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Standard Test Method for Film Hardness by Pencil Test[1]

This standard is issued under the fixed designation D 3363; 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 a procedure for rapid, inexpensive determination of the film hardness of an organic coating on a 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.

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

2. Referenced Documents

2.1 *Other Standards:*

ISO 15184, Determination of film hardness by pencil test.[2]

3. Summary of Test Method

3.1 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 in a 6.5-mm (¼-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).

4. Significance and Use

4.1 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 forced dried using heat.

4.2 This test method is especially useful 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 pencils as well as panels are used. Every effort should be made to standardize the hardness of the lead used and the technique followed.

4.3 If this test method is used as a basis for purchase agreement, maximum precision will be achieved if a given set of referee pencils be agreed upon between the purchaser and the seller.

5. Apparatus

5.1 A set of calibrated drawing leads (preferred) or equivalent calibrated wood pencils meeting the following scale of hardness:

$$\frac{6B-5B-4B-3B-2B-B-HB-F-H-2H-3H-4H-5H-6H}{\text{Softer} \qquad\qquad\qquad\qquad \text{Harder}} \tag{1}$$

The difference between two adjacent leads shall be considered one unit of hardness.

5.2 *Mechanical Lead Holder*, for drawing leads if used.

5.3 *Mechanical Sharpener*, draftsman-type, is helpful for trimming wood pencils if used.

5.4 *Abrasive Paper*, grit No. 400.

6. Test Specimens and Conditions

6.1 Apply the surface coating by appropriate means to a smooth rigid substrate and cure properly, or use representative panels cut from coated stock. The panels used, the curing conditions, and the age of the coating prior to the test shall be within the limits agreed upon between the purchaser and the seller.

6.2 The film thickness of the coating shall be as specified or as agreed upon between the purchaser and the seller.

6.3 Conduct the test at 23 ± 2°C (73.5 ± 3.5°F) and 50 ± 5 % relative humidity.

7. Procedure

7.1 For wood pencils, remove approximately 5 to 6 mm (3/16 to ¼ in.) of wood from the point of each pencil using a draftsman-type mechanical sharpener, being careful to leave an undisturbed, unmarked, smooth cylinder of lead. Holding the pencil holder (when using drawing leads) at an angle of 90° to

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[2] Available from American National Standards Institute, 11 W 42nd St., 13th Floor, New York, NY 10036.

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