



Designation: D4967 – 21

Standard Guide for Selecting Materials to Be Used for Insulation, Jacketing, and Strength Components in Fiber-Optic Cables¹

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1. Scope*

1.1 This guide is intended to provide a list of materials commonly used in components that provide insulation, jacketing and strength in fiber-optic cables. Where these materials are covered by ASTM standards, an appropriate reference is made. Due to changing technology, not all materials being used are necessarily listed here.

1.2 This guide does not include materials used in components for optical purposes (optical fiber and its coating) or external metallic armoring (such as for a barrier to rodents).

1.3 This guide offers two general lists of materials:

1.3.1 A subdivision of fiber-optic cable construction into components that are used for insulation, jacketing, or strength, with a generic material classification for specific applications in each component (see Section 5), and

1.3.2 An alphabetical list of the generic material classifications, showing ASTM standards where they exist (see Table 1).

1.4 *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

D1248 Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

D1457 Specification for Polytetrafluoroethylene (PTFE)

Molding and Extrusion Materials (Withdrawn 1996)³
D1711 Terminology Relating to Electrical Insulation
D2116 Specification for FEP Resin Molding and Extrusion Materials
D2287 Classification System and Basis for Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
D2526 Specification for Ozone-Resisting Silicone Rubber Insulation for Wire and Cable (Withdrawn 2006)³
D3159 Specification for Modified ETFE Fluoropolymer Molding and Extrusion Materials
D3222 Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials
D3275 Classification System for E-CTFE-Fluoroplastic Molding, Extrusion, and Coating Materials
D3307 Specification for Perfluoroalkoxy (PFA) Resin Molding and Extrusion Materials
D3317 Specification for High Modulus, Organix Yarn and Roving (Withdrawn 1985)³
D3664 Specification for Biaxially Oriented Polymeric Resin Film for Capacitors in Electrical Equipment
D3935 Classification System and Basis for Specification for Polycarbonate (PC) Unfilled and Reinforced Material
D4066 Classification System for Nylon Injection and Extrusion Materials (PA)
D4101 Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
D4246 Specification for Ozone-Resistant Thermoplastic Elastomer Insulation for Wire and Cable, 90 °C Operation
D4507 Specification for Thermoplastic Polyester (TPES) Materials (Withdrawn 1999)³
D4730 Specification for Flooding Compounds for Telecommunications Wire and Cable
D4731 Specification for Hot-Application Filling Compounds for Telecommunications Wire and Cable
D4732 Specification for Cool-Application Filling Compounds for Telecommunications Wire and Cable
D5575 Classification System for Copolymers of Vinylidene Fluoride (VDF) with Other Fluorinated Monomers

¹ This guide 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 The last approved version of this historical standard is referenced on www.astm.org.

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

TABLE 1 Materials in Current Use

Material	ASTM Specification
Acrylates	...
Aramids:	
fibers	D3317
tape	...
Fluoroplastics:	
ECTFE	D3275
ETFE	D3159
FEP	D2116
PFA	D3307
PTFE	D1457
PVDF	D3222
PVDF copolymers	D5575
Low-density poly(vinylidene fluoride)	D8318
Glass fibers	...
Glass-fiber reinforced plastics	...
Grease and similar materials	D4730, D4731, D4732
Nylon	D4066
Polybutylene	D4730, D4731, D4732
Polycarbonate	D3935
Polyester tape	D3664
Polyethylene	D1248
Polyimide tape	...
Polypropylene	D4101
Polyurethane	...
Poly(vinyl chloride)	D2287
Rubber	D4730, D4731, D4732
Silicone rubber	D2526
Steel	...
Thermoplastic elastomer	D4246
Thermoplastic polyester	D4507

D8318 Specification for Low-Density Poly (Vinylidene Fluoride) Based Material Intended for Use in Wire and Cable Jacketing

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this guide, refer to Terminology **D1711**.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *buffer, n*—a material that is applied over an optical fiber's protective coating to further protect the fiber from physical damage and provide mechanical protection.

3.2.2 *composite buffer, n*—polymeric material(s) surrounding the optical fiber so that the inner layer is in intimate contact with the fiber cladding or coating with a tightly extruded buffer material overall.

3.2.3 *loose tube(s), n*—a buffer material that surrounds the optical fiber(s) so that it forms a tube or channel whose inside dimension is greater than the fiber's outside diameter (or combined diameters).

3.2.3.1 *Discussion*—When required, the space between the fiber(s) and the inside of the tube may be filled with a suitable filling compound or with strength or cushioning elements, or both.

3.2.4 *slotted core, n*—an element(s) with helical grooves assembled around a central strength member, in which optical fibers, optical fiber ribbons or copper conductors can be placed.

3.2.5 *strength member(s), n*—material(s) used in fiber optic cable construction which provide mechanical integrity and stability.

3.2.6 *tight buffer, n*—a material surrounding the optical fiber so that it is in intimate contact with the coating on the fiber.

4. Significance and Use

4.1 The lists of components and materials are useful in enhancing the user's understanding of the technology and construction of fiber-optics cables and the development of performance standards for cables.

4.2 This guide is intended for use by all parties involved with fiber optics: materials suppliers, cable manufacturers, and end-users.

5. Construction Terminology and Material Selection Options

5.1 Fiber-optic cable components and materials that have been used for each:

5.1.1 *Buffers/Tubes:*

5.1.1.1 *Tight Buffers:*

- (a) Fluoroplastic.
- (b) Nylon.
- (c) Thermoplastic Polyester.
- (d) Poly(vinyl chloride).

5.1.1.2 *Loose Tubes:*

- (a) Fluoroplastic.
- (b) Nylon.
- (c) Thermoplastic Polyester.
- (d) Polycarbonate.
- (e) Polyethylene.

5.1.1.3 *Composite Buffers*—Silicone rubber.

5.1.1.4 *Slotted Cores:*

- (a) Polyethylene.
- (b) Polypropylene.
- (c) Polyethylene.

5.1.1.5 *Pipes*—Polyethylene.

5.1.1.6 *Sheaths:*

- (a) Fluoroplastic.
- (b) Nylon.
- (c) Silicone rubber.
- (d) Thermoplastic elastomer.
- (e) Polyethylene.

5.1.1.7 *Ribbons:*

- (a) Acrylates.
- (b) Silicone Rubber.

5.1.2 *Jackets:*

5.1.2.1 *Outside Jackets:*

(a) *Fluoroplastics*—Fluoroplastics: ethylene tetrafluoroethylene (ETFE), ethylene-chlorotrifluoroethylene (ECTFE), perfluoroalkoxy (PFA), polytetrafluoroethylene (PTFE), polyvinylidene fluoride (PVDF), polyvinylidene fluoride copolymers (PVDF copolymers), low-density poly(vinylidene fluoride).

- (b) Polyethylene.
- (c) poly(vinyl chloride).
- (d) Thermoplastic elastomer.

5.1.2.2 *Inner Jackets:*

(a) *Fluoroplastics*—(ECTFE, PVDF, PVDF copolymers, low-density poly(vinylidene fluoride)).

- (b) Polyethylene.
- (c) Polyurethane.
- (d) Poly(vinyl chloride).