INTERNATIONAL STANDARD

ISO 13736

Second edition
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Determination of flash point — Abel closed-cup method

Détermination du point d'éclair — Méthode Abel en vase clos

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13736 was prepared by Technical Committee ISO/TC 28, *Petroleum products and lubricants*.

This second edition cancels and replaces the first edition (ISO 13736:1997), which has been technically revised.

Introduction

Flash-point values can be used in shipping, storage, 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.

A flash-point value can indicate the presence of highly volatile material(s) in a relatively non-volatile or non-flammable material, and flash-point testing can be a preliminary step to other investigations into the composition of unknown materials.

It is not appropriate that flash-point determinations be carried out on potentially unstable, decomposable, or explosive materials, unless it has been previously established that heating the specified quantity of such materials in contact with the metallic components of the flash-point apparatus within the temperature range required for the method do not induce decomposition, explosion or other adverse effects.

Flash-point values are not a constant physical-chemical property of materials tested. They are a function of the apparatus design, the condition of the apparatus used and the operational procedure carried out. Flash point can, therefore, be defined only in terms of a standard test method, and no general valid correlation can be guaranteed between results obtained by different test methods or with test apparatus different from that specified.

ISO/TR 29662[6] (CEN/TR 15138[7]) gives useful advice in carrying out flash-point tests and interpreting results.

Determination of flash point — Abel closed-cup method

CAUTION — The use of this International Standard can 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 combustible liquids having flash points between − 30,0 °C and 70,0 °C, inclusive. However, the precision given for this method is only valid for flash points in the range − 5,0 °C to 66,5 °C.

This International Standard is not applicable to water-borne paints, which can, however, be tested using ISO 3679[4].

NOTE 1 See 4.1 for the importance of this test to avoid loss of volatile materials.

NOTE 2 Liquids containing halogenated compounds can give anomalous results.

2 Normative references

The following referenced documents are indispensable for the application 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 3170:2004, *Petroleum liquids — Manual sampling*

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

ISO 15528:2000, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

3 Term and definition

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

3.1
flash 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 momentarily and the flame to propagate across the surface of the liquid under the specified conditions of test

4 Principle

4.1 General

Since it is necessary to detect the presence of small proportions of highly volatile materials, this test should be the first determination on a received sample to help avoid the loss of these volatile materials.

4.2 Test principle

The test portion is placed in the test cup of an Abel apparatus and heated to give a constant temperature increase with continuous stirring. A small test flame is directed through an opening in the test cup cover at regular temperature intervals with simultaneous interruption of stirring. The lowest temperature at which application of the test flame causes the vapour of the test portion to ignite and propagate over the surface of the liquid is recorded as the flash point at the ambient barometric pressure. The temperature is corrected to standard atmospheric pressure using an equation. Separate test procedures are defined for liquids with expected flash points between – 30,0 °C and 18,5 °C, inclusive, and between 19,0 °C and 70,0 °C, inclusive.

5 Chemicals and materials

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

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

5.2 Coolant, ethanediol (ethylene glycol), glycerol or silicone oil (optional), for use in the cooling bath or in the Abel apparatus.

See 10.1.2.

5.3 Silicone lubricant (optional), to inhibit the formation of ice crystals on the lid and shutter mechanism when carrying out tests at temperatures below 5,0 °C.

See the Note to 10.1.6.

5.4 Verification liquids, as described in Annex D.

6 Apparatus

6.1 Flash-point 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 International Standard, that the test cup and cover assembly conform to the key dimensions specified in Annex A, and the procedure described in Clause 10 is followed. The user shall ensure that all of the manufacturer's instructions for adjusting and operating the instrument are followed.

6.2 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, conforming to the specification given in Annex C.

It shall be fitted into a collar as described in Annex B.

NOTE Other types of temperature-measuring devices can be used, provided that they meet the requirements for accuracy and have the same response as the thermometers specified in Annex C.

6.4 Timing device, use one of the following:

a) electric/electronic timing device, which can indicate intervals of 1 s;

b) pendulum, of 610 mm effective length, counting one beat from one extremity of the swing to the other;

c) metronome, that beats at a frequency of 75 beats per minute to 80 beats per minute.

6.5 Barometer, accurate to 0,5 kPa.

Barometers pre-corrected to give sea-level readings, such as those used at weather stations and airports, shall not be used.

6.6 Cooling bath, either liquid or metal block, or a recirculating cooler.

See 10.1.4 and 10.2.4.

