



Designation: **D2655—12 D2655 – 17**

Standard Specification for Crosslinked Polyethylene Insulation for Wire and Cable Rated 0 to 2000 V¹

This standard is issued under the fixed designation D2655; 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-~~Scope~~*

1.1 This specification covers a crosslinked polyethylene insulation for electrical wires and cables in conductor sizes 14 AWG [2.08 mm²] and larger. The base polymer of this insulation consists substantially of polyethylene or a polyethylene copolymer.

1.2 This type of insulation is suitable for continuous use on power cables in wet and dry locations, for voltage ratings not exceeding 2000 V and at conductor temperatures not exceeding 90°C for normal operation. For copper conductors, the insulation can be applied over the uncoated metal.

1.3 Materials covered by this specification are not sunlight and weather resistant unless they are carbon black pigmented or contain an additive system designed for this protection.

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

1.5 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.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

[D470 Test Methods for Crosslinked Insulations and Jackets for Wire and Cable](#)

[D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable](#)

[D1711 Terminology Relating to Electrical Insulation](#)

[D2765 Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics](#)

2.2 ICEA Standard:

[ICEA T-28-562 Test Method for Measurement of Hot Creep of Polymeric Insulations](#)³

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this specification refer to Terminology [D1711](#).

3.2 Definitions of Terms Specific to This Standard:

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

¹ This specification is under the jurisdiction of ASTM Committee [D09](#) on Electrical and Electronic Insulating Materials and is the direct responsibility of Subcommittee [D09.07](#) on Electrical Insulating Materials.

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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 Insulated Cable Engineers Association, P. O. Box 440, South Yarmouth, MA 02664 or Global Engineering Documents, 15 Inverness Way East, Englewood, CO 80112.

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

4. Physical Properties Requirements

4.1 The requirements for the insulation are listed in [Table 1](#).

4.2 Tensile Strength and Percent Elongation at Rupture:

4.2.1 The test is conducted in accordance with Test Method [D470](#). The requirements for tensile strength and elongation are given in [Table 1](#) of this Specification.

4.3 Heat Distortion:

4.3.1 The test is conducted in accordance with Standard Test Methods [D0470](#). The requirements for heat distortion are given in [Table 1](#) of this specification.

4.4 Percent Hot Creep and Percent Hot Set:

4.4.1 Conduct these test in accordance with Test Method [ICEA T-28-562](#).

4.4.2 Determine the percent hot creep for 15 min at 150°C (302°F). Meet the filled or unfilled values specified in [Table 1](#).

4.4.3 Determine the percent hot set for 5 min at 150°C (302°F). Meet the filled or unfilled values specified in [Table 1](#).

4.4.4 Determination of gel content is the reference Test Method in case of a dispute, and the test is conducted in accordance with Standard Test Method [D2765](#). Meet the percent extractable requirements specified in [Table 1](#).

4.5 Test Applicable for Sunlight and Weather Resistant Materials:

4.5.1 Test in accordance with “Weatherability for Colored Materials (including white and black)” in Specification [D1248](#). Prepare the specimens in accordance with Test Methods [D0470](#) for physical tests of insulations and jackets (physical test procedures section). THE SPECIMENS SHALL MEET THE REQUIREMENTS FOR CLASS C OR CLASS D IN SPECIFICATION [D1248](#).

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 required. The sequence for other testing is not specified.

5.2 *AC Voltage Test*—Conduct the tests in accordance with Test Methods [D470](#). Subject wires and cables to an ac test voltage for a period of 5 min. Unless otherwise specified, omit this test if the dc voltage test described in [5.4](#) is to be performed. Test at a voltage of 100 V/mil [4 kV/mm] based on the specified nominal thickness of insulation for the rated circuit voltage, phase to phase. Conduct the tests in accordance with Test Methods [D470](#).

5.3 *Insulation Resistance*—The insulated conductor shall have an insulation resistance equal to or greater than that corresponding to a constant of 10 000 at 60°F [15.6°C]. When the temperature of the water in which the insulation is tested differs from 60°F, apply a correction factor. [Table 2](#) of Test Methods [D470](#) 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 [D470](#). Multiply the measured value by the correction factor to obtain the insulation-resistance value corrected to 60°F.

5.3.1 Where a nonconducting separator is applied between the conductor and insulation or where an insulated conductor is covered with a nonmetallic jacket so that the insulation resistance can be measured only on the completed assembly, the required insulation resistance shall be at least 60 % of that required for the primary insulation based on the nominal thickness of that insulation.

TABLE 1 Physical Properties for Crosslinked Polyethylene Insulation

| | |
|--------------------------------------------------------------------------|-------------|
| Unaged Tensile Properties Requirements: | |
| Tensile strength, min, psi [MPa] | 1800 [12.4] |
| Elongation at rupture, min, % | 250 |
| Aged Tensile Properties Requirements: | |
| After Air Oven Test at 121 ± 1°C for 168 h: | |
| Tensile strength, min, % of unaged value | 75 |
| Elongation at rupture, min, % of unaged value | 75 |
| Heat Distortion: | |
| Heat Distortion Requirements: | |
| At 121 ± 1°C, max, % of unaged value: | |
| 4/0 Awg [107 mm ²] and smaller (insulation on cable) | 30 |
| Larger than 4/0 AWG [107 mm ²] (buffed sample of insulation) | 15 |
| Percent Hot Creep Requirements: | |
| Filled (max %) | 100 |
| Unfilled (max %) | 175 |
| Percent Hot Set Requirements: | |
| Filled (max %) | 5 |
| Unfilled (max %) | 10 |
| Percent Extractable Requirement: | |
| After drying for 20 h (** referee test only **) (max) | 30 |