



Designation: D 4039 – 93 (Reapproved 2004)

Standard Test Method for Reflection Haze of High-Gloss Surfaces¹

This standard is issued under the fixed designation D 4039; 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 describes a procedure for using two specular gloss measurements to obtain a haze index for high-gloss nonmetallic specimens (1-4).² It is particularly useful for evaluating the haze in clear finishes on nonglossy substrates, and the haze in reflected images produced by the surfaces of opaque glossy pigmented finishes.

1.2 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*³

D 523 Test Method for Specular Gloss

D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels

D 3964 Practice for Selection of Coating Specimens for Appearance Measurements

E 284 Terminology of Appearance

E 430 Test Methods for Measurement of Gloss of High-Gloss Surfaces by Abridged Goniophotometry⁴

3. Terminology

3.1 *Definitions:*

3.1.1 *specular gloss, n*—ratio of flux reflected in specular direction to incident flux for a specified angle of incidence and source and receptor angular apertures.

3.1.2 *haze, n—in reflection*—scattering of light at the glossy surface of a specimen responsible for the apparent reduction of contrast of objects viewed by reflection at the surface.

3.2 *Definitions of Terms Specific to This Standard:*

¹ This test method is under the jurisdiction of ASTM Committee E12 on Color and Appearance and is the direct responsibility of Subcommittee E12.04 on Color and Appearance Analysis.

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² Boldface numbers in parentheses refer to the list of references at the end of this test method.

³ 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.

⁴ Withdrawn.

3.2.1 *60° specular gloss G_{60}, n* —specular gloss measured with the 60° geometry specified in Test Method **D 523**.

3.2.2 *20° specular gloss G_{20}, n* —specular gloss measured with the 20° geometry specified in Test Method **D 523**.

3.2.3 *haze index, H, n* —a measure of reflection haze, where $H = G_{60} - G_{20}$.

3.3 Appearance terms used in this standard are defined in Terminology **E 284**.

4. Summary of Test Method

4.1 Measurements of 60° and 20° specular gloss are made on a specimen. The haze index is computed as the difference between the two measurements.

4.2 This test method is applicable to nonmetallic specimens having a 60° specular gloss value greater than 70° in accordance with Test Method **D 523**.

4.3 Both 60° and 20° specular gloss depend upon the refractive index of the material being measured. Because 20° gloss changes much more rapidly with index than 60° gloss, the reflection haze value of a specimen also depends on the index of refraction of the material. To establish a correction for the effect of refractive index would require its measurement for each material, which is inconvenient. Comparisons of reflection haze evaluated by this test method are therefore limited to specimens of essentially the same refractive index.

5. Significance and Use

5.1 Measured gloss values of specimens depend on the angle of illumination, refractive index of the material, and the geometric distribution of the reflected light.

5.2 Haze is produced by irregularities in the reflecting surface that affect the distribution of flux reflected around the specular angle. The procedures specified in Test Method **D 523** are not designed to measure reflected-flux scattering characteristics of high-gloss finishes, particularly where specimens having different surface refractive indexes are being compared. A better index of scattering can be obtained by making two specular reflectance measurements, that is, the use of two receptor apertures of different size.

5.3 In this test method, values for reflection haze are obtained from two measurements of specular gloss, one made with a large receptor aperture and the other made with a small receptor aperture. The geometric conditions have been chosen