6.7 Test cup thermal insulating cover (optional), to reduce the formation of ice crystals on the cup and cover assembly during sub-ambient testing.

See 10.1.5.

7 Apparatus preparation

7.1 Location of the apparatus

Support the Abel apparatus (6.1) on a level and steady surface in a draught-free position.

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

DANGER — When testing materials that produce toxic vapours, the apparatus should be located in a fume hood with an individual control of air flow, adjusted such that the vapours can be withdrawn without causing air currents around the test cup during the test.

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 using a stream of clean air to ensure complete removal of the solvent used.

7.3 Apparatus examination

Examine the test cup, the cover and other parts to ensure that they are free from signs of damage and deposits. If any damage is found, either rectify or, if this is not possible, obtain a replacement. If deposits are found, remove them.

7.4 Apparatus verification

7.4.1 Verify the correct functioning of the apparatus at least once a year by testing a certified reference material (CRM) (see 5.4 and Annex D). 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 test. More frequent verification checks shall be made using secondary working standards (SWS).

A recommended procedure for apparatus verification using CRMs and SWSs and for the production of SWSs is given in Annex D.

7.4.2 Do not use the numerical values obtained during the verification check to provide a bias statement, or to make any correction to the flash points subsequently determined using the apparatus.

8 Sampling

8.1 Obtain samples in accordance with the procedures given in ISO 3170, ISO 3171, ISO 15528 unless otherwise agreed.

8.2 Place sufficient sample volume for testing in a tightly sealed container appropriate to the material being sampled and, for safety purposes, ensure that the sample container is filled only to between 85 % and 95 % of its capacity.

8.3 Store the samples in conditions that minimize vapour loss and pressure build-up. Avoid storing the samples at temperatures in excess of 30,0 °C.

9 Sample handling

9.1 Storage prior to testing

If an aliquot of the original sample is stored prior to testing, ensure that the container is filled to more than 50 % of its capacity.

NOTE Results of flash-point determinations can be affected if the sample volume falls below 50 % of the container's capacity.

9.2 Liquids with expected flash points between – 30,0 °C and 18,5 °C

9.2.1 Cool the sample to a temperature of – 35 °C or to at least 17,0 °C below the expected flash point, whichever is the higher, before opening the container.

9.2.2 Cool the liquids that crystallize on cooling to just above their melting points.

9.3 Liquids with expected flash points between 19,0 °C and 70,0 °C

Cool the sample to a temperature of 2 °C or to at least 17,0 °C below the expected flash point, whichever is the higher, before opening the container.

9.4 Samples containing water as a separate phase

If a sample contains water as a separate phase, decant an aliquot from the water prior to mixing.

Flash-point results can be affected by the presence of water. For certain fuels, it might not always be possible to decant the sample from the free water. In such cases, the water should be separated from the aliquot physically, prior to mixing, or, if this is not possible, the material should be tested in accordance with ISO 3679[4].

9.5 Sample mixing

Mix samples by gentle manual shaking prior to the removal of the test portion, taking care to minimize the loss of volatile components, and proceed in accordance with Clause 10.

10 Procedure

10.1 Liquids with expected flash points between – 30,0 °C and 18,5 °C

10.1.1 Using a barometer (6.5), record the ambient pressure in the vicinity of the apparatus at the time of test.

NOTE It is not necessary to correct the barometric pressure for ambient temperature, although some barometers are designed to make this correction automatically.

10.1.2 Use either a mixture of equal volumes of ethanediol (5.2) and water, or glycerol (5.2) and water, or silicone oil (5.2) to completely fill the heating vessel (Clause A.5) and to fill the inner air chamber, which surrounds the test cup (Clause A.2), to a depth of at least 38 mm.

10.1.3 Insert the heating vessel thermometer (6.3).

10.1.4 Adjust the temperature of the heating vessel (Clause A.5), using a cooling bath (6.6) connected via the funnel aperture and overflow pipe, to − 35 °C or to at least 9,0 °C below the expected flash point of the material being tested, whichever is the higher. Carry out a trial flash-point determination if necessary.

10.1.5 Loosely assemble the cover (Clause A.3) and test cup (Clause A.2). Cover with the thermal insulator (6.7), and cool the assembly to − 35 °C or to at least 17,0 °C below the expected flash point, whichever is the higher.

10.1.6 Ensure that neither cooling liquid nor vapour from the cooling bath, which could affect the flash point of the product under test, enters the test cup.

NOTE Cooling a cover or test cup that is wet with water to below 0 °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 °C is usually sufficient to prevent icing, but, alternatively, icing can be minimized by the use of a thermal insulating cover (6.7) and by lubricating the outer face of the lip of the test cup and the slide with a silicone lubricant (5.3).

