



**Public Works Division
Lighting District**

**Fiber Optic Specifications
April 2009**

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**CHARLOTTE COUNTY LIGHTING DISTRICT
FIBER OPTIC SPECIFICATIONS**

APRIL 2009

GENERAL REQUIREMENTS:

The contractor shall furnish and install fiber optic cable as shown on the plans and in accordance with the requirements specified herein. Installation, maintenance, and repair of the County's fiber optic cable network shall be performed by fully trained and qualified technicians, who should possess BICSI ITS Level 2 certification. The fiber optic contractor shall possess certification in the Florida Department of Transportation (FDOT) Maintenance of Traffic, Intermediate Level. The applicant must comply with Charlotte County Maintenance of Traffic (MOT) policy, and a Maintenance of Traffic plan must be approved by the Transportation Engineer prior to starting construction.

During all working hours, the contractor shall have a responsible, English-speaking superintendent on the project with the capabilities and authority required by FDOT Specifications, Section 5-8.

All fiber shall be shipped on reels of marked continuous length. No splices shall be permitted within the fiber jacket. All fiber shall be labeled with the logo "TRAFFIC OPERATIONS," along with the cable length marked at a minimum of every three feet. The fiber optic cable shall have a continuous linear green stripe on the exterior of the cable. After installation, the distance markings at each end run shall be logged and provided to the County. After installation, each run of fiber optic cable shall be marked within one foot of each splice and/or termination with the location that the cable goes to.

The following standards are applicable and are hereby incorporated by reference:

<u>ORGANIZATION</u>	<u>STANDARD</u>	<u>APPLICABILITY</u>
REA	PE-90	Cable Construction
TIA/EIA	598A-95	Color Coding
TIA/EIA	472D	Fiber Optic Cable
BELLCORE	TR-NWT-00020	Optical Characteristics

SINGLE-MODE FIBER OPTIC CABLE:

The single-mode fiber optic cable shall consist of 12, 18, 24, 30, 36, or 48 fibers, as shown in the plans, arranged in color-coded buffer tubes of six individually color-coded fibers. Since less than six buffer tubes are required for the number of fibers, polyethylene filler rods shall be used to maintain cable integrity. Each buffer tube shall be filled with a non-hygroscopic gel for protection of the fibers from impact and moisture ingress. Aramid or Kevlar-strength members shall be bundled with the buffer tubes and filler rods, and the cable jacket or sheath shall contain non-

hygroscopic gel. The entire cable shall conform to REA Specification PE-90, unless the cable manufacturer's recommendation is more stringent.

The minimum bend radius of the cable shall be 20 times the cable diameter when under load and 10 times the diameter when under no load. The maximum tensile strength shall be at least 600 pound force (2700 Newtons) short-term and 135 pound force (601 Newtons) long-term.

The fiber optic cable shall meet the following optical specifications:

- Attenuation at 1310 nanometers <0.5 db/km
- Attenuation at 1550 nanometers <0.4 db/km
- Point discontinuity <0.10 db/km
- Core Diameter 8.3 43/64 m
- Cladding Diameter 1.250 + 1.0 43/64 m
- Core-Clad Concentricity < 0.8 43/64 m
- Coating Diameter 245 + 10 43/64 m
- Numerical Aperture 0.13
- Index of Refraction (1310nm) 1.4675
- Index of Refraction (1550nm) 1.4681

All fiber optic glass shall be Corning Glass Type SMF-28 or County-approved equivalent.

All fiber cable shall be installed in underground conduit with a #14 AWG locate wire. Fifty feet of spare fiber shall be looped neatly in pull boxes, where shown in the plans. At every termination point, spare fiber in each direction shall be looped neatly within the cabinet (30') or in an adjacent pull box (50'). This fiber is for future additions or repairs to the fiber network.

All installation, testing, repair, and connections to the fiber cable required by this specification will be included in Pay Item No. 633-121. All cable ties, cable clamps, terminal connectors, and labor shall be included under this same Pay Item.

In the event a fiber optic cable is cut or damaged, a splice will not be permitted. The responsible party shall make all repairs within five business days of the initial interruption. Charlotte County will provide the responsible party with a list of approved vendor(s), who will be authorized to make the necessary repairs. Charlotte County will not authorize any party to make repairs if not listed on the vendor list. The fiber optic cable shall be completely replaced from point to point. Point to point is defined as the closest original termination where the cable had been cut in two or the closest end termination.

In the event conduit damage occurs, the use of split duct pipe will not be accepted. The applicant shall be responsible for all costs associated to remove the fiber optic cable from the conduit; the necessary repairs to the conduit; and the re-installation of the fiber optic cable, including any terminations and splices.

The contractor shall prepare a cable-pulling plan for approval by the County.

FIBER OPTIC CABLE SPLICING

GENERAL REQUIREMENTS:

All fibers shall be spliced by the fusion method. The contractor shall use a fusion splice machine for this purpose. The splice machine shall be equipped with a method for estimating the achieved splice loss. Either the "Local Injection Detection" or the "Core Alignment Loss Estimation" system is acceptable. The machine used shall be new from the factory or serviced and certified by the factory, or its authorized representative, within the previous six months from the commencement of its use on the project. The contractor shall provide to the County a letter from the manufacturer or authorized agency certifying that this requirement is met.

