BS 2000-10:2011

BSI Standards Publication

Methods of test for petroleum and its products

Part 10: Determination of kerosine burning characteristics 24-hour method (Identical with IP 10/11)

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Publishing and copyright information

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Contents

Summary of pages

This document comprises a front cover, an inside front cover, pages i to ii, pages 1 to 10, an inside back cover and a back cover.

Foreword

Publishing information

This British Standard is published by BSI and came into effect on 31 July 2011. It was prepared by Technical Committee PTI/13, *Petroleum testing and terminology*. A list of organizations represented on this committee can be obtained on request to its secretary.

Supersession

This part of BS 2000 supersedes BS 2000-10:1995, which is withdrawn.

Information about this document

This new edition has been updated to be in line with changes implemented by the Energy Institute.

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 "Standard Methods for Analysis and Testing of Petroleum 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, the revised version of BS 2000-10 will be published by BSI and by the IP (in "Standard Methods for Analysis and Testing of Petroleum Products and British Standard 2000 Parts" and as a separated publication). The numbering of the parts of BS 2000 follows that of the corresponding IP methods. BS 2000-10:2011 is thus identical with IP 10/11.

WARNING. This part of BS 2000 calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

It has been assumed in the preparation of this part of BS 2000 that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

1 Scope

This document specifies a method of test to assist in the evaluation of the burning properties of kerosine used for illumination and/or heating purposes.

NOTE 1 Precision values are only available for char values in the range 0 mg/kg to 30 mg/kg.

NOTE 2 For the purposes of this standard, the terms '% (m/m)' and '% (V/V)' are used to represent respectively the mass fraction and the volume fraction.

WARNING. This part of BS 2000 calls for the use of substances and/or procedures that can be injurious to health if adequate precautions are not taken. It refers only to technical suitability and does not absolve the user from legal obligations relating to health and safety at any stage.

2 Normative

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies.

BS 2000-0.2, *Methods of test for petroleum and its products – Part 0, Section 0.2: Specifications for IP standard reference liquids (Identical with IP Appendix B)*

BS EN ISO 3696:1995, *Water for analytical laboratory use – Specification and test methods*

3 Terms and definitions

For the purposes of this standard, the following definition applies.

3.1 char
the blackened carbonized portion of the wick remaining when kerosine is burned under specified conditions

4 Principle

A sample of kerosine is burned in a test lamp, under specified conditions, for 24 h. At the end of this period, the mass of kerosine burned and the mass of char formed on the wick are measured. Provision is made for the reporting of a qualitative assessment of the appearance of the glass chimney on the completion of the test.

5 Reagents

5.1 Use only reagents of recognized analytical grade and water conforming to the requirements of grade 3 of BS EN ISO 3696:1995.

5.2 *Denatured ethanol*

5.3 *Petroleum spirit*, 60/80, conforming to BS 2000-0.2:1996, Appendix B or an equivalent solvent, where necessary.

5.4 *Water*, unless otherwise specified, meeting the requirements for grade 3 of BS EN ISO 3696:1995.