10.1.7 Place the test cup in position in the apparatus (see Clause A.3) and insert the 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 conform to the size of the reference bead mounted on the cover of the test cup, and maintain it at that size throughout the test.

10.1.8 Apply heat to the heating vessel (Clause A.5) in such a manner that the temperature of the test portion in the test cup rises at a rate of 1 °C/min from the first application of the test flame to the end of the test.

10.1.9 Using the stirrer (Clause A.4), stir the test portion in a clockwise direction (i.e. to give a downward thrust) at 30 r/min ± 5 r/min. Continue stirring in a steady manner for the duration of the test but do not stir during the application of the test flame.

10.1.10 When the temperature of the test portion reaches − 35 °C or at least 9,0 °C below the expected flash point, start the timing device (6.4), apply the test flame by slowly and uniformly opening the slide in the cover while the timer beats three times and closing it during the fourth beat. If an electric/electronic timing device calibrated in seconds is used, the application of the test flame shall be made by slowly and uniformly opening the slide over a period of 2 s and then closing it over a period of 1 s.

10.1.11 If a flash occurs, discontinue the test, discard the test portion and proceed in accordance with 10.1.3, commencing the test at a lower expected flash-point temperature. If no flash occurs, proceed in accordance with 10.1.12. If a flash occurs at a temperature below − 30,0 °C, record and report this fact and discontinue the test.

10.1.12 Apply the test flame in this manner every 0,5 °C rise in temperature until a distinct flash occurs in the interior of the test cup or until a temperature corresponding to a corrected temperature of 18,5 °C is reached. Record the temperature of the test portion when the flash occurs.

10.1.13 Do not confuse the true flash point with the bluish halo that sometimes surrounds the test flame at applications preceding the actual flash point.

10.1.14 Record as the observed flash point the temperature read on the test cup thermometer at the time the test flame application caused a distinct flash in the interior of the test cup.

10.2 Procedure for liquids flashing between 19,0 °C and 70,0 °C

10.2.1 Using the barometer (6.5), record the ambient pressure of the laboratory at the time of test.

10.2.2 Use water to completely fill the heating vessel (Clause A.5) and to fill the inner air chamber, which surrounds the test cup (Clause A.2), to a depth of at least 38 mm.

10.2.3 Insert the heating vessel thermometer (6.3).

10.2.4 Adjust the temperature of the liquid in the heating vessel, using either a cooling bath (6.6) or a heater (Clause A.6) to at least 9,0 °C below the expected flash point of the material being tested, or to 10 °C, whichever is the higher. Carry out a trial flash-point determination if necessary.

10.2.5 Loosely assemble the cover (see Clause A.3) and test cup (see Clause A.2) and cool to 2 °C or to at least 17,0 °C below the expected flash point, whichever is the higher.

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

10.2.7 Place the test cup in position in the apparatus (see Clause A.3). 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 conform to the size of the reference bead mounted on the cover of the test cup, and maintain it at that size throughout the test.

10.2.8 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 °C/min from the first application of the test flame to the end of the test.

10.2.9 Using the stirrer (Clause A.4), stir in a clockwise direction (i.e. to give a downward thrust) at 30 r/min ± 5 r/min. 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.

10.2.10 When the temperature of the test portion reaches 10 °C or at least 9,0 °C below the expected flash point, start the timing device (6.4), apply the test flame by slowly and uniformly opening the slide in the cover while the timer beats three times and closing it during the fourth beat. If an electric/electronic timing device calibrated in seconds is used, the application of the test flame shall be made by slowly and uniformly opening the slide over a period of 2 s and then closing it over a period of 1 s.

10.2.11 If a flash occurs, discontinue the test, discard the test portion and proceed in accordance with 10.1.4 or 10.2.4, as appropriate, commencing the test at a lower expected flash-point temperature. If no flash occurs, proceed in accordance with 10.2.12.

10.2.12 Apply the test flame in this manner every 0,5 °C rise in temperature until a flash point (3.1) is detected, or until a temperature corresponding to a corrected temperature of 70,0 °C is reached. Record the temperature of the test portion when the flash occurs.

10.2.13 Do not confuse the true flash point with the bluish halo that sometimes surrounds the test flame or an enlarged flame at applications preceding the actual flash point.

10.2.14 Record as the observed flash point the temperature read on the test cup thermometer at the time the test flame application caused a distinct flash in the interior of the test cup.

