ITEM 01680.960501 M – FIBER OPTIC DROP CABLE FUSION SPICE
ITEM 01680.960502 M – FIBER OPTIC CONNECTORIZATION
ITEM 01680.960503 M – FIBER OPTIC SPLICE CLOSURE
ITEM 01680.960504 M – FIBER OPTIC SNOWSHOE

DESCRIPTION

Under these items, the Contractor shall provide and install Fiber Optic Drop Cable Fusion Splices, Fiber Optic Connectorization, Fiber Optic Splice Closures, and Fiber Optic Snowshoes at the locations as shown on the plans or as directed by the Engineer.

As shown on the plans, the Traffic Signal System (TSS) trunk cables shall contain 36 or 48 fibers and the OGS trunk cables shall contain 24 or 48 fibers. The TSS drop cables shall contain six fibers and shall run from the splice into the TSS trunk to the intersection controller cabinets. The fiber optic cables are provided under other contract items.

MATERIALS

Fiber Optic Drop Cable Fusion Splices. All splices shall use the fusion technique. Fusion splicing equipment shall be provided by the Contractor and shall be cleaned, calibrated and specifically adjusted to the fiber and environmental conditions at the start of each shift. Tools and procedures shall be approved by the cable manufacturer as being compatible with the cable type being delivered.

Splices specifically required to connect drop cables into the trunk cable system shall be supplied under this contract item. The number and location of all drop cable splices are shown on the plans. Splices of cable segments directly to each other that are required due to reel length or other practical limitations shall be included under the items for fiber optic cables and shall not be paid for separately.

A method of mid-span access to the relevant TSS trunk cable buffer tube that contains the fibers that the drop cable shall be spliced to shall be used. Payment will be made only for splices made to the fibers in this buffer tube. If the contractor elects to splice all fibers of the trunk at these locations then payment will only be made for the splices involving the buffer tube that the drop cable shall be spliced to.

Each spliced fiber shall be packaged in a protective sleeving or housing. Bare fibers shall be completely re-coated with a protective RTV, gel or similar substance, prior to application of the sleeve or housing, so as to protect the fiber from scoring, dirt or microbending.

Splice trays shall be used to hold the spliced fibers, with each fiber neatly secured to the tray.

Splice loss shall not exceed a mean of 0.03 dB. No splice losses above 0.05 dB shall be permitted. If a splice is measured to exceed 0.05 dB during the splicing process, it shall be remade, to a maximum of three attempts, or until its loss falls below 0.05 dB. Each attempt shall be recorded for purposes of acceptance.

All splice losses shall be recorded in tabular form and submitted to the Engineer for approval. An optical time domain reflectometer (OTDR) shall be used and chart recordings of the "signature" shall be submitted with the splice data with a record of all OTDR settings and the OTDR locations written on the trace.

Fiber Optic Connectorization. All fiber optic connectors or connectorized pigtails shall be ST type with a mean loss of less than 0.6 dB and a maximum loss of 0.8 dB at 1310 nm.

All equipment necessary for complete connectorization, such as buffer tube fan out kits or connectorized pigtails, shall be included under this contract item. If splices to fiber optic “pigtails” (short one-fiber cables with connectors attached at the factory) are used to provide the method of connectorizing the fibers, these splices will be paid for under the item for fiber optic connectorization and will not be paid for separately.
Splice Closures. The Contractor shall furnish and install fiber optic splice closures with splice trays in all locations where the fiber optic cables are spliced. The splice closure shall meet the following minimum requirements.

The closure shall be constructed of a rigid, high strength material and shall be waterproof with the appropriate gaskets and protection to provide moisture integrity. When installed, the enclosure shall be capable of withstanding severe conditions of moisture, vibration, impact, cable stress and temperature extremes.

The closure shall be capable of holding splice trays specified for fusion splices. The closure shall have the capability of holding trays from various manufacturers and shall have the capacity to hold sufficient splice trays to accommodate up to 72 splices.

