MATERIAL SPECIFICATIONS FOR FIBER OPTIC CABLE

A. General
   1. Ensure that the fiber optic cable used for outdoor applications is single mode single jacket single armor gel-free with loose buffer tubes and it meets or exceeds all applicable Standards.
   2. When the fiber optic cable is not used for outdoor applications:
      a. Ensure that general use cable is resistant to the spread of fire and labeled OFN.
      b. Ensure that fiber optic cable installed in plenums, ducts or other space used for environmental air has fire-resistant and low smoke producing characteristics and is labeled OFNP.
      c. Ensure that fiber optic cable installed in risers, spaces used for vertical runs in a shaft or from floor to floor has fire-resistant characteristics capable of preventing the spreading of fire from floor to floor and is labeled OFNR.
   3. Standards
      a. Electronic Industry Standards (EIA/TIA), EIA/TIA-455, EIA/TIA-472, EIA/TIA-598
      b. Fiber Optic Testing Parameters (FOTP)
      c. International Telecommunications Union (ITU), ITU G.652.D
      d. ASTM standards, ASTM D3349, ASTM D1248
      e. National Fire Protection Code (NFPA), NFPA 70, National Electrical Code (NEC)
   4. Environmental
      a. Operating temperature range: -40 °F to +158 °F
      b. Installation temperature range: -22 °F to +158 °F
      c. Storage Temperature: -40 °F to +158 °F

B. Cable Characteristics
   1. Ensure that the optical fibers are contained within loose, gel-free buffer tubes that are stranded around an all-dielectric central strength member.
   2. Ensure that the cable core is a tensile strength member and is surrounded by a water swellable yarn.
   3. Ensure that a high or medium density polyethylene outer jacket is provided for overall protection.
   4. Ensure that the fiber optic cable includes the following components:
      a. Color coded single mode optical fibers.
      b. Gel-free color coded buffer tubes.
      c. Central strength member - glass reinforced plastic dielectric rod.
      d. Filler rod - medium or high density polyethylene.
      e. Stranding – buffer tubes stranded around central member and held in place with binders.
      f. Water-swellable yarn and tape that is non-nutritive to fungus, electrically non-conductive, non-toxic, dermatological safe and compatible with all other cable components.
      g. Core separator or binders - non-hygroscopic, non-wicking and dielectric with low shrinkage.
      h. Tensile outer strength member - high tensile strength aramid yarns and fiberglass helically stranded evenly around the cable core.
      i. Ripcord – minimum two ripcords, equally spaced (180° for 2).
      j. Outer jacket - HDPE or MDPE, co-extruded colored stripe, coded and labeled.
      k. Each optical fiber is to be distinguishable from others in the same buffer tube by means of color coding according to EIA/TIA-598-B color coding for fiber optic cable.
      l. In cables containing multiple buffer tubes each buffer tube is to be distinguishable from others in the same cable by means of color coding according to EIA/TIA-598 color coding for fiber optic cable.
   5. Mechanical Characteristics
      a. Maximum tensile loading during installation: 600 lbf (also called loaded)
      b. Maximum tensile loading for the unloaded application: 130 lbf (also called installed)

c. Minimum bending radius of during installation: 15 times the cable diameter
d. Minimum bending radius for unloaded application: 10 times the cable diameter

6. Fiber Characteristics
   a. Single Mode Fiber
   b. Type: Step Index
   c. Core diameter: 8.3 µm (nominal)
   d. Cladding diameter: 125 µm ± 0.7 µm
   e. Core to Cladding Concentricity: ≤ 0.5 µm
   f. Cladding Non-circularity: ≤ 1.0 %
   g. Coating Diameter: 245 µm ± 5 µm
   h. Proof/ Tensile Test: 100 kpsi, minimum
   i. Attenuation:
      (A) @ 1310 nm ≤ 0.64 dB/mile (or ≤ 0.4 dB/km)
      (B) @ 1550 nm ≤ 0.48 dB/mile (or ≤ 0.3 dB/km)
   j. Attenuation at the Water Peak: ≤ 2.1 dB/km @ 1383 ± 3 nm
   k. Chromatic Dispersion:
      (A) Zero Dispersion Wavelength 1302 to 1322 nm
      (B) Zero Dispersion Slope 0.092 ps/ (nm^2•km)
   l. Maximum Dispersion: ≤ 3.5 ps/ (nm•km for 1285-1330 nm
      < 18 ps/ (nm•km) for 1550 nm
   m. Cut-Off Wavelength: <1260 nm
   n. Mode Field Diameter: 9.2 ± 0.4 µm at 1310 µm,
      10.4 ± 0.8 µm at 1550 µm
   o. Macro bending Loss
      Measured on loose fiber of
      100 turns of 75 mm diameter (tested ≤ 0.05 dB @ 1310 nm
      in accordance with EIA-455-62): ≤ 0.10 dB @ 1550 nm

7. Buffer Tubes
   a. Minimum buffer tube diameter: 0.078 inch
   b. Maximum buffer tube diameter: 0.12 inch
   c. Fibers per tube: 2 – 12
   d. Tubes per cable: 1 – 24
   e. Water blocking protection: Water-Swellable yarn

8. Outer Jacket
   a. Materials
      (A) For fiber optic cable designated for outdoor use application: high density or medium density polyethylene as defined by ASTM D1248, Type II, Class C, Category 4, Grade J4, E7 and E8.
      (B) For fiber optic cable designated for other applications: Provide material meeting specifications under section A.
   b. Minimum jacket thickness - 0.055 inch.
   c. Labeling:
      (A) Additional parameters required on the label:
          "NJDOT FIBER OPTIC CABLE"
          # FIBERS "FIBER"
          "SINGLE MODE"
          Manufacturer's name, Date of manufacture.
   d. Sequential Cable labeling is to be printed on the cable outer jacket every two feet or as designated in the contract documents. Use capital letters for labeling with a text height of 0.1 inch.
   e. Use contrasting color to the cable jacket for marking.
   f. Co-extruded stripe color-coded with 0.04 inch stripe width.
   g. Provide ultra-violet light protection.

9. Cable Armor

a. Cable Armor to provide rodent and corrosion resistance while minimizing the susceptibility to lightning damage. Use of stranded wires in conjunction with tape armor is not permitted.
b. Design and Test Criteria: ANSI/ICEA S-87-640
c. Material: Electrolytically chrome coated, low carbon steel tape, coated with Polymer material on both sides
d. Application: Corrugated Single armor applied longitudinally around outside of water-swellable tape with overlapping seam

10. Cable Types
    a. Number of fibers, number of buffer tubes, number of fibers per buffer tube, outer jacket stripe color and outer diameter are to be as shown below:

FIBER OPTIC CABLE TYPE	NUMBER OF FIBERS	NUMBER OF BUFFER TUBES	NUMBER OF FIBERS PER BUFFER TUBE	OUTER JACKET STRIPE COLOR	Nominal Outer Diameter (inch)
Type A	48	8	6	Green	0.63
Type B	36	6	6	Blue	0.55
Type C	24	4	6	Orange	0.52
Type D	18	3	6	White	0.52
Type E	12	2	6	Red	0.52
Type F	6	1	6	Red	0.52
Type G	96	8	12	Green	0.54