Designation: D 2802 – 03

An American National Standard

Standard Specification for Ozone-Resistant Ethylene-Alkene Polymer Insulation for Wire and Cable[1]

This standard is issued under the fixed designation D 2802; 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 specification covers an ozone-resisting crosslinked rubber insulation compound for electrical wires and cables. The polymer shall consist substantially of ethylene-alkene copolymer (EAM) or ethylene-alkene diene terpolymer (EADM). This polymer type includes ethylenepropylene copolymer (EPM) and ethylenepropylene diene terpolymer (EPDM).

1.2 This type of insulation is considered suitable for use on wire or cable which will be used in wet and dry locations with conductor temperatures up to 90°C during continuous operation, to 130°C during emergency overload conditions, and to 250°C during short-circuit conditions. It is considered suitable for all sizes and voltage classifications of single- and multiple-conductor power cables up to 35 000 V phase-to-phase at the 100 % insulation level and up to 25 000 V at the 133 % insulation level as listed in Table 1D, Conductor Sizes, Insulation Thicknesses, Test Voltages, and Corona Extinction Levels for Ethylene-Propylene Rubber Insulation, of Test Methods D 470. Single-conductor cables shall have a supplementary covering over the insulation, and multiple-conductor cables shall have an overall covering.

1.3 Whenever two sets of values are presented, in different units, the values in the first set are the standard, while those in parentheses are for information only.

1.4 In many instances the insulation material cannot be tested unless it has been formed around a conductor or cable. Therefore, tests are done on insulated wire or cable in this specification solely to determine the relevant property of the insulation and not to test the conductor or completed cable.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable

D 1711 Terminology Relating to Electrical Insulation

2.2 *ICEA Standard:*

T-24-380 Guide for Partial Discharge Procedure[3]

3. Terminology

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

3.2 *Definition of Term Specific to This Standard:*

3.2.1 *aging (act of), n*—exposure of materials to air at a temperature of 121°C for 168 h.

4. Physical Properties

4.1 The crosslinked insulation shall conform to the requirements for physical properties specified in Table 1.

4.2 The values specified in Table 1 are applicable only to insulation having a nominal wall thickness of 0.030 in. (0.76 mm) or greater.

5. Electrical Requirements

5.1 *Order of Testing*—Perform the ac voltage withstand, insulation resistance, and dc voltage withstand tests in that order when any of these tests are required. The sequence for other testing is not specified.

5.2 *AC Voltage Withstand Test*—Each insulated conductor in the completed cable shall withstand for 5 min the ac test voltage shown in Table 1D, Conductor Sizes, Insulation Thicknesses, Test Voltages, and Corona Extinction Levels for Ethylene-Propylene Rubber Insulation, of Test Methods D 470, except that for nonshielded conductors rated 5000 V or less, the dc test voltage described in 5.5 may be substituted.

5.3 *Insulation Resistance*:

[1] This specification is under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee D09.18 on Solid Insulations, Nonmetallic Shieldings, and Coverings for Electrical and Telecommunications Wires and Cables. Members of ASTM Committees D02 on Petroleum Products and Lubricants, and B07 on Light Metals and Alloys, have contributed to this specification.

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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.

[3] Available from the Insulated Cable Engineers' Assn., P.O. Box 440, S. Yarmouth, MA 02664.

TABLE 1 Physical Property Requirements for Ozone-Resistant-Type EAM or EADM Insulation

Physical Requirements (original):	
Tensile strength, min, psi (MPa)	700 (4.8)
Elongation at rupture, min, %	250
Physical Requirements (after aging in an air-oven at 121 ± 1°C for 168 h):	
Tensile strength, min, % of unaged value	75
Elongation at rupture, min, % of unaged value	75

5.3.1 Each insulated conductor in the completed cable shall have an insulation resistance value of not less than that corresponding to a constant of 20 000 MΩ-1000 ft at 15.6°C. When the temperature of the water in which the insulation is tested differs from 15.6°C, the measured value obtained shall be multiplied by the proper correction factor from Table 2, Temperature Correction Factors for Insulation Resistance at 60° F, of Test Methods D 470. Use the coefficient supplied by the manufacturer for this particular compound or determine the coefficient as described by Test Methods D 470, Section 35, Determining Temperature Coefficient for Insulation Resistance.

