Designation: D6279 – 20

Standard Test Method for Rub Abrasion Mar Resistance of High Gloss Coatings[1]

This standard is issued under the fixed designation D6279; 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 procedures for evaluating the relative mar resistance of a high gloss coating applied to a flat, rigid surface. Wet rub and dry rub abrasion tests are described. To fully characterize a coating's mar resistance, both tests should be run.

NOTE 1—Dry abrasion mar resistance can also be evaluated by using Test Methods D6037. If a very highly mar resistant coating is being evaluated, Test Methods D6037 will generally provide the better performance discrimination than the dry rub test described here. However, if the equipment described in Test Methods D6037 is not available, the dry rub test described in this test method affords a reasonable alternative. The dry rub test is also useful for evaluating coatings that are not highly mar resistant.

1.2 Mar resistance is assessed by measuring the gloss of the abraded and unabraded areas. Mar resistance is directly related to the coating's ability to retain gloss in abraded areas.

NOTE 2—The mar resistance values obtained by this test method have no absolute significance. They should only be used to derive relative performance rankings for test panels that have been prepared from the series of coatings that are currently being evaluated. If mar resistance values are quoted between laboratories, it is essential that a common standard be measured and that the values be compared to that standard. Even then, the values should be used with caution.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are for information only.

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 the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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]

D16 Terminology for Paint, Related Coatings, Materials, and Applications

D523 Test Method for Specular Gloss

D823 Practices for Producing Films of Uniform Thickness of Paint, Coatings and Related Products on Test Panels

D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers

D3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquer, and Related Materials

D4449 Test Method for Visual Evaluation of Gloss Differences Between Surfaces of Similar Appearance

D6037 Test Methods for Dry Abrasion Mar Resistance of High Gloss Coatings

D7091 Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *mar resistance, n*—the ability of a coating to resist permanent deformation or fracture, resulting from the application of a dynamic mechanical force.

3.1.1.1 *Discussion*—This test method measures resistance to visible damage caused by mild abrasion.

3.2 For definitions of other terms used in this standard, refer to Terminology D16.

4. Summary of Test Method

4.1 The coatings that are being evaluated are applied at uniform dry film thickness to planar panels of uniform surface texture. After drying or curing, or both, panels are marred by the action of dry abrasion media or wet abrasion media, or both, under a reciprocating weighted friction pad. Mar resistance is assessed by measuring the coating's gloss within the

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.55 on Factory Applied Coatings on Preformed Products.

Current edition approved Dec. 1, 2020. Published December 2020. Originally approved in 1998. Last previous edition approved in 2015 as D6279 – 15. DOI: 10.1520/D6279-20.

[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.

abraded and unabraded areas of test panels. Mar resistance is directly related to the coating's ability to retain gloss in abraded areas.

5. Significance and Use

5.1 Coatings, particularly the high gloss coatings used on automobiles, boats, toys, etc., are subject to a wide variety of conditions (for example, wiping, cleaning and exposure) during manufacture and service that can mar their surface. The ability of high gloss coatings to maintain their appearance is an important product attribute. This test method provides a way to estimate the ability of high gloss coatings to resist mar damage.

6. Apparatus

6.1 *Application Equipment,* as described in Practices D823.

6.2 *Film Thickness Measuring Apparatus,* as described in Test Method D1005 or Test Method D7091.

6.3 *Abrader*—The mar tester[3] provides a reciprocating rubbing motion and is so designed that the 16 mm ± 1 mm diameter friction element moves back and forth in a straight line over a 100 mm ± 10 mm (4 in. ± 0.4 in.) track on the test panel, with a downward force of 9 N ± 10 %, at a uniform stroke rate of 60 r/min. One cycle is a complete back and forth motion.

6.4 *Friction Pad*—Cover the instrument's friction element with a pad made of felt or paper. The type of pad affects the abrasion and must be defined for the test by the interested parties. It has been found that generally a thicker felt pad works best for dry abrasion and a thinner paper pad is best for wet abrasion.

