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***भारतीय मानक***

***Indian Standard***

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 **पेट्रोलियम और उसके उत्पाद — परीक्षण पद्धतियाँ**

 **भाग 5 केरोसिन के जलने की विशेषताओं**

 **का निर्धारण — 24 घंटे की विधि**

 **(दूसरा पुनरीक्षण*)***

 **PETROLEUM AND ITS PRODUCTS —**

 **METHODS OF TEST —**

 **PART 5 DETERMINATION OF**

 **KEROSENE BURNING**

 **CHARACTERISTICS — 24 HOUR METHOD**

 **(Second Revision)**

 ICS 75.080

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**July 2024 Price Group X**

Methods of Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (excluding bitumen) Sectional Committee, PCD 01

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Methods of Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (excluding bitumen) Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

This standard was first revised in 1970 to align with the institute of petroleum standard IP 10 /65 and IP 11/63T. The second revision has been taken up to align with revised IP 10/12 and to keep pace with the latest technological developments and international practices.

In this revision following major changes have been made:

a) Sample preparation and calculation for quantitative evaluation has been included; and

b) Specification for wicks and the alternate lamp design incorporated as Annex A and Annex B.

In the preparation of this standard, considerable assistance has been derived from the following standards:

IP10/12 — **Determination of kerosene burning characteristics — 24 h method**

The composition of the Committee, Subcommittee responsible for the formulation of this standard is given in Annex C.

In reporting the results of a test analysis made in accordance with this standard, if the final Value, observed or calculation, is to be rounded off, it shall be done in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’.

*Indian Standard*

PETROLEUM AND ITS PRODUCTS­­ — METHODS OF TEST

**PART 5 DETERMINATION OF KEROSENE BURNING CHARACTERISTICS — 24 HOUR METHOD**

*(Second Revision)*

**1 SCOPE**

This standard prescribes the procedure for determination of the burning properties of kerosene used for illumination and/or heating purposes.

**2 REFERENCE**

The standard contain provisions which, through reference in text constitute provisions of this standard. At the time of publication, the edition indicated was valid. All the standard is subject to revision, and parties to agreement based on this standard is encouraged to investigate the possibility of applying the most recent edition of this standard:

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 1070 : 2023 | Reagent grade water — Specification (*fourth revision*) |

**3 DEFINITIONS**

For the purpose of this Standard, the following definitions apply.

**3.1** **Char**

The blackened carbonized portion of the wick remaining when kerosene is burned under specified conditions.

**4 PRINCIPLE**

Kerosene sample is burnt in a test lamp, under specified conditions for 24 h. At the end of 24 h, the mass of kerosene burnt and the mass of char formed on the wick are measured. Qualitative assessment of the appearance of the glass chimney on the completion of the test is also measured.

**5 REAGENTS**

**5.1** Use only reagents of analytical grade and water conforming to the requirements of Grade 1 of IS 1070.

**5.2** **Denatured Ethanol**

**5.3** **Petroleum Spirit, 60/80, or Equivalent Solvent**

**5.4** **Concentrated Hydrochloric Acid**

**5.5** **Dilute Hydrochloric Acid (1: 1)**

Prepared by mixing one volume of concentrated hydrochloric acid with one volume of water.

**6 APPARATUS**

**6.1** Lamp, conforming to the shape and dimensions shown in Fig.1 or Annex B.

NOTES

**1** The tolerance on the chimney dimensions shall preferably be ±1 mm.

**2** Ensure that the burner fits vertically into the oil reservoir, and that the wick- guide has parallel sides. Any distortion of the wick- guide or dome will lead to distorted flame shape and lead to unreliable qualitative and quantitative results.

**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 with a retention porosity of approximately 25µ.

NOTE — Whatman Grade 4 is recommended.

**6.6** **Oven —** capable of maintaining temperature of (105 ± 5) °C.

**6.7** **Watch Glass —** approximately 100 mm in diameter.

**6.8** **Flat Glass Sheet —** two pieces, approximately 150 mm square.

**6.9** **Brush —** with short, stiff bristles.

**6.10** **Beaker —** glass (100 ml)

**6.11 Balance** **—** with sensitivity 0.1 mg.



All dimensions are in millimeters.

Fig. 1 Lamp

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

**6.13** **Bottle Cleaning Brush**

**6.14** **Metal Forceps**

**6.15** **Sight Gauge —** a suitable flame measuring device.

**7** **SAMPLE AND APPARATUS PREPARATION**

**7.1** Filter approximately 1 litre of sample through a filter paper and store in the container.

**7.2 Wicks Extraction**

**7.2.1** Wicks shall be extracted in the following manner.

**7.2.2** Put a number of wicks into a soxhlet apparatus and extract them with boiling water for 3 h from the end of the first siphoning cycle.

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

**7.2.4** Follow by extracting them with denatured ethanol for 3 h in a soxhlet apparatus.

**7.2.5** Drain the denatured ethanol as much as possible from the extractor, and then extract the wicks for 1 h with petroleum spirit.

**7.2.6** Dry the extracted wicks in air, and store in a glass jar.

**7.3** **Lamp**

**7.3.1** Thoroughly clean the lamp burner and clean the wick guide, air holes, and ducts

**7.3.2** Drain previous sample from the lamp reservoir, if any.

**7.4** **Chimney**

**7.4.1** Soak new chimneys in diluted hydrochloric acid (1: 1) for 24 h. Rinse with water and clean using a bottle cleaning brush. Rinse with water and dry in the oven at (105 ± 1) °C. Subject new chimneys to three preliminary 24 h burning periods after cleaning.

