ITEM 680.96502011 – FIBER OPTIC SPLICE INSTALLATION – TYPE 1
ITEM 680.96502111 – FIBER OPTIC SPLICE INSTALLATION – TYPE 2
ITEM 680.96502211 – FIBER OPTIC SPLICE INSTALLATION – TYPE 3

DESCRIPTION: This work shall consist of splicing fiber optic cable into splice enclosures furnished as part of these items. The type of splice installation depends upon the number of fibers to be spliced. The Type 1 splice installation shall provide 12 splices. The Type 2 splice installations shall provide for 120 splices. The Type 3 splice installation shall provide for 240 splices.

MATERIALS: All splices shall be made in a re-enterable fiber optic splice enclosure of the type indicated. Fusion splicing shall be used.

Re-enterable Fiber Optic Splice Enclosure: The Contractor shall furnish and install fiber optic splice enclosures with splice trays in locations where the fiber optic distribution or backbone cable is spliced to fiber optic drop cables, at intermediate locations designated in the Contract Documents and at other locations approved by the Engineer. The distribution and backbone cables shall be spliced to provide continuous lengths of fiber optic cable. The splice enclosure shall meet the following requirements:

a. Rigid non-filled case.

b. Case molded out of polyester/polycarbonate blend.

c. Able to be re-entered and reassembled without the use of special tools and without disturbing previously installed cables.

d. Capable of holding splice trays and slack baskets specified for fusion splices and for ballooning of unopened buffer tubes. The enclosure shall have the capability of holding trays from various manufacturers. The enclosure shall have the following capabilities:

   • Type 1 splice enclosure shall hold sufficient splice trays to accommodate up to 12 splices and space for ballooning of 8 unopened buffer tubes.

   • Type 2 splice enclosure shall hold sufficient splice trays to accommodate 120 splices and for ballooning of 6 unopened buffer tubes.

   • Type 3 splice enclosure shall hold sufficient splice trays to accommodate 240 splices and for ballooning of 6 unopened buffer tubes.

e. The Type 1 enclosure shall have the input/output capacity to handle two fiber optic cables of 1 in outer diameter and two-fiber optic drop cables of 5/8 in outer diameter of the type specified for this project.

f. The Type 2 and Type 3 enclosure shall have the input/output capacity to handle two fiber optic cables of 1 in outer diameter and four fiber optic drop cables of 5/8 in outer diameter of the type specified for this project.

g. Contain mountings for the splice tray organizers.

h. Air valve for flash testing.

i. All hardware corrosion resistant aluminum or stainless steel.

j. Fiber bend radius controlled to a minimum of 1.5 in.
k. Not allow water entry when sprayed for fifteen minutes from a distance of 3 feet with water at a flow rate of 6.5 gallons per minute at any angle.

l. Not allow water entry when immersed in a six (6) feet head of water for seven (7) days.

m. Provide for strain relief around the cable jacket and internal cable strength members.

n. Cable gripping and sealing hardware shall not cause an increase in fiber attenuation in excess of 0.05 dB/fiber.

o. UL rated.

p. Temperature storage and operation: -40°F to + 158°F.

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

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

b. 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.

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

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

e. The splice enclosure shall be furnished with the number of trays required to accommodate the maximum number of splices specified for that type of enclosure.

f. The fiber optic splice trays shall be stackable within the splice enclosure.

CONSTRUCTION DETAILS:

Splicing Requirements: Personnel involved in the splicing of the cable shall meet the experience requirements specified for the fiber optic cable bid items.

The Contractor shall provide all parts and splicing equipment, and shall conform to the splice manufacturer's instructions for installation. The Contractor shall test each splice at the time of the splicing.

