



Designation: D3145 – 20 (Reapproved 2025)

Standard Test Method for Thermal Endurance of Electrical Insulating Varnishes by Helical Coil Method¹

This standard is issued under the fixed designation D3145; 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 U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination of the thermal endurance of electrical insulating varnishes alone or in combinations with magnet wire insulation. Changes in the helical coil bond strength are used as the test criteria. The coils are made from bare aluminum or copper wire, or from film- or fiber-insulated magnet wire.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

NOTE 1—There is no similar or equivalent IEC 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For a specific precautionary statement, see Section 7.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D1711 Terminology Relating to Electrical Insulation](#)

[D1932 Test Method for Thermal Endurance of Flexible Electrical Insulating Varnishes](#)

¹ This test method is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.01 on Electrical Insulating Products.

Current edition approved Dec. 1, 2025. Published December 2025. Originally approved in 1973. Last previous edition approved in 2020 as D3145 – 20. DOI: 10.1520/D3145-20R25.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[D2307 Test Method for Thermal Endurance of Film-Insulated Round Magnet Wire](#)

[D2519 Test Method for Bond Strength of Electrical Insulating Varnishes by the Helical Coil Test](#)

[D3251 Test Method for Thermal Endurance Characteristics of Electrical Insulating Varnishes Applied Over Film-Insulated Magnet Wire](#)

[D5423 Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation](#)

2.2 *International Electrotechnical Commission Publication:*³

[IEC 60216-1 Guide for the Determination of Thermal Endurance Properties of Electrical Insulation Materials \(Part 1\)](#)

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in the test method, refer to Terminology [D1711](#).

3.1.2 *varnish, electrical insulating, n*—a liquid resin system that is applied to and cured on electrical components providing electrical, mechanical, and environmental protection.

3.1.2.1 *Discussion*—There are two types of electrical insulating varnish: solvent-containing and solventless. The solvent-containing varnish is a solution, dispersion, or emulsion of a polymer or mixture of polymers in a volatile, nonreactable liquid. The solventless type is a liquid resin system free of volatile, nonreactable solvents.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *bond strength, n*—a measure of the force required to separate surfaces which have been bonded together.

3.2.2 *magnet wire, n*—a metal electrical conductor, covered with electrical insulation, for use in the assembly of electrical inductive apparatus such as coils for motors, transformers, generators, relays, magnets, and so forth.

3.2.2.1 *Discussion*—The electrical insulation is usually composed of a film covering formed from a magnet wire

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.