

DESCRIPTION

Under this item the CONTRACTOR shall provide a fully-tested and operational fiber-optic communications link as indicated on the plans or as directed by the ENGINEER.

CONSTRUCTION REQUIREMENTS**Fiber-Optic Cable Installation**

Fiber-optic cables, associated equipment and devices shall be installed in accordance with industry standards and manufacturer's written instructions. Cables shall be installed as shown on the plans and as ordered by the ENGINEER.

The fiber-optic cable shall be installed without damage to fibers, cladding, or jacket. Wheels, pulling sheaves and cable guides shall be used to maintain the fiber-optic bending radius as specified by the manufacturer. No bends smaller than those recommended by the manufacturer shall be permitted. All bends of the fiber-optic cable shall be made without kinking or flattening. The minimum bending radius shall be greater than ten times the diameter of the cable itself.

All fiber-optic cable placement shall be accomplished using pull, push, or push-pull method. Fiber-optic cable tension shall be monitored at all times with the use of an approved tension gauge and a recorder. All records of the fiber-optic cable installation shall be submitted to the Engineer for approval. Fiber-optic cable subjected to tensions and/or stresses greater than those allowed by the manufacturer shall be removed and replaced at no cost.

The use of pulling lubricants shall be in accordance with the cable manufacturer's recommendation.

At fiber-optic cable splicing locations, a minimum of 25' of slack shall be left at each end of the cable, or as shown on the plans.

At splice / pullboxes used as pulling points, a minimum of 25' of fiber-optic cable shall be coiled and left available in the box, or as shown on the plans.

Fiber-optic cable end caps shall be kept sealed at all times during installation, using approved end sealing caps. Tape shall not be used to seal the cable end. The cable shall remain properly sealed until the ends are prepared and terminated.

Fiber-optic cable pulled in innerduct or in conduit shall be installed in continuous lengths between pullboxes and/or splice/pullboxes. Splicing of fiber-optic cable except at designated splice-points shall not be permitted.

Fiber Termination at Specified Points-of-Presence

In preparation for fiber connection to traffic signal modem or camera video equipment, and to facilitate OTDR testing, various fibers from each of the cables available in a particular location (point-of-presence) shall be terminated with factory pre-connectorized one-meter simplex single-mode pigtail cables. The outer jacket color shall be yellow, indicating single-mode type fiber.

Pigtails shall be terminated to specified fibers and identified with PVC cable markers as directed by the ENGINEER. A splice schedule for each location will be provided.

Splices shall be stabilized within a splice tray, and splice trays shall be stored in a commercially-available, metal, network splice organizer box with removable cover.

For traffic signal modems, the connectorized pigtails shall be equipped with factory-made FC type connectors only. For camera video modem equipment, factory-made ST, SC, or FC type connectors are acceptable, in accordance with the video modem specifications.

FIBER-OPTIC CABLE TESTING REQUIREMENTS

All testing to be performed in the presence of the ENGINEER.

1. The test plan shall include tests for continuity, length, anomalies, and attenuation.
2. Documentation:

The CONTRACTOR shall submit sample forms for documenting cable, splice, and connector losses, OTDR traces and anomalies. The form shall include manufacturer, model / type number, serial number and date of calibration test equipment. The sample forms shall be submitted for approval within 60 working days after the Contract award date.

OTDR traces shall be submitted on paper and as data to be displayed on a personal computer as part of a finished software package. (for waveform analysis).

After the successful completion of each required test the CONTRACTOR shall submit, within three (3) working days, two (2) paper copies of the test results to the ENGINEER.

3. Required Testing:

- a. Cable-on Reel Test: Single-direction OTDR at 1310 nm, test all fiber in the cable. This shall be done on-site prior to installation.
- b. Segment Testing: After installation of a segment of cable, a single-direction

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OTDR test at 1310 nm of any two fibers in each buffer tube.

- c. Splice Testing: After all splices have been installed, a single-direction OTDR test at 1310 nm of all spliced fibers in all buffer tubes.
- d. System Acceptance Test: End-to-end testing of the completed system shall consist of a bi-directional OTDR test of all fibers in all buffer tubes at 1310 nm. Using a laser source and power meter, measure loss and power level at 1310 nm.

Minimum acceptance criteria:

- Attenuation: maximum allowable value = 1.0 dB / km
- Anomalies: no event shall exceed 0.3 dB
- Splice Loss: 0.10 dB or less per splice

An example of this type of program is Corning's *Softview* available in CD-ROM format at this writing (January 2004).

METHOD OF MEASUREMENT

The quantity to be paid for shall be the number of meters of each fiber-optic cable installed, tested, and documented.

BASIS OF PAYMENT

The bid price shall be a unit price per linear meter for installing, testing and documenting all fiber-optic cables in the project, including all labor, tools, and equipment required for installation.

Payment shall be made as follows:

- 20% of the contract price shall be paid upon completion of installation and successful segment tests.
- 30% of the contract price shall be paid after successful completion of splice tests.
- 40% of the contract price shall be paid after successful completion of System Acceptance test.
- 10% of the contract price shall be paid after receipt of all test documentation.

Payment will be made under:

<u>Item No.</u>	<u>Item</u>	<u>Pay Unit</u>
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