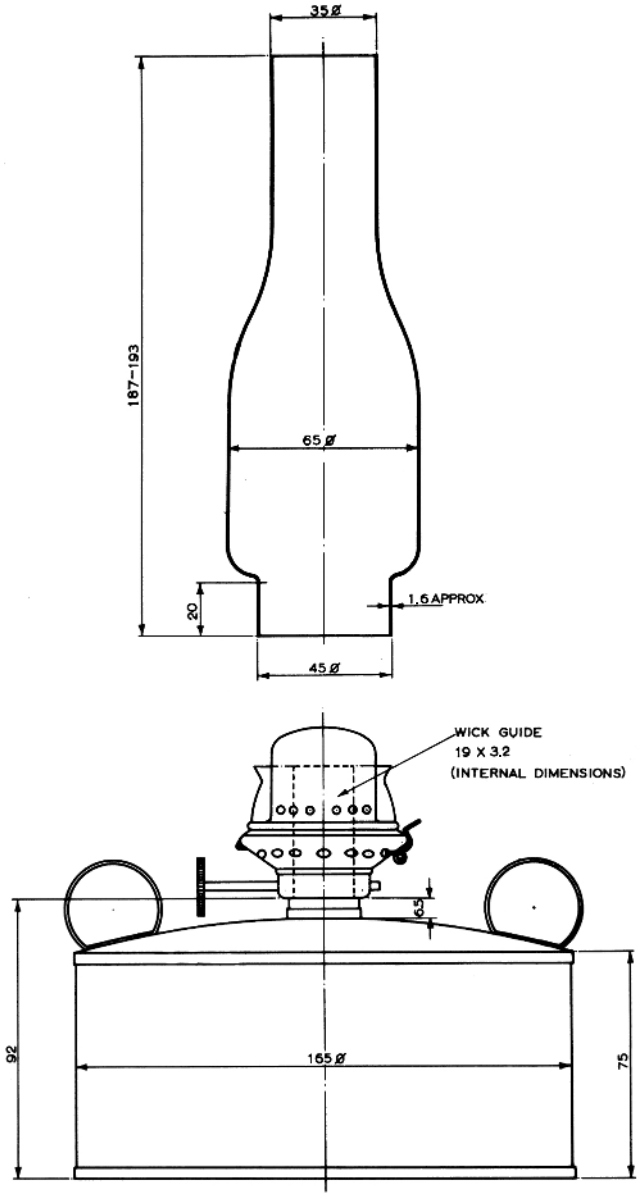
5.5 *Hydrochloric acid*, concentrated.

5.6 *Dilute hydrochloric acid (1:1)*, prepared by mixing one volume of concentrated hydrochloric acid (**5.3**) with one volume of water (**5.4**).

6 Apparatus

6.1 *Lamp*, conforming to the shape and dimensions shown in Figure 1 or Annex B. Ensure that the burner fits vertically into the oil reservoir, and that the wick-guide has parallel sides and is centrally disposed in relation to the slot in the dome of the burner.

Figure 1 **Lamp**



Dimensions shown in millimetres.

NOTE 1 Any distortion of the wick-guide or dome makes the production of the necessary flame shape difficult, and renders subsequent char values unreliable.

NOTE 2 Except where otherwise stated, the tolerance on the chimney dimensions shall preferably be ±1 mm.

6.2 *Wick*, conforming to the specification given in Annex A.

6.3 *Draught shield* (if necessary), approximately 600 mm in diameter and tall enough to protect the lamp from all draughts.

6.4 *Soxhlet apparatus*

6.5 *Filter paper (qualitative)*, with a retention porosity of approximately 25 µm.

NOTE Whatman grade 4 has been found to be suitable.

6.6 *Oven*, capable of being maintained at (105 ±5) °C.

6.7 *Watch glass*, approximately 100 mm in diameter.

6.8 *Flat glass sheet*, approximately 150 mm square (two pieces).

6.9 *Brush*, with short, stiff bristles.

6.10 *Beaker*, glass, 100 mL capacity.

6.11 *Balance*, sensitivity 0.1 mg.

6.12 *Balance*, top loading with a capacity of 3 kg, sensitivity 1 g.

6.13 *Bottle brush*

6.14 *Metal forceps*

6.15 *Sight gauge*, a suitable flame-measuring device.

7 Sample preparation

Filter approximately 1 L of sample through a filter paper (**6.5**).

8 Apparatus preparation

8.1 Wicks

8.1.1 Prior to use, wicks shall be extracted in the following manner.

8.1.2 Put a number of wicks into a well lagged Soxhlet apparatus in such a manner as to prevent distortion, and extract them with boiling water (**5.4**) for 3 h from the end of the first siphoning cycle.

8.1.3 Remove the wicks from the apparatus, lay them flat between sheets of filter paper and press them gently to remove excess moisture.

8.1.4 Extract them with denatured ethanol (**5.2**) for 3 h in an unlagged Soxhlet.

8.1.5 Drain the denatured ethanol as completely as possible from the extractor, and then extract the wicks for 1 h with petroleum spirit (**5.3**).

8.1.6 Air dry the extracted wicks, and store in a glass jar.

8.2 Lamp

8.2.1 Clean thoroughly the lamp burner, removing completely any deposit from the wick guide, air holes, and ducts.

8.2.2 Drain the reservoir free from any previous sample.

8.3 Chimney

8.3.1 Soak new chimneys in hydrochloric acid (**5.6**) for 24 h. Rinse with tap water and clean using a bottle brush. Rinse with water (**5.4**) and dry in the oven (**6.6**) at 105 °C. Subject new chimneys to three preliminary 24 h burning periods.

