apparatus.....	2
6 Preparation of apparatus.....	3
7 Sampling.....	3
7.1 Paints, varnishes and related products.....	3
7.2 Petroleum and related products.....	3
8 Procedure.....	4
9 Assessment of results.....	5
10 Verification.....	5
11 Calculation of temperature adjustment.....	5
12 Precision.....	5
13 Test report.....	6
Annex A (normative) Combustibility tester.....	7
Annex B (normative) Apparatus verification.....	10
Bibliography.....	11

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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. 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. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 28, *Petroleum products and lubricants*, (WG 9) in conjunction with Technical Committee ISO/TC 35, *Paints and varnishes*.

This second edition cancels and replaces the first edition (ISO 9038:2002), which has been technically revised.

The main technical changes are the inclusion of 3 reference materials for verification in [Annex B](#).

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Introduction

A product with a flash point within a given range can continue to burn after initial ignition, while a similar product, although it has a similar flash point, may not. This International Standard describes a method for discriminating between those products that sustain combustion and those that do not.

The method determines whether a flammable product, when maintained at a selected test temperature, gives off sufficient flammable vapour to cause ignition when an ignition source is applied, and continues to generate sufficient vapour to burn when the ignition source is removed.

This test method does not determine the flash point of the product under test but, by means of a pass/fail procedure, merely determines if it sustains combustion (fail) at a selected test temperature, as can be required to comply with laws or regulations relating to the storage, transport and use of flammable products. Before performing this test, it will normally be necessary to determine either the actual flash point of the material or the temperature range in which the flash point is located.

The apparatus specified in this International Standard enables a result to be determined by a rapid procedure using a small test portion (2 ml).

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Determination of sustained combustibility of liquids

WARNING — The use of this International Standard may involve hazardous materials, operations or 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 to determine the applicability of regulatory limitations prior to use.

1 Scope

This International Standard specifies a pass/fail procedure, at temperatures up to 100 °C, to determine whether or not a liquid product, that would be classified as “flammable” by virtue of its flash point, has the ability to sustain combustion at the temperature or temperatures specified in the appropriate regulations.

NOTE 1 Many national and international regulations classify liquids as presenting a flammable hazard on the basis of their flash point, as determined by a recognized method. Some of these regulations allow a derogation if the substance cannot “sustain combustion” at some specified temperature or temperatures.

NOTE 2 In connection with the United Nations recommendations on the Transport of Dangerous Goods as well as with the Globally Harmonized System of Classification and Labelling of Chemicals, and also with derived national/EC regulations, temperatures of 60,5 °C and 75,0 °C are specified for this test.^{[1][2]}

The procedure is applicable to paints (including water-borne paints), varnishes, paint binders, solvents, petroleum or related products and adhesives, which have a flash point. It is not applicable to painted surfaces in respect of assessing their potential fire hazards.

NOTE 3 This test method can be used, in addition to test methods for flash point, in assessing the fire hazard of a product.

NOTE 4 Particular care needs to be taken in translating results from this test method to large scale (real life) situations, as liquids in large quantities may not behave in the same way as small samples.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1513, *Paints and varnishes — Examination and preparation of test samples*

ISO 3170, *Petroleum liquids — Manual sampling*

ISO 3171, *Petroleum liquids — Automatic pipeline sampling*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Terms and definitions

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

3.1

sustained combustibility

behaviour of a material, under specified test conditions, whereby its vapour can be ignited by an ignition source and, after ignition, sufficient flammable vapour is produced for burning to continue for at least 15 s after the source of ignition has been removed

3.2 flash point

lowest temperature, as measured in the prescribed manner, of a test portion, corrected to a barometric pressure of 101,3 kPa, at which application of an ignition source causes the vapour of the test portion to ignite momentarily and the flame to propagate across the surface of the liquid, under the specified conditions of test

4 Principle

A test portion of specified volume is introduced into the test cup, which is maintained at the test temperature. After a specified time an ignition source is applied.

The ability of the product to sustain combustion is assessed on the basis of its ability to ignite, when exposed to an ignition source, and whether it continues to burn after the ignition source has been removed.

5 Apparatus

5.1 **Combustibility tester**, as specified in [Annex A](#).

5.2 **Electrical heater**, attached to the bottom of the test cup in a manner that provides efficient transfer of heat. The heater control shall be capable of maintaining the test cup temperature, as measured on the temperature measuring device, and in a draught-free area, within $\pm 0,5$ °C for test temperatures up to and including 100 °C.

