Designation: D4449 – 08

StandardTest Method for Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance[1]

This standard is issued under the fixed designation D4449; 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 the visual evaluation of gloss differences of coating surfaces, using special types of lamps for illumination. It identifies six aspects or types of gloss that one may look for when using the lamp to assess gloss differences between surfaces. It describes the conditions for using the lamps to best identify small differences in each of the six types of gloss. Four levels of visual gloss differences are distinguished.

1.2 While this technique is useful for both weathered and unweathered specimens, it has not been applied to metallics.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D3964 Practice for Selection of Coating Specimens for Appearance Measurements

E284 Terminology of Appearance

3. Terminology

3.1 *Definitions*—For definitions of terms used in this method, see Terminology E284.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *directionality of surface, n*—perceived change of glossy appearance of a surface with rotation of the surface in its own plane (see Fig. 1).

3.2.2 *gloss, distinctness-of-image, n*—perceived sharpness of images reflected by an object surface (see Fig. 2).

3.2.3 *gloss, of a surface, n*—perceived directionally selective reflecting properties responsible for the degree to which reflected highlights or images of objects may be seen as superimposed on the surface.

3.2.4 *reflection haze, n*—cloudy or milky appearance of a surface adjacent to directions of specular reflection (see Fig. 3).

3.2.5 *sheen, n*—perceived shininess at a near-grazing angle of incidence for an otherwise matte specimen (difficult to photograph).

3.2.6 *specular gloss, n*—the relative luminous reflectance factor of a specimen in the specular direction. The luminous reflectance factor is the ratio of the luminous flux reflected from, to that incident on, a specimen for specified solid angles (see Fig. 4).

3.2.7 *texture, n*—perceived structure, pattern, or topography or combination thereof, of a surface (see Fig. 5).

4. Summary of Test Method

4.1 Test specimens are illuminated by special light sources that provide reflected images suitable for rating the gloss of coating surfaces. Two types of lamps may be used to produce reflected images. Lamp A consists of a modified fluorescent desk lamp covered with screen mesh. Lamp B consists of an incandescent bare filament bulb installed in an adjustable angle fixture.

4.2 Light from the selected lamp illuminates the test specimens. The reflected images reveal specular gloss reflection; the sharpness of the images of the screen or lamp filament reveals the detail and quality of the surface reflection (distinctness of image); and spreading of the reflected light into dark areas, such as the space between fluorescent tubes or near the filament image, reveals the presence of near-specular haze.

[1] This test method is under the jurisdiction of ASTM Committee E12 on Color and Appearance and is the direct responsibility of Subcommittee E12.11 on Visual Methods.

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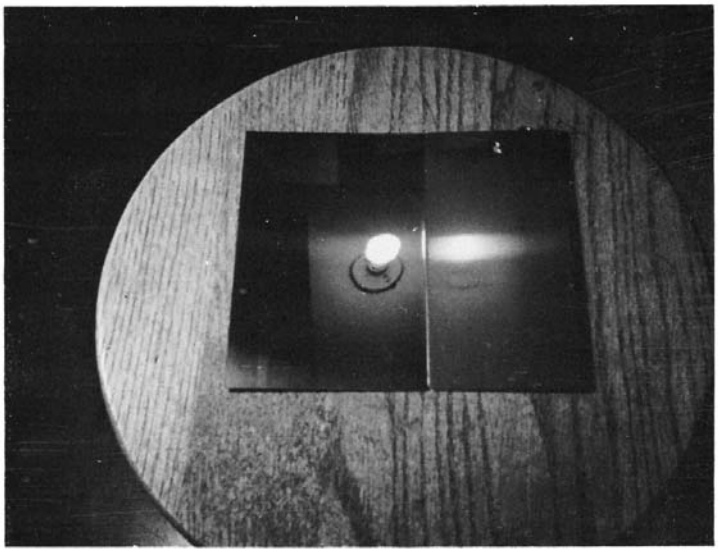
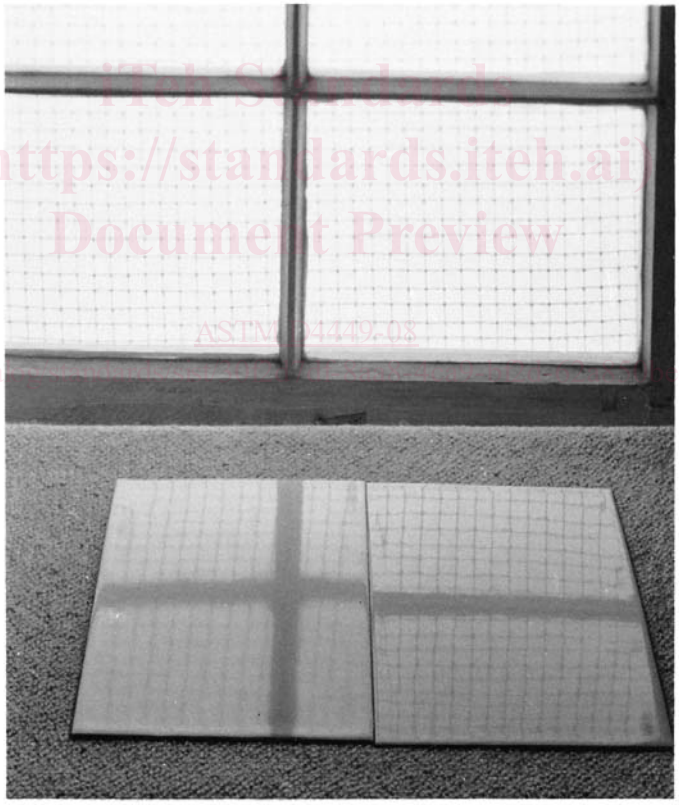
[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



NOTE 1—The left panel is free of directionality. The right panel is highly directional because of buffing marks.

