CORNING OPTICAL COMMUNICATIONS GENERIC SPECIFICATION FOR GEL-FREE LOOSE TUBE OPTICAL FIBER CABLES FOR INTER- AND INTRABUILDING APPLICATIONS

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PGS073
Revision 6

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

Master Format 27 13 23 Communications Optical Fiber Backbone Cabling

1.0 General Considerations

The cable must meet the requirements of the National Electrical Code® (NEC)® Section 770.

1.1 The cable must meet the requirements of the National Electrical Code® (NEC)® Section 770 for the intended application space:

1.1.1 Plenum Applications - Applicable Flame Test: NFPA 262. Cables shall be listed OFNP (OFCP).

1.1.2 Non-Plenum Applications - Applicable Flame Test: UL-1666. Cables shall be listed OFNR (OFCR).

1.2 Finished cables shall conform to the applicable performance requirements of the Insulated Cable Engineers Association, Inc. (ICEA) *Standard for Indoor-Outdoor Optical Fiber Cable* (ICEA S-104-696).

2.0 Fiber Specifications

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.

3.2 Each buffer tube shall contain up to 12 fibers.

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

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

3.5 The fibers shall be colored with ultraviolet (UV) curable inks. In buffer tubes containing multiple fibers, the colors shall be stable across the specified storage and operating temperature ranges, and not subject to fading or smearing onto each other. Colors shall not cause fibers to stick together.

3.6 Buffer tubes containing fibers shall be color coded with distinct and recognizable colors in accordance with TIA/EIA-598, "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.

3.6.2 For dual layer buffer tube construction cables, standard colors are used for tubes 1 through 12 and standard colors with 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. The tube color sequence shall start from the inside layer and progress outward.

3.7 Each buffer tube shall contain a water blocking element for water-blocking protection. The water swellable element shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter. This element will preclude the need for other water-blocking material; the buffer tubes shall be gel-free.

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

3.9 The buffer tubes shall be resistant to kinking.

3.10 Filler rods 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.

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

3.12 Buffer tubes shall be stranded around the dielectric central member using the reverse oscillation, or "S-Z", stranding process. Water blocking yarn(s) shall be applied longitudinally along the central member during stranding.

3.13 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.

3.14 For single layer cables, a water blocking tape shall be applied longitudinally around the outside of the stranded tubes/fillers. The tape shall be held in place by a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

3.15 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 blocking tape shall be applied longitudinally over both the inner and outer layers with each being held in place with a single polyester binder yarn. The water blocking tape shall be non-nutritive to fungus, electrically non-conductive and homogenous. It shall also be free from dirt and foreign matter.

3.16 The cable shall contain at least one ripcord under the sheath for easy sheath removal.

3.17 The tensile strength shall be provided by the central member, and additional dielectric yarns as required. The dielectric yarns shall be helically stranded evenly around the cable core.

3.18 A flame-retardant tape may be applied to provide additional resistance to flame propagation for higher fiber count cables.

3.19 Cables shall be sheathed with flame-retardant polyvinyl chloride (PVC). Jacketing material shall be applied directly over the tensile strength members and water blocking tape. The PVC shall contain carbon black or a UV stabilized colored compound to provide ultraviolet light protection and shall not promote the growth of fungus.

3.20 Cable jackets shall be capable of being colored any of the 12 colors identified in EIA/TIA-598, “Optical Fiber Cable Color Coding”, if requested to enhance cable identification. Colored jackets shall contain UV stabilizers to provide ultraviolet light protection.

3.21 The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the

cable with a tough, flexible, protective coating, able to withstand the stresses expected in normal installation and service.

3.22 Cable jackets shall be marked with the manufacturer's name or file number, 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, flame rating and listing marking. 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.

3.23 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, the secondary choice will be blue.

3.24 The maximum pulling tension shall be 2700 N (600 lbf) during installation (short term) and 810 N (180 lbf) long term installed.

3.25 The cable specified herein shall be available in two sheath designs.

3.25.1 Un-armored, all-dielectric cables shall be listed OFNP or OFNP and shall be as described previously in this section.

3.25.2 Interlocking armored cables shall be as described previously in this section but shall also include an interlocking aluminum armor applied helically around the outside of the cable jacket. The interlocking armor may be left un-jacketed or may have a PVC outer jacket. The color of the armor jacket (if specified), shall match the jacket color of the optical fiber cable located inside of the armor. The armor for these cables shall be comparable to liquid tight flexible metal conduit if jacketed, or flexible metal conduit if not jacketed. Because of the interlocking metallic armor, this cable shall be listed OFCP or OFCR. The interlocking armor and outer jacket options will be specified on the purchase order. Cables with interlocking armor shall be available in fiber counts up to 288 fibers.

