



Designation: A 889/A 889M – 93 (Reapproved 1998)

Standard 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 Frame¹

This standard is issued under the fixed designation A 889/A 889M; 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 [250-mm] Epstein test frame and the 25-cm [250-mm] double-lap-jointed core.

1.2 The magnetic properties of materials are determined from measurements on Epstein core specimens with the core and test coils treated as though they constituted a series-parallel equivalent circuit (Fig. A1.1) for the fundamental frequency of excitation where the apparent parallel inductance, L_1 , and resistance, R_1 , are attributable to the test specimen.

1.3 This test method is suitable for the determination of core loss, rms volt-amperes, rms exciting current, reactive volt-amperes, and related properties of flat-rolled magnetic materials under ac magnetization.

1.4 The frequency range of this test method is normally that of the commercial power frequencies 50 to 60 Hz. It is also acceptable for measurements at frequencies from 25 to 400 Hz. This method is customarily used on nonoriented electrical steels at inductions up to 10 kG [1.0 T] and for grain-oriented electrical steels at inductions up to 15 kG [1.5 T].

1.5 For reactive properties, both flux and current waveforms introduce limitations. Over its range of useful inductions, the varmeter is valid for the measurement of reactive volt-amperes (vars) and inductance permeability. For the measurement of these properties, it is suggested that test inductions be limited to values sufficiently low that the measured values of vars do not differ by more than 15 % (Note 1) from those calculated from the measured values of exciting volt-amperes and core loss.

NOTE 1—This limitation is placed on this test method in consideration of the nonlinear nature of the magnetic circuit, which leads to a difference between vars based on fundamental frequency components of voltage and current and current after harmonic rejection and vars computed from rms current, voltage, and watt values when one or more of these quantities are nonsinusoidal.

¹ This test method is under the jurisdiction of ASTM Committee A-6 on Magnetic Properties and is the direct responsibility of Subcommittee A06.01 on Test Methods.

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

1.7 Explanation of terms, symbols, and definitions used may be found in the various sections of this test method. The official list of definitions and symbols may be found in Terminology A 340.

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 its use.*

1.9 The values stated in either customary (cgs-emu and inch-pound) units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system shall be used independently of the other. Combining values from the systems may result in nonconformance with this test method.

2. Referenced Documents

2.1 ASTM Standards:

- A 34/A 34M Practice for Sampling and Procurement Testing of Magnetic Materials²
- A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing²
- A 343 Test Method for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame²

3. Significance and Use

3.1 This test method may be used to determine the specific core loss, specific reactive power, specific exciting power, inductance permeability, and impedance permeability of flat-rolled magnetic materials over a wide range of inductions and at frequencies up to 400 Hz for symmetrically magnetized test samples.

3.2 These measurements are used by the producer and user of the flat-rolled material for quality control purposes. The fundamental assumption inherent in these measurements is that

² *Annual Book of ASTM Standards*, Vol 03.04.

