



Standard Test Method for Determining Electrical Conductivity Using the Electromagnetic (Eddy-Current) Method¹

This standard is issued under the fixed designation E1004; 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 Department of Defense.

1. Scope*

1.1 This test method covers a procedure for determining the electrical conductivity of nonmagnetic metals using the electromagnetic (eddy-current) method. The procedure has been written primarily for use with commercially available direct reading electrical conductivity instruments. General purpose eddy-current instruments may also be used for electrical conductivity measurements but will not be addressed in this test method.

1.2 This test method is applicable to metals that have either a flat or slightly curved surface and includes metals with or without a thin nonconductive coating.

1.3 Eddy-current determinations of electrical conductivity may be used in the sorting of metals with respect to variables such as type of alloy, aging, cold deformation, heat treatment, effects associated with non-uniform heating or overheating, and effects of corrosion. The usefulness of the examinations of these properties is dependent on the amount of electrical conductivity change caused by a change in the specific variable.

1.4 Electrical conductivity, when evaluated with eddy-current instruments, is usually expressed as a percentage of the conductivity of the International Annealed Copper Standard (IACS). The conductivity of the Annealed Copper Standard is defined to be 0.58×10^8 S/m (100 % IACS) at 20°C.

1.5 The values stated in SI units are regarded as 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.*

¹ This test method is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.07 on Electromagnetic Method.

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2. Referenced Documents

2.1 ASTM Standards:²

B193 Test Method for Resistivity of Electrical Conductor Materials

E105 Practice for Probability Sampling of Materials

E122 Practice for Calculating Sample Size to Estimate, With Specified Precision, the Average for a Characteristic of a Lot or Process

E543 Specification for Agencies Performing Nondestructive Testing

E1316 Terminology for Nondestructive Examinations

2.2 ASNT Documents:

Recommended Practice SNT-TC-1A for Personnel Qualification and Certification in Nondestructive Testing³

ANSI/ASNT-CP-189 Standard for Qualification and Certification of NDT Personnel³

2.3 AIA Document:

NAS-410 Certification and Qualification of Nondestructive Testing Personnel⁴

3. Terminology

3.1 *Definitions*—Definitions of terms relating to eddy-current examination are given in Terminology E1316.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *temperature coefficient*—the fractional or percentage change in electrical conductivity per degree Celsius change in temperature.

4. Significance and Use

4.1 Absolute probe coil methods, when used in conjunction with reference standards of known value, provide a means for determining the electrical conductivity of nonmagnetic materials.

² 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.

³ Available from American Society for Nondestructive Testing (ASNT), P.O. Box 28518, 1711 Arlington Ln., Columbus, OH 43228-0518, <http://www.asnt.org>.

⁴ Available from Aerospace Industries Association of America, Inc. (AIA), 1000 Wilson Blvd., Suite 1700, Arlington, VA 22209-3928, <http://www.aia-aerospace.org>.

*A Summary of Changes section appears at the end of this standard