11 Calculation

11.1 If the barometric pressure reading, taken in accordance with 10.1.1 or 10.2.1, is in a unit other than kilopascals, convert to kilopascals using the following conversions, as appropriate:

Reading in hPa × 0,1 = kPa

Reading in mbar × 0,1 = kPa

Reading in mmHg × 0,133 322 = kPa

NOTE For the purposes of correcting flash-point values to standard barometric pressure, it is not considered necessary to correct the barometer readings for ambient temperature. However, some barometers are designed to automatically correct the barometric pressure for ambient temperature.

11.2 Calculate the corrected flash point, T_c, using Equation (1):

$$T_c = T_o + 0{,}25(101{,}3 - p) \quad (1)$$

where

T_o is the observed flash point, expressed in degrees Celsius;

p is the ambient barometric pressure, expressed in kilopascals.

NOTE Equation (1) is strictly correct only within the barometric pressure range from 98,0 kPa to 104,7 kPa.

For practical purposes, 4 kPa is equivalent to a flash-point temperature change of 1 °C.

12 Expression of results

Report the flash point, corrected to standard atmospheric pressure, rounded to the nearest 0,5 °C.

13 Precision

13.1 General

The precision, as determined by statistical examination of inter-laboratory test results, is given in 13.2 and 13.3, and applies over the range − 5,0 °C to 66,5 °C.

NOTE The precision is being revised for both manual and automated apparatus.

13.2 Repeatability, r

The difference between two test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material, would in the long run, in the normal and correct operation of the test method, exceed the value in Equation (2) in only one case in 20:

$$r = 1{,}0\ °C \quad (2)$$

13.3 Reproducibility, R

The difference between two single and independent test results, obtained by different operators operating in different laboratories on identical test material, would in the long run, in the normal and correct operation of the test method, exceed the value in Equation (3) in only one case in 20:

$$R = 1{,}5\ °C \tag{3}$$

14 Test report

The test report shall contain at least the following information:

a) a reference to this International Standard (ISO 13763:2008);

b) the type and complete identification of the sample tested;

c) the ambient barometric pressure in the vicinity of the apparatus (see 10.1.1 and 10.2.1);

d) the result of the test (see Clause 12);

e) any deviation, by agreement or otherwise, from the procedure specified;

f) the date of the test.

Annex A
(normative)

Abel flash-point apparatus

A.1 Apparatus

The apparatus shall consist of a test cup, cover assembly and heating vessel as described below and detailed in Figures A.1 and A.2.

NOTE Automated apparatus that can have different heating and cooling configurations can be used; however, the precision is still being evaluated for these alternative configurations.

A.2 Test cup

The test cup shall be made of brass and conform to the form and dimensions shown in Figure A.1.

A gauge, consisting of a rod bent upwards and terminating in a point, shall be fixed within the test cup through the wall and silver-soldered or brazed into place.

A.3 Test cup cover assembly

The test cup shall be provided with a close-fitting cover made of brass and conform to the form and dimensions shown in Figure A.1. A downwardly projecting rim barely reaching the flange on the test cup shall either form part of the top or shall be silver-soldered or brazed into place.

Upon the cover shall be mounted a thermometer socket, a bush for the stirrer, trunnions to support a test gas jet, a pair of guides in which a slide moves, and a bead or other reference mark to depict the required 3,6 mm to 4,1 mm size of the ignitor flame. The top of the cover shall be pierced by three rectangular holes symmetrically placed on a diameter, one in the centre and the other two as close as practicable to the inner sides of the rim and opposite each other.

These three holes shall be covered or uncovered by means of a slide moving in suitably disposed guides. The slide shall have two apertures, one corresponding to the centre hole in the cover and the other to one of the holes at the side. The movement of the slide shall be restricted by suitable stops, and its length and the disposition of the holes shall be such that, at the outer extremity of the movement of the slide, the holes in the cover are just completely opened, and at the inner extremity of the movement of the slide, they are completely closed.

The trunnions supporting the test gas jet shall be fixed to the top of the guides and the gas jet shall be mounted in the trunnions so that it is free to oscillate. The test gas jet shall be arranged so that when the slide is moved to uncover the holes, the oscillating test gas jet is caught by a pin fixed in the slide and tilted over the central hole in such a way that the lower edge of the cover bisects the circle formed by the bore of the jet when in the lowest position. The flame shall then occupy a central position within the hole in both directions.

