Designation: D 1400 – 00

Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base[1]

This standard is issued under the fixed designation D 1400; 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 the nondestructive measurement of the dry film thickness of electrically nonconductive coatings applied over a nonferrous metal base using commercially available eddy current instruments. This test method is intended to supplement manufacturers' instructions for the manual operation of the gages, and is not intended to replace them.

1.2 This test method is not applicable to coatings that will be readily deformable under the load of the measuring instruments, as the instrument probe must be placed directly on the coating surface to take a reading.

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:*

D 823 Practices for Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels[2]

D 1730 Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting[3]

3. Summary of Test Method

3.1 Instruments complying with this test method measure coating thickness by the use of eddy currents. The instrument must be placed directly on the coating surface to take a reading.

4. Significance and Use

4.1 The instrument probe is energized by alternating current that induces eddy currents in the metal substrate. The eddy currents in turn create opposing alternating magnetic fields in the substrate that modify the electrical characteristics of the probe coil. The extent of such changes is dependent upon the distance between the probe and the metal, and the distance being shown on the instrument meter as thickness (mils or microns) of the intervening coating.

5. Apparatus

5.1 *Eddy Current Thickness Gages*, commercially available, suitable to measure coating thickness accurately.

5.2 *Coating Thickness Standards*, with assigned values traceable to national standards are available.

6. Test Specimens

6.1 When this test method is used in the field, the specimen is the coated structure or article on which the dry film thickness is to be evaluated.

6.2 For laboratory use, apply the materials to be tested to panels of similar roughness, shape, thickness, and composition on which it is desired to determine the thickness.

NOTE 1—Applicable test panel description and surface preparation methods are given in Practices D 1730.

NOTE 2—Coatings should be applied in accordance with Practices D 823, or as agreed upon between the purchaser and the seller.

7. Verification of Calibration of Apparatus

7.1 Different gage manufacturers follow different methods of calibration or adjustment. Verify calibration according to manufacturer's instructions.

7.2 Use a bare section of the substrate after the specified surface preparation method has been accomplished. If an uncoated section of the substrate is not available, an uncoated test panel of the same metal type over which the specified preparation has been performed may be used.

7.3 Use nonconductive thickness shims to verify calibration or test blocks bearing calibrated nonconductive coatings that are traceable to a suitable national standard.

7.4 Follow the manufacturer's instructions for the specific adjustment of the instrument.

7.5 Measure the thickness of a series of calibration standards covering the expected range of coating thickness. To guard against measuring with an inaccurate gage, recheck the gage at regular intervals. That interval should be set and

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[2] *Annual Book of ASTM Standards*, Vol 06.01.

[3] *Annual Book of ASTM Standards*, Vol 02.05.

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maintained throughout the control process.

7.6 If the substrate material to be tested changes in roughness, shape, thickness or composition, re-verify calibration and adjust as necessary.

8. Procedure

8.1 Use the instrument only after it has been calibrated in accordance with Section 7.

8.2 Ensure that the coating is dry prior to use of the instrument.

8.3 Inspect the probe tip and surface to be measured to ensure that they are clean. Otherwise erroneous readings can result.

8.4 Take readings in areas free of electrical or magnetic fields.

8.5 Verify calibration periodically to ensure that the instrument continues to read properly. If the instrument is found to be out of adjustment, remeasure the thicknesses taken since the last satisfactory calibration check was made.

8.6 Take a sufficient number of readings to characterize the surface.

8.6.1 For laboratory measurements a recommended minimum of three—for a 75 by 150-mm (3 by 6-in.) panel, and more in proportion to size.

8.6.2 For field measurements a recommended minimum is five determinations at random for every 100 ft^2 (10 m^2) of the surface area. Each of the five determinations should be the mean of three separate gage readings within the area of a 4-cm (1.5-in.) diameter circle.

8.7 Take measurements at least 13 mm (½ in.) away from any edge or corner of the specimen. If it is necessary to measure closer than ½-in., recheck the base metal reading in the specific areas to determine the extent of the effect (if any) the edge has on the measurement.

9. Report

9.1 Report the following information:

9.1.1 instrument used, serial number,

9.1.2 range, mean of the thickness readings, and

9.1.3 depending upon the application, record the individual readings as well.

10. Precision and Bias

10.1 *Precision*—A new round-robin study was performed recently. Data are being analyzed statistically. When completed, the required repeatability and reproducibility sections of this test method will be written and the round-robin study documented in an ASTM research report.

10.2 *Bias*—The bias for this test method for measuring dry film thickness cannot be measured at this time, because each instrument has its own bias.

11. Keywords

11.1 coating thickness; dry film thickness; Eddy current thickness gages; nondestructive thickness; paint thickness

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