



Designation: D7027 – 20

Standard Test Method for Evaluation of Scratch Resistance of Polymeric Coatings and Plastics Using an Instrumented Scratch Machine¹

This standard is issued under the fixed designation D7027; 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 laboratory procedure using an instrumented scratch machine to produce and quantify surface damage under controlled conditions. This test method is able to characterize the scratch resistance of polymers by measuring many significant material parameters. The scratch-inducing and data acquisition process is automated to avoid user-influenced effects that may affect the results.

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

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.*

NOTE 1—This standard is equivalent to ISO 19252.

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

[A276/A276M Specification for Stainless Steel Bars and Shapes](#)

[D618 Practice for Conditioning Plastics for Testing](#)

[D638 Test Method for Tensile Properties of Plastics](#)

[D883 Terminology Relating to Plastics](#)

[D1894 Test Method for Static and Kinetic Coefficients of Friction of Plastic Film and Sheeting](#)

[E177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods](#)

[E456 Terminology Relating to Quality and Statistics](#)

[G99 Test Method for Wear Testing with a Pin-on-Disk Apparatus](#)

[G171 Test Method for Scratch Hardness of Materials Using a Diamond Stylus](#)

3. Terminology

3.1 Terms used in this standard are defined in accordance with Terminology [D883](#), unless otherwise specified. For terms relating to precision and bias and associated issues, the terms used in this standard are defined in accordance with Terminology [E456](#).

3.2 Definitions:

3.2.1 *ASV Software, n*—Automatic Scratch Visualization, a computer program which automates the identification of the point of failure in a rising load scratch tests using contrast as the failure criteria.

3.2.1.1 *Discussion*—The ASV software determines failure if a continuous change in contrast between the scratch groove and the undamaged material surface reaches +3 %, -3 %, or ± 3 %. The continuity criterion is defined as a region of length equal to 2 diameters of the scratch stylus with 90 % or more of the region exceeding the contrast criterion. The lowest load point on the scratch from which there is a continuous contrasting region is considered the point of failure. This program is useful for visual analysis of the test and may be used for other applications, such as pass-fail criterion for scratch visibility. An example of the application of ASV is shown in [Fig. 1](#).

3.2.2 *critical normal load, n*—the normal load at which failure (see [3.2.4](#)) of the material within the scratch groove first occurs.

3.2.3 *normal load, n*—a load applied onto the scratch stylus that is imposed in a vertically downward direction, perpendicular to the surface of the specimen.

3.2.3.1 *Discussion*—The normal load is also referred to as the “Z-direction load.”

3.2.4 *point of failure, n*—the point along a rising-load scratch path at which the damage to the surface is first considered to be unacceptable.

¹ This test method is under the jurisdiction of ASTM Committee [D20](#) on Plastics and is the direct responsibility of Subcommittee [D20.10](#) on Mechanical Properties. Current edition approved Sept. 1, 2020. Published October 2020. Originally approved in 2005. Last previous edition approved in 2013 as D7027–13. DOI: 10.1520/D7027-20.

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.

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