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8.3.2 Before carrying out a test, clean chimneys with detergent and tap water. Rinse thoroughly with water (**5.4**) and dry at 105 °C. Allow to cool to room temperature before use.

9 Procedure

9.1 Dry the wick for 1 h in the oven (**6.6**) at 105 °C, and soak it in the sample while still hot. Fit into the wick-guide.

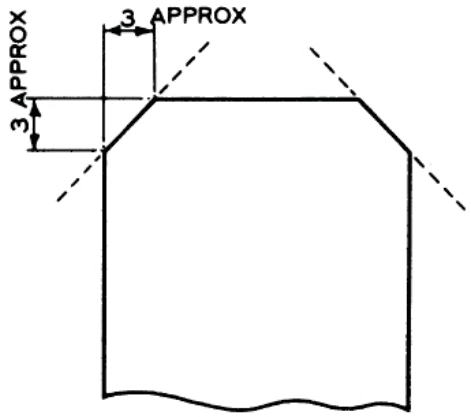
9.2 Rinse out the lamp reservoir with filtered sample. Fill the reservoir with (900 ±10) ml of filtered sample. Assemble the lamp.

9.3 Hinge back the dome and chimney and trim the wick as follows, using sharp scissors:

a) Cut the wick level with the wick guide.

b) Raise the wick approximately 20 mm, cut off triangular portions as shown in Figure 2 and round off any sharp corners.

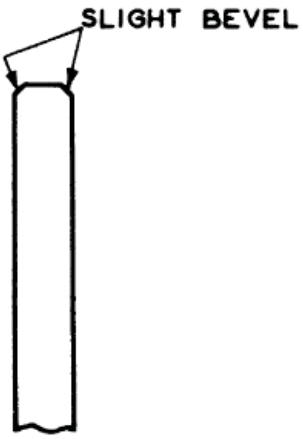
Figure 2 **Front view of the wick**



Dimensions shown in millimetres.

c) Trim off any ragged projections from the top edge of the wick by bevelling them slightly to give the result shown in Figure 3.

Figure 3 **Side view of wick**



Dimensions shown in millimetres.

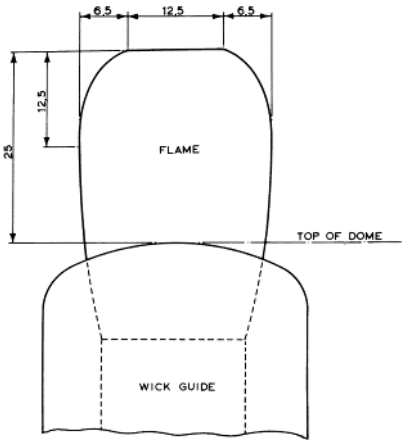
9.4 Weigh the lamp (without the chimney), and record the mass, S0, to the nearest 1 g.

9.5 Place the lamp in a well ventilated room, surrounded by a draught shield (**6.3**), if necessary. The temperature of the room and of the oil under test shall be above 15.5 °C throughout the test. Place lamps with their centres at least 300 mm apart and 300 mm away from a wall or other equipment.

If required, record the maximum and minimum temperatures, and the atmospheric conditions (humid, foggy, etc.) during the test.

9.6 Light the lamp, and place the chimney in position. Allow the flame to stabilize, and then adjust the wick to give a flame of the dimensions shown in Figure 4, to a tolerance of ±1.5 mm. If it is not possible to adjust the flame to the correct dimensions, extinguish the flame by turning down the wick, and retrim in accordance with **9.3**. Repeat until the correct flame is obtained.

Figure 4 **Shape and size of flame**



Dimensions shown in millimetres.

NOTE It is not necessary to reweigh the lamp unless it has burned for more than 30 min during the trimming process.

Measure the flame with a gauge (**6.15**) placed approximately 150 mm from the flame.

9.7 Allow the lamp to burn for 1 h, and readjust the wick, if necessary.

9.8 Allow the lamp to burn for a further 23 h ±15 min without further adjustment. Extinguish the flame and remove the chimney. Record the condition of the chimney by taking note of the predominating colour, and the general appearance of the bloom, as follows:

a) predominating colour - brown, greyish-brown or grey;

b) general appearance - normal or abnormal.

