



# Standard Specification for Synthetic Rubber Heat-and Moisture-Resisting Insulation for Wire and Cable, 75°C Operation<sup>1</sup>

This standard is issued under the fixed designation D 1679; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers a crosslinked rubber insulating compound for electrical wires and cables. The polymer consists substantially of synthetic rubber.

1.2 This type of insulation is suitable for continuous operation at conductor temperatures not exceeding 75°C in dry or wet locations and operating voltages not exceeding 2000 V. This insulation may have low-temperature limitations. Consult the manufacturer for specific recommendations for installation or application.

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 document solely to determine the relevant property of the insulation material and not to test the insulated conductor or completed cable.

## 2. Referenced Documents

### 2.1 ASTM Standards:

D 470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable<sup>2</sup>

D 1711 Terminology Relating to Electrical Insulation<sup>2</sup>

## 3. Terminology

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

### 3.2 *Definitions of Terms Specific to This Standard*:

3.2.1 *aging (act of), n*—exposure of materials to the following: air at 80 psi (0.55 MPa) and 127°C for 20 h; exposure to oxygen at 300 psi (2.1 MPa) and 80°C for 168 h.

<sup>1</sup> 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, Non-Metallic Shieldings and Coverings for Electrical and Telecommunication Wires and Cables.

Current edition approved March 10, 2002. Published June 2002. Originally published as D 1679 – 59 T. Last previous edition D 1679 – 97.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 10.01.

## 4. Physical Properties

4.1 Requirements for physical properties are listed in Table 1.

4.2 *Thickness of Insulation*—Table 1 A (Conductor Sizes, Insulation Thicknesses and AC Test Voltages for Rubber Insulations) of Test Methods D 470 lists the average thickness for the insulation. The required minimum thickness is at least 90 % of that given in Table 1 A (Conductor Sizes, Insulation Thicknesses and AC Test Voltages for Rubber Insulations) of Test Methods D 470.

## 5. Electrical Requirements

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

5.2 *AC Voltage Test*—Test each insulated conductor for 5 min at the ac withstand test voltage given for ozone-resisting insulations in Table 1 A (Conductor Sizes, Insulation Thicknesses and AC Test Voltages For Rubber Insulations) of Test Methods D 470 under the columns labelled “Other Than Ozone-Resisting Insulations.” Unless otherwise specified, omit this test for nonshielded conductors rated up to 5000 V if the dc voltage test described in 5.4 is to be performed.

### 5.3 *Insulation Resistance*:

5.3.1 The insulated conductor shall have an insulation resistance value of at least that which corresponds to a constant of 4000 M $\Omega$ -1000 ft (305 m) at 60°F (15.6°C).

5.3.2 If the temperature at the time measurement was made differs from 60°F (15.6°C), correct the insulation resistance to 60°F. Table 2 (Temperature Correction Factors for Insulation Resistance at 60°F) of Test Methods D 470 contains the correction factors. Each insulation manufacturer can furnish the 1°F coefficient for the insulation material by using the procedure given in Test Methods D 470. Multiply the measured value by the correction factor to obtain the insulation resistance value corrected to 60°F.

5.3.3 If a nonconducting separator is applied between the conductor and insulation or if an insulated conductor is covered with a nonmetallic jacket so that the insulation resistance can be measured only on the completed assembly, the required

**TABLE 1 Requirements for Physical Properties<sup>A</sup>**

Unaged Requirements:	
Tensile strength, min, psi (MPa)	600 (4.1)
Elongation at rupture, min, %	350
Set in 2-in. or 50-mm gage length, max, %	25
Aged Requirements:	
After air pressure heat test at $80 \pm 2.0$ psi ( $0.55 \pm 0.01$ MPa) and $127 \pm 1^\circ\text{C}$ for 20 h:	
Tensile strength, min, % of unaged value	50
Elongation at rupture, min, % of unaged value	50
After oxygen pressure test at $300 \pm 15$ psi ( $2.1 \pm 0.1$ MPa) and $80 \pm 1^\circ\text{C}$ for 168 h:	
Tensile strength, min, % of unaged value	50
Elongation at rupture, min, % of unaged value	50

<sup>A</sup>The values specified are applicable to insulation having a nominal wall thickness of 0.030 in. (0.76 mm) or greater.

**TABLE 2 Accelerated Water Absorption Test Requirements**

Electrical Method:	
Permittivity after 1 day, max	6.0
Increase in capacitance, max, %:	
From 1 to 14 days	5.0
From 7 to 14 days	3.0
Stability factor after 14 days, max	1.0
Alternative: Stability factor difference, 1 to 14 days, max	0.5

insulation resistance shall be at least 60 % of that required for the primary insulation based on the thickness of that insulation.

**5.4 DC Voltage Test (Cables Rated at 5000 V or Less)**— Unless otherwise specified, omit this test if the ac voltage test

described in 5.2 has been performed. After completion of the insulation resistance test, test each nonshielded conductor rate for service up to 5000 V for 5 min at the dc test voltage given for other than ozone-resisting insulations in Table 1 B (Conductor Sizes, and DC Test Voltages for Rubber Insulations) of Test Methods D 470.

## 6. Accelerated Water Absorption Requirements

6.1 The insulated conductors insulation shall meet the requirements given in Table 2. Conduct the Electrical Method tests in accordance with Test Methods D 470 at 60 Hz with a water temperature of  $75 \pm 1^\circ\text{C}$ .

## 7. Sampling

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

## 8. Test Methods

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

## 9. Keywords

9.1 accelerated water absorption; ac voltage test; dc voltage test; insulation; insulation resistance; synthetic rubber; synthetic rubber heat- and moisture-resistant insulation

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