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

**8** **PROCEDURE**

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

**8.2** Rinse the lamp reservoir with filtered sample. Fill the reservoir with (900 ± 10) ml of filtered sample and fix the wick guide.

**8.3** 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 the edges in to triangular portions as shown in Fig. 2 and round off any sharp corners; and



Fig. 2 Front View of the Wick

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



Fig. 3 Side View of Wick

**8.4** Weigh the lamp without chimney and record the mass, W0, to the nearest 1g.

**8.5** Place the lamp in a well-ventilated room, surrounded by a draught shield, 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 centers at least 300 mm apart and 300 mm away from a wall or other equipment if any.

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

**8.6** Light the lamp, and fix the chimney in position. Allow the flame to stabilize, and then adjust the wick to give a flame of the dimensions shown in Fig. 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 re-trim in accordance with **8.3**. Repeat until the correct flame is obtained.

 

All dimensions are in millimeters.

Fig. 4. Shape and Size of Flame

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

Measure the flame with a sight gauge placed approximately 150 mm away from the flame.

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

**8.8** 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 observing the predominating colour, and the general appearance of the bloom, as follows:

a) Predominating colour — brown, grayish brown or grey; and

b) General appearance — normal or abnormal.

Reweigh the lamp and record the mass, *W*1, to the nearest 1 g.

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

**8.9** Open the lamp, and turn up the wick. Cut approximately 13 mm below the charred portion of the wick and collect it in a 100 ml beaker, together with any pieces of char which have been detached.

**8.10** Scrap off carefully any char adhering to the wick guide, and add to the beaker.

**8.11** Wash the content of the beaker with petroleum spirit to free it from kerosene, using a decantation technique.

**8.12** Place the beaker and its contents in an oven and dry at (105 ± 1) °C for 30 min.

**8.13** Clean, dry and weigh a watch glass. Record the mass *M*1, to the nearest 0.1mg.

**8.14** Place the glass sheet on a sheet of white paper, in a draught-free environment, and transfer the contents of beaker to the glass sheet. Remove the char from the wick by gently scrapping along and across the wick with metal forceps. Remove and discard any pieces of thread from the char, and transfer collected char to the weighed watch glass.

**8.15** Remove the fine, fluffy fiber as completely as possible by moving the mixture from one glass sheet to another, and by collecting the fiber on a brush. Care should be taken to avoid the loss of any char.

**8.16** Transfer the remaining char and inseparable fiber to the weighed watch glass. Reweigh the watch glass with char. Record the mass, *M*1, to the nearest 0.1 mg.

**9** **CALCULATION**

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

*C* = $\frac{\left(M1-M0\right) × 10^{3}}{(W0-W1)}$

where

*M*0 = mass, in mg, of the watch glass,;

*M*1 = mass, in mg, of the watch glass and char.

*W*0 = mass, in g, of the lamp before lighting; and

*W*1 = mass, in g, of the lamp after burning.

**10** **EXPRESSION OF RESULTS**

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

**11** **PRECISION**

**11.1** The precision of the method, as derived from statistical analysis of inter-laboratory test is given in **11.2** and **11.3.**

**11.2** **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**

(*Clause* 11.2)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Char value,**mg/kg | **Repeatability 1** |
| (1) | (2) | (3) |
| i) | 0 to 30 | 0.91√x |
| ii) | Above 30 | Not established |
| 1. x is the average of the results being compared.
 |

**11.3** **Reproducibility**

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

**Table 2 Reproducibility**

(*Clause* 11.3)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Char value,** mg/kg | **Repeatability 2** |
| (1) | (2) | (3) |
| i) | 0 to 30 | 2.9√x |
| ii) | Above 30 | Not established |
| 1. x is the average of the results being compared.
 |

**ANNEX A**

(*Foreword and* *Clause* 6.2)

**SPECIFICATION FOR WICKS**

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

**A-2** Use 19 mm width super quality paraffin flat wick, 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 face woven with approximately 16 picks per 10 mm and weighing normally 15g/m.

**A-3** After weaving, the wick shall be boiled in water and dried thoroughly then it is made into rolls, and left for 7 days before it is cut into 200 mm lengths. The cut wicks shall then have subjected to suitable packing.

**A-4** If it is not possible to confirm, by examination, that the wick conforms to the required specification certificate of conformity shall be obtained from the suppliers.

**ANNEX B**

(*Foreword and* *Clause* 6.1)

**ALTERNATIVE LAMP DESIGN**

**B-1** An alternative lamp design can be used to complete this test. The alternative lamp shall conform to the dimensions as mentioned in Fig. B1 and can be used as replacement to the lamp specified in **6.1**.



 

All dimensions are in millimeters.

FIG. B1 ALTERNATIVE LAMP DESIGN

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *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 | 1.8 × 3.05 | 19.5 × 3.55 |

 NOTE — Any distortion of the dimensions of wick guide or dome makes the production of specified flame shape difficult, and leads to the unreliable char value.

**ANNEX C**

(*Foreword*)

**COMMITTEE COMPOSITION**

Methods of Sampling and Test for Petroleum and Related Products of Natural or Synthetic Origin (excluding bitumen) Sectional Committee, PCD 01

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Physico-Chemical Test Methods for Petroleum and Related Products of Synthetic or Biological Origin (Excluding Bitumen, Lubricants, Greases and Gaseous Fuels) Sub Committee, PCD 1:3

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