BRITISH STANDARD

BS 2000 :
Part 196 : 1997
ISO 2049 : 1996

Methods of test for

Petroleum and its products

Part 196. Petroleum products - Determination of colour (ASTM scale)

(Identical with IP 196/97)

BSI
British Standards

National foreword

This British Standard was published under the authority of the Materials and Chemicals Sector Board and comes into effect on 1st March 1997. It is identical with ISO 2049 : 1996, prepared by Technical Committee 28, Petroleum products and lubricants, of the International Organization for Standardization (ISO).

This British Standard supersedes BS 5859 : 1980 which is withdrawn.

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 'IP Standard methods for analysis and testing of petroleum and related 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 : Part 196 will be published by the IP (in 'Standard methods for analysis and testing of petroleum and related products and British Standard 2000 Parts' and as a separate publication). The numbering of the Parts of BS 2000 follows that of the corresponding IP methods. BS 2000 : Part 196 : 1997 is thus identical with IP 196/97.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

The following BSI references relate to the work of this standard:
Committee reference PTI/13
Draft for comment 93/502907 DC

Petroleum products — Determination of colour (ASTM scale)

WARNING — The use of this International Standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this 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 visual determination of the colour of a variety of petroleum products, such as lubricating oils, heating fuels, diesel fuels and petroleum waxes. It is limited to products that do not contain artificial dyes.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 3015:1992, *Petroleum products — Determination of cloud point.*

ISO 3016:1994, *Petroleum products — Determination of pour point.*

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods.*

ISO 6271:—[1], *Clear liquids — Estimation of colour by the platinum-cobalt scale.*

ISO 6353-2:1983, *Reagents for chemical analysis — Part 2: Specifications — First series.*

3 Principle

A test portion of the petroleum product is viewed under an artificial daylight source and the colour compared with a number of standard colour glasses. The matching colour standard, or that closest to it on the darker side, is recorded as the colour value. If the colour is darker than the darkest standard, dilution with a specified solvent can be applied to permit matching.

4 Reagents and materials

4.1 Water, complying with the requirements of Grade 3 of ISO 3696 and colour no greater than 10 units (Hazen) in accordance with ISO 6271.

4.2 Kerosine, lighter in colour than a potassium dichromate ($K_2Cr_2O_7$) solution formed by dissolving 4,8 mg of pure anhydrous potassium dichromate, as specified in ISO 6353-2, in 1 litre of water (4.1).

5 Apparatus

5.1 Colorimeter, consisting of a light source, glass colour standards, sample container housing with cover and viewing piece, conforming to one of the designs described in annex A.

5.2 Sample container, of clear colourless glass. For referee tests, use the glass sample jar shown in figure 1. For routine tests, it is permissible to use a glass jar such as is used for the cloud point and pour point tests, in accordance with ISO 3015 and ISO 3016 respectively, i.e. a cylindrical jar with a flat bottom of 30 mm to 32,4 mm internal diameter, 115 mm to 125 mm external height, and a wall thickness no greater than 1,6 mm.

1) To be published. (Revision of ISO 6271:1981)

Dimensions in millimetres

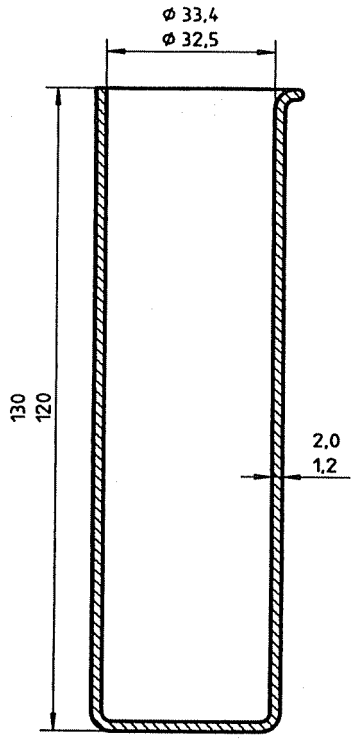

Figure 1 — Glass sample jar

5.3 Sample cover, of any suitable material that is dull black on the inside and is designed to completely shield the containers as described in 7.2.

