

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

September 2017

PGS066

Revision 5

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-87-640-2006 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 Unshifted 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."

- 2.2 Ribbon Characteristics

- 2.2.1 Detailed information on the optical fiber ribbon can be found in the following document:

Generic Specification F5, "Generic Specification For Optical Fiber Ribbons."

- 2.2.2 All ribbons in the cable shall be usable and meet required specifications.

- 2.2.3 Individual fiber ribbons shall contain 12 fibers.

- 2.2.4 The fiber ribbon dimensions shall be measured in accordance with FOTP-123, "Measurement of Optical Fiber Ribbon Dimensions."

- 2.2.5 All fibers in the ribbon shall be parallel with no cross over along the entire length of the cable.
- 2.2.6 The fibers shall be colored with ultraviolet (UV) curable inks.
- 2.2.7 Each fiber within a 12-fiber ribbon shall be distinguishable by means of color coding in accordance with TIA/EIA-598-A, "Optical Fiber Cable Color Coding."
- 2.2.8 The ribbon matrix material shall be removable with industry standard peelable methods or commercially available heat strippers.

3.0 Cable Construction

- 3.1 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.
- 3.2 Optical fiber ribbons shall be placed inside a central buffer tube.
- 3.3 The buffer tube shall contain up to eighteen 12-fiber ribbons.
- 3.4 The fiber ribbons shall not adhere to the inside of the buffer tube.
- 3.5 The central buffer tube shall contain dry water-blocking technology. The water-swallowable material shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.
- 3.6 The ribbon shall exhibit sufficient coupling to the central tube to restrict ribbon movement during operation. Due to sufficient coupling, the cable shall not require locking loops during installation as recommended by United States Department of Agriculture Rural Utilities Service (RUS) document IP 344-2, "List of Materials Acceptable for Use on Telecommunications Systems of RUS Borrower's."
- 3.7 A water-swallowable tape shall be applied longitudinally around the outside of the central buffer tube. The water-swallowable tape shall be non-nutritive to fungus, electrically non-conductive, and homogenous. It shall also be free from dirt and foreign matter.

- 3.8 The cable core shall contain multiple elements, applied in parallel and in opposing positions over the water-swellable tape or armor, to provide longitudinal tensile and anti-buckling strength.
- 3.8.1 The 12- to 432-fiber non-armored, all-dielectric designs shall contain four glass reinforced plastic rods arranged in two opposing pairs.
- 3.8.2 The 12- to 432-fiber armored designs shall contain two opposing steel rods.
- 3.8.3 The 72- to 432-fiber toneable designs shall contain a glass reinforced plastic rod and a 14 AWG copper wire placed in pairs. The pairs shall be placed opposing each other.
- 3.9 All-dielectric and toneable cables shall contain two ripcords within the outer jacket for easy sheath removal. For armored designs, the cable shall contain one ripcord under the steel armor and two ripcords under the outer jacket.
- 3.10 All-dielectric cables shall be sheathed with polyethylene (PE). The minimum nominal jacket thickness over the strength members shall be 0.75 mm. Jacketing material shall be applied directly over the water swellable tape and core elements. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 1 for the cable design containing 12 to 216 fibers.

