



Designation: D3363 – 22

# Standard Test Method for Film Hardness by Pencil Test<sup>1</sup>

This standard is issued under the fixed designation D3363; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope\*

1.1 This test method covers a procedure for rapid, inexpensive determination of the film hardness of an organic coating on a metal or similarly hard substrate in terms of drawing leads or pencil leads of known hardness.

1.2 This test method is similar in content (but not technically equivalent) to ISO 15184.

NOTE 1—Other procedures are available to measure permanent deformation of organic coatings under the action of a single point (stylus tip) including but not limited to Test Methods D2197, D5178, and G171.

1.3 The values stated in SI units are to be regarded as the 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:*<sup>2</sup>

D2197 Test Method for Adhesion of Organic Coatings by Scrape Adhesion

D5178 Test Method for Mar Resistance of Organic Coatings

G171 Test Method for Scratch Hardness of Materials Using a Diamond Stylus

<sup>1</sup> 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 D01.23 on Physical Properties of Applied Paint Films.

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

2.2 *Other Standards:*

ISO 15184 Determination of film hardness by pencil test<sup>3</sup>

## 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *gouge hardness, n*—the hardest pencil lead that will leave the film uncut for a stroke length of at least 3 mm ( $\frac{1}{8}$  in.); also referred to as pencil hardness.

3.1.2 *scratch hardness, n*—the hardest pencil lead that will not rupture or scratch the film.

## 4. Summary of Test Method

4.1 A coated panel is placed on a firm horizontal surface. The pencil is held firmly against the film at a 45° angle (point away from the operator) and pushed away from the operator for a minimum of 6.5 mm ( $\frac{1}{4}$ -in.) stroke. The process is started with the hardest pencil and continued down the scale of hardness to either of two end points: one, the pencil that will not cut into or gouge the film (pencil hardness), or two, the pencil that will not scratch the film (scratch hardness).

NOTE 2—A result in which the film coating is removed, revealing the substrate or previous coating layer if two or more coatings are present is considered a cut or gouge. A result in which the lead leaves a blemish or defacement of the film coating, but does not reveal the substrate is considered a scratch. A result in which the lead is transferred to the film coating, but does not result in any damage is a pencil mark. See Fig. 1 and Fig. 2.

## 5. Significance and Use

5.1 Pencil hardness measurements have been used by the coatings industry for many years to determine the hardness of clear and pigmented organic coating films. This test method has also been used to determine the cure of these coatings, especially when using forced dried heat.

5.2 This test method is convenient in developmental work and in production control testing in a single laboratory. It should be recognized that the results obtained may vary between different laboratories when different manufacturer's pencils as well as when different substrates are used. To

<sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

