



# Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable<sup>1</sup>

This standard is issued under the fixed designation D1351; 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 thermoplastic insulation which consists substantially of polyethylene.
- 1.2 This type of insulation is considered suitable for use on wire or cable that will be used for continuous operation at conductor temperatures up to 75 °C with a maximum conductor size of 1000 kcmil (507 mm<sup>2</sup>). The maximum voltage rating shall not exceed 35 000 V for power application or 9 000 V for series lighting.
- 1.3 In many instances the insulation material cannot be tested unless it has been formed around a conductor. Therefore, tests done on insulated wire or cable in this specification are solely to determine the relevant property of the insulation material and not to test the insulated conductor or completed cable.
- 1.4 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.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

- D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
- D1711 Terminology Relating to Electrical Insulation
- D2308 Specification for Thermoplastic Polyethylene Jacket for Electrical Wire and Cable
- D2633 Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable
- D3349 Test Method for Absorption Coefficient of Ethylene Polymer Material Pigmented with Carbon Black

### 2.2 ICEA Standard:

- T-24-380 Guide for Partial-Discharge Procedure<sup>3</sup>

## 3. Terminology

### 3.1 Definitions:

- 3.1.1 Refer to Terminology D1711 for definitions of terms used in this specification.

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

- 3.2.1 *aging (act of), n*—exposure of materials to air at a temperature of 100 °C for 48 h.

## 4. Conductor Shields

- 4.1 Conductor shields shall be used on solid and stranded conductors of power cables having rated circuit voltages above 2000 V. This requirement does not apply to series lighting cables. Conductor shielding is conducting material at least 0.0025 in. (0.06 mm) thick applied over the surface of the conductor. The options include conducting nonmetallic tape, conducting compound, or conducting cement.

<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 Jan. 1, 2008; March 1, 2014. Published February 2008; April 2014. Originally approved in 1954. Last previous edition approved in 2002 as D1351-02-08. DOI: 10.1520/D1351-08; 10.1520/D1351-14.

<sup>2</sup> 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.

<sup>3</sup> Available from The Insulated Cable Engineers Association, Inc. (ICEA), P.O. Box 1568, Carrollton, GA 30112, <http://www.icea.net>.

\*A Summary of Changes section appears at the end of this standard

## 5. Physical Properties

5.1 The polyethylene, before application to the conductor, shall comply with the requirements of Specification **D1248** for Type I; Class A, B or C; Category 4 or 5; Grade E4 or E5. The requirements of Specification **D1248** do not apply to insulation removed from the conductor.

5.2 Insulation exposed to sunlight or weather requires Specification **D1248**, Class C compound or suitable protective coverings. Class C compound shall meet the minimum absorption coefficient requirement in **Table 1**.

5.3 Specimens removed from the wire or cable and tested at 20 to 30 °C (68 to 8086 °F) shall conform to the requirements for physical properties specified in **Table 1**. Alternatively, the insulation shall be air-oven aged without removal from the conductor.

5.4 *Thickness of Insulation*—The minimum average insulation thickness shall be as specified in **Table 2** or **Table 3** of this specification. The minimum thickness shall be at least 90 % of the specified minimum average thickness.

5.5 *Absorption Coefficient*—Test according to Test Method **D3349**. Alternatively, a certification by the manufacturer of the polyethylene compound that the requirement has been complied with shall suffice.

## 6. Electrical Requirements

6.1 *Order of Testing*—Perform the partial discharge, 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.

6.2 *Partial Discharge*—When tested in accordance with ICEA T-24-380, as modified in Test Methods **D2633**, each length of completed shielded power cable rated for service at 2001 V and above shall comply with the minimum partial discharge extinction level. See Test Methods **D2633**.

6.3 *AC Voltage Test*—The insulated conductor shall withstand the ac voltage specified in **Table 2** or **Table 3** for 5 min. Unless otherwise specified, this test shall be omitted for nonshielded conductors rated up to 5000 V if the dc voltage test described in **6.6** is performed.

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**TABLE 1 Physical Properties of Compound**

Unaged Requirements:	
Tensile strength, min, psi (MPa)	1400 (9.7)
Tensile strength, min, psi (MPa)	1500 (10.4)
Elongation at rupture, min, %	350
Aged Requirements:	
After air oven aging at 100 ± 1 °C for 48 h:	
Tensile strength, % retention, min	75
Elongation at rupture, % retention, min	75
Absorption Coefficient, min, absorbance/nm	320