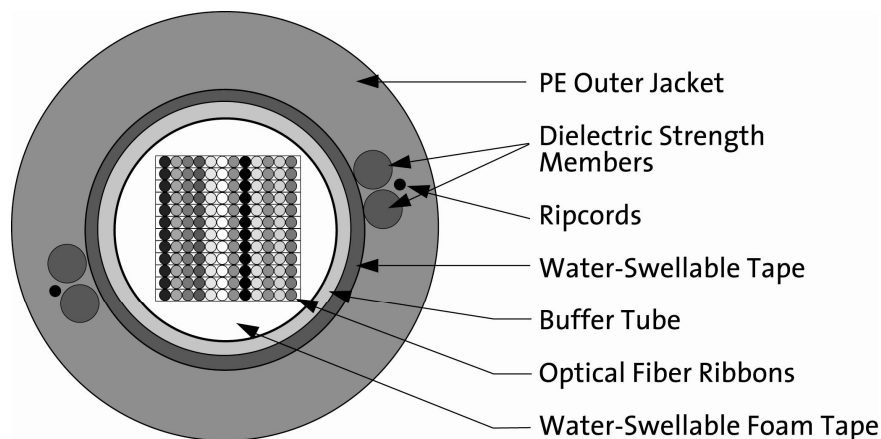


Figure 1: All dielectric cable design for 12 to 216 fibers

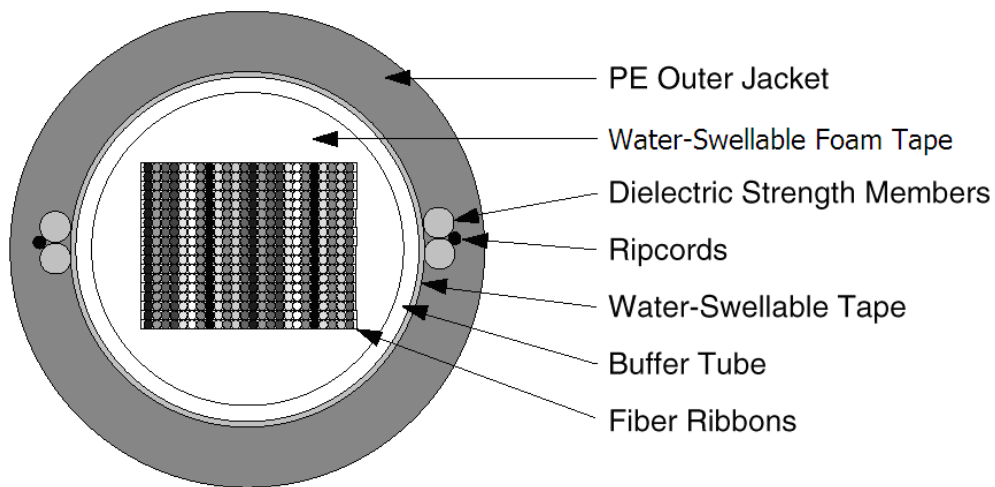


Figure 2: All dielectric cable design for 240 to 432 fibers

- 3.11 Armored cables shall have armor composed of a corrugated steel tape, plastic-coated on both sides for corrosion resistance, and shall be applied with an overlapping seam with the corrugations in register. The outer jacket shall be applied over the corrugated steel tape armor. The outer jacket for single armor cables shall be a PE with a minimum nominal jacket thickness of 0.75 mm over the elements. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus. See Figure 2 for the cable design containing 12 to 216 fibers and Figure 3 for the cable design containing 240 to 432 fibers.

