



## Standard Specification for Ozone-Resistant Thermoplastic Elastomer Insulation For Wire and Cable, 90°C Dry/75°C Wet Operation<sup>1</sup>

This standard is issued under the fixed designation D 4245; 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-resistant insulating compound for electrical wire and cables 14 AWG and larger. This compound consists substantially of a thermoplastic elastomer.

1.2 This type of insulation is suitable for continuous operation at conductor temperatures not exceeding 90°C in dry locations and 75°C in wet locations. Operating voltages are not to exceed 2000 V. The minimum installation temperature is -40°C.

1.3 The values stated in inch-pound units are the standard, except in cases where SI units are more appropriate. The values in parentheses are for information only.

1.4 In many instances the insulation 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 and not to test the 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 2633 Methods of Testing Thermoplastic Insulations and Jackets for Wire and Cable<sup>3</sup>

### 3. Terminology

#### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *aging, n*—exposure of materials to air at 121°C for 168 h.

### 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

**TABLE 1 Requirements for Physical Properties**

<i>Unaged Requirements:</i>	
Tensile strength, min, psi (MPa)	1000 (6.9)
Elongation at rupture, min, %	300
<i>Aged Requirements:</i>	
After air-oven test at 121 ± 1°C for 168 h:	
Tensile strength and elongation at rupture, min, % of unaged value	75
<i>Heat Distortion</i> (At 150 ± 1°C, max, % of unaged value):	
4/0 AWG (107 mm <sup>2</sup> ) and smaller (insulation on cable)	50
Larger than 4/0 AWG (107 mm <sup>2</sup> ) (buffed sample of insulation)	50

Insulations) of Test Methods D 470 lists the minimum average thickness for the insulation. The required minimum thickness is 90 % of the specified average thickness.

### 5. Electrical Requirements

5.1 *Order of Testing*—Perform the ac voltage test, 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*—Unless otherwise specified, omit this test if the dc voltage test described in 5.4 is to be performed. Test each insulated conductor for 5 min at the ac withstand voltage given in Table 1(a) (Conductor Sizes, Insulation Thicknesses, and AC Test Voltages for Rubber Insulations) of Test Methods D 470 under the columns labelled “Ozone-Resisting Insulation.”

#### 5.3 Insulation Resistance

5.3.1 The insulated conductor shall have an insulation resistance value if at least that corresponding to a constant of 10 000 at 60°F (15.6°C).

5.3.2 If the water 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 the insulated conductor is covered with a non-metallic sheath so that the insulation resistance can be measured only on the completed 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.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee D-9 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 Telecommunications Wires and Cables.

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

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 10.02.

**TABLE 2 Accelerated Water Absorption Test Requirements**

<i>Electrical Method:</i>	
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

5.4 *DC Voltage Test*—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 insulated conductor for 5 min at the dc test voltage given in Table 1(b) (Conductor Sizes, and DC Test Voltages for Rubber Insulations) of Test Methods D 470 under the columns labelled “Ozone-Resisting Insulations.”

## 6. Cold Bend

6.1 The insulation shall not show any cracks when tested at a temperature of  $-55^{\circ}\text{C}$  in accordance with the procedure and Table 7 (Mandrel Diameters for Cold Bend Test) in Methods D 2633.

## 7. Ozone

7.1 The insulation shall show no cracking or surface checking visible to the unaided eye after exposure to an ozone concentration of not less than 0.025 nor more than 0.030 % by volume, when tested in accordance with Test Methods D 470.

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## 8. Heat Distortion

8.1 The insulation shall meet the requirements in Table 1 when tested in accordance with the procedure in Methods D 2633.

## 9. Accelerated Water Absorption

9.1 The insulated conductor shall meet the requirements in Table 2 when tested in accordance with the procedure in Test Methods D 470. Conduct the electrical method test at 60 Hz with the water temperature at  $75 \pm 1^{\circ}\text{C}$ .

## 10. Sampling

10.1 Unless otherwise instructed, sample the insulation in accordance with Test Methods D 470.

## 11. Test Methods

11.1 Unless otherwise instructed, test the insulation in accordance with Test Methods D 470.

## 12. Keywords

12.1 accelerated water absorption; ac voltage test; dc voltage test; insulation; insulation resistance;  $90^{\circ}\text{C}$  dry/ $75^{\circ}\text{C}$  wet insulation; ozone-resistant; thermoplastic elastomer; thermoplastic elastomer insulation