



Standard Test Methods for Permeability of Weakly Magnetic Materials¹

This standard is issued under the fixed designation A342/A342M; 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.

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

1. Scope

1.1 These test methods cover four procedures for determination of the permeability [relative permeability]² of materials having a permeability not exceeding 6.0.

1.2 The test methods covered are as follows:

1.2.1 *Test Method 1—Fluxmetric Method* is suitable for materials with permeabilities between 1.0 and 4.0. This method permits the user to select the magnetic field strength at which the permeability is to be measured.

1.2.2 *Test Method 2—Permeability of Paramagnetic Materials* has been eliminated as an acceptable method of test.

1.2.3 *Test Method 3—Low Mu Permeability Indicator* is suitable for measuring the permeability of a material as “less than” or “greater than” that of calibrated standard inserts with permeability between 1.01 and 6.0, as designated for use in a Low-Mu Permeability Indicator.³ In this method, a small volume of specimen is subjected to a local magnetic field that varies in magnitude and direction, so it is not possible to specify the magnetic field strength at which the measurement is made.

1.2.4 *Test Method 4—Flux Distortion* is suitable for materials with permeability between 1.0 and 2.0. In this method, a small volume of specimen is subjected to a local magnetic field

that varies in magnitude and direction, so it is not possible to specify the magnetic field strength at which the measurement is made.⁴

1.2.5 *Test Method 5—Vibrating Sample Magnetometry* is suitable for materials with permeability between 1.0 and 4.0. This test method permits the user to select the magnetic field strength at which the permeability is to be measured.

1.3 Materials typically tested by these methods such as austenitic stainless steels may be weakly ferromagnetic. That is, the magnetic permeability is dependent on the magnetic field strength. As a consequence, the results obtained using the different methods may not closely agree with each other. When using Methods 1 and 5, it is imperative to specify the magnetic field strength or range of magnetic field strengths at which the permeabilities have been determined.

1.4 The values and equations stated in customary (cgs-emu and inch-pound) or SI units are to be regarded separately as standard. Within this standard, SI units are shown in brackets except for the sections concerning calculations where there are separate sections for the respective unit systems. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with this standard.

1.5 *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:⁵

¹ These test methods are under the jurisdiction of ASTM Committee A06 on Magnetic Properties and are the direct responsibility of Subcommittee A06.01 on Test Methods.

Current edition approved May 1, 2014. Published May 2014. Originally approved in 1949. Last previous edition approved in 2012 as A342/A342M-04 (2012). DOI: 10.1520/A0342_A0342M-14.

² Test Methods 1 and 5 actually measure magnetic susceptibility. The permeability (μ) [relative permeability (μ_r)] is related to the susceptibility (κ) by the equations:

$$\mu = 1 + 4\pi\kappa \text{ (cgs-emu)}$$
$$\mu_r = 1 + \kappa \text{ (SI)}$$

The term permeability has been retained in these test methods because of its widespread commercial and technological usage.

³ The sole source of supply of the apparatus known to the committee at this time is Low-Mu Permeability Indicator, manufactured by Severn Engineering Co., Inc., 555 Stage Rd., Suite 1A, Auburn, AL 36830, <http://www.severnengineering.com>. (Indicators can be returned for recalibration.) 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,¹ which you may attend.

⁴ The sole source of supply of the apparatus known to the Committee at this time is the Magnetoscoop manufactured by INSTITUT DR. POERSTER GmbH & Co. KG, in Laisen 70, 72766, Reutlingen, Germany. (Probes can be returned for calibration.) If you are aware of alternate suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.

⁵ 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.