



Designation: D 5007 – 99 (Reapproved 2003)

## Standard Test Method for Wet-to-Dry Hiding Change<sup>1</sup>

This standard is issued under the fixed designation D 5007; 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.

### 1. Scope

1.1 This test method covers the determination of the change in hiding power of an architectural coating during drying, by visual evaluation of the wet and dry film.

1.2 This test method is not recommended for colors other than white and tints.

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 *ASTM Standards:*<sup>2</sup>

D 2805 Test Method for Hiding Power of Paints by Reflectometry

D 3924 Specification for Standard Environment for Conditioning and Testing Paint, Varnish, Lacquers, and Related Materials

### 3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *hiding index,  $h_S$* —the Spreading Index at a standard film opacity. In this test method the latter is a visual contrast standard prepared by applying a semi-opaque white coating on a black and white hiding-power chart to give a contrast ratio of 0.98 (98 %) which is just short of complete hiding, and is the conventional so-called *full hiding* end point in photometric hiding-power methods such as Test Method D 2805. Refer to the hiding indices of the wet and dry films as  $h_{SW}$  and  $h_{SD}$  respectively.

3.1.1.1 *Discussion*—Since this test method is intended to measure hiding-power difference rather than hiding power itself, a 0.98 (98 %) contrast ratio standard is not required. It is necessary only that the same standard be used for measuring both wet and dry films. See 3.1.8. For this purpose the standard needs to lie within the contrast range of both the wet and dry stripes, which is true of the 0.98 (98 %) contrast-ratio standard for most commercial paints. With paints of unusually low hiding, a lower contrast standard may be required, which can be simply one of the stripes taken from a drawdown of the test paint.

3.1.2 *hiding power*—the spreading rate of a paint applied uniformly on a standard black and white hiding power chart to give a standard degree of contrast just short of complete hiding.

3.1.2.1 *Discussion*—In reflectometry the standard contrast for hiding power measurements is generally accepted as the contrast ratio  $C = 0.98$  (98 %), which with white and light tinted coatings is equivalent to a visual color difference of about 0.75 CIELAB units. That amount of color difference can reasonably be described as “just-short-of complete-hiding.” Since this is a visual method it employs a visual comparator as a standard, which is a hiding power chart with a white coating applied at a contrast ratio of 0.98 (98 %).

3.1.3 *logicator*—a multi-notch applicator with clearances, and corresponding wet film thicknesses and spreading rates, in equal percentage steps.

3.1.4 *logicator scale*—a scale with values directly related to the logarithms of corresponding spreading rates. A specified change in scale value represents the same percentage change in spreading rate over any part of such a scale.

3.1.5 *spreading index,  $h$* —the spreading rate expressed in logicator scale units (LU) as described in 3.1.4 and 3.1.7.

3.1.6 *spreading rate,  $H$* —the area covered per unit quantity of coating. (In this test method the quantity is volumetric).

3.1.7 *TG19 logicator*—a logicator designed for this test method with eight notches numbered at four-unit intervals on a scale from 20 to 48, the notch clearances ranging from 67 to 264  $\mu\text{m}$  (2.65 to 10.4 mils) corresponding to wet film thicknesses from 37 to 145  $\mu\text{m}$  (1.46 to 5.7 mils) and spreading rates from 6.9 to 27  $\text{m}^2/\text{L}$  (280 to 1100  $\text{ft}^2/\text{gal}$ ), with one scale unit representing a change of 5 % and the four-unit interval between notches a cumulative change of 21.55 % in the clearance and

<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 D01.42 on Architectural Coatings.

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<sup>2</sup> 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.

corresponding film thicknesses and spreading rates. Refer to this scale unit as a logicator unit (LU). (See Fig. 1.)

3.1.7.1 Discussion—The percentage difference between notches is calculated as  $(1.05^4 - 1) \times 100 = 21.55$ . This percentage is applicable precisely to the notch clearances and approximately to their related wet-film thicknesses and spreading rates. The detailed relationships between scalar value and the notch clearance, wet film thickness, and spreading rate are given in Table 1 and Table 2.

3.1.8 wet-to-dry hiding change (WDHC)—the difference in the Hiding Index of a paint between the wet and the dry state, expressed in logicator units (LU) as follows:

$$WDHC = \Delta h_s = h_{SD} - h_{SW} \quad (1)$$

3.1.8.1 Discussion—The WDHC is unchanged if the contrast level of the hiding standard is varied, because the resultant changes in the two hiding power values are proportional and their ratio therefore constant.

3.1.8.2 Discussion—The WDHC is unaffected by deviations from the estimated film thickness/clearance ratio  $T/N$  (see Note 1, Table 1), because the ratio of the two recalculated hiding-power values is unchanged.

#### 4. Summary of Test Method

4.1 The test paint is applied with a TG19 Logicator on a logicator test chart (see 6.2 and Fig. 2) and the drawdown examined in comparison with an agreed hiding standard immediately after application and again after drying.

