



Standard Test Method for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame¹

This standard is issued under the fixed designation A 343/A 343M; 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 tests for the magnetic properties of basic flat-rolled magnetic materials at power frequencies (25 to 400 Hz) using a 25-cm Epstein test frame and the 25-cm double-lap-jointed core. It covers the determination of core loss, rms exciting power, rms and peak exciting current, and several types of ac permeability and related properties of flat-rolled magnetic materials under ac magnetization.

1.2 This test method shall be used in conjunction with Practice A 34/A 34M.

1.3 This test method² provides a test for core loss and exciting current at moderate and high magnetic flux densities up to 15 kG [1.5 T] on nonoriented electrical steels and up to 18 kG [1.8 T] on grain-oriented electrical steels.

1.4 The frequency range of this test method is normally that of the commercial power frequencies 50 to 60 Hz. With proper instrumentation, it is also acceptable for measurements at other frequencies from 25 to 400 Hz.

1.5 This test method also provides procedures for calculating ac impedance permeability from measured values of rms exciting current and for ac peak permeability from measured peak values of total exciting currents at magnetic field strengths up to about 150 Oe [12 000 A/m].

1.6 Explanation of symbols and abbreviated definitions appear in the text of this test method. The official symbols and definitions are listed in Terminology A 340.

1.7 The values and equations stated in either 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 in 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.

1.8 *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 Materials³

A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing³

A 677/A 677M Specification for Nonoriented Electrical Steel Fully Processed Types³

A 683/A 683M Specification for Nonoriented Electrical Steel, Semiprocessed Types³

A 876/A 876M Specification for Flat-Rolled, Grain-Oriented, Silicon-Iron, Electrical Steel, Fully Processed Types³

A 889/A 889M Test Method for Alternating-Current Magnetic Properties of Materials at Low Inductions Using the Wattmeter-Varmeter-Ammeter-Voltmeter Method and 25-cm (250-mm) Epstein Frame³

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods⁴

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method⁴

E 1338 Guide for the Identification of Metals and Alloys In Computerized Material Property Databases⁵

3. Significance and Use

3.1 This test method is a fundamental method for evaluating the magnetic performance of flat-rolled magnetic materials in either as-sheared or stress-relief annealed condition.

3.2 This test method is suitable for design, specification acceptance, service evaluation, and research and development.

¹ This test method is under the jurisdiction of ASTM Committee A06 on Magnetic Properties and is the direct responsibility of Subcommittee A6.01 on Test Methods.

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² See Burgwin, S. L., "Measurement of Core Loss and A-C Permeability with the 25-cm Epstein Frame," *Proceedings*, American Society for Testing and Materials, ASTEA Vol 41, 1941, p. 779.

³ *Annual Book of ASTM Standards*, Vol 03.04.

⁴ *Annual Book of ASTM Standards*, Vol 14.02.

⁵ *Annual Book of ASTM Standards*, Vol 02.05..