

Terminating and crimping for fiber optics: methods and tips



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For any fiber optic network, it's important that the fibers are connected properly. A reliable connection will maintain efficient network operation by minimising light loss, and will avoid any problems from moisture or dirt getting in to the connector.

To connect to other devices or equipment, an optical fiber needs to be terminated. This means either fitting a connector to its end, or connecting it directly to another fiber, known as splicing. If a connector is used, the two fibers can later be disconnected for testing or to change the routing of the cable, while splicing is permanent.

Splicing methods compared

There are two main methods of splicing: mechanical and fusion. In mechanical splicing, the ends of the two fibers are lined up so light can pass, and then a cover is used to hold them together permanently. Fusion splicing typically uses an electric arc to melt the ends of the two fibers, and bond them together in a permanent weld.

Comparing these two methods, mechanical splicing is straightforward, and the covers are small and low cost. Fusion splicing, on the other hand, requires the use of an expensive fusion splicer machine, but creates a connection that has lower transmission losses than mechanical splicing and lower reflectance, as well as providing a more reliable connection, with no polishing required. Light can be lost or reflected if fibers are not properly aligned, if there is an air gap, or if there is dirt or moisture between the two fibers.

Connector termination methods

For termination with a connector, one method is to use a 'pigtail', which is a short single optical fiber, with a connector pre-installed at one end. The bare fiber end can be spliced, typically using fusion splicing, to the main fiber we wish to terminate. If it is a multi-fiber cable, each of the component fibers can be connected to a separate pigtail, and hence to a separate connector.

An alternative method is to use a 'fanout kit', also known as a 'breakout kit'. This enables each fiber in a multi-fiber cable to be terminated by using an empty 'jacket' that fits over the end of the fiber, and which can then be attached to a connector. One advantage of this method is that no splicing is required, saving time and cost.

The choice of method used depends on the application, the performance required, and whether we are using single-mode or multi-mode fiber. Single-mode fiber requires a cleaner, more accurate connection to avoid loss and reflectance, so is often pre-terminated in a factory, while multi-mode fiber is easier to terminate in the field.

The role of crimping

To attach the connector to the fiber, the installer can use glue or crimping. An epoxy or other adhesive can be used to glue the fiber into the connector's ferrule, and the end of the fiber then polished. The epoxy needs curing, which can take overnight, or be speeded up using a curing oven.

An alternative is to connect the connector by crimping, where a crimping tool is used to apply mechanical force to a crimp barrel (a small metal sleeve or ring), thus deforming it and forming a tight bond with the connector itself. Crimping is faster than gluing, but is typically more expensive, and can result in slightly higher light losses than a glued connection.

For successful crimping, make sure to use the correct crimping tool and sleeve, as recommended by the connector manufacturer. The operator also needs to use the specified force when crimping, to avoid damage to the connector and potentially the fiber itself. While the procedure is not overly

difficult, the operator must be properly trained, particularly when they are required to install multiple different types of connector and cable, and to select the right crimping tool every time.

Connection in harsh environments

Whichever method of termination is used, the connector should be robust and reliable enough for the conditions. For outdoor applications, this means selecting a rugged connector such as the 4000 series from Bulgin. This protects the ends of the fiber from dirt and damage, and provides a seal to prevent any moisture ingress and thus ice forming.

The 4000 series provides an industry-standard LC interface as specified by IEC 61754-20. To save time and simplify installation, the connectors are available as pre-terminated options, already connected to a suitable cable of up to 450m in length.

4000 Series Fiber product code: PXF4050

For duplex fiber connections, the 6000 Series Fiber would be more fitting. Like the 4000 Series Fiber, the 6000 Series Fiber connector is suited for outdoor broadcasting, FTTx, server room engineering, civil engineering and aviation & rail applications.

The 6000 series harsh environment optical connector is designed for years of service in areas where unprotected physical contact fiber, isn't an option. Featuring a secure, yet easy to operate 30 degree locking mechanism, this series has field proven IP68 and IP69K performance.

In comparison to the simplex 4000 Series Fiber connector, the additional glass fiber on this duplex cable can double the data transmission capabilities where required.

6000 Series Fiber product code: PXF6050

Visit Bulgin's [Connectivity Community](#) forum and blog for expert advice on [optical fiber connectors](#) and installations in harsh environments.