The thermometer socket shall be in the form of a split tube, mounted on a diameter at right angles to the diameter through the centres of the holes, and fitted at such an angle as to bring the bulb of the thermometer when in place, vertically below the centre of the cover and at the correct distance from it.

A bush for the stirrer shall be mounted on the cover in a position diametrically opposite the thermometer mounting. Its length and the angle at which it is set shall be such that the stirrer rod clears the oil level gauge and the blades operate below the level of and without fouling the thermometer bulb. The bush shall be placed as near as practicable to the outer edge of the cover.

A.4 Stirrer

This shall be made of brass and conform to the form and dimensions given in Figure A.1.

It shall consist of a round stem having four blades or vanes silver-soldered in place at one end. The blades of the stirrer shall be set so that the liquid is thrust in a downward direction when the stirrer is rotated clockwise.

A collar shall be fixed onto the stem so that when the stem is inserted into the stirrer bush from below, it is arrested at a position such that the correct length protrudes into the test cup. The top end of the stem shall be reduced and screwed.

A long sleeve having an internally screwed, knurled knob soldered to its upper end shall be passed over the upper end of the stem and screwed home. The length of the sleeve shall be such that a flat-faced collar at its lower end just comes into contact with the upper end of the stirrer bush, leaving the stirrer free to rotate without appreciable vertical play.

A flat-headed cylindrical plug shall be provided for insertion in the stirrer bush when the stirrer is not in use.

A.5 Heating vessel

This shall be made of copper and conform to the form and dimensions given in Figure A.2. It shall consist of two flat-bottomed, cylindrical copper vessels (heating vessel and inner air chamber) placed coaxially one inside the other and soldered at their tops to a flat copper ring, greater in outside diameter than the smaller vessel. Thus, the space between the two vessels shall be totally enclosed and used as a water jacket.

An ebonite or fibre ring of right-angled section shall be fitted into the hole in the centre of the flat ring to form the top of the heating vessel. When the apparatus is in use, the test cup shall fit into, and its flange rest upon, the ebonite or fibre ring so that the test cup is centrally disposed within the heating vessel. The ebonite or fibre ring shall be secured in place by means of six small screws having their heads sunk below the surface of the ring to avoid metallic contact between the heating vessel and the test cup.

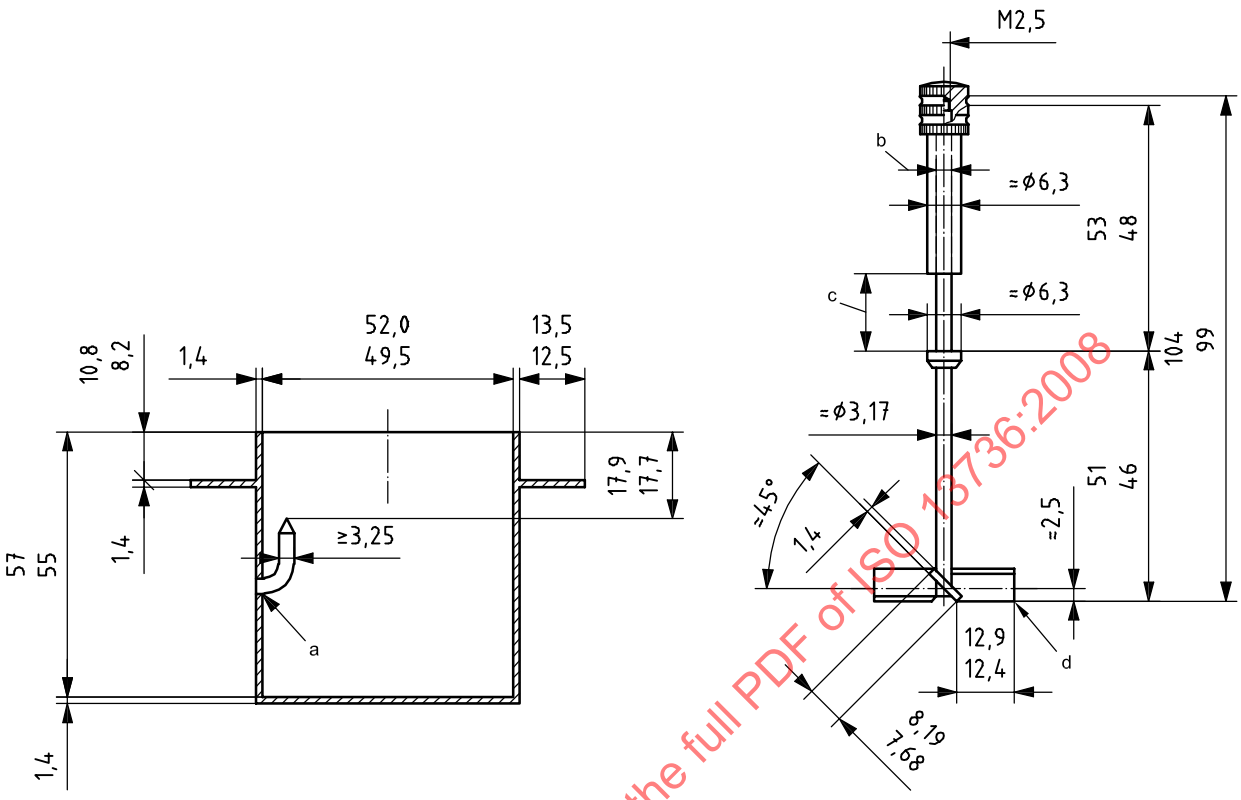
A split socket, similar to that on the cover of the test cup, but set vertically, shall allow a thermometer to be inserted into the water-space. A funnel and overflow pipe shall also be connected with the water space through the top plate and two loop handles provided thereon.

