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Methods of testing petroleum and associated products

Visual haze rating of liquid fuels

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NATIONAL STANDARD OF CANADA

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Methods of testing petroleum and associated products

Visual haze rating of liquid fuels

1 Scope

This test method describes two procedures for the visual haze rating or appearance of contamination of liquid fuels with an ASTM colour rating of 5 or less, and a cloud point below the reported temperature of the test.

The testing and evaluation of a product against this method require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this method has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use.

2 Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this method. The referenced documents may be obtained from the sources noted below.

NOTE The addresses provided below were valid at the date of publication of this method.

An undated reference is to the latest edition or revision of the reference or document in question, unless otherwise specified by the authority applying this method. A dated reference is to the specified revision or edition of the reference or document in question.

2.1 ASTM International

D1500 — *Standard test method for ASTM color of petroleum products (ASTM Color Scale)*

D2500 — *Standard test method for cloud point of petroleum products*

D4057 — *Standard practice for manual sampling of petroleum and petroleum products*

D5773 — *Standard test method for cloud point of petroleum products (constant cooling rate method)*

D5854 — *Standard practice for mixing and handling of liquid samples of petroleum and petroleum products*

E1 — *Standard specification for ASTM liquid-in-glass thermometers.*

2.1.1 Source

The above may be obtained from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, U.S.A., telephone 610-832-9585, fax 610-832-9555, Web site www.astm.org, or from IHS Global Canada Ltd., 200-1331 MacLeod Trail SE, Calgary, T2G 0K3, telephone 613-237-4250 or 1-800-267-8220, fax 613-237-4251, Web site www.global.ihs.com.

3 Summary of test method

3.1 Procedure A: Numerical haze rating

A nominal 1 L volume of transparent liquid fuel sample is collected in a colourless and clear sample container. This sample is visually examined for suspended matter (visual haze) with the use of a reference chart then immediately swirled to create a vortex to visually detect the presence of precipitated matter. The report includes a numerical rating of 1 through 6 and a statement of the presence of precipitated water, particulate, or both. The temperature of the test is also reported in °C or °F.

3.2 Procedure B: Visual haze (Pass/Fail)

A nominal 1 L volume of transparent liquid fuel sample is collected in a colourless and clear sample container. This sample is visually examined for suspended matter (visual haze) then immediately swirled to create a vortex to visually detect the presence of precipitated matter. The report includes a statement as to the presence of suspended matter and a statement of the presence of precipitated water, particulate, or both. The temperature of the test is also reported in °C or °F.

4 Terms and definitions

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

4.1
appearance
visual rating of a liquid fuel under specified conditions.

4.2
cloud point
temperature at which the smallest observable cluster of wax crystals first appears in a fuel upon cooling under prescribed test conditions (ASTM D2500 or D5773).

4.3
clear-and-bright
absence of haze. A numerical haze rating of “1” by definition.

4.4
standard bar chart (Figure 1)
consists of five horizontal black bars of varying thickness positioned parallel to each other on a white background.

4.5
standard rating chart (Figure 2)
consists of six numbered photographic images each depicting a sample with a different degree of visual haze. The amount of free or undissolved water increases at higher haze ratings and depicts the following six degrees of visual haze:

No. 1 — A clear fuel, all bars clearly and completely visible
No. 2 — A slightly hazy fuel, all bars visible, but with slightly reduced sharpness and optical density
No. 3 — A progressive visual haze, all bars visible, but with significantly reduced sharpness and optical density
No. 4 — A progressive visual haze, lowest bar not discernable, second lowest bar barely visible
No. 5 — A progressive visual haze, lowest bar invisible, second and third lowest bars barely visible
No. 6 — A heavy haze, no bars visible.

4.6
visual haze
scatter of light from an accumulation of suspended matter (particulates or water droplets) in the liquid fuel detectible by eye.

5 Interferences

5.1 The sample containers shall be colourless, clean, and free of dust or other particulates.

5.2 A sample tested at or below its expected cloud point temperature may appear hazy as a result of wax crystals.

5.3 Samples with an ASTM D1500 colour rating of 5 or greater are too dark to allow visual haze rating by this method.

5.4 The solubility of water in liquid fuel generally varies with temperature, therefore the temperature of the sample can affect the observed visual haze.

6 Apparatus

6.1 Insertion mixer: non-aerating, stand-alone device as described in ASTM D5854.

6.2 Sample container: pre-cleaned, colourless, clear, cylindrical, 1 L capacity sample bottle, or equivalent with an outer diameter of approximately 8 to 10 cm.

6.3 Standard bar chart (Figure 1)[2].

6. 4 Standard rating chart (Figure 2)[2].

6. 5 Thermometer: Glass or digital with an accuracy of 0.2°C at the temperature of the test. ASTM 12C or equivalent.

6.6 Temperature-controlled bath: suitable dimensions to accommodate the sample container, and capable of controlling the sample temperature within ±0.5°C of the test temperature.

7 Precautions

7.1 This test method involves the handling of potentially volatile or flammable liquid fuels. Appropriate measure shall be taken to minimize associated hazards including the use of personal protective equipment.

8 Procedure

8.1 Sampling

8.1.1 For field measurements it is recommended to take a sample in a clean, colourless and clear 1 L sample bottle filled to approximately 80%. Cleaning can be accomplished by rinsing the container twice with the sample to be tested.

8.1.2 Samples received in opaque containers or in volumes greater than 1 L may be transferred to the recommended sample container provided they are first homogenized[3] to ensure they remain representative when transferred, and that they are transferred into a clean, dry, colourless and clear 1 L container.