FIG. 1 Reflection of Bright Incandescent Lamp in Two Panels



NOTE 1—The panels exhibit a difference in distinctness-of-reflected image.

FIG. 2 Two White Porcelain Enamel Panels

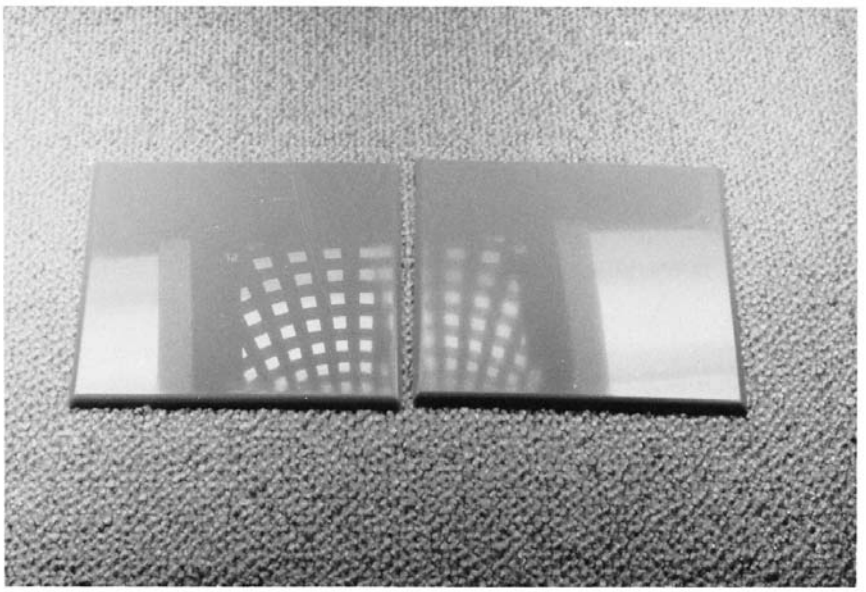
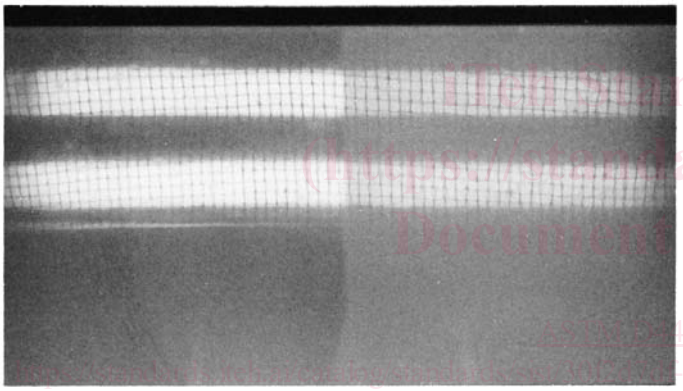


FIG. 3 Two Blue Plastic Wall Tiles Exhibiting a Difference in Reflection Haze



NOTE 1—The panel is polished on left end to produce higher specular gloss than the right end.

FIG. 4 Panel Coated with an Automobile Finish

5. Significance and Use

5.1 Gloss[3] is associated with the capacity of a surface to reflect more light in some directions than in others. The directions associated with mirror (or specular) reflection normally have the highest reflectances. Gloss is best seen and analyzed when the surfaces studied are illuminated by a light source that provides strong contrasting patterns of light and dark. Such a light source is described in this test method.

5.2 The simplest concept of gloss is that it corresponds to the mirror-like reflectances of surfaces. However, the distributions and intensities of this surface-reflected light are (for real materials) highly variable and affected by a variety of factors: surface smoothness and contour, refractive index, absorptance, angle of incidence, and (to a generally small extent) wavelength. From the great variety of surface-reflection patterns met in materials of commerce, it has been possible to identify seven surface-reflection criteria or "types of gloss" regularly used by skilled technologists for intercomparing and rating their products for gloss. Six of the seven criteria, or "types of gloss," are identified in the section on definitions. The seventh, luster or contrast gloss, is seldom of concern to the coatings industry.

6. Apparatus

6.1 *Lamp A*—The recommended apparatus is constructed by modifying a conventional fluorescent desk lamp that has two 15-W, 18-in. (450-mm) tubes. Fig. 6 is a photograph; Fig. 7 is a drawing of this lamp. The conventional lamp is modified by painting matte black the normally white reflector behind the lamp tubes. Then, after replacing the tubes, a piece of ¼-in. (6.3-mm) mesh hardware cloth is fastened to the front of the reflector.

6.2 *Lamp B*—The recommended apparatus is an incandescent bare filament bulb mounted on an adjustable angle fixture.[4]

7. Preparation of Specimens

7.1 Since gloss is ascribable largely to the top layer of the surface of any given object, dirt and other surface contamination significantly affect gloss. Therefore, the conditions and care of the surface, while preparing and examining it for gloss, are critically important.

7.2 Methods for preparing paint surfaces for examination are described in Practice D3964.

[3] For a more detailed account of gloss, its measurement, and relationship to appearance generally, see R. S. Hunter and R. W. Harold, *The Measurement of Appearance, 2nd Edition* , John Wiley and Sons, New York, NY, 1986.

[4] Suitable bare filament bulbs and mounting fixtures such as a night light bulb mounted in a" goose-necked" desk lamp equipped with a screw-in receptacle or mounted in a hanging lamp socket equipped with screw-in receptacle, or an auto bulb, installed in an adjustable microscope lamp fixture, or a 120V 25-W tubular bulb, installed in a "goose-necked" desk lamp or installed in a hanging lamp socket have been found suitable for this purpose.