The enclosure shall have the input/output capacity for at least four 48 fiber cables.

The enclosure shall be re-enterable without disturbing the fibers or the fiber splices. No special tools shall be required for installation of maintenance of the enclosure. All hardware and miscellaneous parts shall be standard industry equipment.

The splice enclosure shall be mounted using stainless steel hardware, or other manufacturer approved hardware.

The splice enclosure shall have a termination block to terminate the central strength members of the fiber optic cables.

Splice Trays. The Contractor shall furnish and install fiber optic splice trays to organize and store splices within the splice closures. The trays shall be compatible with the fiber optic splices and splice enclosures specified herein and shall meet the following minimum requirements:

The tray shall be compatible with the fusion splices specified herein.

The tray shall accommodate loose tube buffers. No cable ties are to be used. The loose tube buffers shall be secured with a tube guide or channel snap.

The tray shall accommodate both 250 micron and 900 micron fiber.

Slack fiber within the tray shall be placed in an oval shape along an inside wall of the tray.

The fiber optic splice trays shall be stackable within the splice enclosure. Any tray within a stack shall be accessible without disassembly of any of the other trays.

Fiber Optic Snowshoes. As shown on the plans or as directed by the Engineer, the Contractor shall furnish and install fiber optic snowshoes to store fiber optic cable within the aerial areas of the cable plant. All hardware required to attach the snowshoes to the messenger cable assemblies shall be provided under this contract item.

The snowshoe shall be designed so that the bend radius of the stored fiber optic cable is not less than 406.4mm.

Environmental Requirements. All equipment and procedures provided under these contract items shall meet all of their specified requirements during and after being subjected to any combination of the following requirements:

- Shipping/storage temperature: $-50^\circ C$ to $+70^\circ C$
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- Installation temperature: -30°C to + 70°C
- Operating temperature: -40°C to + 70°C
- Relative humidity: 0% to 95%, non-condensing

CONSTRUCTION DETAILS

The Contractor shall furnish and install all of the above items, including all necessary mounting hardware and any other ancillary equipment required to provide a complete and operational fiber optic cable plant at the locations shown in the plans and as directed by the Engineer.

Testing Requirements. All fibers shall be tested bi-directionally at both 1310 nm and 1550 nm. The Contractor shall submit detailed test procedures for approval by the Engineer.

All items in this specification shall be subjected to the levels of testing described in the General Provisions of the Special Specifications.

Documentation Requirements. Ten (10) complete sets of Operation and Maintenance Documentation shall be provided. The documentation shall, as a minimum, include the following:

- Complete and accurate as-built diagrams showing the fiber optic cable plant and locations of all splices.
- Installation, splicing, terminating and testing procedures.
- Complete parts list including names of vendors.
- Complete maintenance and trouble-shooting procedures.
- Complete performance data of the cable plant showing the losses at each splice location and each terminal connector.

Experience Requirements. Personnel involved in the installation and testing of these items cables shall meet the requirements called for in the specifications for Fiber Optic Cables.

METHOD OF MEASUREMENT

The Fiber Optic Drop Cable Fusion Splices, Fiber Optic Connectorization, Fiber Optic Splice Closures and Fiber Optic Snowshoes will be measured for payment as each complete unit furnished, installed, tested and approved.

BASIS OF PAYMENT

The unit prices bid for the Fiber Optic Drop Cable Fusion Splices, Fiber Optic Connectorization, Fiber Optic Splice Closures, and Fiber Optic Snowshoes shall include the cost of furnishing all labor, materials, tools, equipment and incidentals necessary to complete the work.

Only splices specifically required to connect drop cables into the trunk cable system shall be paid for under this contract item. Splices of cable segments directly to each other that are required due to reel length or other practical limitations shall be included under the items for fiber optic cables and shall not be paid for separately.

A method of mid-span access to the relevant TSS trunk cable buffer tube that contains the fibers that the drop cable shall be spliced to shall be used. Payment will be made only for splices made to the fibers in this buffer tube.