

Welcome to GR-3120:

Rugged Connector Technology for Outside Plant

By Randy Reagan ■ *ADC (formerly FONS Corporation)*

Pre-connectorized fiber optic cable emerged over the past year as a major innovation that lowers installation cost, speeds up construction time, and improves reliability. But what about the connectors themselves? Connector technology has also kept pace. New connector designs are rugged enough to be used in the outside plant, and rugged enough to withstand rough handling by installers as new businesses and dwelling units are added to the network.

The result: Service providers can place optical cables and connectors near potential subscribers so that consumers can be connected quickly. When the consumer requests service, the installer routes a pre-connectorized fiber drop cable from the street to the customer premises to complete the fiber circuit and enable service activation.

Here's what to think about when laying out a network to take advantage of the new technology, and here's what to look for when you specify connectors to match.

Moving Connectors Outdoors

Fiber optic connector designs of just a few years ago were restricted to indoor use, due to instability at temperature and humidity extremes. Recent materials enhancements in precision plastic and ceramic components have improved performance and repeatability, however.

What's more, enhancements to epoxy application and polishing have resulted in highly accurate ceramic end face geometries that are extremely stable under wide ranges in temperature and humidity, even outdoors in harsh climates. Today connectors such as the SC Ultra-polished Connector (UPC) or Angled Polish Connector (APC) are designed and tested to maintain reliable performance.

Make no mistake. These improved connectors still require housings and clo-

sures to seal out moisture and isolate the connectors from rugged handling typically found in the outside plant. Enclosures forming a secondary layer of protection are often costly and make access difficult. Further innovations in enclosure design would increase the ability of fiber optic connectors to stand up to the rigors of the outside plant environment.

Here's How They Work

New rugged fiber optic connector systems have connectors and adapters that are hardened with a rugged outer plastic shell to protect against outside plant environmental factors including extreme temperature, moisture, ultra-violet radiation, and even chemical exposure. The rugged connectors are designed to provide mechanical strength for attached cables so that they can withstand the stress of rugged installation forces for drop cables.

The rugged connector systems are also watertight and can be installed on the external surface of an enclosure to provide easy access points in underground as well as above-grade or aerial installations.

The rugged connector systems are based on standard connector technology that specifies high performance ceramic ferrules and sleeves as the basis for mating fiber terminations. These connectors conform to industry standards, including GR-326 and the FOCIS specifications defining intermateability and connector geometry.

Rugged adapters are typically mounted in multi-port terminals or closures strategically located, for instance at the street outside a residence.

Rugged adapters are also used to attach the drop cable that runs from the terminal to the Optical Network Terminal (ONT) located at the premises. The rugged connector is typically provided as part of a factory connectorized drop cable assembly that is pre-tested and certified to meet performance requirements.

The rugged connector is sealed to the adapter using O-rings as it is installed into the adapter. The rugged connector should also come with a protective cap that seals the connector and keeps the end-face clean until it is ready for use.

Multi-Fiber Connectors, Too

The rugged connector technology has been extended to include multiple fibers within a single connector. The rugged multi-fiber connector employs the MT technology to simultaneously align fibers in a linear array.

Like in the single-fiber "simplex" connector, the rugged multi-fiber connector is provided with a rugged plastic outer shell that protects against all the hazards in the outside plant environment. Rugged multi-fiber connectors allow rugged drop terminals to be quickly connected in place if the main fiber cable comes with multi-fiber outlet ports. Relatively unskilled workers can connect multiple fibers with a single twist!

Not only drop cables can be deferred. Because of the ease of mating the rugged multi-fiber connectors to the outlet ports, installation of the adjoining cable and associated rugged terminal can be deferred until service is requested as well. They can be installed to the residence within hours of service-order completion. This drastically cuts up-front deployment costs and reduces the service provider's risk.

Get the new Standard

A full qualification program for these connectors ensures a particular design can achieve the desired reliability. A new requirement document, "GR-3120 Generic Requirements for Hardened Fiber Optic Connectors," has been published just this year to fully define the testing program for rugged connectors.

GR-3120 is based on GR-326, "Generic Requirements for Single Mode Connectors and Cable Assemblies," which

defines testing programs for standard SC (APC or UPC) connectors. But it includes additional requirements for direct exposure of connectors to the outdoor elements. All of these reliability tests are designed to examine the ability of the rugged connector system to sustain optical performance over the intended life of the design.

Designed for Intermateability

Yes, you can mix and match standard connectors! Rugged connectors and adapters have interface specifications that enable connectors and adapters from different manufacturers to be connected together without impacting performance.

More than mechanical mating is re-

quired. The testing includes mating connectors from one supplier to adapters of another supplier and vice versa. The cross-mated pairs are subjected to a series of environmental tests that include temperature and humidity variation, vibration, mechanical stress tests and a sealing test under stressed conditions. These tests are monitored optically to ensure that rugged connectors and adapters from the various suppliers can be used together in the same service environment. **BBP**

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Getting the Standards

FOCIS refers to the Telecommunications Industry Association (TIA) requirements for Fiber Optic Connector Intermateability Standards. See <http://www.thefoa.org/tech/focis.html> for details. TIA (www.tiaonline.org) published this as "Fiber Optic Connector Intermateability Standard (FOCIS), Type SC and SC-APC, FOCIS-3," TIA-604-3-B. The document is a revision of TIA-604-3-A, was issued as an addendum to TIA/EIA 604, and 604's provisions apply to it. To obtain copies, contact Global Engineering Documents at 800-854-7179 or visit global.ihs.com.

TIA sets the physical dimensions, but it does not do testing for interoperability. For that, see GR-3120, Generic Requirements for Hardened Fiber Optic Connectors (HFOCs), which was issued by Telcordia Technologies last March. Telcordia develops standards for sale.

Under the Telecommunications Act of 1996, industry-wide "Generic Requirements" from organizations such as Telcordia that are not accredited by the American National Standards Institute (ANSI), must be established through a process that is open to participation by all interested parties. Otherwise, they are subject to antitrust prosecution. Unlike accredited organizations (IEEE, ASTM, and so forth), there is a fee for companies that want to participate. The standards discussed in this article are available for sale by Telcordia, at www.telcordia.com/services/genericreq/index.html or call 800-521-2673. The company is in Piscataway, NJ. Telcordia sells these standards for enterprise-wide use; fees vary by enterprise size.

– Steven S. Ross

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