The heating vessel shall rest upon a cast-iron tripod stand, attached to the ring of which is a cylindrical copper jacket not less than 0,56 mm in thickness flanged inwards at the top, and of such dimensions that the heating vessel, while resting firmly on the iron ring, just touches with its outward projecting flange the inward-turned flange of the jacket. Two handles shall be provided on the outer jacket.

A.6 Heating device

Use any suitable device for heating the vessel, such as gas flame, electric heater or spirit lamp.

Dimensions in millimetres

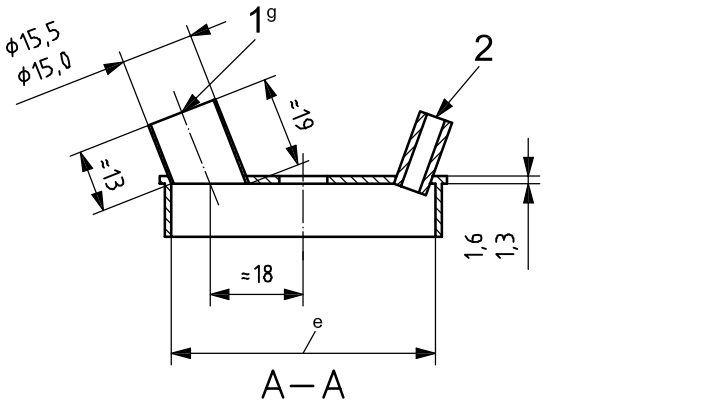


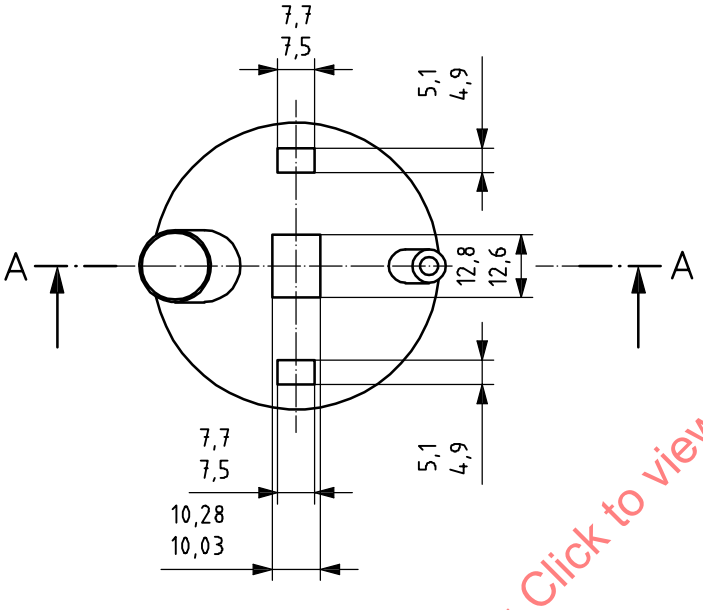
a) Test cup

b) Stirrer

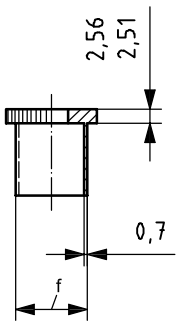
Figure A.1 (*continued*)

Dimensions in millimetres





c) **Cover**



d) **Thermometer collar**

Key

1 thermometer socket

2 stirrer bush

a Brazed or silver-soldered.

b Inside diameter of sleeve is a sliding fit on stem.

c This dimension is such that the stirrer rotates freely with no appreciable end play when assembled on cover.

d All corners are rounded.

e Close fit over test cup.

