



Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Electrodeposited Nickel Coatings on Magnetic and Nonmagnetic Substrates¹

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

1. Scope

1.1 This test method covers the use of magnetic instruments for the nondestructive measurement of the thickness of an electrodeposited nickel coating on either a magnetic or nonmagnetic substrate.

1.2 These instruments measure either the magnetic attraction between a magnet and the coating-substrate combination, or the reluctance of a magnetic flux path passing through the coating and the basis metal.

1.3 For this test method, there are two types of coating-substrate combinations that can be encountered: Type A, nickel coatings on a magnetic substrate, and Type B, nickel coatings on a nonmagnetic substrate.

1.4 The effective measuring ranges of instruments using the principle of magnetic attraction are up to 50 μm for Type A coatings, and up to 25 μm for Type B coatings. For reluctance gages, the effective ranges are much greater, and measurements up to 1 mm or more, can be made on both types of coatings.

1.5 Measurements made in accordance with this test method will be in compliance with the requirements of ISO Standard 2361 as printed in 1982.

1.6 *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 ISO International Standard:

ISO 2361 Electrodeposited Nickel Coatings on Magnetic and Nonmagnetic Substrates—Measurement of Coating Thickness—Magnetic Method²

3. Significance and Use

3.1 The thickness of a coating is often critical to its performance. This magnetic method is suitable for measuring nondestructively the thickness of some nickel coatings and for specification acceptance.

3.2 This method requires that the magnetic properties of the coating and its substrate be the same as those of the calibration standards.

4. Factors Affecting the Measuring Accuracy

4.1 *Coating Thickness*—Inherent in the method is a measuring uncertainty that, for thin coatings, is constant and independent of the coating thickness; for thicknesses greater than about 50 μm , this uncertainty is proportional to the coating thickness.

4.2 *Magnetic Properties of the Basis Metal (Type A coatings only)*—Magnetic thickness measurements are affected by variations in the magnetic properties of the basis metal. For practical purposes, magnetic variations in low-carbon steel can often be considered to be insignificant. To avoid the influences of severe or localized heat treatments and cold working, the instrument should be calibrated using a calibration standard having a basis metal with the same magnetic properties as that of the test specimen or, preferably and if available, with a sample of the part to be tested before application of the coating.

4.3 *Basis Metal Thickness (Type A coatings only)*—For each instrument, there is a critical thickness of the basis metal above which the measurements will not be affected by an increase in that thickness. Since it depends on the instrument probe (Note 1) and the nature of the basis metal, its value should be determined experimentally, if it is not supplied by the manufacturer.

NOTE 1—The term “instrument probe” also includes the term “magnet.”

4.4 *Edge Effect*—The method is sensitive to abrupt changes in the surface contour of the test specimen. Therefore, measurements made too near an edge or inside corner will not be valid, unless the instrument is specially calibrated for such a measurement. This also applies to measurements made on geometrically limited areas, such as narrow conductors on

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