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# Optical Fiber Cables for Indoor/Outdoor Applications

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Optical fiber cables are designed to provide optimum performance over their service life when deployed in applications for which they are intended. When selecting an optical fiber cable design, a number of factors must be considered to ensure that the best-fit cable design is selected for a particular application. The primary considerations in selecting an appropriate cable design are the installation method, the environment (including the potential for extreme weather or the need to span diverse environments), system performance requirements, fiber count, and termination method.

### **Outside Plant Environment**

Outside plant cables must be capable of withstanding a variety of environmental and mechanical extremes. Such cables must offer excellent attenuation performance over a wide range of temperatures while providing protection from water ingress, solar radiation (ultraviolet protection) and the effects of lightning or gnawing rodents. Waterblocking capabilities must be provided to ensure that water cannot migrate through the cable and freeze or seep into sensitive electronics. The cable must be sufficiently rugged to endure the rigors of installation. These cables are designed to comply with ICEA-640, "Standard for Fiber Optic Outside Plant Communications Cables," in accordance with TIA/EIA-568-B.3, "Optical Fiber Cabling Components Standard," for outside plant applications.

### **Inside Plant Environment**

Unlike outside plant cables, inside plant cables generally experience a controlled, stable environment. The cables must meet the stringent flame-resistance and/or smoke generation requirements of the National Electrical Code<sup>®</sup> (NEC<sup>®</sup>) and local building codes, dependent upon their installed location and be marked for the intended application as OFN/OFC (general purpose), OFNR/OFCR (riser), or OFNP/OFCP (plenum). The cables should be easy to terminate and must be available in fiber counts required by the network architecture. These cables are designed to comply with ICEA-596, "Standard for Fiber Optic Premises Distribution Cable," in accordance with TIA-568-B.3 for inside plant applications.

### **Indoor/Outdoor Optical Fiber Cables**

It is often advantageous to install a single cable in both the indoor and outside plant environments of a network. The system designer can reduce complexity and cost by eliminating a transition splice or cross connect point where the cable transitions from the outside plant into the building. Cables suited for both indoor and outdoor applications must be specifically constructed to withstand the harsh environmental conditions of the outside plant and to pass the rigorous industry flame testing requirements for building safety. These indoor/outdoor cables

are designed to comply with ICEA S-104-696, "Standard for Indoor-Outdoor Optical Fiber Cable." ICEA-696 is a newly published industry standard which establishes requirements for indoor/outdoor cables. Prior to ICEA-696 there was no industry standard for optical fiber cables installed in indoor/outdoor applications.

### **FREEDM® Optical Fiber Cables**

Corning Cable Systems offers a family of cable designs that give the network designer various options to efficiently manage indoor/outdoor applications with a single cable type. Corning Cable Systems offers ribbon, loose tube, and 900 µm tight buffered fiber cable constructions such as the FREEDM® Loose Tube Cable, FREEDM® /LST™, FREEDM® Ribbon Cable, and FREEDM® One Cable.

Corning Cable Systems has historically designed, specified and recommended optical fiber cable solutions in accordance with Industry Standards. ICEA-696, the optical fiber indoor/outdoor cable standard provides cable design and performance guidance that includes a tight buffer cable option in addition to loose tube and ribbon cable designs. To date, this is the first ICEA standard that provides guidance on tight buffer cable in the outside plant. The ICEA-696 document covers optical fiber communications cables intended for use in Indoor-Outdoor optical fiber applications and is not intended to be a carte blanc approval of tight buffer cable for outside plant applications. FREEDM® One indoor/outdoor tight buffered cable has been designed and tested to meet ICEA-696 criteria such that reliable outside plant performance is achieved.

### **FREEDM® One Indoor/Outdoor Tight-Buffered Cable**

FREEDM® One Indoor/Outdoor tight-buffered cable contains 900 µm tight buffered fibers with water-swellaible strength yarns and a flame retardant outer jacket. The cable is designed for use in inter-building campus backbone, building backbone, and horizontal applications for fiber counts up to 72 fibers. FREEDM® One cable is listed either OFNP for plenum applications or OFNR for building riser applications. The cable can also be installed in other environments according to the NEC and local building codes. The OFNP listing allows the cable to be installed in all applicable areas of a building to include a single run from the point of entrance, through a riser space, and into the work area in the horizontal (plenum) space. FREEDM® One cable is a fully dry water-blocked, UV-resistant cable designed to meet the mechanical and environmental requirements for aerial, direct buried, and duct outside plant applications. Additionally the cable contains tight buffered optical fibers, which are optical fibers that are directly coated with a thermoplastic buffer to a diameter of 900 µm. Tight buffered fibers can be directly terminated with field installable optical fiber connectors, such as the Corning Cable Systems' UniCam® connectors, which reduce installation time and expense when compared to loose tube cable termination with buffer tube fan-out kits. The cable is also smaller, lighter and more flexible.

### **FREEDM® Loose Tube Cable**

FREEDM® loose tube cable is designed primarily for inter-building campus backbone and building backbone applications where the fiber count exceeds 24 fibers. The loose tube design allows greater fiber density when high fiber counts are required. Corning Cable Systems FREEDM® loose tube cable is OFNR listed for riser applications according to the NEC and local building codes where the majority of high fiber count backbone cables are installed. FREEDM® is also OFNP listed for plenum applications. FREEDM® loose tube cable is available in fiber counts up to 288 fibers for riser rated and 72 fibers for plenum in a proven, reliable cable design.

**FREEDM® LST™**

FREEDM® LST™ cable offers the benefits of FREEDM® loose tube cable with compact design in fiber counts from 2 to 24 fibers. FREEDM® LST™ is preferred for inter-building campus backbone and building backbone applications where fiber counts are low and conduit space is limited. FREEDM® LST™ is OFNR listed for riser applications.

**FREEDM® Ribbon Cable**

FREEDM® Ribbon cable is designed primarily for inter-building campus backbone and building backbone applications where the installed base of outside plant cabling consists of ribbon cable. The FREEDM® Ribbon cable is available in fiber counts up to 216 fibers and incorporates a single tube design in which fiber ribbons are placed in a gel-filled central buffer tube to isolate them from external forces. The FREEDM® Ribbon cable is OFNR listed for riser applications. Ribbon cable provides higher fiber counts in a very small cable diameter. Ribbon cable offers advantages when terminated with factory made ribbon assemblies or modules using mass-fusion splicing techniques, or when installed as a factory terminated cable assembly complete with hardware and/or connectors on one or both ends.

**Summary**

Indoor/outdoor cable must be designed and tested to provide reliable performance in all environments. Corning Cable Systems' FREEDM® family of indoor/outdoor cables are available in tight buffered, loose tube and ribbon cable types and are thoroughly designed and qualified in accordance with the industry standard, ICEA-696. These cables are flame retardant, ETL listed, UV-stabilized and fully waterblocked. They are suitable for installation in duct, aerial, and direct buried applications as well as inside buildings because they are listed either OFNR or OFNP. FREEDM® cables offer many advantages and reduce complexity since there is no need for a transition splice or inter-connect point when entering a building.