6 Preliminary examination of sample

6.1 Liquid petroleum products

Fill the sample container to a depth of 50 mm or more and observe the colour. If the sample is not clear, heat it to a temperature 6 °C above the point at which the cloud or haze disappears, and determine the colour at that temperature. If the sample is darker than 8,0 colour (see table A.2), mix 15 volumes of the sample into 85 volumes of kerosine (4.2) and determine the colour of the mixture.

6.2 Petroleum waxes, including petrolatum

Heat the sample to a temperature 11 °C to 17 °C above the melting point of the wax. If the sample is darker than 8,0 colour (see table A.2), mix 15 volumes of melted sample with 85 volumes of kerosine (4.2) brought to the same temperature, and determine the colour of the mixture at that temperature.

7 Procedure

7.1 Fill two sample containers (5.2) if using a two-field comparator, or three sample containers if using a three-field comparator, with water (4.1) to a depth of at least 50 mm, and place one container in the sample compartment and the other(s) in the standard glasses compartment of the colorimeter. Switch on the artificial daylight source and confirm that the light intensity through all compartments is equal when the standard glasses are not in the path of the daylight source.

7.2 Place a sample container (5.2) or containers, filled to a depth of at least 50 mm with water (4.1), in that compartment or compartments of the colorimeter through which the standard glasses will be observed. Place the sample in its container in the other compartment. Cover the containers with the sample cover (5.3) to exclude all exterior light.

7.3 Switch on the light source of the colorimeter and compare the colour of the sample with that of the standard glasses. If using a three-field comparator, bracket the sample by darker and lighter glass discs or by an exact match and a darker glass disc. Determine, for two-field comparators, which glass matches the colour of the sample; or if an exact match is not possible, then use that glass which has the next darker colour.

8 Expression of results

Report as the colour of the sample, the designation of the glass producing a matching colour, for example: "7,5 colour".

If the colour of the sample is intermediate between those of two standard glasses, report the designation of the darker glass preceded by the letter "L", for example: "L7,5 colour".

Never report the colour of a sample as being darker than a given standard except those samples darker than 8, for which the designation "D8 colour" shall be given.

If the sample has been diluted with kerosine (4.2), report the colour of the mixture followed by the abbreviation "Dil", for example: "L7,5 Dil colour".

9 Precision

The following criteria shall be used for judging the acceptability of results (95 % confidence level) when using the reference sample containers.

NOTE 1 The precision was derived by an interlaboratory test programme using sample containers of the dimensions

shown in figure 1. The changes that have been introduced into the dimensions for routine analysis, in order to align with those specified in other International Standards stipulating similar glassware, are not expected to change the precision values, although this has not been verified.

9.1 Repeatability

The difference between successive test results, obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the normal and correct operation of the test method, exceed 0,5 of a colour number only in one case in 20.

9.2 Reproducibility

The difference between two single and independent test results, obtained by different operators working in different laboratories on nominally identical test material would, in the normal and correct operation of the test method, exceed 1 colour number only in one case in 20.

10 Test report

The test report shall contain at least the following information:

a) a reference to this International Standard;

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

c) the results of the test (see clause 8);

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

e) the date of the test.

Annex A
(normative)

Colorimeter and associated apparatus

A.1 Colorimeter

Use an instrument that will illuminate and permit observation of the sample and any one of the colour standards (or in the case of a three-field instrument, any two of the colour standards) simultaneously, either by direct viewing or with an optical eye-piece.

A two-field instrument shall show two illuminated areas of equal size and shape, one filled with light transmitted by a colour standard, the other with light transmitted by the sample. These illuminated areas shall be disposed symmetrically about a vertical median line and shall be separated in a horizontal direction so that the horizontal separation of the closest portions subtends the eye of the observer not less than 2° nor more than 3,6°.

A three-field instrument shall show three illuminated areas in the field of view. Two areas shall be filled with light transmitted by two different colour standards, and these shall be disposed symmetrically about the third area which shall be filled with light transmitted by the sample. The rectangular dimensions of each of the three areas shall be the same, and the left- and right-hand corners of the full field of view shall be rounded with a radius not exceeding half the vertical dimension. The illuminated areas shall be separated in a horizontal direction by vertical lines so that the closest portion of the sample area and any one of the colour standards' illuminated areas subtends the eye of the observer not less than 0,3° nor more than 0,6°.