Reweigh the lamp and record the mass, S_1, to the nearest gram.

NOTE The consumption during the test is typically 20 g/h.

9.9 Open the lamp, and turn up the wick. Remove the top section of the wick by making a cut approximately 13 mm below the charred section and place it in a 100 ml beaker (**6.10**), together with any pieces of char which have become detached.

9.10 Scrape off carefully any char adhering to the wick guide, and add to the beaker.

9.11 Wash the contents of the beaker free from kerosine, using a wash and decantation technique with petroleum spirit (**5.3**).

9.12 Place the beaker and its contents in an oven (**6.6**) and dry at 105 °C for 30 min.

9.13 Clean, dry and weigh a watch glass (**6.7**). Record the mass, M0, to the nearest 0.1 mg.

9.14 Place the glass sheets (**6.8**) on a sheet of white paper, in a draught-free environment, and remove the char from the wick by breaking the structure and gently scraping along and across the wick with metal forceps (**6.14**). Remove and discard any pieces of thread from the char, and transfer any coarse char to the watch glass (**6.7**).

9.15 Remove the fine, fluffy fibre as completely as possible by moving the mixture from one glass plate to another, and by collecting the fibre on a brush (**6.9**). Take great care not to remove char at the same time.

9.16 Transfer the remaining char and inseparable fibre to the watch glass, together with any char from the beaker. Reweigh the watch glass and char. Record the mass, M1, to the nearest 0.1 mg.

10 Calculation

Calculate the char value, *C*, in mg/kg, using the following equation:

$$C = \frac{(M_1 - M_0)10^3}{(S_0 - S_1)}$$

where:

M_0 is the mass of the watch glass, in mg;

M_1 is the mass of the watch glass and char, in mg;

S_0 is the mass of the lamp (without chimney) and contents before lighting, in g;

S_1 is the mass of the lamp (without chimney) and contents after burning, in g.

11 Expression of results

Report the char value, *C*, to the nearest 1 mg/kg, and the condition of the chimney, if required.

12 Precision

12.1 The precision of the method, as derived from statistical analysis by BS 2000-367 of interlaboratory test results, is given in **12.2** and **12.3**.

12.2 Repeatability

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 given in Table 1 in only one case in 20.

Table 1 **Repeatability**

Char value mg/kg	**Repeatability**[A)]
0 to 30	$0.91\sqrt{x}$
Above 30	Not established

[A)] x is the average of the results being compared.

12.3 Reproducibility

The difference between two single and independent results obtained by different operators working in different laboratories on nominally identical test material would, in the long run, exceed the value given in Table 2 in only one case in 20.

Table 2 **Reproducibility**

Char value mg/kg	**Reproducibility**[A)]
0 to 30	$2.9\sqrt{x}$
Above 30	Not established.

[A)] x is the average of the results being compared.

13 Test report

The test report shall contain at least the following information:

a) a reference to this standard;

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

c) the result of the test (see Clause **11**) and, if required, the condition of the chimney;

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

e) the date of the test.

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Annex A (normative) Specification for wicks

A.1 The ash content of the wick shall be less than 0.4% (m/m).

A.2 Use 19 mm paraffin flat wick, super quality, containing approximately 43 ends of three-ply yarn, woven double plain weave with stitching ends, one blue stripe on one face and one green stripe on the other, woven with approximately 16 picks per 10 mm and weighing normally 15 g/m.

A.3 After weaving, the wick shall be boiled in water (**5.4**) and dried thoroughly. The wick shall then be made into rolls, and left for 7 days before it is cut into 200 mm lengths. The cut wicks shall then be packed into suitable containers.

A.4 When it is not possible to confirm, by examination, that the wick conforms to this specification, request a certificate of conformity from the suppliers.

Annex B (normative) Alternative lamp design

An alternative lamp design can be used to complete this test. The alternative lamp shall conform to Figure B.1 and can be used in place of the lamp specified in **6.1**.

