

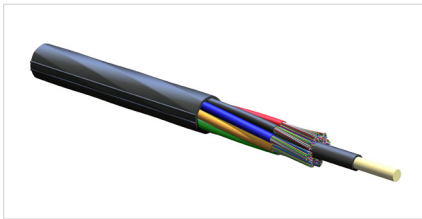


# MicroTechnology Solutions Guide

Accelerate network deployment with MicroCables, MicroDucts, and jetting



# Innovation from a team you can trust



MiniXtend® HD 288F



MiniXtend Plenum 12F

In today's market, having the ability to speed up deployment, improve labor efficiency, and increase density in congested pathways is critical for project success. Switching from traditional cable and duct infrastructure to innovative MicroTechnology from Corning and Dura-Line – a combination of MicroCables plus MicroDucts – gives you the tools you need to install faster and reduce overall costs, while building in high-quality, scalable, future-ready capability.

## In this guide you'll get an overview of MicroTechnology, including:

- The differences between traditional and MicroTechnology cabling systems, along with the advantages MicroDucts enable.
- The latest innovations in fiber and cable design that push the limit on density.
- The key components and processes of MicroTechnology projects, including MicroDuct deployments and MicroCable installations via air-jetting.
- Novel deployment techniques for more challenging scenarios, including re-use of legacy duct infrastructure.



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## Heritage meets innovation

With a combined 100+ years of optical fiber manufacturing and installation experience, Corning and Dura-Line are each highly respected in the communications industry for developing high-quality products that reliably and efficiently solve customers' real-world needs.

### Why Corning?

Corning's end-to-end fiber solutions form the backbone that connects businesses, homes, and people across the globe. Our solutions deliver premium performance at the industry's most attractive total cost of ownership backed by an unparalleled commitment to customer service. As the inventor of the first commercially viable low-loss optical fiber, no one understands how to provide brilliant connections for tomorrow, today, quite like we do.

Optical fiber is at the heart of today's modern connected world, transmitting massive amounts of data daily. Invented more than 50 years ago, fiber has undergone numerous evolutions: from connecting disparate locations with long straight cable runs; to highly interconnected networks connecting 400M homes with video, telephone, and data; to high-data-rate meshed networks. Fiber is integral to many of the technological advances that are driving the future, like AI and machine learning. Optical fiber is the present and future of connectivity, keeping the world connected in the most sustainable way while expanding the bandwidth of human potential.

### Why Dura-Line?

Orbia's Connectivity Solutions business, Dura-Line, is a leading manufacturer and distributor of high-density polyethylene (HDPE) conduit, accessories, and other connectivity solutions for the telecommunications, data center, and power markets.

With more than 50 years of experience and a long-standing reputation for the safety, efficiency, and durability of its products, Dura-Line produces more than 500 million meters of infrastructure annually, forming the physical pathways for fiber and power networks that connect people worldwide.

Dura-Line operates manufacturing facilities across the world—serving more than 50 countries through a global sales and distribution network. Each of Dura-Line's global manufacturing facilities is certified under ISO 9001 and 45001.