The splices shall meet the following requirements:

a. Splices shall be made only at locations designated in the approved cable plant layout or as approved by the Engineer.

b. Where two backbone cables are routed in the same duct bank, both cables shall not be spliced in the same pullbox.

c. At all designated splice locations, other than drop locations, fibers shall be spliced to provide continuous fiber optic cable lengths.
d. At all designated drop locations, only fibers designated for splicing shall be spliced. All other distribution and backbone fibers shall be routed through the splice enclosure maintaining a continuous fiber optic cable length, with at least 3 feet of slack left within the splice enclosure.

e. Only buffer tubes containing fibers to be spliced shall be opened, except as needed to perform testing of all fibers including spare/dark fiber. The other tubes shall be neatly looped and stored in the enclosure.

f. 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. Splice enclosures, tools and procedures, shall be approved by the cable manufacturer as being compatible with the cable type being delivered.

g. Each spliced fiber shall be protected by shrink sleeving or other method per the fiber manufacturer’s recommendation so as to protect the fiber from scoring, dirt or microbending.

h. Splice loss shall not exceed a mean of 0.1 dB per link. A link is defined as the fiber optic path between any two active components. No splice losses above 0.15 dB shall be permitted. If a splice is measured to exceed 0.15 dB during the splicing process, it shall be remade until its loss falls below 0.15 dB or the Engineer waives the 0.15 dB requirement. Each attempt shall be recorded for purposes of acceptance. If the mean exceeds 0.1 dB in any link, splices in the link shall be remade until the mean loss does not exceed 0.1 dB.

i. All splice losses shall be measured at 1310 nm and 1550 nm in both directions using an optical time domain reflectometer (OTDR). Tabular recordings of the loss and chart recordings of the signature shall be submitted to the Engineer for approval with a record of the OTDR settings and the location of the OTDR locations written on the trace. The Contractor shall submit this information in hard copy and digital format, on CD that may be displayed on a PC operating under the Windows operating system. The Windows operating system version shall be submitted to the Engineer for approval as part of the cable plant design submission. The Contractor, shall provide to the Engineer three copies on CD of any specialized software required to display the data. The State shall have the right to make additional copies of such software.

Testing:

Splice Immersion Test: Prior to installation of the splice enclosures, the following test shall be performed by the splice installer at the Contractor’s facility for each re-enterable splice enclosure model and configuration (i.e., in-line, pedestal, Type 1, Type 2 and Type 3):

Three samples of each type and configuration proposed for installation in the system shall be tested. Each sample shall consist of 72-fiber, 24-fiber and 6-fiber optical fiber cables of the outdoor types described in these special specifications installed into the splice enclosure. Each sample shall be immersed in water under a head of six (6) feet for a period of one week. The ends of the cables installed into the enclosures shall either be sealed so as to prevent water penetration or installed such that they are above the top of the water head. After seven days, each of the samples shall be removed and examined for water ingress. Any visible dampness shall be cause for failure. Failure shall require that the test be repeated after the cause of the failure has been corrected for three samples of the type and configuration that failed.
Splice Enclosure Flash Test: A flash test shall be performed on each splice enclosure after installation of all the splices and sealing of the enclosure. The enclosure shall be pressurized in accordance with the manufacturer’s recommendation and all seals and the air valve shall be thoroughly soaped. The seals and valve shall be monitored for integrity for five minutes. There shall be no air leakage.

METHOD OF MEASUREMENT: Fiber Optic Splice Installation – Type 1, Type 2 and Type 3 will be measured for payment as the number of the type specified actually furnished and installed.

BASIS OF PAYMENT: The unit price bid for each fiber optic splice installation shall include the cost of furnishing all labor, materials, documentation, equipment and testing of the fiber optic cable to complete the work. The cost of the fiber optic cables will be paid for under their respective terms.

Progress payments will be made as follows:

- Ninety percent of the bid price of each item will be paid when it has satisfactorily completed the Fiber Optic Cable Post Installation Test as defined in the Fiber Optic Cable, Single Mode bid items and the Splice Enclosure Flash Test.
- Ten percent will be paid upon system acceptance.