5.3.2 Where a nonconducting separator is applied between the conductor and insulation, or where an insulated conductor is covered with a nonmetallic sheath so that the insulation resistance can be measured only on the complete assembly, the required insulation resistance shall be not less than 60 % of that required for the primary insulation based on the thickness of that insulation.

5.4 *DC Voltage Withstand Test for Cables Rated at 5001 V and Above*—Upon completion of the insulation resistance test, each insulated conductor in the completed cable rated for service at 5001 V and above shall withstand for 15 min the dc test voltage shown in Table 1D, Conductor Sizes, Insulation Thicknesses, Test Voltages, and Corona Extinction Levels for Ethylene-Propylene Rubber Insulation, of Test Methods D 470.

5.5 *DC Voltage Withstand Test for Cables Rated at 5000 V and Less*—Upon completion of the insulation resistance test, each non-shielded insulated conductor in the completed cable rated up to 5000 V shall withstand for 5 min the dc test voltage shown in Table 1D, Conductor Sizes, Insulation Thicknesses, Test Voltages, and Corona Extinction Levels for Ethylene-Propylene Rubber Insulation, of Test Methods D 470 unless the ac voltage test described in 5.2 is performed.

5.6 *Capacitance and Dissipation Factor*—After 24-h immersion in water at room temperature, a specimen of the insulated conductor rated for service at 5001 V and above shall be tested for capacitance and dissipation factor with suitable 60-Hz equipment, and shall have a permittivity not exceeding 4.0 and dissipation factor not exceeding 0.02. The measurements shall be made at the rated voltage to ground of the cable under test.

5.7 *Partial Discharge (Corona) Level Test*:

5.7.1 Each length of completed shielded cable rated for service at 2001 V and above shall comply with the minimum partial discharge (corona) level specified in Table 2 when tested in accordance with ICEA T-24-380.

5.7.2 Unless otherwise specified, the cable will be rated at 100 % insulation level.

6. Accelerated Water Absorption

6.1 The insulation shall conform to the requirements shown in Table 3. The Electrical Method tests shall be conducted at 60 Hz with a water temperature of 75 ± 1°C.

7. Ozone Resistance

7.1 The insulation shall show no visible cracking after exposure for 3 h to an ozone concentration between 0.025 and 0.030, %, volume, when tested in accordance with Test Methods D 470.

8. Sampling

8.1 Sample the insulation in accordance with Test Methods D 470.

9. Test Method

9.1 Test the insulation in accordance with Test Methods D 470.

10. Keywords

10.1 AC voltage withstand test; accelerated water absorption; DC voltage withstand test; ethylene-propylene rubber; insulation resistance; ozone resisting

TABLE 2 Minimum Partial Discharge (Corona) Level for Completed Power Cable

Rated Circuit Voltage, Phase-to-Phase, V	Minimum Partial Discharge (Corona) Extinction Level, kV	
	100 % Insulation Level	133 % Insulation Level
2001 to 5000	4.0	5.0
5001 to 8000	6.0	8.0
8001 to 15 000	11.0	15.0
15 001 to 25 000	19.0	26.0
25 001 to 28 000	21.0	...
28 001 to 35 000	26.0	...

TABLE 3 Accelerated Water Absorption Test Requirements

Electrical Method:	
Permittivity, max after 24-h immersion, tested at 80 V/mil (3.1 kV/mm)	4.0
Capacitance increase, max, %	
1 to 14 days	3.5
7 to 14 days	1.5
Stability factor after 14 days, max	1.0
Alternate to stability factor, 1 to 14 days, max	0.5