



# Standard Specification for Hot-Application Filling Compounds for Telecommunications Wire and Cable<sup>1</sup>

This standard is issued under the fixed designation D4731; 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.

<sup>ε1</sup> NOTE—The units statement in subsection 1.3 was corrected editorially in July 2008.

## 1. Scope

1.1 This specification covers a variety of petroleum-based and other compounds used for filling the air spaces in telecommunications wires and cables (both electrical and fiber optic) for the purpose of preventing water and other undesirable fluids from entering or migrating through the cable structure. (For related standards see Specifications D4730 and D4732).

1.2 A hot-application compound is a material that requires melting in order to be applied as a liquid and its melting point may affect its performance in the finished cable product.

1.3 The values stated in SI units are to be regarded as standard. The values given in parentheses are mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

## 2. Referenced Documents

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

- D6 Test Method for Loss on Heating of Oil and Asphaltic Compounds
- D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester
- D97 Test Method for Pour Point of Petroleum Products
- D127 Test Method for Drop Melting Point of Petroleum Wax, Including Petrolatum
- D150 Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
- D257 Test Methods for DC Resistance or Conductance of Insulating Materials

- D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D938 Test Method for Congealing Point of Petroleum Waxes, Including Petrolatum
- D1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
- D2161 Practice for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity
- D3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
- D3954 Test Method for Dropping Point of Waxes
- D4565 Test Methods for Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable
- D4568 Test Methods for Evaluating Compatibility Between Cable Filling and Flooding Compounds And Polyolefin Wire and Cable Materials
- D4730 Specification for Flooding Compounds for Telecommunications Wire and Cable
- D4732 Specification for Cool-Application Filling Compounds for Telecommunications Wire and Cable
- D4872 Test Method for Dielectric Testing of Wire and Cable Filling Compounds

## 3. Terminology

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

3.1.1 *filling material*—any of several materials used to fill the air spaces in the cores of multi-conductor insulated wires and cables, or between buffer tubes covering optical fibers, or within such buffer tubes, or any combination of these configurations and any other cable components, for the purpose of excluding water and other undesirable fluids; especially with regard to telecommunications wire and cable, including optical cable, intended for outside aerial, buried, or underground installations.

3.1.2 *producer*—the primary manufacturer of the material.

3.1.3 *suppliers*—jobbers and distributors as distinct from producers.

<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. Subcommittee D02.10 contributed in the development of this standard.

Current edition approved May 1, 2008. Published July 2008. Originally approved in 1987. Last previous edition approved in 2002 as D4731-02. DOI: 10.1520/D4731-02R08E01.

<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.

#### 4. Classification

4.1 Two basic types of filling compounds are covered, as follows:

4.1.1 *Type I*—General-purpose filling compounds include all materials to be used for filling cables that are not required to function under electrical stress (for example, all dielectric fiber-optic cable), including filling compounds for fiber-optic loose buffer tubes.

4.1.2 *Type II*—Electrical-type filling compounds include materials having prescribed electrical properties and used for filling wires and cables that are required to function fully or partially under electrical stress (including hybrid fiber-optic cable).

#### 5. Ordering Information

5.1 Orders for material under this specification shall include the following information:

5.1.1 Quantity (mass or volume) of each item,

5.1.2 Generic name of the material, such as hot-application cable filling material,

5.1.3 Type of material: Type I, General Purpose or Type II, Electrical,

5.1.4 How Furnished: drums or barrels, tank cars or tank trucks, and the like,

5.1.5 Certification, if required (Section 14).

5.1.6 This specification designation, and

5.1.7 Any special requirements, as listed in 7.2, 9.2 and 10.2 and in Sections 11 and 12 that apply.

#### 6. Materials and Manufacture

6.1 The material and manufacturing methods used shall be such that the resulting products will conform to the properties and characteristics prescribed in this specification.

#### 7. Chemical Composition

7.1 The chemical composition of these materials is not specified. The material may be of any chemical composition suitable for the intended purpose and that meets the requirements of this specification as hereinafter stated.

7.2 When agreed upon between the producer and the purchaser, antioxidant stabilizing additives may be included in the compound formulation to assure specified results in thermal oxidative stability testing.

7.3 Once established, the producer shall not change the composition of the compound in successive lots of material without prior approval of the purchaser.

#### 8. Electrical Properties

8.1 When a Type II (electrical) filling compound is specified, the compound shall exhibit the electrical properties in 8.1.1 and 8.1.2. The electrodes used shall be parallel plates of solid or foil metal of a size and shape appropriate for the specimen holder. Other electrodes may be used as agreed upon between the producer and the purchaser. The voltage applied and the time of electrification shall be appropriate for the instrumentation used and as agreed upon between the producer and the purchaser.

8.1.1 When tested, in accordance with Test Methods D150 or D4872, at a temperature of  $23 \pm 3$  °C, the dissipation factor shall not exceed 0.0010 at a frequency of 1 MHz and the permittivity shall not exceed 2.30.

8.1.1.1 **Warning**—If any bubbles are formed in melting the compound to prepare the specimen for test, the sample shall be discarded and a new sample selected.

8.1.2 When tested, in accordance with Test Methods D257, at a temperature of  $23 \pm 3$  °C, the volume resistivity shall be not less than  $10^{13}$  Ω·cm.

#### 9. Physical Properties

9.1 Filling compound furnished under this specification shall inhibit the corrosion of any metallic wire and cable elements with which it comes in contact, while serving as a radial and longitudinal barrier to moisture transmission. Contact of the filling compound with any cable component shall not cause degradation of performance of the cable component. The filling compound shall display adhesive properties to provide adhesion between metallic sheath elements and the outer jacket materials of wire and cable.

##### 9.2 Other Physical Properties:

9.2.1 Other property requirements such as Flash Point (for example, Test Method D92), high-temperature drip/oil separation (syneresis) in the raw material state, and the like, shall be as agreed upon between the producer and the purchaser. (Additional information on oil separation is given in the appendix of this specification.)

#### 10. General Requirements

10.1 All filling compounds manufactured in accordance with this specification shall meet the following requirements:

10.1.1 *Homogeneity*—The compound shall be homogeneous and free of agglomerates.

10.1.2 *Color and Opacity*—The compound shall be as nearly colorless as is commercially feasible, consistent with the requirements of the end products for which the filling compound is intended. In general, identification of cable members coated with filling compound shall not be significantly inhibited because of filling-compound color or opacity.

10.1.3 *Color Stability*—After aging a specimen of filling compound in a suitable container for a period of  $120 \pm 1$  h (5 days) at a temperature of 266 °F (130 °C) in a static air oven, measure the compound color in accordance with Test Method D1500. Unless otherwise specified, the color of the aged compound shall not exceed 2.5.

10.1.4 *Foreign Material*—The compounds shall be free of dirt, metallic particles, and other foreign matter.

10.2 *Other Properties*—Other property requirements such as Volatility (for example, Test Method D6), thermal oxidative stability (for example, testing similar to Test Method D3895), corrosion prevention and the like, shall be as agreed upon between the producer and the purchaser.

NOTE 1—If Test Method D6 is referenced, a test cycle of 22 h at 107 °C (225 °F) is recommended in lieu of the 163 °C (325 °F) temperature required by Test Method D6.