4.0 Cable Identification

4.1 The outer cable jacket shall be marked with the manufacturer's name or ETL file number, date of manufacture, shop order number, optional SOC code (SR##########), 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 Temperature Range.

The storage temperature range for the cable on the original shipping reel shall be -40 °C to +70 °C. The installation temperature range for the cable shall be -10 °C to +60 °C. The operating temperature range for the cable shall be -40 °C to +70 °C. Testing shall be in accordance with FOTP-3.

5.2 Tensile Loading and Fiber Strain

When tested in accordance with FOTP-33, "Fiber Optic Cable Tensile Loading and Bending Test," and FOTP-38, “Measurement of Fiber Strain in Cables Under Tensile Load,” a length of cable shall be tested to the rated tensile load. The rated tensile load shall be 2670 N (600 lbf). While under the rated tensile load, the fiber shall not experience a measured fiber strain greater than 60% of the fiber proof test level. After being held at the residual load (30% of the rated tensile load) the fiber shall not experience a measured fiber strain greater than 20% of the fiber proof test level nor an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode). After the tensile load is removed, the fibers shall not experience an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode).

5.3 Compressive Loading Test

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 0.40 dB at 1550 nm for single-mode fibers and 0.60 dB at 1300 nm for multimode fiber.

5.4 Cyclic Flexing Test

When tested in accordance with FOTP-104, "Fiber Optic Cable Cyclic Flexing Test," the cable shall withstand 25 mechanical flexing cycles at a rate of

30 ± 1 cycles per minute. The fiber shall not experience an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode). No cracks, splits, tears or other opening shall be present on the inner or outer surface of the jacket. No visible cracks greater than 5 mm in the armor, if present, shall be present.

5.5 Twist Test

When tested in accordance with FOTP-85, "Fiber Optic Cable Twist Test," a length of cable no greater than 2 meters will withstand 10 cycles of mechanical twisting. The fiber shall not experience an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode). No cracks or splits in the jacket shall be present when inspected under 5X magnification.

5.6 High and Low TemperatureBend

When tested in accordance with FOTP-37, "Fiber Optic Cable Bend Test, Low and High Temperature," the cable shall withstand four full turns around a mandrel at test temperatures of -10 °C and +60 °C. The fibers shall not experience an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode).

5.7 Impact Resistance

When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," the cable shall withstand a minimum of 2 impact cycles at 3 locations separated by at least 150 mm. The impact energy shall be 4.4 N•m. The fibers shall not experience an attenuation change greater than 0.40 dB at 1550 nm (single-mode) or greater than 0.60 dB at 1300 nm (multimode). The presence of visible cracks, splits, tears, or other openings on the outer surface of the jacket constitute a failure.

5.8 Temperature Cycling

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components," the change in attenuation after 2 cycles at extreme operational temperatures (-40 °C to +70 °C) shall not exceed 0.40 dB/km at 1550 nm (single-mode) or 0.60 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling after the last low and last high temperature.

5.9 Water Penetration

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.

5.10 Cold Impact Test

When tested in accordance with FOTP-25, "Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies," the cable shall withstand a minimum of 2 impact cycles at 3 locations separated by at least 150 mm. The impact energy shall be 2.9 N•m. The cable shall be conditioned for at least 4 hours at the minimum installation temperature (-10 °C). The presence of visible cracks on either the inner or outer surface of the jacket constitutes a failure. No optical measurements are required.

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 optical fibers in cables lengths of 1000 m or greater shall be 100 % attenuation tested. The attenuation shall be measured at 850 nm and 1300 nm for multimode fibers. The attenuation shall be measured at 1310 nm and 1550 nm for single-mode fibers. The manufacturer shall store these values for a minimum of 5 years. These values shall be available upon request.

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 PGS073 Revision History

Revision #	Date	Reason for Change
1	Nov 04	Changed tensile rating values to match ICEA 696.
2	July 09	Changed Fiber count in paragraph 3.24.2 from 120 to 288 fibers
3	Aug. 2010	Updated by Will Miller
4	April 2012	Added information on colored jackets
5	Sept 2017	Reformatted, added Master Format number and added Identification section.