



Standard Specification for Hot-Application Filling Compounds for Telecommunications Wire and Cable¹

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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 D 4730 and D 4732).

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 the standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 6 Test Method for Loss on Heating of Oil and Asphaltic Compounds²
- D 92 Test Method for Flash and Fire Points by Cleveland Open Cup³
- D 97 Test Method for Pour Point of Petroleum Oils³
- D 127 Test Method for Drop Melting Point of Petroleum Wax Including Petrolatum³
- D 150 Test Methods for A-C Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulating Materials⁴
- D 257 Test Methods for D-C Resistance or Conductance of Insulating Materials⁴
- D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)³
- D 938 Test Method for Congealing Point of Petroleum Waxes, Including Petrolatum³
- D 1500 Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)³
- D 2161 Practice for Conversion of Kinematic Viscosity to Saybolt Universal Viscosity or to Saybolt Furol Viscosity³

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² Annual Book of ASTM Standards, Vol 04.04.

³ Annual Book of ASTM Standards, Vol 05.01.

⁴ Annual Book of ASTM Standards, Vol 10.01.

- D 3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Colorimetry⁵
- D 3954 Test Method for Dropping Point of Waxes⁶
- D 4565 Test Methods for Physical and Environmental Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable⁷
- D 4568 Test Methods for Evaluating Compatibility Between Cable Filling and Flooding Compounds and Polyolefin Wire and Cable Materials⁷
- D 4730 Specification for Flooding Compounds for Telecommunications Wire and Cable⁷
- D 4732 Specification for Cool-Application Filling Compounds for Telecommunications Wire and Cable⁷
- D 4872 Test Method for Dielectric Testing of Wire and Cable Filling Compounds⁷

3. Terminology

3.1 Description of Terms Specific to This Standard

3.2 *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.

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

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

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 are used

⁵ Annual Book of ASTM Standards, Vol 08.02.

⁶ Annual Book of ASTM Standards, Vol 15.04.

⁷ Annual Book of ASTM Standards, Vol 10.02.

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 13).
- 5.1.6 This specification designation, and
- 5.1.7 Any special requirements, as listed in 7.2 and 9.2 and in Sections 10 and 11, 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 through 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 D 150 or D 4872, at a temperature of $23 \pm 3^\circ\text{C}$, 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 **Caution:** 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 D 257, at a temperature of $23 \pm 3^\circ\text{C}$, the volume resistivity shall be not less than $10^{13} \Omega\text{-cm}$.

9. General Requirements

9.1 All filling compounds manufactured in accordance with

this specification shall meet the following requirements:

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

9.1.2 *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.

9.1.3 *Color Stability*—After aging a specimen of filling compound in a suitable container for a period of 120 ± 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 D 1500. Unless otherwise specified, the color of the aged compound shall not exceed 2.5.

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

9.2 *Other Properties*—Other property requirements such as Flash Point (for example, Test Method D 92), Volatility (for example, Test Method D 6), high-temperature drip/oil separation (syneresis) in the raw material state, thermal oxidative stability (for example, testing similar to Test Method D 3895), 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.)

NOTE 1—If Test Method D 6 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 D 6.

10. Temperature Characteristics

10.1 Raw material temperature characteristics, if needed, may be specified by use of pour point (for example, Test Method D 97), drop-melting point (for example, Test Method D 127), viscosity (for example, Test Method D 445 and Practice D 2161), congealing point (for example, Test Method D 938), drop point (for example, Test Method D 3954), or as otherwise agreed upon between the producer and the purchaser.

NOTE 2—Although cited in 10.1, Test Method D 127 is “not” a preferred method for determining melting point of wire and cable filling compounds since results tend to be too high to be useful in predicting material behavior in the cable-filling process. However, this may be a good test for quality control purposes. (Refer to the appendix of this specification for additional information.)

10.2 The purchaser (individual cable manufacturer or other) shall specify any other expected temperature conformance requirements (high and low) needed to ensure compliance with such end product requirements as cable drip-out temperature, cold bend, low temperature flexibility, and the like (for example, Test Methods D 4565).

11. Compatibility with other Materials

11.1 It is the responsibility of the purchaser to ensure that the filling compound ordered is suitable for the intended application and is compatible with any other components that it may come into contact with.

11.2 The purchaser shall specify the materials that the compound must be compatible with when tested in accordance with Test Methods D 4568.