At each splice location where cables are joined, 50 feet of fiber on each side of the splice shall be coiled to allow for future access to the cable. All fiber optic cable splicing shall be performed in an air-conditioned environment, such as a work trailer or van specifically equipped for fiber optic splicing.

Splice enclosures may encounter high water table conditions. Splice enclosures shall be non-filled (no encapsulate), airtight and prevent water intrusion, be able to accommodate pressurization, and have the capability to be reentered without requiring specialized tools or equipment. Splice enclosures shall also be supplied with all hardware necessary to provide solid mounting to the wall of the pull box in which it is to be housed. All enclosures and associated facilities provided under this contract shall include a quality assurance/quality control inspection for materials, workmanship, and compliance of the product to meet these specifications. The contractor shall provide to the County an executed Certificate of Compliance from the manufacturer indicating that the splice enclosures meet the requirements included herein.

Where a fiber cable is to be accessed for signal insertion or drop, only the buffer tube containing the fiber(s) to be accessed shall be opened. Only the actual fiber to be accessed shall be cut. If a fiber end is not to be used at the time, it shall be cut to a length equal to that of the fiber to be used and the spare neatly laid into the splice tray. At least 1½ revolutions of the splice tray of the fiber shall be left on each end of fiber after splicing. The number of fibers shown in the plans for a branch cable shall be continuous for the entire length of that branch. The drop cable shall be terminated into a Corning Cable Systems enclosure, part #SPH-01P.

SPLICE MATERIALS:

At each splice point, splice organizer trays shall be provided to contain and protect the bare fibers and splices.

The splice trays shall have a means to affix the buffer tube rigidly in place, space and guides to allow "race tracking" of the fiber, and guides to locate the splice protectors.

The splice trays for mass or single fusion and mechanical splicing shall be layered above the transition/storage compartment and shall be easily slipped into place on two studs and secured with a hold-down strap. Splice trays shall have fixed rigid slots for fiber placement.

Each tray shall be made of injection-molded plastic and have a hinged clear plastic cover for maximum fiber protection that allows for visible inspection of the fibers. The covers shall have a lock mechanism to hold them in place.

All splices shall be protected with a heat-shrink sleeve containing a stainless steel strength rod or protective sleeve and housing. Completed splice protectors shall be held in place with RTV silicone or adhesive tape. Where optical splitters are used, they shall be placed within the tray in one of the mounts for a splice. No more than 12 splices, or 12 splices and optical splitters, shall be placed in one tray.

FIBER OPTIC TERMINATIONS

GENERAL REQUIREMENTS:

All terminations to fiber optic cable shall be made with ST or ST-II connectors to single fiber break-out cable of 2.4 or 3 mm diameter. Where access to a trunk fiber or local fiber cable is made, a length of single fiber break-out cable shall be spliced onto the trunk fiber by the method outlined below. Nowhere shall a fiber be terminated directly. Where single fiber break-out cable is used, it shall be marked within six inches of the connector with appropriate nomenclature to identify it. All single-mode, single fiber break-out cable shall be yellow in color. The contractor shall utilize the color codes and the splice diagrams shown in the plans or provided by the County for the termination of all cables.

FIBER OPTIC CONNECTORS:

All ST-II connectors shall conform to the AT&T specifications for ST-II connectors, and all connectors shall utilize a ceramic ferrule and a metallic body. No plastic body or ferrules shall be permitted. The connectors shall be applied by the adhesive and polish method. At least two grades of polish film shall be used and the fiber visually inspected with a magnifying device after polishing. Any marks on the fiber core, or on the cladding within a core diameter from the core, shall be cause for rejection and re-termination of the fiber and shall be tested when the fiber is spliced. The fiber strength member shall be affixed to the connector by crimp ring or by epoxy. If a crimp ring is used, it shall be crimped with a ratcheting tool that ensures correct crimp pressure. The completed termination shall exhibit a loss of no more than 0.25 dB per mated pair when tested with an OTDR and a standard test cable. This requirement applies equally to field terminations and factory terminated pigtailed.

FIBER OPTIC TERMINATION ASSEMBLY (INTERFACE PANEL):

A fiber optic termination assembly shall provide for the termination of an interconnection of fiber optic cables and incorporate facilities to house fiber optic splices. The capacity of this assembly shall vary depending on the quantity of fiber optic cables to be terminated at a local controller or camera cabinet. The

contractor shall provide a complete assembly that meets the requirements of each location. A fiber optic termination assembly includes connector housing, splice tray housing, splice trays, and connector panels.

A splice center consists of the splice tray housing and the splice trays. The splice center shall house adequate splice trays to splice the fiber optic cables with no more than 12 splices per tray; shall have facilities for physically holding both the trays and the trunk cable; and shall have a means to route the excess buffer tubes, such that the minimum bend radius is maintained. When closed, the splice center shall provide dust protection for the trays and buffer tubes. Gaskets, grommets, or other means shall seal the cable entry points from foreign material. The splice center may be made of aluminum, painted steel, or a thermoplastic. If a local fiber cable is spliced where it is not terminated, the splice center shall be sized to accept the number of trays needed for the splice. A fiber distribution center shall be used for trunk cable, branch fiber cable, or both at any time that a termination is made. This distribution center shall be similar to the splice center, with the addition of panels to contain bulkhead connectors for the mating of the fiber connectors.