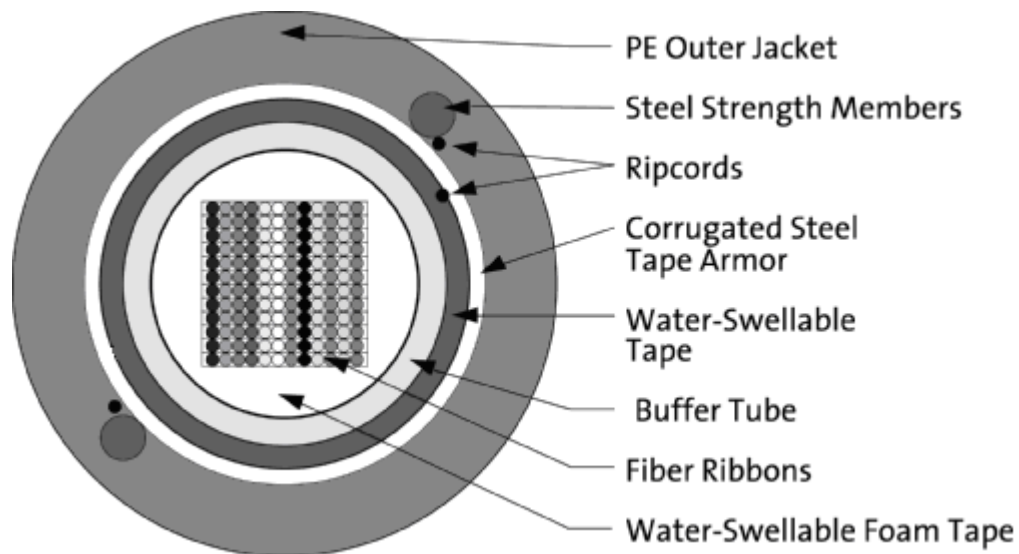


Figure 2: Armored cable design for 12 to 216 fibers

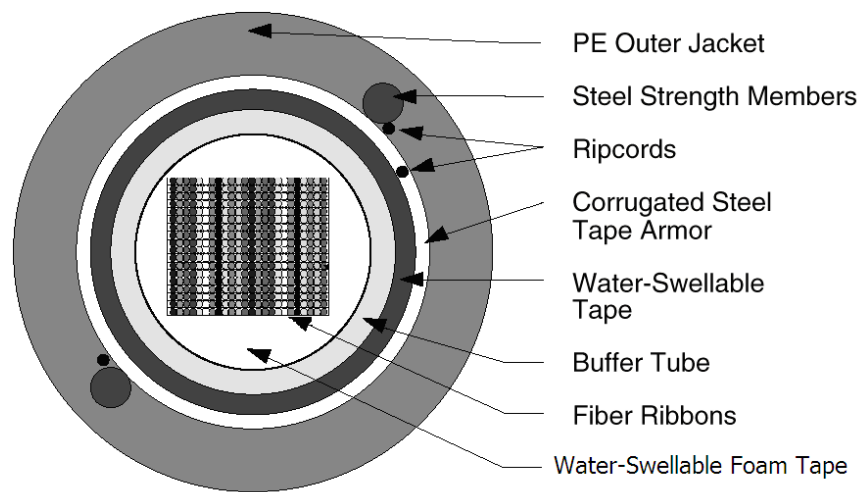


Figure 5: Armored cable design for 240 to 432 fibers

- 3.12 Non-armored toneable cables shall have two pairs of a glass reinforced plastic rod and a 14 AWG copper wire placed on opposing sides. The outer jacket for single armor cables shall be a PE with a minimum nominal jacket thickness of 0.75 mm over the elements. The polyethylene shall contain carbon black to provide ultraviolet light protection and shall not promote the growth of fungus.

See Figure 6 for the cable design containing 12 to 216 fibers and Figure 7 for the cable design containing 240 to 432 fibers.

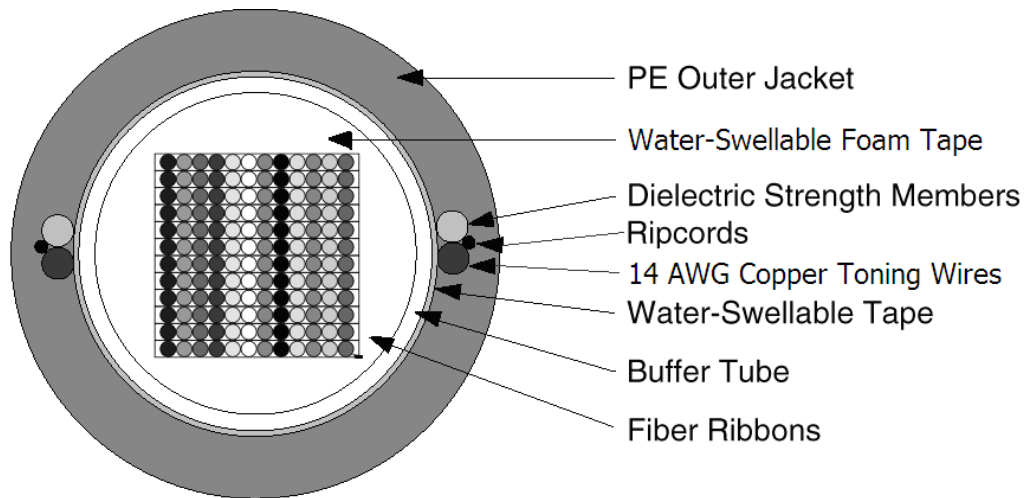


Figure 6: Toneable cable design for 12 to 216 fibers

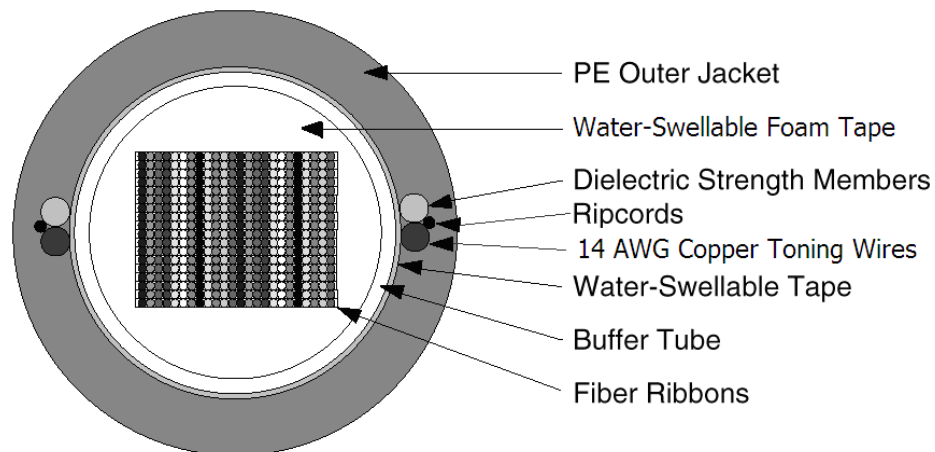


Figure 7: Toneable cable design for 240 to 432 fibers

- 3.13 The PE jacket material shall be as defined by ASTM D1248, Type II, Class C and Grades J4, E7 and E8.

