Designation: D 4881 – 01

An American National Standard

Standard Test Method for Thermal Endurance of Varnished Fibrous- or Film-Wrapped Magnet Wire[1]

This standard is issued under the fixed designation D 4881; 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 thermal endurance of rectangular and square fibrous- or film-wrapped magnet wire coated with an insulating varnish.

1.2 The values given in SI units are the standard. The values given in parentheses are for information only.

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 and health practices and determine the applicability of regulatory limitations prior to use.* A specific precautionary statement is given in Section 5.

NOTE 1—There is no similar or equivalent IEC Standard.

2. Referenced Document

2.1 *ASTM Standards:*

D 1711 Terminology Relating to Electrical Insulation[2]

D 2307 Test Method for Relative Thermal Endurance of Film-Insulated Round Magnet Wire[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

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

3.1.1.1 *Discussion*—There are two types of electrical insulating varnishes—solvent-containing and solventless. Solvent-containing types are solutions, dispersions, or emulsions of a polymer or a mixture of polymers in a volatile, nonreactable liquid. Solventless types are liquid resin systems free of volatile, nonreactable solvents.

3.1.2 Refer to Terminology D 1711 for definitions of other terms.

4. Significance and Use

4.1 Individual varnishes may behave differently when applied to the same fibrous- or film-wrapped magnet wire and aged at elevated temperatures. Likewise, a varnish may not behave the same when applied to different types of fibrous or film-wrapped magnet wires and aged at elevated temperatures.

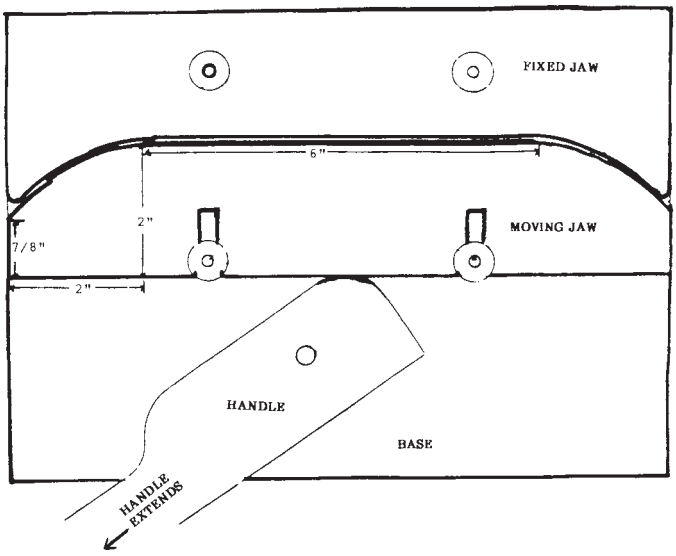

FIG. 1 Jig for Forming Wire

5. Safety Precautions

5.1 It is unsafe to use varnish at temperatures above the flash point without adequate ventilation, especially if the possibility exists that flames or sparks are present. Store varnish in sealed containers.

6. Test Specimens

6.1 *Construction of Test Specimens*:

6.1.1 Cut two 250-mm (10-in.) lengths of wire for each specimen to be made.

6.1.2 Form each length in a fixture as shown in Fig. 1.

6.1.3 Prepare a test specimen by placing the two formed wires together back to back and wrap tightly with glass yarn

[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 Varnishes, Powders, and Encapsulating Compounds.

Current edition approved Sept. 10, 2001. Published November 2001. Originally published as D 4881 – 88. Last previous edition D 4881 – 97.

[2] *Annual Book of ASTM Standards*, Vol 10.01.

over the middle 6-in. (150-mm) section. The glass yarn shall have a gap between turns and there must be intimate contact of the two wires.

6.1.4 Prepare ten specimens for each test temperature.

6.2 *Varnishing the Test Specimens*:

6.2.1 Adjust the consistency of a solvent-containing varnish to give a 0.025 ± 0.005-mm (0.0010 ± 0.0002-in.) cured film on each side of a 0.13-mm (0.005-in.) copper strip withdrawn at a rate of 100 mm/min (4 in./min). Use solventless varnish as received.

6.2.2 Submerge the test specimens vertically in the varnish to be tested. Withdraw them at a rate of 100 mm/min (4 in./min). Drain the test specimens for 10 to 12 min. Cure according to the manufacturer's recommendations. If a solvent-containing varnish is being tested, the test specimens shall be dipped in the reverse direction and cured as before.

7. Procedure

7.1 After selecting the test voltage from Table 1, follow the procedure in Test Method D 2307.

TABLE 1 Test Voltages

Difference Between Bare and Insulated Wire Thickness, mm (in.)	Test Voltage, 60 Hz ac RMS
0.036 – 0.050 (0.0015 – 0.0020)	300
0.051 – 0.064 (0.0021 – 0.0025)	375
0.065 – 0.076 (0.0026 – 0.0030)	450
0.077 – 0.089 (0.0031 – 0.0035)	550
0.090 – 0.102 (0.0036 – 0.0040)	650
0.103 – 0.114 (0.0041 – 0.0045)	700
0.115 – 0.127 (0.0046 – 0.0050)	750
0.128 – 0.140 (0.0051 – 0.0055)	800
0.141 – 0.152 (0.0056 – 0.0060)	850
>0.153 (>0.0061)	1000

8. Calculation

8.1 After all specimens have failed, calculate the average life at each test temperature in accordance with Test Method D 2307.

8.2 Plot the results using the average life calculated for each temperature as the ordinate on a logarithmic time scale and the reciprocal of the absolute temperature as the abscissa.

8.3 Calculate the temperature index using the procedure given in the Appendix of Test Method D 2307. The temperature index is calculated at 20 000 h.

9. Report

9.1 Report the following information:

9.1.1 Identification of the varnish used,

9.1.2 Identification of the magnet wire used including size and build,

9.1.3 Temperature index, and

9.1.4 Correlation coefficient.

10. Precision and Bias

10.1 *Precision*—This test method has been in use for many years, but no statement of precision has been made and no activity is planned to develop such a statement.

10.2 *Bias*—This test method has no bias because the value for thermal endurance of varnished-fibrous or film-wrapped magnet wire is defined in terms of this test method.

11. Keywords

11.1 electrical insulating; fibrous-wrapped wire; film-wrapped wire; thermal endurance; varnish