CORNING OPTICAL COMMUNICATIONS GENERIC SPECIFICATION FOR GEL-FREE LOOSE TUBE OPTICAL FIBER CABLES FOR OUTDOOR APPLICATIONS

November 2023
PGS067
Revision 6

Corning Optical Communications reserves the right to update this specification without prior notification.

Master Format 33 83 00 Communications Distribution

1.0 General Considerations

1.1 The cable shall meet all requirements stated in this specification. The cable shall be an accepted product of the United States Department of Agriculture Rural Utilities Service (RUS) 7 CFR 1755.900 (PE-90) and meet the requirements of ANSI/ICEA Standard for Fiber Optic Outside Plant Communications Cable, ANSI/ICEA S-87-640 and GR-20-CORE.

2.0 Fiber Characteristics

2.1 Detailed information on the fiber types available for this cable design can be found in the following documents:

Dispersion Un-shifted and Non-zero Dispersion Shifted Single-mode Fiber: Generic Specification F1, “Generic Specification for Single-mode Optical Fiber in Loose Tube and Ribbon Cables.”

50/125 µm and 62.5/125 µm Multimode Fiber: Generic Specification F2, “Generic Specification for Multimode Optical Fiber in Loose Tube and Ribbon Cables.”

3.0 Cable Construction

3.1 Optical fibers shall be placed inside a loose buffer tube. The nominal outer diameter of the buffer tube shall be 2.5 mm. The buffer tube shall be polypropylene.

3.2 The buffer or buffer tube color shall be natural for simplex cables. For cables with two fibers, the individual buffers shall be color coded for identification. The optical fiber color coding shall be in accordance with EIA/TIA-598, "Optical Fiber Cable Color Coding." The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

3.3 Each buffer tube shall contain up to 12 fibers.

3.4 The fibers shall not adhere to the inside of the buffer tube.

3.5 Each fiber shall be distinguishable by means of color coding in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding."

3.6 The fibers shall be colored with ultraviolet (UV) curable inks.

3.7 Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598-B, "Optical Fiber Cable Color Coding."

3.6.1 Buffer tube colored stripes shall be inlaid in the tube by means of co-extrusion when required. The nominal stripe width shall be 1 mm.

3.8 For cables containing more than 12 buffer tubes, standard colors are used for tubes 1 through 12 and stripes are used to denote tubes 13 through 24. The color sequence applies to tubes containing fibers only, and shall begin with the first tube. If fillers are required, they shall be placed in the inner layer of the cable. The tube color sequence shall start from the inside layer and progress outward.

3.9 In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature range and shall not be subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

3.10 The buffer tubes shall be resistant to external forces and shall meet the buffer tube cold bend and shrinkback requirements of 7 CFR 1755.900.

3.11 Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. Fillers shall be placed so that they do not interrupt the consecutive positioning of the buffer tubes. In dual layer cables, any fillers shall be placed in the inner layer. Fillers shall be nominally 2.5 mm in outer diameter.

3.12 The central member shall consist of a dielectric, glass reinforced plastic (GRP) rod (optional steel central member). The purpose of the central member is to provide tensile strength and prevent buckling. The central member shall be overcoated with a thermoplastic when required to achieve dimensional sizing to accommodate buffer tubes/fillers.

3.13 Each buffer tube shall contain water blocking material embedded in the inside wall of the buffer tube for water-blocking protection. The water blocking material shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This material will preclude the need for other water-blocking materials such as gels, yarns, foams, or tapes; the buffer-tube shall be gel-free.

3.14 The optical fibers shall not require cleaning before placement into a splice tray or fan-out kit.

3.15 Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process.

3.16 Water swellable yarn(s) shall be applied longitudinally along the central member during stranding. Water blocking elements shall be applied uniformly throughout the buffer tube.

3.17 Two polyester yarn binders shall be applied contrahelically with sufficient tension to secure each buffer tube layer to the dielectric central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking, and dielectric with low shrinkage.