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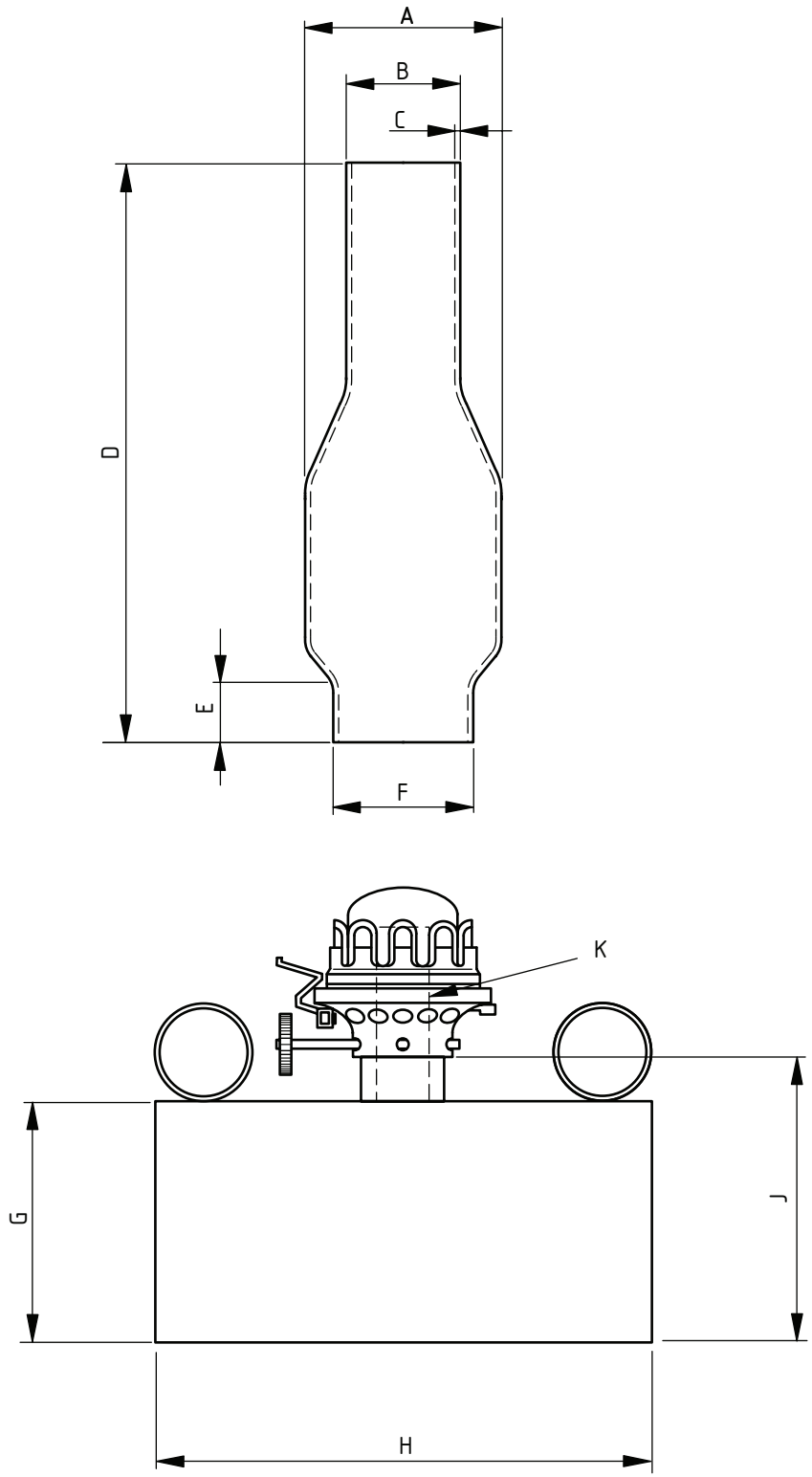
Figure B.1 **Alternative lamp**



Dimensions shown in millimetres.
K - wick guide

Key	Min.	Max.	**Key**	Min.	Max.
A	64	66	F	44	46
B	35	37	G	78	82
C	1.2	1.6	H	161	165
D	187	193	J	93	97
E	19	21	K	18.5 × 3.05	19.5 × 3.55

NOTE Any distortion of the wick-guide or dome makes the production of the necessary flame shape difficult, and renders subsequent char values unreliable.

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 2000-367, *Petroleum products – Determination and application of precision data in relation to methods of test*

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