NOTE The combustibility tester, heater and heater control unit can consist of an integrated apparatus.

5.3 **Gauge**, for checking that the height of the centre of the gas jet above the top of the test cup is $2,2 \text{ mm} \pm 0,1 \text{ mm}$. A calibrated metal strip is suitable.

5.4 **Temperature measuring device**, <https://standards.iteh.ai/catalog/standards/sist/a8e0ea9d-a9d9-4a29-83d5-9a8e278a4b6b/iso-9038-2013>

5.4.1 This shall be suitable for horizontal operation, and of suitable range and dimensions.

5.4.2 Resolution to be able to be read to the nearest 0,5 °C.

5.4.3 Accuracy $\pm 0,5$ °C.

5.4.4 When in position in the block, the temperature measuring device shall be surrounded with heat transfer paste to ensure good heat transfer between the block and the measuring device.

NOTE It is recommended that the accuracy of the temperature measuring device be checked at least every 12 months or when indicated by a user verification check schedule.

5.5 **Stopwatch or other suitable timing device**, capable of measuring $15 \text{ s} \pm 1 \text{ s}$, $30 \text{ s} \pm 1 \text{ s}$ and $60 \text{ s} \pm 2 \text{ s}$. The timing device can be fitted with a means of producing an audible signal.

5.6 **Syringe or pipette**, capable of delivering 2,00 ml to an accuracy of $\pm 0,05 \text{ ml}$.

5.7 **Ignition source and gas supply**. The ignition source can be fuelled by natural gas, coal gas, butane or any other gas found to be suitable. The fuel supply to the gas jet shall be fitted with a suitable regulator, or other means of regulating the gas flow, such that the width of the flame can be adjusted to $4,0 \text{ mm} \pm 0,5 \text{ mm}$.

5.8 **Draught shield**, to minimize draughts, fitted at the back and two sides of the instrument. A shield 350 mm high, 480 mm wide and 240 mm deep is suitable.

5.9 **Barometer**, measuring absolute pressure, with an accuracy of 0,5 kPa. Do not use aneroid barometers pre-corrected to give sea level readings, such as those used at weather stations and airports.

6 Preparation of apparatus

- 6.1** Do not carry out the test in a small confined area because of the risk of explosion.
- 6.2** Thoroughly clean and dry the test cup and assembly before use, taking care not to damage the surface of the test cup.
- 6.3** Position the combustibility tester on a level, stable surface and away from strong light (to facilitate observation of a flash or flame). Ensure that the top of the metal block is horizontal.
- 6.4** Use the gauge (5.3) to check that the jet is $2,2 \text{ mm} \pm 0,1 \text{ mm}$ above the top of the block (see Figure A.2).
- 6.5** It is essential that the apparatus is set up in a draught free area (see Notes 1 and 2). It can be necessary to surround the tester on three sides with a draught shield (5.8) for protection. If a fume hood is used, minimize the exhaust draught.

NOTE 1 The air speed within 50 mm of the top of the test cup should preferably be less than 0,05 m/s.

NOTE 2 Because the combustibility tester has an open test cup, the apparatus should always be used with a draught shield in place.

7 Sampling

7.1 Paints, varnishes and related products

Take a representative sample of the product to be tested, as described in ISO 15528, and examine and prepare it for testing, as described in ISO 1513.

7.2 Petroleum and related products

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7.2.1 Sampling procedure

Take a representative sample of the product to be tested, as described in ISO 3170 or ISO 3171, as appropriate. The container shall be made of a material appropriate to the product being sampled and be filled to between 85 % and 95 % of its capacity.

7.2.2 Sample handling

7.2.2.1 Obtain a representative sample of at least 50 ml and store in a clean, tightly closed container in a cool place to minimize vapour loss or pressure build-up.

7.2.2.2 The sample shall receive only the minimum treatment to ensure homogeneity, to minimize the possible loss of volatile constituents. After removing each test portion, immediately close the sample container tightly to ensure that no volatile components escape from the container. If this closure is not secure, obtain a new sample.

7.2.2.3 Ensure that the sample is at least 10 °C below the selected test temperature before opening to remove the test portion. For mobile materials, mix the sample by gentle shaking. For viscous samples, if necessary heat the sample in its container to a temperature such that the sample can be mixed by gentle shaking or to at least 10 °C below the selected test temperature, whichever is lower. Ensure that high pressures do not develop in the container.