3.18 For single layer cables, a water swellable tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

3.19 For dual layer cables, a second (outer) layer of buffer tubes shall be stranded over the original core to form a two layer core. A water swellable tape shall be applied longitudinally over both the inner and outer layer. The water swellable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

3.20 Non-armored cables shall contain one ripcord under the sheath for easy sheath removal. Armored cables shall contain two ripcords under the steel armor for easy armor removal. Additionally, armored cables that have an inner sheath will also contain one ripcord under the inner sheath.

3.21 All tensile strength shall be provided by the central member.

3.22 Non-armored cables shall be sheathed with polyethylene (PE). The minimum nominal jacket thickness shall be 1.3 mm. Jacketing material shall be applied directly over cable core and water swellable tape. The polyethylene (PE) shall provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 1.

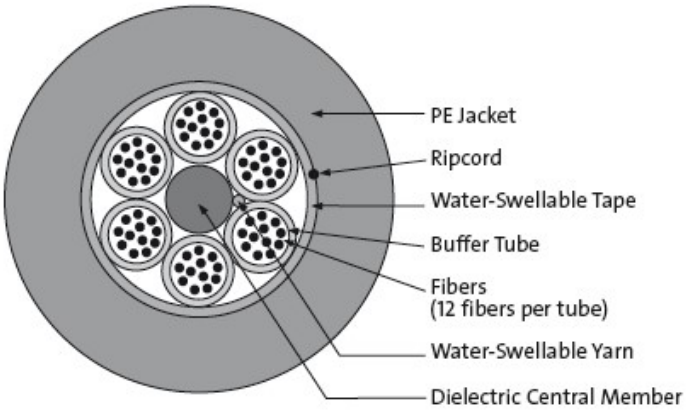

Figure 1

3.23 Armored cables without an inner jacket shall have an armor layer applied directly over the cable core and water swellable tape. The armor shall be a corrugated steel tape, plastic-coated on both sides for corrosion resistance, and shall be applied around cable core and water swellable tape with an overlapping seam with the corrugations in register. The outer jacket shall be applied over the corrugated steel tape armor. The outer jacket shall be a PE with a minimum nominal jacket thickness of 1.3 mm. The polyethylene (PE) shall provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 2.

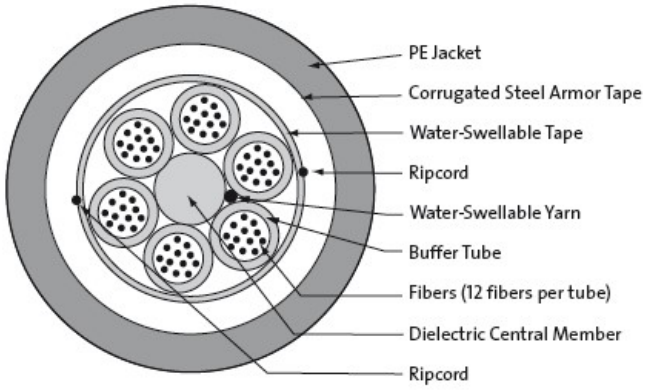

Figure 2

3.24 Armored cables with an inner jacket shall have an inner sheath of PE. The minimum nominal jacket thickness of the inner sheath shall be 0.8. The inner jacket shall be applied directly over the cable core and water swellable tape. A water swellable tape shall be applied longitudinally around the outside of the inner jacket. The armor shall be a corrugated steel tape, plastic-coated on both

sides for corrosion resistance, and shall be applied around the outside of the water blocking tape with an overlapping seam with the corrugations in register. The outer jacket shall be applied over the corrugated steel tape armor. The outer jacket shall be a PE with a minimum nominal jacket thickness of 1.3. The polyethylene (PE) shall provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 3.

