Engineering Services Department
800 17th St NW | PO Box 489
Hickory, North Carolina 28603-0489

800 743-2671
f 828 901-5533
www.corning.com/opcomm

Applications Engineering Note

Microduct Cable Air-Assisted Installation Considerations

AEN096, Revision 5

When installing optical fiber cables into microducts (Table 1), some unique parameters must be considered. Applications Engineering Note 049, entitled, “Air-Assisted Cable Installation Technique,” provides relevant information that is also applicable to the installation of optical fiber cables into microducts. This document, however, offers specific guidance and considerations that apply to micro cable installations, such as those using Corning MiniXtend® Cable, in addition to the information presented in AE Note 049.

Jetting vs. Blowing

Jetting and blowing are two common air-assisted cable installation techniques. Both methods require pushing the cable with a tractor mechanism while blowing compressed air into a pre-installed duct around the cable being installed. Both rely on airflow to help “float” the cable inside the duct, minimizing sidewall pressures to reduce friction between the cable and the duct.

Jetting and blowing differ, though, in how pulling force is applied to the cable. Jetting uses a reaction head (or parachute) attached to the cable. A differential pressure across the reaction head creates a pulling force on the cable. Blowing does not use a reaction head. Instead, the pulling force on the cable is due to fluid drag of air rushing along the cable. This pulling force is distributed along the cable length.

MiniXtend Cable

MiniXtend cables are designed with high-density polyethylene (HDPE) outer sheaths in order to minimize friction with the inner surface of microducts. These cables were also designed with optimal stiffness properties to help ensure they will resist buckling forces yet easily negotiate changes in direction of the microduct along the installation route. The MiniXtend cable design also provides the highest fiber density, yielding a relatively small cable OD. The individual fibers are bundled into groups of twelve within the cable’s buffer tubes, much like a standard outside plant cable. MiniXtend HD cables have 24 fibers in each tube, allowing for higher fiber counts for a given cable size or smaller cables for a given fiber count. The buffer tubes inside MiniXtend cable contain filling compound in order to prevent water migration along the length of the cable in the event of a breached cable sheath. The cables are rated for outdoor use and have been tested to meet the rigorous water ingress tests for outside plant cabling (i.e. IEC60794-5-10). In line with standard industry practice for micro cables, Corning recommends these cables be placed in a duct or microduct for protection.

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MiniXtend® Cable		Duct	
Maximum Fiber Count	Nominal Outer Diameter (mm)	Smallest Recommended Microduct Size (ID, mm)	Calculated Fill Ratio (%) (1)
72	5.4	8	68
96	6.3	8	79
144	8.1	10	81

(1) Fill ratios have been calculated based on cable diameter vs. duct inner diameter

Table 1: Smallest Recommended Microduct sizes for MiniXtend Cable

MiniXtend HD Cable		Duct	
Maximum Fiber Count	Nominal Outer Diameter (mm)	Smallest Recommended Microduct Size (ID, mm)	Calculated Fill Ratio (%)(1)
144	6.3	8	79
192	7.5	10	75
216	8.0	10	80
288	9.7	12	80

(1) Fill ratios have been calculated based on cable diameter vs. duct inner diameter

Table 2: Smallest Recommended Microduct sizes for MiniXtend HD Cable

Microduct

There are many different sizes of microducts available today with inner diameters ranging from 3.5 mm to 14 mm. Microducts are typically specified with an outer diameter and an inner diameter (i.e. 12.7/10 mm which is 12.7 mm outer diameter and 10 mm inner diameter). Fill ratio is very important when considering which duct to use. High fill ratios greater than 85% decrease the amount of airflow around the cable, resulting in decreased blowing distance.

Some microduct manufacturers use self-lubricating technology inside of the duct and do not require lubrication to be used during installation. Some blowing equipment manufacturers still recommend the use of jetting lubrication. Corning Optical Communications recommends consulting with the duct manufacturer to see if additional lubrication is needed. Today's microducts are suitable for many different types of installations. They can either be direct buried into the ground, or can be pulled into pre-existing conduit and used as innerduct. Microduct can be used for aerial applications as well, including lashed or self-supporting options. Duct manufacturers also pre-bundle microducts allowing for faster installations. This duct network configuration allows service providers to blow in micro cables as needed to optimize initial system cost.

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Figure 1: Bundled Microduct

Figure 2: Microduct Coupler

Installation

The air-assisted installation technique involves pushing the cable with a tractor mechanism while blowing compressed air into a pre-installed microduct. This technique allows the cable to “float” inside the duct during installation while minimizing sidewall pressures by reducing friction between the cable and the duct wall. Corning Optical Communications has conducted field trials that have confirmed the capability of blowing MiniXtend® cable for distances up to 6,500 ft. (2000 m) at installation speeds up to 490 ft. /min (150 m/min). Distances beyond 6,500 ft. (2000 m) are possible in fully optimized conditions. A realistic target distance for most scenarios is between 3,000 ft. (915 m) and 5,000 ft. (1,520 m). Distances and speeds are dependent on a number of factors including the ambient temperature, microduct conditions (route and number of bends), fill ratio and blowing equipment utilized during the install.

A standard air compressor is used to supply air for blowing micro cables. An air cooler at the discharge of the compressor is recommended in order to maintain lower air temperatures within the microduct during installation. The lower air temperatures help to ensure the lowest friction between the microduct and the cable sheath. Additionally, the air should be as dry as possible for optimal jetting. The ideal compressor for this applications would supply air at a pressure of 220 psig (15 bar) and a rate of up to 33 cfm (0.93 cubic meters/min) for the installation, although, excellent results can also be achieved using compressors with lower ratings.

The mechanical push force for the micro cable installation can be driven by either a pneumatic or an electric motor. For added protection of components, the motor should have an automatic shut-off or clutch feature that limits the push force that is applied to the cable. This can also be done by pre-calibrating the machine by completing a crash test before the installation starts. This ensures that cable and duct damage can be prevented in the event that the cable stops abruptly within the microduct during the installation process.

For additional questions, please contact Corning Optical Communications Customer Care at 1-800-743-2671.

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