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CAN/CGSB-3.0 No. 28.8-2020

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Methods of testing petroleum and associated products

Visual haze rating of liquid fuels

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Preface

This National Standard of Canada CAN/CGSB-3.0 No. 28.8-2020 supersedes the 2015 edition.

Changes since the previous edition

- Updated ASTM International references to include ASTM D4177, D5842 and D6045.
- Removed all references to reporting temperature in °F.
- Removed the word “precipitated” throughout document and replaced with “settled”.
- Modified definition of clear and bright.
- Updated interferences to include notes on sample temperature and sample mixing.
- Updated sampling methods to include ASTM D4177 and D5842.

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No. 28.8-2015

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 requires 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.

Units of measurement – Quantities and dimensions in this standard are given in SI units.

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 source information provided below was 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

Annual Book of ASTM Standards (see Annex A)

2.1.1 Source

The above may be obtained from ASTM International, telephone: 610-832-9585, fax: 610-832-9555, Web site: www.astm.org, or from IHS Global Canada Ltd., 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 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 settled matter. The report includes a numerical rating of 1 through 6 and statements indicating the presence or absence of settled water and particulates. The temperature of the test is also reported in °C.

3.2 Procedure B: Visual haze (Pass/Fail)

A nominal 1 L volume of 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 settled matter. The report includes a pass-fail rating and statements indicating the presence of any suspended matter, settled water or particulates. The temperature of the test is also reported in °C.

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
clear and bright (clean and bright)
absence of visually discernible haze and settled (precipitated) matter, including free water.

4.3
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 ASTM D5773).

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 suspended 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, clear 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 colour rating greater than 5 by ASTM D1500 or ASTM D6045 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. Warming a sample can cause suspended water droplets producing haze to dissolve, giving a clear fuel sample at the warmer temperature.

5.5 Visual determination of fine particulate matter may become evident after allowing the sample to sit undisturbed. In some cases it may be beneficial to allow the sample to sit for 24 hours prior to analyzing.

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)[1].

Print this electronic chart on a high quality colour printer and laminate.

6.4 **Standard rating chart** (Figure 2)[1].

Print this electronic chart on a high quality colour printer and laminate.

6.5 **Thermometer**: Glass or digital with a minimum accuracy of 0.2 °C at the temperature of the test. Refer to ASTM 12C or equivalent (See ASTM E1).

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 measures shall be taken to minimize associated hazards including the use of personal protective equipment.

8 Procedure

8.1 Sampling

8.1.1 Obtain a representative sample taken in accordance with ASTM D4057, D4177 or D5842.

[1] 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.

8.1.2 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.

8.1.3 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[2] to ensure they remain representative when transferred, and that they are transferred into a clean, dry, colourless and clear 1 L container.

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 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.

8.2.2 Immediately remove the thermometer and place the standard bar chart (Figure 1, see 6.3) directly behind the sample container in a well-lit area (ensure the outside of the container is wiped clean of any water droplets or frost prior to rating).

8.2.3 Compare the observed visual haze of the sample with the standard rating chart (Figure 2, see 6.4) and record the haze rating that provides the best match. Disregard the colour of the sample.

8.2.4 Remove the bar chart and swirl the sample container to produce a vortex. Examine the bottom of the vortex at arm's length for particulates and water droplets. Record the presence of any settled particulates or water.

8.3 Procedure B

8.3.1 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.

8.3.2 Immediately remove the thermometer and hold the sample up to the light and visually examine for the presence of visual haze (ensure the outside of the container is wiped clean of any water droplets or frost prior to rating).

8.3.3 Swirl the sample container to produce a vortex. Examine the bottom of the vortex at arm's length for particulates and water droplets. Record the presence of any settled particulates or water.

9 Report

9.1 Report the results as follows:

9.1.1 Procedure A

Visual haze rating at test temperature = numerical rating of 1 through 6.

Free Water (see 8.2.4) — Pass (absent) or fail (present).

Particulates (see 8.2.4) — Pass (absent) or fail (present).

[2] Refer to ASTM D5854 for a suggested best practice.

9.1.2 Procedure B

Visual haze rating at test temperature = pass or “clear and bright” if there is no visually discernible haze and there is no settled water or particulates.

Visual haze rating at test temperature = fail or “not clear and bright” if there is visually discernible haze, settled water or particulates, or both.

The reason for any failure shall 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 °C and 20 °C.

10.2 A significant departure in sample colour from that shown in the standard rating chart (ASTM colour of L1.0) will have a marked effect on precision. Ratings may be very imprecise or impossible to take with very dark samples (ASTM colour greater than 5).

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 L1.5) blended with up to 200 mL/m^3 of water for different periods 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 L1.5) 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 L3.5) blended with up to 200 mL/m^3 of water for different periods 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 L3.5) blended with up to 200 mL/m^3 of water for different periods in a blender.