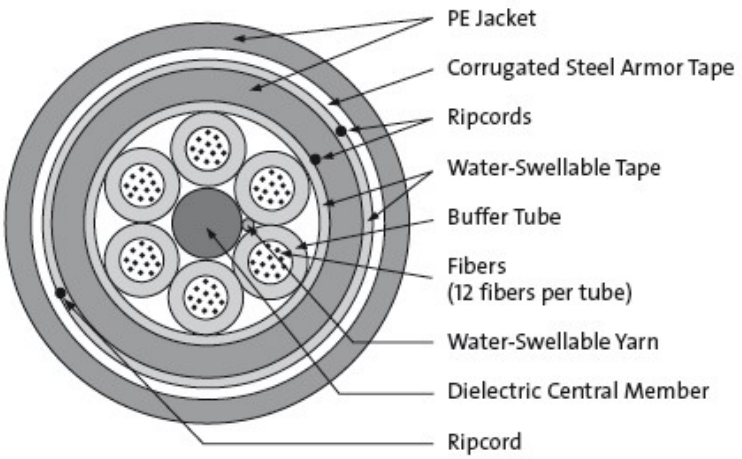

Figure 3

3.25 The jacket material shall be Type M for type, class, category, and grade as described in ICEA S-87-640

3.26 The jacket or sheath shall be free of holes, splits, and blisters.

3.27 The cable jacket shall contain no metal elements and shall be of a consistent thickness.

3.28 Cable jackets shall be marked with the manufacturer's name, month and year of manufacture, sequential meter or foot markings, a telecommunication handset symbol as required by Section 350G of the National Electrical Safety Code® (NESC®), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The print color shall be white, with the exception that cable jackets containing one or more coextruded white stripes, which shall be printed in light blue. The height of the marking shall be approximately 2.5 mm.

3.29 If the initial marking fails to meet the specified requirements (i.e., improper text statement, color, legibility, or print interval), the cable may be remarked using a contrasting alternate color. The numbering sequence will differ from the previous

numbering sequence, and a tag will be attached to both the outside end of the cable and to the reel to indicate the sequence of remarking. The preferred remarking color will be yellow, with the secondary choice being blue.

3.30 The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

3.31 The minimum bend radius shall be 15 times the cable outside diameter while under tension and 10 times the cable outside diameter installed.

3.32 The shipping, storage, and operating temperature range of the cable shall be -40°C to +70°C. The installation temperature range of the cable shall be –30°C to +70°C.

4.0 Cable Identification

4.1 The outer cable jacket shall be marked with the manufacturer's name, date of manufacture, fiber count, fiber type, flame rating, listing symbol, and sequential length markings every two feet (e.g., “CORNING OPTICAL COMMUNICATIONS OPTICAL CABLE - MM/YY. XXXXX (feet or meters). The marking shall be in contrasting color to the cable jacket.

5.0 Cable Performance Specifications

5.1 When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation at extreme operational temperatures (-40°C and +70°C) shall not exceed 0.15 dB/km at 1550 nm for single-mode fiber and 0.3 dB/km at 1300 nm for multimode fiber.

5.2 When tested in accordance with FOTP-82, "Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable," a one meter length of unaged cable shall withstand a one meter static head or equivalent continuous pressure of water for one hour without leakage through the open cable end.

5.3 When tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable," the cable shall exhibit no flow (drip or leak) of filling and/or flooding material at 70°C.

5.4 When tested in accordance with FOTP-41, "Compressive Loading Resistance of Fiber Optic Cables," the cable shall withstand a minimum compressive load of 220 N/cm (125 lbf/in) applied uniformly over the length of the sample. The 220 N/cm (125 lbf/in) load shall be applied at a rate of 2.5 mm (0.1 in) per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 110 N/cm (63 lbf/in). Alternatively, it is acceptable to remove the 220 N/cm (125 lbf/in) load entirely and apply the 110 N/cm (63 lbf/in) load within five minutes at a rate of 2.5 mm (0.1 in) per minute. The 110 N/cm (63 lbf/in) load shall be maintained for a period of 10 minutes. Attenuation measurements shall be performed before release of the 110 N/cm (63 lbf/in) load. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fibers and 0.30 dB at 1300 nm for multimode fiber.

5.5 When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles around a sheave diameter not greater than 20 times the cable diameter. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

5.6 When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," except that the number of cycles shall be two at three locations along a one meter cable length and the impact energy shall be atleast 4.4 Nm (in accordance with ICEA S-87-640)", the change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

5.7 When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," using a maximum mandrel and sheave diameter of 560 mm, the cable shall withstand a rated tensile load of 2670N (601 lbf) and residual load of 30% of the rated installation load. The axial fiber strain shall be $\leq$ 60% of the fiber proof level after completion of 60 minute conditioning and while the cable is under the rated installation load. The axial fiber strain shall be $\leq$ 20% of the fiber proof level after completion of 10 minute conditioning and while the cable is under the residual load. The change in attenuation at residual load and after load removal shall not exceed 0.15 dB at 1550 nm for single mode fiber and 0.30 dB at 1300 nm for multimode fiber.

