STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
TRENTON, NEW JERSEY 08625

METRIC SPECIFICATIONS FOR FUSION SPLICE AND SPLICE ENCLOSURE FIBER OPTIC CABLE

N.J. Specification No. EBM-FOC-SPLC-1 Effective Date: July 1, 2001

New Jersey Department of Transportation Specifications for Fiber Optic Fusion Splice and Splice Enclosure.

The purpose of these specifications is to describe minimum acceptable design requirements for this item.

GENERAL - I

1-1 Select fibers in a fiber optic trunk cable shall be spliced to another trunk cable or to a termination cable as required for the connection of system components at locations as shown in the contract documents, and shall conform to these special provisions.

1-2 The splices shall only be fusion type, mechanical splices are not permitted.

1-3 The splices shall be encased in a splice enclosure at all locations identified in the contract documents.

1-4 If the installer requires additional splice enclosures to support the pulling plan, these enclosures shall be provided and installed at no additional cost to the State.

1-5 The construction and testing of the fiber optic splices and splice enclosures shall comply with all applicable Electronic Industry Standards (EIA/TIA), International Telegraph and Telephone Consultative Committee (CCITT), ANSI, ASTM standards and FDDI specifications.

SPLICE CHARACTERISTICS - II

2-1 The field splices shall connect the fibers of two or more fiber optic trunk cables together or shall connect termination cable fibers to trunk cable fibers as indicated on the plans and conductor schedules. All remaining fibers shall be passed through the splice enclosure without damage.

2-2 All fusion splices shall be made with a fusion splicer. The unit shall be portable, capable of AC or internal battery-powered operation. The unit must be able to splice fibers with 250 micrometer coating and 900 micrometer coating with little or no modification in the field. The fusion splicer shall be capable of full battery recharge in an eight-hour charging period. The fusion splicer shall have the following capabilities:
A. splice-protection-sleeve heater

B. battery with charging unit and associated power cables,

C. spare electrodes, fuses and lamps

D. power meter/light source with carrying cases.

2-3 The power meter/light source shall be a calibrated pair that is portable, battery operated. The units will meet or exceed the following parameters for operation on single mode fiber:

A. operating wavelength: 1 300 / 1 550 nanometers

B. range: +3 to -45 dBm

C. measurement scale: dBm

D. accuracy: 0.5 dB or better

2-4 Splice construction is detailed in the Supplemental Specifications.

SPLICE ENCLOSURE CHARACTERISTICS - III

3-1 The splice enclosure shall be air tight, water tight, corrosion resistant, rodent proof, and re-enterable.

3-2 The splice enclosure shall be manufacturer certified for below ground, junction box (pull box) installation.

3-3 The splice enclosure shall be no larger than 178 millimeters diameter by 762 millimeters long (nominal). Small junction boxes or enclosures may require a smaller splice case, for which the splice case shall be approximately 572 millimeters long, 140 millimeters wide, and 127 millimeters high (inner splice case shell dimensions).

3-4 The splice case shall be designed and equipped with the necessary mounting hardware to be attached to the side of the junction box, and to be suspended vertically with sufficient clearance at each end for acceptable cable bends.

3-5 The splice enclosure shall be a complete kit including the following:

A. Connection brackets

B. Stand-off studs with locking nuts

C. Grounding clamps

D. Outer shell (usually in 2 halves)

E. Inner shell assembly in two parts

F. Splice trays with all required retainers and supports

G. Cable restraints

H. End plates (caps) as required

I. Inner shell supports

J. Outer shell clamp assemblies

K. Insulation/sealing tape

L. Resin filling cups and funnels

M. Resin encapsulant sealant

3-6 The splice enclosure shall be designed so that the encapsulant sealant will fill the area between inner and outer shells and provide a moisture barrier. The sealant input method shall be by pouring in through sealable ports. The sealant shall be such that it is easily removed to provide for a re-enterable enclosure.

