Designation: D 4880 – 03

An American National Standard

Standard Test Method for Salt Water Proofness of Insulating Varnishes Over Enamelled Magnet Wire[1]

This standard is issued under the fixed designation D 4880; 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 performance in a specified water solution of an insulating varnish applied over enamelled magnet wire.

1.2 The values stated in SI units are the 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 and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

NOTE 1—There is no IEC method equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1676 Test Method for Testing Film-Insulated Magnet Wire

D 1711 Terminology Relating to Electrical Insulation

3. Terminology

3.1 *Definitions:* For definitions of terms used in this test method refer to Terminology D 1711.

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 varnish— solvent–containing and solventless. The solvent-containing varnish is solution, dispersion, or emulsion of a polymer or a mixture of polymers in a volatile, nonreactable liquid. The solventless type is a liquid resin system free of volatile, nonreactable solvents.

3.1.2 *varnished, adj*—referring to any item on to which varnish has been applied and cured.

4. Significance and Use

4.1 This test method is useful in determining the performance of varnishes over enamelled magnet wire when subjected to the specified sodium chloride solution. It is useful in evaluating the resistance of varnished magnet wire to a diluted sodium chloride solution under applied voltage.

5. Apparatus

5.1 *Description of Electrical Apparatus*:

5.1.1 The apparatus shall contain devices for limiting or interrupting the current to each specimen whenever a failure occurs. In particular, 7.5 W light bulbs or 1/10 A fuses have been used. Lighting of the bulb or "blowing" of the fuse indicates failure.

5.1.2 The power supply shall provide a source of filtered 120 ± 2 V dc which drops by less than 2 V when a current of 0.5 A is drawn.

5.1.3 A positive polarity of 120 V dc is applied to the specimens. The surrounding sodium chloride solution is at ground potential. The ground connection, using an immersed electrode, is made using Nichrome, stainless steel, or other non-corrosive wire. Do not use iron, carbon steel, copper, or brass (see Fig. 1).

5.2 An appropriate container shall be selected for the sodium chloride solution. Fit it with a cover to prevent evaporation of the solution.

6. Safety Precautions

6.1 Do not use varnish at temperatures above the flash point when inadequate ventilation, and possibility of flames or sparks exist. Store varnish in sealed containers. These precautions shall also apply to the handling of the reagents and solvents called for in this test method.

6.2 (**Warning—**Lethal voltages are a potential hazard during the performance of this test. It is essential that the test apparatus, and all associated equipment electrically connected to it, be properly designed and installed for safe operation. Solidly ground all electrically conductive parts which it is possible for a person to contact during the test. Provide means

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[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.

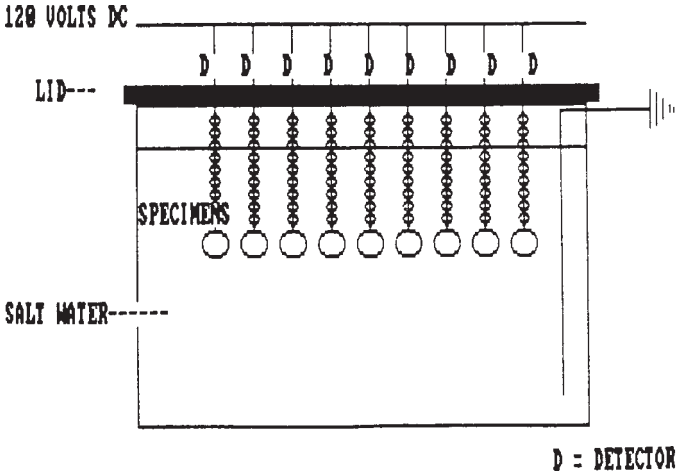

FIG. 1 Typical Test Apparatus

for use at the completion of any test to ground any parts which were at high voltage during the test or have the potential for acquiring an induced charge during the test or retaining a charge even after disconnection of the voltage source. Thoroughly instruct all operators as to the correct procedures for performing tests safely. When making high voltage tests, particularly in compressed gas or in oil, it is possible for the energy released at breakdown to be sufficient to result in fire, explosion, or rupture of the test chamber. Design test equipment, test chambers, and test specimens so as to minimize the possibility of such occurrences and to eliminate the possibility of personal injury. If the potential for fire exists, have fire suppression equipment available.)

7. Test Specimens Preparation

7.1 *Selection of Enamelled Magnet Wire*— The type of enamelled magnet wire used for this test shall be agreed upon between the varnish user and the manufacturer. Seven of the nine unvarnished test specimens shall fail within the specified test time.

7.2 Twist a section of 1.02-mm (0.0403-in.) (18-AWG) enamelled magnet wire with the appropriate number of twists and tension as described in Test Methods D 1676 (see Fig. 2). Note however, that one end of the specimen is a continuous loop instead of two loose ends.

7.3 Prepare 18 specimens in the manner described in 7.2.

7.4 *Dipping*:

7.4.1 Adjust the consistency of the 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 (.005-in.) copper strip withdrawn at a rate of approximately 100 mm/min (4 in./min). Use solventless varnish as received.

7.4.2 Dip nine twisted specimens in the varnish to be tested. After the specimens are submerged in the varnish, withdraw them at a rate of approximately 100 mm/min (4 in./min). Drain the specimens for a minimum of 10 min. Cure according to the manufacturer's specifications. Dip the specimens again in the reverse direction if a solvent-containing varnish was used. When testing solventless varnishes, dip test specimens only once.

FIG. 2 Test Specimen

8. Procedure

8.1 Perform the following for nine unvarnished specimens and nine varnished specimens.

8.2 Remove the enamel from the loose ends of the twisted specimens. Use these legs to make the electrical connections.

8.3 For each test, prepare a solution of distilled water and sodium chloride in which the sodium chloride is at a concentration of 3.5 ± 0.1 % by weight.

8.4 Set up the appropriate circuit as outlined in Section 5. Connect the specimen to the electrical circuit. Then submerge the specimens so that approximately 76 mm (3 in.) of the twisted sections of the specimens are submerged in the sodium chloride solution.

8.5 Apply 120 ± 5 V dc between the specimen and the sodium chloride solution.

8.6 Check for failures daily or more often if possible and then record the total elapsed time from the application of the test voltage to when failures are detected. The length of time of the test is 100 h unless otherwise agreed upon between the user and the manufacturer.

8.7 if seven of the nine unvarnished test specimens do not fail within the test time, repeat the test with a different enamelled magnet wire as specified in 7.1.

9. Report

9.1 Report the following information:

9.1.1 Identification of the varnish used,

9.1.2 Identification and film build of the magnet wire used,

9.1.3 The number of unvarnished specimens failed at the end of the test time and the elapsed time when each failure was detected,

9.1.4 The number of unvarnished specimens that did not fail at the end of the test time,

9.1.5 The number of varnished specimens that failed at the end of the test time and the elapsed time when each failure was detected, and

9.1.6 The number of varnished specimens that did not fail at the end of the test time.

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 salt water proofness is defined in terms of this method.

11. Keywords

11.1 electrical insulating; enamelled wire; magnet wire; salt water; varnish