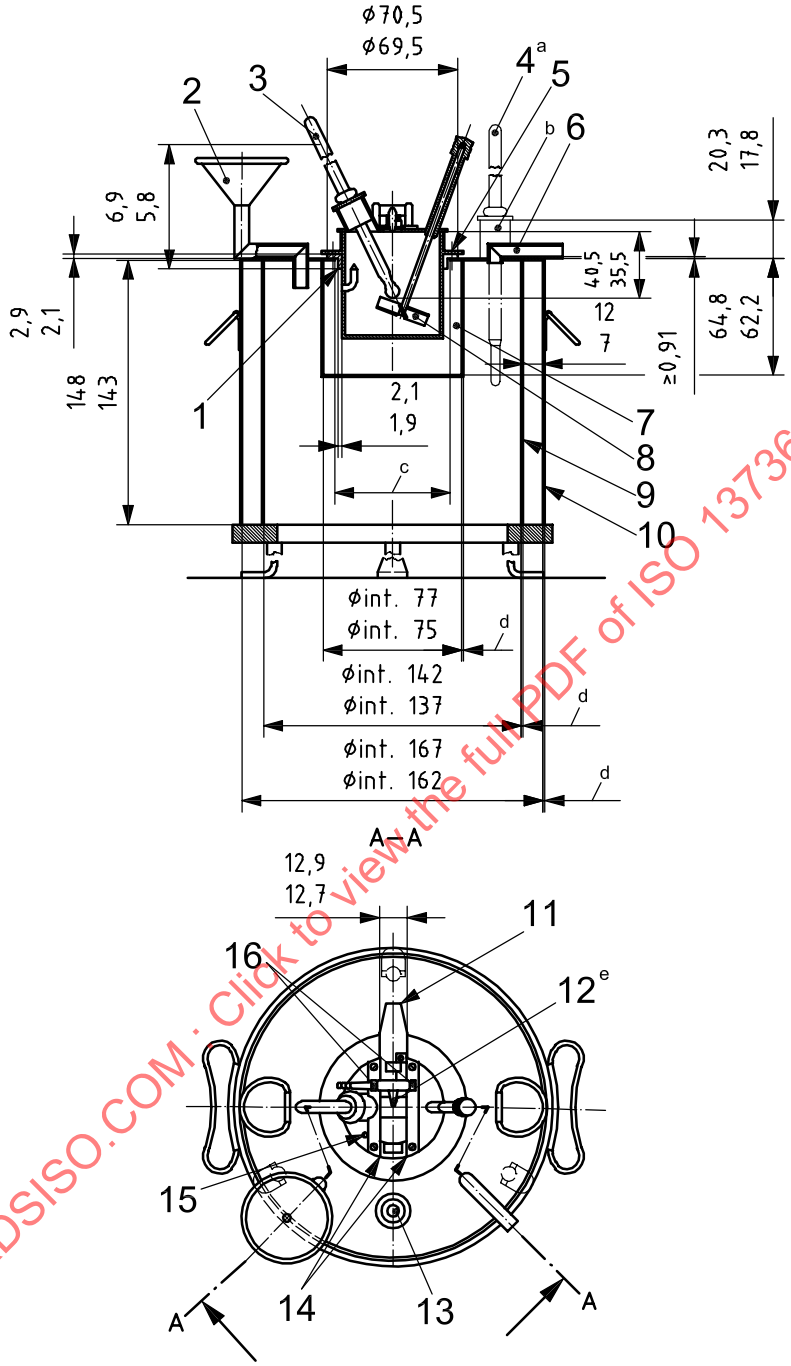
f Push fit in thermometer socket on cover and heating vessel.

g It is recommended that in order to achieve interchangeability, the internal diameter of the thermometer socket should be between 15,235 mm and 15,253 mm and that the external diameter of the thermometer collar should be between 15,222 mm and 15,232 mm.

NOTE All items of the apparatus shown are made of brass.

Figure A.1 — Abel flash-point apparatus — Test cup, cover, stirrer and thermometer collar

Dimensions in millimetres



Key

1 ebonite or fibre ring, which fits easily on cup
2 funnel
3 test cup thermometer
4 heating vessel thermometer
5 ø 2,2 × 3,8 for long CSK screws
6 copper overflow pipe
7 inner (air) chamber
8 stirrer
9 heating vessel
10 outer jacket
11 slide 20 SWG 0,91 brass
12 gas jet or pilot light
13 heating vessel thermometer
14 guides
15 white bead ø 3,6 mm to 4,1 mm of suitable material
16 trunnions

[a] For actual position, see plan view.