- 3.14 The jacket or sheath shall be free of holes, splits, and blisters.
- 3.15 Cable jackets shall be marked with 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[®]), the Telcordia[®] Suggested Optical Cable Code (SOC Code), fiber count, and fiber type. The actual length of the cable shall be within -0/+1% of the length markings. The marking shall be in contrasting color to the cable jacket. The height of the marking shall be approximately 2.5 mm.
- 3.16 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 shall differ from the previous numbering sequence, and a tag shall be attached to both the outside end of the cable and to the reel to indicate the sequence of remarking. The preferred remarking color shall be yellow, with the secondary choice being blue.
- 3.17 The maximum pulling tension shall be 2700 N (600 lbs) during installation (short term) and 890 N (200 lbs) long term installed.
- 3.18 The minimum bend radius shall be 15 times the cable outside diameter while under tension and 10 times the cable outside diameter installed
- 3.19 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 1 m length of unaged cable shall withstand a 1 m static head or equivalent continuous pressure of water for 1 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 Dielectric and Non-armored metallic cable designs 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 load shall be applied at a rate of 2.5 mm 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) and be maintained for a period of 10 minutes.
- Armored cables shall withstand a minimum compressive load of 440 N/cm (250 lbf/in) uniformly over the length of the sample. The 440 N/cm load shall be applied at a rate of 2.5 mm per minute. The load shall be maintained for a period of 1 minute. The load shall then be decreased to 220 N/cm for 10 minutes.
- Attenuation measurements shall be performed before release of the 110 N/cm load for Dielectric and Non-armored metallic cable designs and the 220 N/cm load for Armored designs. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fibers and 0.3 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 ≤ 20 times the cable diameter. The change in attenuation shall not exceed 0.15 dB at 1550 nm for single-mode fiber and 0.3 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 impacts shall be two at three locations along a one-meter cable length and the impact energy shall be at least 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 0.3 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 2670 N 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 0.3 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 m 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 0.3 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 80 kA without loss of fiber continuity. A damped oscillatory test current shall be used with a maximum time-to-peak value of 15 μ s (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 - 70 μ s.
- 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 $+60^{\circ}\text{C}$. 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 0.3 dB at 1550 nm for single-mode fiber and 0.5 dB at 1300 nm for multimode fiber.
- 5.11 When tested for ribbon coupling, the ribbon stack in a 30 meter piece of cable shall be attached to a load frame with the cable fixed. The load frame will pull the ribbons at a rate of 100 ± 25 mm per minute. The ribbon stack shall require a force of 0.1625 N times the number of fibers in the ribbon stack before moving. For example, the passing force for a 216-fiber ribbon cable is 35.1 N. The cable shall then be temperature cycled according to GR-20, section 6.6.3. The pull out force shall remain the same after temperature cycling.
- 5.12 Ribbon Performance Specifications

- 5.12.1 When tested in accordance with FOTP-141, "Twist Test for Optical Fiber Ribbons," the individual fibers from a 0.3 meter length of ribbon shall not separate when subject to 20 mechanical cyclic twists at 30 cycles per minute while under a 500 g load. Each cyclic twist shall rotate the ribbon 180° in each direction.
- 5.12.2 When tested in accordance with FOTP-131, "Measurement of Optical Fiber Ribbon Residual Twist," the change in ribbon flatness of a 50 cm ribbon sample shall be $\leq 8^\circ/\text{cm}$ while under a 100 g load. Prior to testing, the ribbon sample shall be aged at 85°C, uncontrolled relative humidity, for 30 days.
- 5.12.3 When tested in accordance with ANSI/ICEA S-87-640-2006, Part 7.17, "Ribbon Separability Test," a 0.3 m ribbon sample shall be separable by hand. After separation, there shall be no mechanical damage to the fibers, and the color of the fibers shall still be discernible.

6.0 Packing and Shipping

- 6.1 The completed cable shall be packaged for shipment on non-returnable or reusable 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	Gross Weight
Shipped Cable Length in Meters	Job Order Number
Manufacturer Product Number	Customer Order Number
Date Cable was Tested	Manufacturer Order Number
Cable Length Markings	Item Number
a: Top (Inside End of Cable)	
b: Bottom (Outside End of Cable)	

The reel (one flange) marking shall include:

"Corning Optical Communications"
Country of origin (*i.e.*, 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 PGS066 Revision History

Revision #	Date	Reason for Change
1	10/24/03	Removed ribbon performance to allow it to be solely handled by Fiber Gen Spec F5
2	10/13/10	Added toneable designs. Changed 4 strength rods on armored to 2. Changed ripcords on armored. Added RUS listing for Ultraribbon. Added ribbon performance to make consistent

		with gel-filled gen spec.
3	11/4/10	Added ribbon coupling and bend radius
4	2/3/11	Changed wording on toneable cables
5	9/18/17	Reformatted and added Identification section.