



Designation: D3964 – 10 (Reapproved 2020)

Standard Practice for Selection of Coating Specimens for Appearance Measurements¹

This standard is issued under the fixed designation D3964; 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 practice provides a guide to selection of specimens for appearance measurement by reflected light as well as a discussion of factors to be considered in their preparation for measurement. Standardized selection and presentation procedures will assist in achieving agreement between evaluations carried out in different laboratories as well as helping to achieve better correlations between visual evaluations and instrumental measurements.

NOTE 1—This standard is not a practice for preparation of test panels of coatings; see Practices [D823](#).

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

1.3 *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

[D823](#) Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels

[E284](#) Terminology of Appearance

3. Terminology

3.1 *Definitions:*

¹ This practice is under the jurisdiction of ASTM Committee [D01](#) on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee [D01.26](#) on Optical Properties.

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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.

3.1.1 For definitions of terms used in this practice, refer to Terminology [E284](#).

4. Significance and Use

4.1 Many of the specimens that are regularly submitted to measurement depart in some degree from the ideal requirements. For this reason instrumental readings are affected importantly by the manner in which specimens are selected and presented for measurement. Reproducible measurements are facilitated by standardization and control of test conditions.

5. General Requirements

5.1 *Selection*—In making appearance measurements it is important that the specimens selected be representative of the material of interest. Once selected, the specimens must be carefully examined to determine if they are suitable for measurement, and if not, they must be cleaned or otherwise prepared. Careful attention to these factors is necessary if the measurements are to be valid.

5.2 *Specimen Size*—The minimum size is dictated by the size of the specimen port of the instrument to be used for measurement. When an instrument provides a choice of specimen port sizes, use the largest port that can be completely covered by the specimen. A large measured area helps to minimize the effect of any small area nonuniformity and is therefore more likely to provide results that agree with the involuntary averaging that takes place when specimens are observed visually. In addition, a large specimen also permits the operator to make measurements on several areas of the specimen when desired, thereby providing further specimen averaging.

5.3 *Opacity*—For determination of gloss or color, an opaque specimen shall be selected whenever possible. When the specimen is translucent or transparent, the following practices shall be implemented:

5.3.1 *For Gloss Evaluation*—The specimen shall preferably be sufficiently thick that a secondary reflection from the back or second surface of the specimen cannot enter the receptor optics of the glossmeter. When thin transparent specimens must be measured, adopt one of the following procedures:

5.3.1.1 Back the specimen with a light-absorbing material of the same refractive index as the specimen, and in optical contact with it.

5.3.1.2 Use an agreed-upon specimen thickness, including coating and substrate, and place a black backing behind the specimen.

5.3.2 *For Color Evaluation*—The choice of backing of even slightly translucent specimens will affect their measurement. Use the most applicable of the backing techniques that follow. In each case it is essential that the backing material and color be reproducible, stable, and durable for reliable results.

5.3.2.1 Back the specimen with the same material with which it will be backed in its intended use.

5.3.2.2 Back the specimen with identical or similar material.

5.3.2.3 Back the specimen with a neutral material whose luminous reflectance is essentially the same as that of the specimen being evaluated.

5.3.2.4 Back the specimen with a black surface such as a painted panel or black glass.

5.3.2.5 Back the specimen with a white backing of known reflectance.

6. Physical Properties

6.1 The specimen shall preferably be rigid and have a plane surface. Specimens of thin, flexible material that can bulge or sag when presented to an instrument require special holding equipment. When the specimen is moderately flexible, a plane surface may be achieved by pressing the specimen against the instrument with a flat, rigid object. The pressing technique must be reproducible. A vacuum plate or specially designed clamping device has proven satisfactory in some applications. Note that specimens coated on thin plastic film or paper may trap air between the specimen and the holder (vacuum plate or clamping device) causing the specimen to billow (blister) resulting in erroneous readings.

6.2 *Surface Texture*—Some coatings have pronounced surface texture, making it desirable to rotate a specimen in its own plane. Those with marked directionality, usually due to the production process, will have different values when measured in different directions. Good practice dictates that measurements be made with the plane of measurement of the instrument both parallel to as well as perpendicular to the process direction.

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7. Cleaning of Specimens

7.1 The specimen shall be clean. There should be no dirt, dust, oil or foreign material on the surface that will affect the instrumental evaluation of the specimen. If the specimen appears to require cleaning, the procedure should be agreed upon and it should be carried out with care. Any cleaning of a low-gloss or fragile surface may scratch or polish the surface and thus change the appearance of the specimen and render it useless for measurement. A high-gloss specimen may usually be washed with clear water and blotted with untreated lens tissue or paper towel. If the specimen is durable, a mild nonfluorescent, nonionic detergent that does not leave a film can be used with a soft cloth or bristle brush. If the specimen is durable and has an oily or stubborn contamination that should be removed, reagent grade isopropyl alcohol may be used. Follow all cleaning techniques with a warm water rinse and drying by blotting, using untreated lint-free paper towel.

NOTE 2—Ceramic or porcelain-enamelled instrument calibration standards require periodic cleaning and the above procedures can generally be used safely. Care should be taken to ensure that no water or other cleaning agent enters the edges of these standards.

8. Handling Specimens

8.1 Handle specimens by their edges. Do not allow objects to contact the front surface of the specimen. When placing the specimen on the instrument, avoid sliding it across the specimen port.

9. Report

9.1 When the specimens submitted for appearance measurements depart from the ideal requirements, report the following:

9.1.1 Their condition (Section 6),

9.1.2 Method of cleaning (Section 7),

9.1.3 Method of backing (5.3.1, 5.3.2, and 6.1), and

9.1.4 Indicate direction of specimen submitted for measurement or averaging of data, or both, when required by directionality (6.2).

10. Keywords

10.1 appearance; color; gloss; measurement; opacity; uniformity