4.2 The scale numbers of the wet and dry stripes that match the standard in contrast are recorded as the Wet Hiding Index,  $h_{SW}$ , and the Dry Hiding Index  $h_{SD}$ .

4.3 The difference between the wet and dry hiding indices is recorded as the wet-to-dry hiding change WDHC.

4.4 If desired, the percent change in hiding power corresponding to the WDHC value is calculated and reported.

#### 5. Significance and Use

5.1 Many architectural paints, particularly white and light tints, change significantly in film opacity as they dry. An increase in hiding is sometimes associated with porosity and poor film integrity with conventionally formulated coatings. A decrease can result in a disappointing paint job. The wet-to-dry hiding change is therefore a property of great practical importance.

5.2 This test method can be used in paint specifications and as a short, simple procedure for evaluation and quality control.

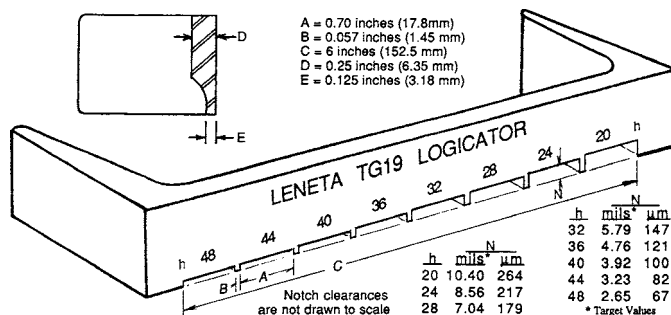


FIG. 1 Diagram of the Leneta TG19 Logicator

TABLE 1 Equations Relating the Logicator Scale Value or Spreading Index,  $h$ , to the Notch Clearance,  $N$ , Wet Film Thickness,  $T$ , and Spreading Rate,  $H$

NOTE 1—The relationships involving  $T$  and  $H$  are based on a presumed  $T/N$  ratio of 0.55, which ratio is approximate and somewhat variable, depending on coating rheology, drawdown technique, and clearance.

Inch-Pound Units (mils, ft <sup>2</sup> /gal):	Metric Units (μm, m <sup>2</sup> /L):
$N = 1.05^{68-h} = 27.6 \div 1.05^h$	$N = 25.4 \times 1.05^{68-h} = 701 \div 1.05^h$
$h = 68 - 47.2 \log N$	$h = 134.3 - 47.2 \log N$
$T = 0.55 N = 15.18 \div 1.05^h$	$T = 0.55 N = 385.5 \div 1.05^h$
$h = 55.75 - 47.2 \log T$	$h = 122.05 - 47.2 \log T$
$H = 105.7 \times 1.05^h$	$H = 2.594 \times 1.05^h$
$h = 47.2 \log H - 95.52$	$h = 47.2 \log H - 19.54$

#### 6. Apparatus

6.1 TG19 Logicator<sup>3</sup>—A multi-notch, varied-clearance applicator designed specifically for this test method (see 3.1.7 and Fig. 1).

6.2 Logicator Test Charts<sup>3</sup>—Black and white hiding charts with a chevron-stripe pattern and scale numbers printed at the top corresponding to the paint stripes applied by the Logicator (see Fig. 2).

6.3 Vacuum Plate, for holding the chart flat while the drawdown is made.

6.4 Visual Hiding Standard<sup>4</sup>—A narrow stripe cut from a logicator test chart on which a durable glossy white coating had been applied to obtain a contrast ratio of 0.98. The stripe is mounted on a blank card for convenient handling, as illustrated in Fig. 3.

#### 7. Procedure

7.1 Prepare a hiding standard as described in 6.4, or use the standard supplied with the logicator test charts.

NOTE 1—Strong colors were measured according to this test method using standards prepared with the self-same coatings. Some test methods were also made using the regular white standard. Due to poor correlation in these tests it was decided to exclude strong colors from the scope of the test method. However, should measurements with such colors be attempted anyway, it is of interest to note that the white standard apparently served as well for that purpose as a standard made with the identical color.

7.2 Place a test chart on the vacuum plate. Then place the logicator at the top of the chart with its arms extending toward the operator.

7.3 Spread about 6 mL of the test paint evenly in front of the logicator, then draw down the full length of the chart (about 254 mm (10 in.)) at a uniform speed such that the total drawdown time is about 2.5 to 3 s.

7.4 Promptly after film application, determine the Wet Hiding Index ( $h_{SW}$ ) in accordance with 7.5.

7.5 Observation of the Hiding Index ( $h_c$ ):

<sup>3</sup> The sole source of supply of logicator test charts known to the committee at this time is the Leneta Company, 15 Whitney Rd., Mahwah, NJ 07430. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

<sup>4</sup> A white standard of this description is supplied with the TG19 Logicator Test Charts.