



# Standard Test Method for Alternating Current Magnetic Properties of Materials Using the Wattmeter-Ammeter-Voltmeter Method, 100 to 10 000 Hz and 25-cm Epstein Frame<sup>1</sup>

This standard is issued under the fixed designation A 348/A348M; 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 the determination of the magnetic properties of flat-rolled magnetic materials using Epstein test specimens with double-lap joints in the 25-cm Epstein frame. It covers determination of core loss, rms and peak exciting current, exciting power, magnetic field strength, and permeability. This test method is commonly used to test grain-oriented and nonoriented electrical steels but may also be used to test nickel-iron, cobalt-iron, and other flat-rolled magnetic materials.

1.2 This test method shall be used in conjunction with Practice A 34/A 34M and Test Method A 343.

1.3 Tests under this test method may be conducted with either normal ac magnetization or with ac magnetization and superimposed dc bias (incremental magnetization).

1.4 In general, this test method has the following limitations:

1.4.1 *Frequency*—The range of this test method normally covers frequencies from 100 to 10 000 Hz. With proper equipment, the test method may be extended above 10 000 Hz. When tests are limited to the use of power sources having frequencies below 100 Hz, they shall use the procedures of Test Method A 343.

1.4.2 *Magnetic Induction* (may also be referred to as *Induction*)—The range of induction for this test method is governed by the test specimen properties and by the available instruments and other equipment components. Normally, for many materials, the induction range is from 1 to 15 kG [0.1 to 1.5 T].

1.4.3 *Core Loss and Exciting Power*—These measurements are normally limited to test conditions that do not cause a test specimen temperature rise in excess of 50°C or exceed 100 W/lb [220 W/kg].

1.4.4 *Excitation*—Either rms or peak values of exciting current may be measured at any test point that does not exceed

the equipment limitations provided that the impedance of the ammeter shunt is low and its insertion into the test circuit does not cause appreciably increased voltage waveform distortion at the test induction.

1.4.5 *Incremental Properties*—Measurement of incremental properties shall be limited to combinations of ac and dc excitations that do not cause secondary voltage waveform distortion, as determined by the form factor method, to exceed a shift of 10 % away from sine wave conditions.

1.5 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 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.

1.6 *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 ASTM Standards:

A 34/A 34M Practice for Sampling and Procurement Testing of Magnetic Materials<sup>2</sup>

A 340 Terminology of Symbols and Definitions Relating to Magnetic Testing<sup>2</sup>

A 343 Test Method for Alternating-Current Magnetic Properties of Materials at Power Frequencies Using Wattmeter-Ammeter-Voltmeter Method and 25-cm Epstein Test Frame<sup>2</sup>

A 347 Test Method for Alternating Current Magnetic Properties of Materials Using the Dieterly Bridge Method with 25-cm Epstein Frame<sup>3</sup>

<sup>1</sup> 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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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 03.04.

<sup>3</sup> Discontinued, see 1995 *Annual Book of ASTM Standards*, Vol 03.04.