5.8 When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.30 dB at 1300 nm for multimode fiber.

5.9 When tested in accordance with FOTP-181, "Lightning Damage Susceptibility Test for Optic Cables with Metallic Components," the cable shall withstand a simulated lightning strike with a peak value of the current pulse equal to 55 kA without loss of fiber continuity. A damped oscillatory test current shall be used

with a maximum time-to-peak value of 15 μs (which corresponds to a minimum frequency of 16.7 kHz) and a maximum frequency of 30 kHz. The time to half-value of the waveform envelope shall be from 40 to 70 μs.

5.10 When tested in accordance with FOTP-37, "Low or High Temperature Bend Test for Fiber Optic Cable," the cable shall withstand four full turns around a mandrel of ≤ 20 times the cable diameter after conditioning for four hours at test temperatures of -30°C and +60°C. Neither the inner or outer surfaces of the jacket shall exhibit visible cracks, splits, tears, or other openings. The change in attenuation shall not exceed 0.30 dB at 1550 nm for single mode fiber and 0.50 dB at 1300 nm for multimode fiber.

6.0 Packing and Shipping

6.1 The completed cable shall be packaged for shipment on non-returnable wooden reels. Required cable lengths shall be stated in the purchase order.

6.2 Top and bottom ends of the cable shall be available for testing.

6.3 Both ends of the cable shall be sealed to prevent the ingress of moisture.

6.4 Each reel shall have a weather resistant reel tag attached identifying the reel and cable.

The reel tag shall include the following information:

Cable Number
Shipped Cable Length in Meters
Corning Product Number
Date Cable was Tested
Cable Length Markings
- a: Top (inside end of cable)
- b: Bottom (outside end of cable)

Gross Weight
Job Order Number
Customer Order Number
Corning Order Number
Item Number

The reel (one flange) marking shall include:

"Corning Optical Communications"
Country of origin (e.g., USA)
An arrow indicating proper direction of roll when handling
Fork lift-handling illustration
"DO NOT SHIP REEL ON SIDE" or
“DO NOT LAY REEL ON ITS SIDE”

6.5 Each cable shall be accompanied by a cable data sheet.

The cable data sheet shall include the following information:

Corning Cable Number	Corning Product Number
Corning Factory Order Number	Customer Name
Alternate Customer	Customer Cable Number
Customer Purchase Order Number	Alternate Code
Mark for Information	Ordered Length
Maximum Billable Length	Actual Shipped Length
Measured Attenuation of Each Fiber (for lengths > 1000 m)	Bandwidth Specification (where applicable)

7.0 Quality Assurance Provisions

7.1 All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.

7.2 The cable manufacturer shall be TL 9000 registered

8.0 Miscellaneous

8.1 At the request of the customer, the cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

Gen Spec PGS067 Revision History

Revision #	Date	Reason for Change
1	8/31/04	Changed Lightning Damage Susceptibility Category from 1 to 2 (105kA to 80kA) due to the cable failing at 105kA during test.
2	3/15/06	Added reference to RUS listing in section 1.1
3	9/1/2008	Updated 1.1 - ANSI/ICEA document reference to reflect 2006 document, Updated 3.1 – include 2.5mm OD buffer tube dimensions Updated 3.12 – include water blocking element as another gel-free method Updated 3.15 – include water blocking element distributed throughout tube Updated 3.22 and 3.23– Corrected jacket thickness and added ALTOS RD dimensions, Updated 3.24 – Updated jacket thicknesses for ALTOS RD and New cable designs, Updated 3.30 – tension conversion Updated 4.9 – Changed 105kA to 55kA of cables with smaller buffer tubes
4	11/8/10	Removed all mention of 3.0 mm buffer tubes Removed all mention of yarns in buffer tubes Removed tensile yarns Removed ALTOS RD as RD is gel-filled only. Added 15x/10x bend radius requirement
5	9/18/17	Reformatted.