



Standard Test Method for dc Magnetic Properties of Materials Using Ring and Permeameter Procedures with dc Electronic Hysteresigraphs¹

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1. Scope

1.1 This test method provides dc hysteresigraph procedures (B - H loop methods) for the determination of basic magnetic properties of materials in the form of ring, toroidal, link, double-lapped Epstein cores, or other standard shapes that may be cut, stamped, machined, or ground from cast, compacted, sintered, forged, or rolled materials. It includes tests for normal induction and hysteresis taken under conditions of continuous sweep magnetization. Rate of sweep may be varied, either manually or automatically at different portions of the curves during tracing. Total elapsed time for tracing a hysteresis loop is commonly 10 to 120 s per loop.

1.2 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. 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.

1.3 *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:

A 34/A 34M Practice for Sampling and Procurement Testing of Magnetic Materials²

A 341/A 341M Test Method for Direct Current Magnetic Properties of Materials Using D-C Permeameters and the Ballistic Test Methods²

A 343 Test Method for Alternating-Current Magnetic Prop-

erties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame²

A 596/A 596M Test Method for Direct-Current Magnetic Properties of Materials Using the Ballistic Method and Ring Specimens²

2.2 Other:

IEC Publication 404-4: Magnetic Materials—Part 4: Methods of Measurement of dc Magnetic Properties of Iron and Steel (1995)³

3. Summary of Test Method

3.1 As in making most magnetic measurements, a specimen is wound with an exciting winding (the primary) and a search coil (the secondary) for measuring the change in flux. When an exciting current, I , is applied to the primary winding, a magnetic field, H , is produced in the coil, and this in turn produces magnetic flux ϕ in the specimen. In uniform specimens that do not contain air gaps, such as ring samples, all of the exciting current is used to magnetize the specimen, and H is proportional to I in accordance with the following equation:

$$H = KI \quad (1)$$

where:

H = magnetic field strength, Oe [A/m];

I = current in the exciting coil A; and

K = constant determined by the number of primary turns the magnetic path length of the specimen and system of units.

3.1.1 The magnetic flux may be determined by integration of the instantaneous electromotive force that is induced in the secondary coil when the flux is increased or decreased by a varying H . The instantaneous voltage, e , is equal to:

$$e = -NK \frac{d\phi}{dt} \quad (2)$$

¹ This test method is under the jurisdiction of ASTM Committee A06 on Magnetic Properties and is the direct responsibility of Subcommittee A06.01 on Test Methods.

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² Annual Book of ASTM Standards, Vol 03.04.

³ Available from American National Standards Institute, 25 W. 43rd St., 4th Floor, New York, NY 10036.

