



## Standard Specification for Track-Resistant Black Crosslinked Polyethylene Insulation for Wire and Cable, 90°C Operation<sup>1</sup>

This standard is issued under the fixed designation D 3555; 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 ~~black~~ track-resistant black crosslinked polyethylene insulation, the base polymer which consists substantially of polyethylene or its copolymers. This insulation shall be carbon black pigmented.

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 90°C.

1.3 This insulation is suitable for use on wire or in cable used for power transmission in overhead spaced-line service, installed at temperatures above -25° and exposed to sunlight and other atmospheric environments between -55 and +7590°C.

1.34 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.

### 2. Referenced Documents

2.1 *ASTM Standards:*

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee ~~D-9~~ 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.

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

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>

D 2132 Test Method for Dust-and-Fog Tracking and Erosion Resistance of Electrical Insulating Materials<sup>2</sup>

~~D-2633 Methods of Testing Thermoplastic Insulations and Jackets for Wire and Cable<sup>3</sup>~~

~~D 2765 Test Methods for Determination of Gel Content and Swell Ratio of Crosslinked Ethylene Plastics<sup>3</sup>~~

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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~~: 08.03.

2.2 ICEA Standard:

ICEA T-28-562 Test Method for Measurement of Hot Creep of Polymeric Insulations<sup>4</sup>

**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 When tested for physical and aging requirements, heat distortion, cold bend, U-bend discharge, surface resistivity, and track resistance in accordance with Test Methods ~~D 470~~ and for solvent extraction in Test Methods ~~D 2765, D 470~~, the track-resistant black crosslinked polyethylene insulation shall meet the requirements specified in Table 1. The insulation is to meet the requirements for percent hot creep and hot set specified in Table 1. The test is to be performed in accordance with ICEA T-28-562. Only in case of dispute, the solvent extraction (gel content and swell ratio) test in Test Methods D 2765 is to be the referee method. The extractables, after a drying time of 20 h, shall be no more than 30 %.

**5. Electrical Requirements**

5.1 Subject cable specimens to a 5 min ac or dc voltage withstand test at voltages which are based on the nominal thickness of the insulation. Conduct tests in accordance with Methods ~~D 2633~~ D 470 using 125 V/mil (5 kV/mm) for ac tests or 375 V/mil (15 kv/mm) for dc tests.

**6. Sampling**

6.1 Sample the insulation in accordance with Test Methods D 470, D 2765, and ~~D 2765~~ ICEA T-28-562.

**7. Test Methods**

7.1 Test the insulation in accordance with Test Methods D 470, D 2132, and D 2765, modified as noted in Table 1, and ICEA T-28-562.

Annual Book of ASTM Standards, Vol 08.02.

<sup>4</sup> 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.

**TABLE 1 Physical Requirements for Black Track-Resistant Black Crosslinked Polyethylene Insulation**

Physical requirements (original):	
Physical requirements (unaged):	
Tensile strength, min, psi (MPa)	1800 (12.4)
Elongation at rupture, min, %	250
Physical requirements [after aging in an air oven at 121 ± 1°C for 168 h]:	
Tensile strength, min, % of original value	75
Elongation at rupture, min, % of original value	75
Heat distortion at 121 ± 1°C, max, % of original thickness:	
Heat distortion at 121 ± 1°C, max, % of unaged thickness:	
4/0 AWG (107 mm <sup>2</sup> ) and smaller (insulation on cable)	30
Larger than 4/0 AWG (107 mm <sup>2</sup> ) (buffed sample of insulation)	15
Solvent extraction:	
Percent Hot Creep	
After 20-h drying time, max, %	3400
After 20-h drying time, max, %	100
Unfilled	175
Percent Hot Set	
Filled	5
Unfilled	10
Cold bend, -25 ± 1°C for 1 h	no cracks
U-bend discharge, 125 V/mil (5 kV/mm)	no cable failures or cracks in insulation surface
Surface resistivity, min, MΩ	200 000
Track resistance:	
Average time to failure, min, h	200

## 8. Keywords

8.1 ac test; cold bend; crosslinked polyethylene; dc test; elongation; environmental cracking; heat distortion. surface resistivity; tensile strength; track-resistant; u-bend discharge

## SUMMARY OF CHANGES

- (1) Added new paragraphs 1.2, 1.4, and 2.2.
- (2) Revised paragraph 4.1 to add hot creep.
- (3) Revised Table 1.

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