6.4.1 Felt pads can be attached by wrapping the felt around the friction element and holding it in place with a suitable spring clip or clamp.

6.4.2 Paper pads must be cut so they cover the area of the friction element that contacts the coating. They can be attached to the friction element with two-sided tape.

6.5 *Dry Abrasion Media*—Feldspar/calcite, non-silicate cleaning powder.

6.6 *Wet Abrasion Media*—Prepare an aluminum oxide (grit) slurry as follows:

aluminum oxide (220 mesh)	10.0 (by weight)
polyacrylic acid	6.0
distilled water	83.3
2-aminopropanol	0.7
Total	100.0

6.6.1 The slurry ingredients can be combined by using a mixer or spatula. The slurry gets very thick, but is easy to mix.

6.6.2 The slurry prepared by this formula should have a pH of 7.9 to 8.0 and a viscosity of 190 P to 210 P (as measured on a rotational viscometer with a spindle that is a right circular cylinder 3.2 mm in diameter and 31.0 mm in length, 10 r/min). If the pH and viscosity are low, add 2-aminopropanol until the pH is 7.9 to 8.0. If the pH is on target but the viscosity is low, add more polyacrylic acid.

[3] A list of machines suitable for this purpose is found in Research Report RR:D01-1117. Contact ASTM Customer Service at service@astm.org.

6.7 *Glossmeter,* with 20° geometry and a maximum width of the measurement area of 10 mm; complying with Test Method D523.

NOTE 3—For coatings that are semi- to high-gloss, a glossmeter with a 60° geometry may be better suited. Small differences in performance between highly abrasion-resistant materials are more likely to be detected with 20° gloss measurements than with 60° gloss measurements.

7. Preparation of Specimens

7.1 Prepare a minimum of two (2) 100 mm by 150 mm (4 in. by 6 in.) panels for each coating that is being tested. Alternatively, if the abrader can accommodate them, larger panels such as 100 mm by 300 mm (4 in. by 12 in.) may be used. Prepare the coated panels as described in Practices D823.

7.2 Gloss measurements are color dependent. Abraded areas on dark colored panels tend to give lower gloss readings than similarly abraded areas on light colored panels. For consistent results, it is recommended that testing be done using black coatings. Clearcoats can be applied over a black basecoat. If it is necessary to use other colors, a black panel should be included as a control.

8. Conditioning

8.1 Condition the test specimens at 23 °C ± 2 °C (74 °F ± 4 °F) and 50 % ± 5 % relative humidity in accordance with Specification D3924 unless otherwise specified by the interested parties.

9. Procedure

9.1 Securely fasten the friction element to the reciprocating arm.

9.2 Set the number of cycles at 10, unless otherwise specified. Set fewer cycles for easily marred panels and more cycles for more mar resistant materials.

9.3 Attach a new friction pad to the friction element such that a flat, unwrinkled surface comes into contact with the coated panel. See 6.4.

9.4 *Dry Abrasion*—Sprinkle a liberal amount of dry abrasion media over approximately one half of the panel. Holding the panel so its plane is near vertical, tap its bottom edge firmly on a hard surface so that an even, thin layer of dry adhesion media remains on the panel. Place the test panel on the abrader and secure.

9.5 *Wet Abrasion*—Place the test panel on the abrader and secure. Spread wet abrasion media on the pad using a spatula to cover the pad well. Lower the friction element to the panel. Excess media should be visible on all sides of the friction element. This indicates full coverage of the friction pad. Ensure that the friction pad lies flat on the panel.

9.6 For both wet and dry abrasion start the test and run the selected number of cycles. When desired, a plot of the percent gloss retention versus the number of abrasion cycles can be generated by subjecting the test panel to an increasing number of test cycles.

9.7 Lift the reciprocating arm from the panel, then remove and discard the friction pad.