Each illuminated area in the two-field instrument shall cover a circle of diameter subtending at least 2,2°, and may be enlarged to any size provided that no two illuminated points in the field of view are separated by a distance subtending more than 10°. In the case of the three-field direct viewing instrument, the subtending angles become 2,6° and 6,4° respectively.

NOTE 2 The angle subtended by a line of length d, in a plane perpendicular to the line of sight, and separated from the eye of the observer by a distance D, is given in degrees by 57,3 d/D. The angle subtended by the image of this line, seen by viewing it through an eye-piece of magnification M, is given in degrees by 57,3 Md/D_i, where D_i is the distance between the eye of the observer and the plane of the image.

A.2 Artificial daylight source

A.2.1 Source

This may be a separate unit or an integral part of the colorimeter. The source consists of a lamp of colour temperature 2 750 K (or if a quartz halogen lamp is used, 3 300 K), a daylight filter glass (A.2.2) and a flashed opal glass. The combined elements possess spectral characteristics similar to northern daylight. The source shall provide a transluscent or opaque diffuse background of 900 lx ± 100 lx brightness, against which the colour standards and sample shall be viewed. The background of illuminated opal glass shall be free from glare or shadows. The light source shall be designed so that there is no extraneous light interfering with the observation.

NOTE 3 When electric current is not available, the colorimeter may be designed to use diffused daylight provided that direct sunlight is avoided. Coloured objects should be excluded from the immediate foreground when using diffused daylight.

A.2.2 Filter

A spectrometric test of an acceptable daylight filter glass shall indicate a transmittance of radiant energy of not less than 0,60 at 410 nm with a smooth curve down to a transmittance below 0,10 at 700 nm. This curve shall also be without the pronounced hump which is characteristic of excess cobalt, the typical cobalt curve having an increased transmittance at 570 nm above a straight line drawn between the points indicating transmittance at 540 nm and 590 nm, and also a transmittance band above 660 nm. The transmittance of an acceptable filter shall not, at 570 nm, exceed by more than 0,03 that indicated by a straight line drawn between the points indicating transmittance at 540 nm and 590 nm, nor shall the transmittance for 700 nm exceed that for any shorter wavelength (such as 660 nm) by more than 0,03.

An acceptable daylight filter shall also possess such characteristics that the chromaticity coordinates, x, y and z, and luminous transmittance, T, when calculated from the spectral transmittance data using the 1931 CIE Standard Illuminant A, shall be as shown in table A.1.

A.3 Glass colour standards

Use glass colour standards as specified in table A.2. The standards shall be mounted in such a way that they may be conveniently manipulated. The width of the glass colour standards shall be not less than 14 mm.

Table A.1 — Filter characteristics

Characteristic	Value of characteristic	
	Lamp colour temperature K	
	2 750	3 300
T	0,107 to 0,160	0,075 to 0,125
x	0,314 to 0,330	0,300 to 0,316
y	0,337 to 0,341	0,325 to 0,329
z	0,329 to 0,349	0,355 to 0,375

Table A.2 — Glass colour standards

Colour to ISO 2049	Chromaticity coordinates[1]			Luminous transmittance (CIE standard source C)
	red	green	blue	
0,5	0,462	0,473	0,065	0,86 ± 0,06
1,0	0,489	0,475	0,036	0,77 ± 0,06
1,5	0,521	0,464	0,015	0,67 ± 0,06
2,0	0,552	0,442	0,006	0,55 ± 0,06
2,5	0,582	0,416	0,002	0,44 ± 0,04
3,0	0,611	0,388	0,001	0,31 ± 0,04
3,5	0,640	0,359	0,001	0,22 ± 0,04
4,0	0,671	0,328	0,001	0,152 ± 0,022
4,5	0,703	0,296	0,001	0,109 ± 0,016
5,0	0,736	0,264	0,000	0,081 ± 0,012
5,5	0,770	0,230	0,000	0,058 ± 0,010
6,0	0,805	0,195	0,000	0,040 ± 0,008
6,5	0,841	0,159	0,000	0,026 ± 0,006
7,0	0,877	0,123	0,000	0,016 ± 0,004
7,5	0,915	0,085	0,000	0,008 1 ± 0,001 6
8,0	0,956	0,044	0,000	0,002 5 ± 0,000 6

1) The chromaticity coordinates are expressed according to the RGB UCS system, with a tolerance of ± 0,006.

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