

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION
SUPPLEMENTAL SPECIFICATION 904
FIBER OPTIC CABLE
FOR TRAFFIC SIGNAL INTERCONNECT**

JANUARY 19, 2007

904.01 Fiber Optic Cable. Furnish single mode (SM) cable containing the number of fibers as specified. Single-mode cable shall have an 8.3 micron nominal core diameter.

All fiber optic cable supplied shall utilize water blocking tape technology inside the outer cable jacket and shall be an accepted cable with the Rural Utility Service (RUS).

All fiber optic cable glass shall be supplied by the same manufacturer and shall be part of a fiber optic cable utilizing loose tube construction with the following properties:

Parameters	Single Mode
Type	Step Index
Core Diameter	8.3 μm (nominal)
Cladding Diameter	125 $\pm$ 1.0 μm
Core to Cladding Offset	$\leq$ 0.8 μm
Coating Diameter	245 $\pm$ 10 μm
Cladding Non-Circularity	$\leq$ 1.0%
Proof Tensile Test	0.7 GPa
Attenuation	@ 1310 nm $\leq$ 0.4 dB/km @ 1550 nm $\leq$ 0.3 dB/km
Chromatic Dispersion Zero Dispersion	1310 $\pm$ nm (centered on a nominal operating wavelength of 1310)
Zero Dispersion Slope	$\leq$ 0.092 ps/nm ² /km
Maximum Dispersion	$\leq$ 2.8 ps/nm/km at 1285 – 1330 nm
Cut-Off Wavelength	1260 nm

Where armored cable is specified, it shall be on the RUS acceptable material list.

Where self supporting cable is specified, the messenger cable shall be 0.25 inch (6 mm) diameter and shall be on the RUS acceptable material list.

Provide documentation showing RUS acceptance.

Cables shall be packaged wound on wood spools or reels. All reels shall be the property of the Contractor and he is solely responsible for the return or disposal of the reels that the cable is shipped on. The diameter of the drum shall be a minimum of 20 times the

diameter of the cable. Each reel shall contain only one continuous length of cable. Labels shall be attached to the reel showing length, cable identification name and number and date of manufacture.

The outer ends of the cable shall be securely fastened to the reel head so as to prevent the cable from becoming loose during transit. Both ends of the cable shall extend a minimum of 10 feet (3 m) into the inside of the cable reel to provide access for testing. Test tails shall be secured to the inside of the reel in such a manner that they will not become loose during transportation. End seals shall be applied to each end of the cable to prevent the intrusion of moisture into the cable.

Documentation shall accompany each reel documenting the tested attenuation of each cable fiber in db/km.

All fiber optic cable used as part of the communication system shall be rated for outdoor use unless specifically noted in the plans. Cable shown for indoor use shall be riser and plenum rated.

Provide fiber optic cable rip cords made from either standard Telco nylon material or from braided Kevlar. No un-braided Kevlar will be accepted.

Cable jacketing shall be permanently labeled approximately every two feet (0.6 m) with the cable manufacturer's name, cable type, fiber count, manufacturing date and incremental cable length. Cable length shall refer to the cable sheath length.

904.02 Fan-Out Kit. Furnish fiber fan-out kits for loose tube drop cable terminal ends that need to be fitted with connectors. The fan-out kit can be an individual buffer tube kit, multiple buffer tube kit or spider design kit. All fan-out kits shall have a minimum of 24" (600 mm) of tubing covering each fiber when installation is complete. Only one type of fan-out kit may be used throughout the project. Fan-out kits shall be rated for outdoor use (-40° F to 158° F (-40° C to 70° C)).

904.03 Drop Cable. Furnish fiber drop cables for loose tube fiber optic cables. Drop cables shall be made by the same glass and cable manufacturer that provides the trunk cable.

904.04 Fiber Optic Patch Cord. Furnish a fiber patch cord between each fiber optic transceiver and each termination panel. The fibers shall be single mode as required to match the trunk cable and transceiver. Patch cords shall be fitted with ST type connectors unless the proposed/existing equipment requires a different connector. Connectors shall be attached to the patch cords using an epoxy crimped methodology where the Kevlar is crimped to the connector. Patch cords shall be factory manufactured and tested and have the same type and size fiber as used on the project. Patch cords shall be color coded for single mode fiber.

904.05 Fiber Optic Connector. Unless a different connector is required for compatibility with existing or proposed active components, fiber optic connectors shall be field installable ST compatible, ceramic ferrule, with the fiber permanently secured within the ferrule by epoxy (heat set), chemically cured or a hot melt adhesive in accordance with the connector and/or the epoxy manufacturer. When connectors are installed outside of a controlled environmental location, the connector operating temperature shall be minimum -40° F to +158° F (-40°C to +70°C). For those applications within a controlled environmental location, the operating temperature shall be minimum -4° F to +140° F (-20°C to +60°C).

904.06 Splice Enclosure. Splice enclosures shall be waterproof. Included with each enclosure shall be aerial or pull box wall mounting brackets as required by the particular splice location. Where armored cable is specified, the armor shall be grounded in the grounding system provided with the enclosure. As a minimum, a 12 fiber splice tray shall be provided with the enclosure. Where more than 12 fibers are specified, additional splice trays shall be included as necessary to accommodate the fiber count. The splice enclosure shall feature a moisture tight sealing arrangement which is re-enterable for system expansion and repair. No stress shall be placed on finished splices within the splice enclosure.

904.07 Fiber Optic Modem. Data communications on the fiber optic cable shall require fiber optic modems. The use of laptops on the fiber optic system will require fiber optic modems with RS-232 ports to communicate with the central location. The modems shall be active devices providing full-duplex communications via RS-232 hard-wired to a female connector or a pre-approved RS-232 data connector. The nominal operating wavelength shall be 850 nm. The minimal power budget shall be 14 dB minimum with single mode fiber. The modem shall have an operating temperature range of -40°F to +158°F (-40°C to +70°C).