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## BOF for big performance

by David Mazzaresse

Today's high-speed networks are pushing optical fiber into buildings and closer to the workstation to carry fiber's high bandwidth to the end-user. As fiber is installed in the last mile of these networks, it is subject to a greater degree of bending, since it is being installed in smaller distribution cabinets and more compact fiber-management systems.

All this is placing more stringent demands on the reliability and bend performance of singlemode fibers than ever before. These applications have led the industry to develop new types of fiber optimized for use in the small spaces found in these sections of access networks and enterprise networks.

Specifying the best of these "bend-optimized" fibers (BOF) for specific network needs begins with an understanding of BOF's design and performance attributes. Important for the user to realize is that bend performance is just the first of the characteristics to look for to ensure getting the most value.

In fiber applications, bends can be defined as deviations from a straight fiber path. Such deviations can cause light to scatter and escape from the core of the optical fiber, resulting in a loss of signal.

There are two types of bends. Macrobends are large enough to be seen by the human eye; they can be caused, for example, by the routing of a jumper in a patch panel. Microbends are microscopic deviations along the fiber axis; a microbend can result if fiber is squeezed by the cable buffer or jacket material as it contracts at low temperatures. Both types of bends can result in increased attenuation (loss of signal).

While bend-optimized fiber is designed to reduce attenuation caused by bending, the best value is a fiber that has bend performance optimized for the application, to provide superior optical and mechanical performance for the life of the fiber. A bend-optimized fiber should provide top performance in both microbending and macrobending, enabling its use in smaller enclosures and innovative cable designs. It should be fully compliant with the new International Telecommunications Union (ITU) G.657 standard and fully compatible with standard industry requirements and procedures for splicing, polishing, cleaving and connecting.

Other critical performance characteristics to look for in a BOF include: full spectrum attenuation performance from 1,260 nm to 1,625 nm (even in tight bends); zero water peak to ensure the product is ready for future bandwidth upgrades; low splice loss when splicing either to itself or to the existing fiber base; and low polarization mode dispersion (PMD).

The G.657 standard describes two categories of this fiber type. Class A fibers are suitable for use from 1,260 nm to 1,625 nm. These have tighter dimensional tolerances than G.652D fibers for improved connectivity. The attributes of these fibers are optimized for reduced macrobend loss for bends as small as 10 mm radius, while their specifications for attenuation, chromatic dispersion and PMD remain the same as those specified in G.652D.

Class B fibers are suitable for transmission at 1,310 nm, 1,550 nm and 1,625 nm for restricted distances that are associated with in-building transport of signals. These fibers are capable of low macrobend losses at tight bend radii, but can have different splicing and connection properties than G.652 fibers, due to their varied designs and broad range of values for mode field diameter.

One of the most critical considerations is the mechanical reliability of the fiber under reduced bends. Be wary of any bend-insensitive fiber design that allows for bends that are so tight they threaten the mechanical reliability of the fiber. Low loss in a tight bend (e.g. 5 mm to 7 mm in radius) may look like good performance during installation, but a bend this tight could result in a catastrophic fiber break a few years after installation.

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