



Designation: D4731 – 13

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 [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 affects 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*:²

[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.

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

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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.

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

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 shall be of a 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 shall 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 are 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 D1500 or D4872, at a temperature of 23 ± 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 ± 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 ± 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.

11. Temperature Characteristics

11.1 Raw material temperature characteristics, such as Pour Point (for example, Test Method D97), Drop-Melting Point (for example, Test Method D127), Viscosity (for example, Test Method D445 and Practice D2161), Congealing Point (for