

SECTION 33 82 00 – CABLING FOR UNDERGROUND COMMUNICATIONS OUTSIDE PLANT

1.01 SUMMARY:

- A. ^{A19}**Scope:** Scope of work shall be in accordance with Paragraph 1.01 D. of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), as required, for parts of the Works. ^{A19} This Section of the Employer's Requirements shall be read in conjunction with the Sections listed in Table 33 82 00-1.

- B. **Related Sections:**

Table 33 82 00-1: Related Sections			
1.	Section 01 81 26	-	Communications, Control, Safety, and Security Systems.
2.	Section 01 89 16	-	Site Construction
3.	Section 33 81 26	-	Outside Plant Pathways for Underground Communications.

1.02 REFERENCE:

- A. **Applicable Publications:** Refer to Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.02.

1.03 REQUIREMENTS:

- A. **General Requirements:**

- General:** The Contractor shall meet all applicable requirements of Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.03.
- Cable Pulling Tension Calculations:** Shall be done for all cable segments, using the newest version of American Polywater Pull-Planner or equal software.
- Fiber Optic Link Budget Calculations:** Shall include, but not be limited to, the following: Launch power, connector losses, coupling losses, fiber attenuation, splice losses, and minimum allowable received signal level.
- Reels:** Shall be made of wood or other stronger material, and have adequate protection covering cables.
- ^{A17}**Service Life:** Cables shall be useable for 20 years or longer. ^{A17}

B. Equipment and Materials:

1. General:

- a. ^{A19}Outside Plant cables shall have a jacket with ultra-violet radiation (UV) light protection. ^{A19}

2. Cable Lubricant:

- a. Lubricant shall produce a thin film or coating that immediately reduces friction and tension, lasting even as the lubricant dries.
- b. Lubricant shall be easy to apply and use without mess, quick clean-up with water, non-flammable, non-sensitizing, non-staining, non-toxic, and suitable for pulling or pushing.
- c. Lubricant shall be UL listed and compatible with cable jacket and duct materials.

3. Copper Cables:

- a. Cables shall have individually insulated copper cables with standard color coding, and the number of pairs as determined by design requirements plus 50% spare.
- b. Gauge shall be as required but not smaller than #22 AWG.

4. ^{A20}Fiber Optic Cables:

a. General:

- 1) Cables shall be suitable for underground and above ground conduit, for tray installation (covered or exposed), and dry and water filled environments.
- 2) Cables shall be all dielectric and have a sturdy, UV, fungus, oil resistant and flame retardant outside sheath suitable for cable blowing.
- 3) Single mode fibers shall be zero or low water peak (LWP) type.
- 4) Unless otherwise specified, fiber optic cables shall have the following or better characteristics:

TABLE 33 82 00-2: CHARACTERISTICS OF UNDERGROUND FIBER OPTIC CABLES FOR OUTSIDE PLANT			
Parameter		Multimode Fibers	Single-mode Fibers
Optical Characteristics:			
Attenuation		1.5 dB/km at 1,300 nm 3.7 dB/km at 850 nm	0.4 dB/km at 1,310 nm 0.2 dB/km at 1,550 nm
Chromatic Dispersion (ps/nm-km)		≤120 at 850 nm ≤6 at 1,300 nm	≤3.5 between 1,525 and 1,575 nm
Index of Refraction	Profile	Gradual	Step
	Value	-	To be submitted for review
Losses due to Flexion			< 0.5 dB at 1,550 nm for 100 turns of fiber reeled with a radius of 37.5 mm
Numeric Aperture		Between 0.18 y 0.24	N/A
Optical Bandwidth		500 MHz-km at 1,300 nm 160 MHz-km at 850 nm	> 800 MHz
Polarization Mode Dispersion (PMD)		-	0.1 ps/(√km)
Spectral Efficiency		-	1 b/s/Hz
Other		In accordance with EIA 492A000, 492AAAA, and ITU-T G.651	<ul style="list-style-type: none"> Generally shall be in accordance with ITU-T G.652.C. On special occasions, G.653 or G.655 is required as specified this section.
Physical Characteristics:			
Circularity Error		< 2% for cladding, and < 6% for core	<2%
Cladding		125 μm ±3 μm silicon	
Concentricity Error		<6%	< 1 μm
Core		62.5 μm ±3 μm diameter, made of high purity silicon	9 μm ±3 μm diameter, made of high purity silicon

- 5) Fibers and buffer tubes shall have standard color coding for easy identification in accordance with TIA 598-A.
- 6) The Employer prefers bend-insensitive or bend-tolerant fibers.
- 7) Tight buffer and gel filled cables are unacceptable.

b. Fiber Optic Cables for Installation in Micro-duct Tubes:

- 1) These cables shall be small bundles of optical fibers with no less than 24 fibers. Cables shall not require bulky strength elements, fillers, or tensile strength members found in traditional fiber optic cable.

