Designation: D8148 – 22

Standard Test Method for Spectroscopic Determination of Haze in Fuels[1]

This standard is issued under the fixed designation D8148; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers a spectroscopic procedure for determining the level of suspended water and particulate contamination (haze) in liquid middle distillate fuels including those blended with synthesized hydrocarbons or biofuels.

1.1.1 An ordinal, whole-number, Instrument Haze Rating (IHR) from 1 to 6 and a Haze Clarity Index (HCI) from 50.0 to 100.0 are determined on a test specimen at a temperature of 22.0 °C ± 2.0 °C.

1.1.1.1 The stated precision only applies at this temperature.

1.1.1.2 Fuels analyzed at other test specimen temperatures may not be as precise.

1.2 The values stated in SI units are to be regarded as standard. Other units of measurement included in this standard are defined in Section 3.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D4057 Practice for Manual Sampling of Petroleum and Petroleum Products

D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants

D4176 Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)

D4177 Practice for Automatic Sampling of Petroleum and Petroleum Products

D6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *check standard cuvette, n*—cuvette containing a certified solid semi-transparent material that is used to confirm instrument operation and calibration.

3.2.2 *clear-and-bright (also termed clean-and-bright), adj*—a condition in which the fuel is free of haze or cloudiness.

3.2.2.1 *Discussion*—This clear and bright definition does not consider the presence of visible water droplets or solid particulates and is restricted to the presence of visible haze or cloudiness in the sample.

3.2.3 *crown glass, n*—a type of optical glass having a low refractive index and low dispersion.

3.2.4 *cuvette transfer time, n*—a user-set timed event that limits the amount of time the operator has to prepare the test specimen and instrument for analysis.

3.2.5 *Haze Clarity Index (HCI), n*—a numerical value from 50.0 to 100.0 that indicates fuel clarity derived from spectroscopic measurements and an algorithm.

3.2.5.1 *Discussion*—The HCI values increase with sample clarity and ranges from 100.0 HCI (very clear and bright) to 50.0 HCI (very cloudy and opaque). Accordingly, a fuel with an HCI value of 90.0 has less haze than a fuel with an HCI value of 80.0. HCI can be used to evaluate haze intensity changes within a given IHR.

3.2.6 *Instrument Haze Rating (IHR), n*—an ordinal, whole-number from 1 to 6, that corresponds to haze ratings defined in Test Method D4176, Procedure 2 and is assigned to the test specimen based upon spectroscopic measurements and an algorithm.

3.2.7 *optically clear, adj*—transparent to light having wavelengths from 340 nm to 2500 nm.

[1] This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.14 on Stability, Cleanliness and Compatibility of Liquid Fuels.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

3.2.8 *sample shaking time, n*—a user-set timed event that establishes the duration of sample agitation or swirling prior to beginning test specimen preparation.

3.3 *Abbreviations:*

3.3.1 *D*—depth

3.3.2 *H*—height

3.3.3 *HCI*—Haze Clarity Index

3.3.4 *IHR*—Instrument Haze Rating

3.3.5 *IR*—infrared

3.3.6 *LED*—light emitting diode

3.3.7 *NIR*—near-infrared

3.3.8 *W*—width

4. Summary of Test Method

4.1 The test unit (sample) is conditioned (allowed to heat or cool) to a test temperature of 22.0 °C ± 2.0 °C. **Warning—** Some laboratory analyzed fuel samples may not exhibit the presence of haze found when the sample was originally collected. See Appendix X1.

4.2 Proprietary optics, software, and calibration materials are used to provide a numerical Instrument Haze Rating (IHR) and Haze Clarity Index (HCI) of the fuel sample after a test specimen is placed into an optically clear cuvette and measured according to Beer-Lambert Law for percent transmittance and nephelometric principles for percent light scatter.

4.2.1 The IHR and HCI are obtained by comparison of the measurements in 4.2 to a previously prepared calibration curve and applied to an algorithm to obtain:

4.2.1.1 An ordinal instrument haze rating (IHR) from 1 to 6 corresponding to those described for Test Method D4176, Procedure 2.

4.2.1.2 A Haze Clarity Index (HCI) from 50.0 to 100.0 that may be used to evaluate haze intensity in general.

5. Significance and Use

5.1 It has long been the practice to include in fuel specifications a requirement that the fuel is clear and bright.

5.2 One primary cause for failure to meet this specification requirement is the occurrence of a cloudy or hazy appearance caused by suspended solid particulates or water or some combination of both.

5.2.1 This cloudiness or haze can range from barely visible to opaque.

5.3 This test method provides an objective analytical means for providing a haze rating that does not depend on subjective visual ratings that typically vary with operator and lighting conditions.

6. Apparatus

6.1 *Haze Rating Instrument,*[3] meeting the following specifications:

NOTE 1—All precision testing has been performed using Color Choice hz and Clarity Choice hz instruments. The precisions statistics provided in Section 16 will not apply to tests performed using other instrumentation.

6.1.1 The instruments are portable and self-contained units operating on an alternating current (ac) power source. Power cords are furnished for various voltages.

6.1.2 Both instrument models are identically sized and share the same control panel as shown in Fig. 1.

6.1.3 All of the controls are located in a push-button array on the control panel. Both instrument types may also be controlled by the touch screen or by computer mouse.

6.1.4 The spectrometer, nephelometric sensors, and test specimen temperature measuring device are located in the test specimen cuvette chamber.

6.1.4.1 *Spectrometer/Nephelometer,* consisting of a combination of a near-infrared (NIR) light-emitting diode (LED) light source and photodiodes positioned to measure transmission and scatter across the test specimen.

6.1.4.2 *Temperature Measuring Device,* non-contact infrared (IR) thermopile-based temperature sensor, with an accuracy of ±2.0 °C and a range of 4.0 °C to 38.0 °C.

6.2 *Check Standard Cuvette(s),*[3] one or more 10.0 mm W by 15.0 mm D by 38.0 mm H inside dimension crown glass cuvettes having four optically clear walls that contain a certified solid semi-transparent material (optional).

6.3 *Crown Glass Cuvette,* inside dimensions 10.0 mm W by 15.0 mm D by 38 mm H; optically clear on all four sides.

6.3.1 Cuvette dimensions are ±0.1 mm.

6.4 *Printer,* (optional).

[3] The sole source of supply for the apparatus, calibration materials and check standard cuvettes known to the committee at this time is Choice Analytical, Inc., 527 21st St., Suite 327, Galveston, TX 77550, www.choiceanalytical.com. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.

FIG. 1 Haze Apparatus Models