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[2] Provided in laminated paper format at the time of purchase of the method. When the figures are not in use, store them in an opaque envelope at room temperature to minimize image deterioration that could be caused by exposure to light or heat.

[3] Refer to ASTM D5854 for suggested best practice.

NOTE When wide mouth containers are used, it is good practice to cover the mouth of the container with a watch glass, clear plastic-wrap or an equivalent closure modified to permit the insertion of a temperature measuring device.

8.2 Procedure A

8.2.1 Obtain a representative sample taken in accordance with ASTM D4057.

8.2.2 Insert the thermometer into the sample and record the temperature to the nearest 0.5°C. The use of a bath is acceptable to obtain visual ratings at temperatures other than ambient.

8.2.3 Immediately remove the thermometer and place the standard bar chart (Figure 1) behind the sample container in a well-lit area, (ensure the outside of the container is wiped clean prior to rating).

8.2.4 Compare the observed visual haze of the sample with the standard rating chart (Figure 2) and record the haze rating that provides the best match.

8.2.5 Remove the bar chart and swirl the sample container to produce a vortex. Examine the bottom of the vortex at arm's length for particulate matter, water droplets, or both. Record the presence of any precipitated particulates or water.

8.3 Procedure B

8.3.1 Obtain a representative sample taken in accordance with ASTM D4057.

8.3.2 Insert the thermometer into the sample and record the temperature to the nearest 0.5°C. The use of a bath is acceptable to obtain visual ratings at temperatures other than ambient.

8.3.3 Immediately remove the thermometer and hold the sample up to the light and visually examine for the presence of visual haze.

8.3.4 Swirl the sample container to produce a vortex. Examine the bottom of the vortex at arm's length for particulate matter, water droplets, or both. Record the presence of any precipitated particulates or water.

9 Report

9.1 Report the results as follows:

9.1.1 Procedure A

Visual haze rating @ test temperature = numerical rating of 1 through 6

Free Water—Pass (absent) or fail (present)

Particulates—Pass (absent) or fail (present).

9.1.2 Procedure B

Visual haze rating @ test temperature = pass/or clear and bright if there is no visually discernible haze and there is no precipitated water or particulates.

Visual haze rating @ test temperature = fail/ or not clear and bright if there is visually discernible haze, precipitated water or particulates, or both.

9.1.3 For both procedures the reason for any failure should also be recorded and reported.

10 Precision and bias

10.1 The precision and bias of the method has not been developed because circulating samples of uniform haze is difficult. The haze rating results recorded in Tables 1 to 4 were obtained for samples at 5 and 20°C.

10.2 A significant departure in sample colour from that shown in the standard rating chart (ASTM D1500, colour L 1.0) will have a marked effect on precision. Ratings may be very imprecise or impossible to take with very dark samples (ASTM D1500, colour rating of 5 or greater).

Table 1 — Comparative haze ratings of light-coloured diesel fuel (5°C)

Operators	Samples[a]								
	A	B	C	D	E	F	G	H	I
1	2	3	2	6	4	4	1	3	2
2	2	4	1	6	4	5	1	5	2
3	2	4	2	6	5	5	1	5	2
4	2	5	2	6	5	5	1	5	3
5	2	5	2	6	5	4	1	5	3
6	2	5	1	6	3	4	1	5	2
7	2	3	1	6	3	2	1	5	2
8	2	3	2	6	3	6	1	6	3
9	2	5	2	6	5	5	1	5	3

[a] A diesel fuel (ASTM D1500, colour L 1.5) blended with up to 200 mL/m^3 of water for different period in a blender.

Table 2 — Comparative haze ratings of light-coloured diesel fuel (20°C)

Operators	Samples[a]								
	A	B	C	D	E	F	G	H	I
1	1	6	5	4	1	1	2	6	3
2	1	6	5	5	1	1	2	5	4
3	1	6	4	3	1	1	2	6	3
4	1	6	4	3	1	1	2	6	4
5	1	6	5	4	1	1	2	5	4
6	1	6	5	4	1	1	2	5	3
7	1	6	5	5	1	1	2	5	4
8	1	6	5	4	1	1	2	6	4
9	1	6	4	3	1	1	2	5	5
10	1	6	4	1	2	2	6	5	5

[a] A diesel fuel (ASTM D1500 colour L 1.5) blended with up to 200 mL/m^3 of water for different periods in a blender.

Table 3 — Comparative haze ratings of dark-coloured diesel fuel (5°C)

Operators	Samples[a]								
	A	B	C	D	E	F	G	H	I
1	2	5	2	3	5	6	5	5	2
2	3	6	4	5	5	6	6	5	3
3	5	6	2	4	5	6	6	5	3
4	2	5	4	4	5	6	6	5	3
5	3	5	3	5	5	6	6	4	3
6	4	5	4	5	6	6	6	5	5
7	2	5	2	3	5	6	6	5	2

[a] A diesel fuel (ASTM D1500, colour L 3.5) blended with up to 200 mL/m^3 of water for different period in a blender.

Table 4 — Comparative haze ratings of dark-coloured diesel fuel (20°C)

Operators	Samples[a]								
	A	B	C	D	E	F	G	H	I
1	2	2	1	6	2	2	2	3	3
2	2	2	1	6	2	1	2	4	3
3	4	3	2	6	4	2	4	5	5
4	2	1	2	6	2	1	2	3	3
5	1	2	6	2	1	1	2	3	3
6	2	1	2	6	2	1	2	3	2
7	2	2	2	6	2	2	3	2	3
8	2	1	1	5	2	2	1	2	2
9	3	3	1	6	4	2	4	5	5

[a] A diesel fuel (ASTM D1500, colour L 3.5) blended with up to 200 mL/m^3 of water for different periods in a blender.