- 2) These cables shall have a jacket made of foamed polyethylene or better material, to enable the fiber to blow easily through tube cable.

c. **Fiber Optic Cables for Telecommunications Backbone and All Other Outside Plant Uses:**

- 1) Cables shall have strength member protection, with Kevlar or Aramid yarns, and rip cords surrounding the buffer tubes core and in sub-cables.
- 2) Cables shall have no less than 48 fibers^{A20} and the following or better characteristics:

TABLE 33 82 00-3: CHARACTERISTICS OF UNDERGROUND FIBER OPTIC CABLES FOR OUTSIDE PLANT BACKBONE		
Parameter	Multimode Fibers	Single-mode Fibers
Physical Characteristics:		
Exterior Jacket	Black polyethylene with minimum thickness of 2.5 mm, suitable for underground use, resistant to sunlight and temperatures up to 60 °C. There shall be no bubbles, cracks, or other imperfections.	
Fiber Protection	Loose buffer tube, preferably tied individually	
Pulling Resistance	45 kg (100 lbs)	

5. **Pigtails:** If any, shall be at least 3,658 mm (12') long.

C. **Installation:**

1. **General:**

- a. Cables to be installed by the pulled or blown methods shall be provided with suitable quantity of cable lubricant adequate for the cables and ducts.

2. **Copper Cables:** Copper cables shall be installed strategically employing underground ducts and pathways. These shall be used in any combination suitable for the best future distribution, coverage, performance and aesthetics of the new Locks complexes.

3. **Fiber Optic Cables:** ^{A20}Shall be installed in underground ducts or micro-duct tubes, refer to Section 33 81 26 (*Outside Plant Pathways for Underground Communications*), as well as cable trays and ducts in tunnels.^{A20}

4. **Splices:** Splices are allowed only in case fiber optic connectors use pigtails. Loss shall not exceed 0.1 dB per fiber optic cable splice.

1.04 DESIGN CRITERIA/SYSTEM PERFORMANCE:

A. **General:**

1. **Problem to be Solved:** ^{A19}Outside Plant cabling shall solve the following business needs:
 - a. Provide reliable media to transport telephone and data signals, video, security, control systems, and any other low voltage circuitry information as required for locks Operations.
 - b. Maintain the security of cable runs, providing alternate routing for Disaster recovery, and considering the location of local exchange carrier facilities, and the physical terrain of the new locks premises. ^{A19}
 - c. Provide extra pathways to be used for maintenance purposes.
2. **Restrictions to be Considered:** (reserved)

B. **Design Criteria:** Shall be in accordance with Section 33 81 26 (*Outside Pathways for Underground Communications*), Paragraph 1.04 A.

C. **System Performance:** (reserved)

1.05 SUBMITTALS: The following shall be submitted for substantiation purposes:

A. **Design:** The following shall be in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.05 D.

1. Calculations, including the following:
 - a. Cable pulling tension calculations.
 - b. Power budgets for fiber optic links.
2. Critical path method (CPM) diagram, with monthly updates.
3. Descriptive literature.
4. Drawings.
5. Specifications.
6. Any other data required for review.

B. **Re-Submittals Just Prior to Purchasing Materials:** All items specified in Sub-paragraph A., above, that have changed from original submittal shall be resubmitted in a design conference in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.05.

C. **Upon Receipt of Shipped Items in Panama:**

1. Packing lists.

2. Test reports, including attenuation of fiber optics cables before installation.

D. Prior to Issuance of Taking Over Certificate:

1. As-Built drawings.
2. Test reports, including attenuation and splice losses of fiber optic cables.

1.06 QUALITY ASSURANCE: Shall include the following in accordance with Section 01 81 26 (*Communications, Control, Safety, and Security Systems*), Paragraph 1.06:

- A. ^{A3}**Attenuation Tests:** All fiber optic cables shall be tested before and after installation in two wavelengths and in both directions. Single mode fibers shall be tested at 1,310 and 1,550 nm.^{A3}
- B. Factory quality control tests (FQCT).
- C. Final field inspection tests (FFIT) in accordance with the applicable requirements of EIA 455, EIA 526, and TIA TSB 63.
- D. Warranty.

END OF SECTION