3-7 The splice enclosure shall be designed so that the fiber optic cable shall enter the splice enclosure through the end plates. The end plates (or caps) of the splice enclosure shall be air and water tight, and shall form an air and water tight seal with the splice case body. Each end plate shall have factory installed cable entry inserts for two cables for securing the entering cables in an air and water tight seal. Fiber optic cables shall be restrained within the splice enclosure such that there is no discernible tensile force on the optical fiber.

3-8 The splice enclosures shall have sufficient capacity to splice up to 144 optical fibers; although, the nominal maximum number of optical fiber splices is 48 per enclosure. In some cases one trunk cable fiber shall result in two fiber splices. This situation occurs whenever trunk cable fibers are spliced to termination cable fibers. The fibers in the trunk cable are cut and spliced to two termination cable fibers to provide a continuous path from the trunk cable, into the serviced item through the termination cable, and back out to the trunk cable fiber (and on to the next serviced item).

3-9 Splice trays shall be provided in each enclosure for holding, protecting and organizing the optical fibers. Splice trays shall be all dielectric, provide sufficient space for coiling of optical fibers to prevent micro bending, and have capability to pass uncut/unaffected fibers through the enclosure. The placement of the bare optical fibers in the splice tray shall be such that there is no discernible tensile force on the optical fiber.

3-10 A single splice tray shall be used for no more than the maximum number of optical fiber splices , depending on the manufacturer's specification. Sufficient splice trays shall be provided with each splice enclosure to accommodate the required splices.

TESTING - IV

4-1 Attenuation tests shall be performed on all spliced optical fibers with an OTDR (Optical Time Domain Reflectometer) capable of recording and displaying anomalies of 0.2 decibels as a minimum. Single mode fibers shall be tested at 1 300 nanometers and 1 550 nanometers. The OTDR with transit case shall be designed for use on single mode fiber at 1 300 and 1 550 nanometer wavelength, and shall be a field unit exhibiting the following characteristics:

A. dead zone: 15 meters or better

B. attenuation range: 15 decibels or better

C. distance range: 10 kilometers or longer

D. accuracy: ± 2.0 meters

E. printer: must be capable of printer output internal storage.

4-2 The OTDR shall have a printer capable of producing a verifying test trace with fiber identification, numerical loss values, the date and the operator's name. It shall also have a DOS based 90 millimeter disk recording capability that has associated software to do comparisons and reproductions on A4 paper (210 by 297 millimeters), via a personal computer.

TRAINING - V

5-1 Prior to constructing the first splice unit, training shall be provided for the Department's engineering, maintenance and operations staff, at a facility provided by the Department. The training shall include all material and manuals required for each participant.

5-2 Maintenance training of fusion splicer and OTDR operation shall be provided for a minimum of 32 hours for at least 5 personnel with an electronics background. The training shall include operation instructions, theory of operation, circuit description, field adjustments, preventive maintenance procedures, troubleshooting, interpretation of results, and repair of all components.

INSTRUCTIONS AND GUARANTEES - VI

6-1 One set of complete assembly plans and instructions, and installation and use manuals shall be supplied with each five splice enclosures furnished.

6-2 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this specification shall be addressed to the Manager, Office of ITS Engineering, New Jersey Department of Transportation, P.O. Box 613, 1035 Parkway Avenue, Trenton, New Jersey 08625.

6-3 The Supplier agrees upon the request of the Manager, Office of ITS Engineering to deliver to the Office, a sample of a completed spliced cable in a splice enclosure, to be supplied in compliance with these specifications for inspection and test before acceptance. The sample shall be returned.

6-4 The supplied splice enclosures shall carry a two-year warranty, from the date of project acceptance by the State, to be free of defects. The installer shall fully inspect the units prior to installation and within the warranty period. The installer shall be fully responsible for the installation of defect free units and for the replacement of any unit found to be defective due to improper construction or improper installation for two years after the State's acceptance of the project.