[b] Inside diameter of thermometer socket 15 mm to 15,5 mm.

[c] 2,5 mm maximum clearance in top plate.

[d] 0,6 copper.

[e] Length of jet is approximately 15 mm; the bore at the end of the jet is 1,71 mm maximum and 1,46 mm minimum.

Figure A.2 — Abel flash-point apparatus — Assembly plus heating vessel

Annex B
(normative)

Positioning and fixing of test cup and heating vessel thermometers into thermometer collar

B.1 Thermometer

The collar shall be made of brass and shall have the following dimensions:

a) outside diameter: push fit in socket;

b) thickness of tube: 0,69 mm to 0,73 mm;

c) thickness of flange: 2,515 mm to 2,565 mm.

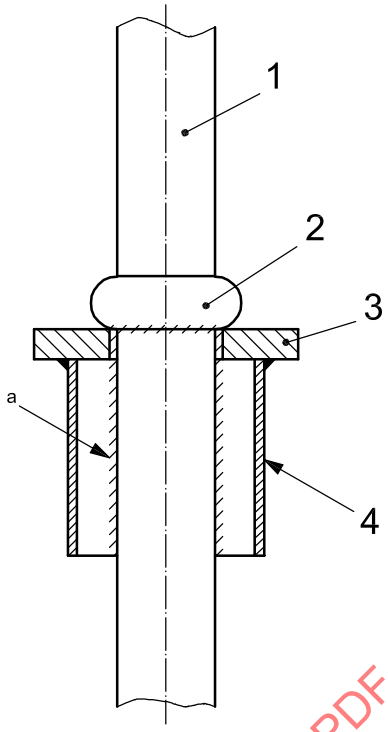
B.2 Position

Secure the thermometer in the collar in accordance with Figure B.1, by means of either

a) a mixture of plaster-of-Paris and glycerine, or

b) an epoxy-resin-based commercial adhesive.

NOTE Automated equipment can use alternative thermometer collars to enhance removal and fitting of the thermometers.



Key

1 thermometer stem
2 glass swelling
3 brass collar
4 0,69 mm to 0,73 mm wall tube push fit in socket

[a] Areas for application of adhesive.

Figure B.1 — Position of thermometer stem in collar

Annex C
(normative)

Thermometer specifications

C.1 Test cup thermometer

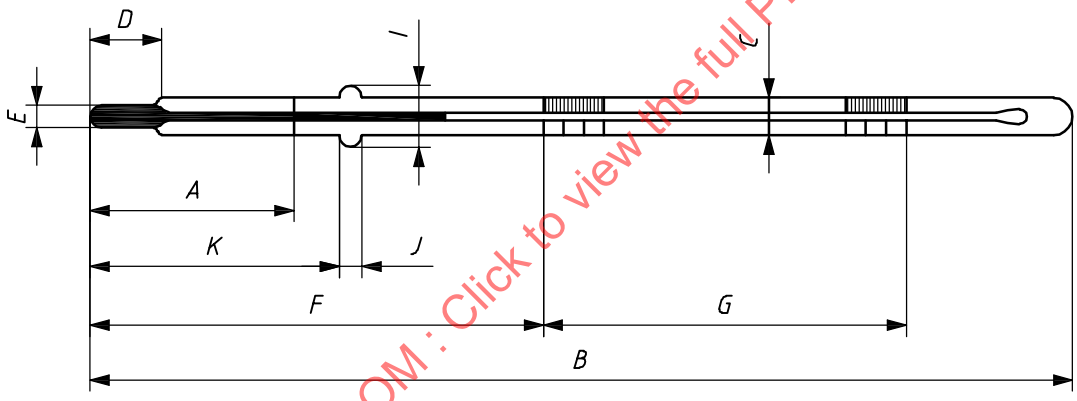
Specifications for the test cup thermometer are shown in Figure C.1.

NOTE The thermometer IP 74C (see BS 2000-0.1[8]) conforms to these requirements.

C.2 Heating vessel thermometer

Specifications for the heating vessel thermometer are shown in Figure C.1.

NOTE The thermometer IP 75C (see BS 2000-0.1[8]) conforms to these requirements.



See Table C.1 for description of symbols.

Figure C.1 — Test cup and heating-vessel thermometers