Figure 1 — Visual Haze Rating — Standard Bar Chart

NOTE This chart should be printed on high-quality glossy photo paper for accuracy.

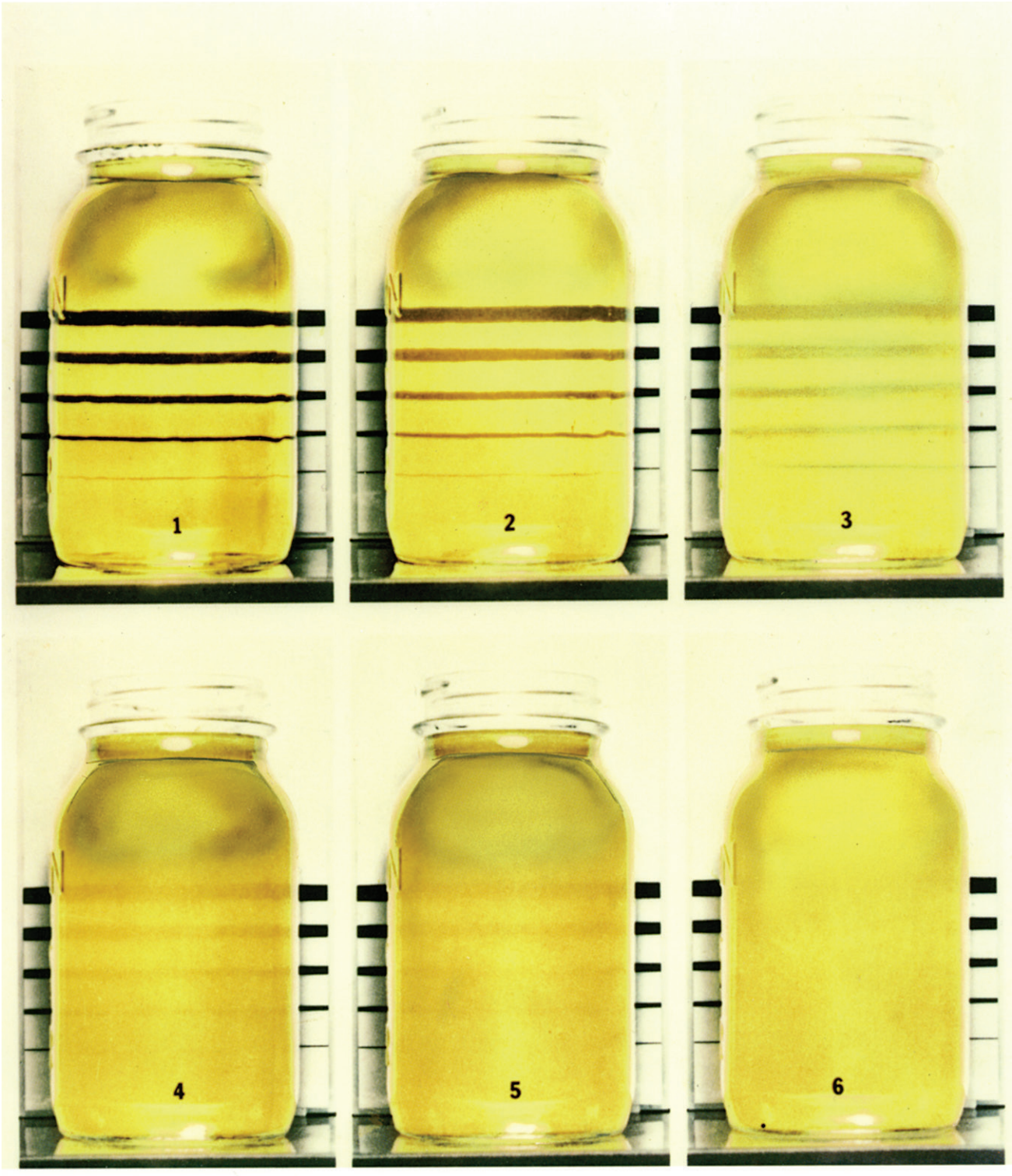

Figure 2 — Visual Haze Rating — Standard Rating Chart

NOTE This chart should be printed on high-quality glossy photo paper for accuracy.

Annex A
(normative)

Referenced ASTM International publications (see 2.1)

Annual Book of ASTM Standard

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

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

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

D4177 — *Standard practice for automatic sampling of petroleum and petroleum products*

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

D5842 — *Standard practice for sampling and handling of fuels for volatility measurement*

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

D6045 — *Standard test method for color of petroleum products by the automatic tristimulus method*

E1 — *Standard Specification for ASTM Liquid-in-Glass Thermometers*