# What is MicroTechnology?

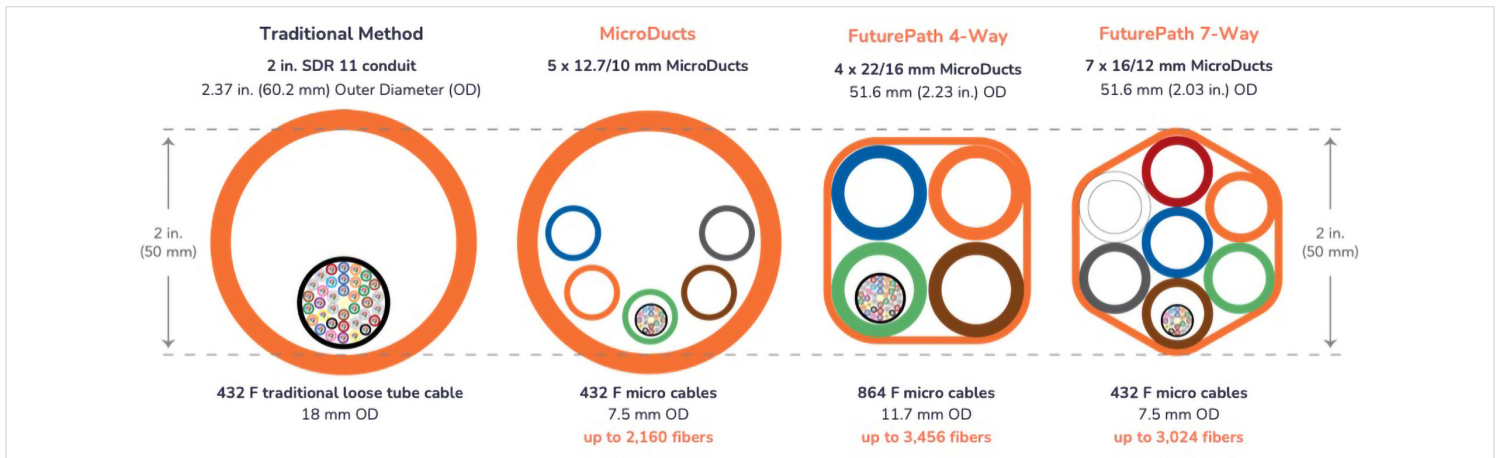
“MicroTechnology” is the innovative combination of miniaturized cables, miniaturized conduit, and air-jetting. Like a 3-legged stool, each of these components, working in balance, is essential for enabling several practical and commercial benefits vs. traditional cable systems, both outdoors and inside buildings.

MicroTechnology has three basic differences vs. traditional methods:

- 1 Replaces traditional cables with MicroCables.
- 2 Replaces standard conduit with MicroDucts and bundles.
- 3 Installs via air-assisted installation (jetting) vs. cable pulling.

Compared to standard ducts and cables, MicroTechnology:

- Allows higher fiber density — more pathways and fiber in the same or even a smaller space.
- Is easier and faster to install, scale, and maintain, with fewer personnel required.
- Makes it easy to upgrade without permits and digging, minimizing costly civil works and trenching.
- Enables simple fiber management and routing to distributed locations.
- Can be placed within existing ducts to get more from legacy infrastructure.
- Boosts the sustainability of optical communications networks.



Comparison of traditional 2-in conduit vs. MicroDucts and FuturePath® bundles. Image courtesy of Dura-Line. Illustrations drawn to scale.

## What is fiber density?

As fiber connectivity expands across homes, businesses, and infrastructure, the demand for higher fiber density in ducts is accelerating. Fiber density refers to the number of optical fibers that can be packed into a given cross-sectional area of a cable, typically measured in fibers per square millimeter (fibers/mm<sup>2</sup>). It is a key metric for evaluating how efficiently a cable uses physical space. Fiber-dense solutions have smaller, more efficient cable designs that can deliver more capacity in less space. MicroCables, enabled by fiber miniaturization and paired with MicroDucts enable flexible, future-ready options for high fiber density.



Want to learn more about fiber density? Explore Corning's mini course on Dura-Line Academy here!

# MicroTechnology components: MicroCables

## What are MicroCables?

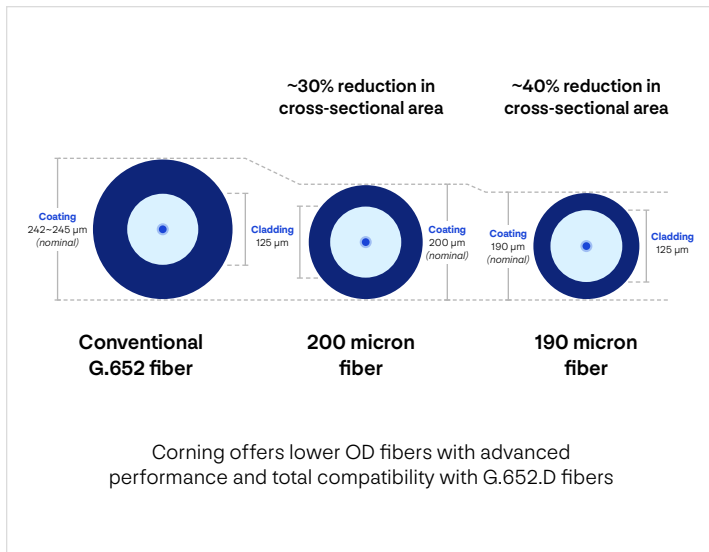
Fiber MicroCables are high-density, slim optical cables designed to be installed by jetting (or blowing) them into MicroDucts, which are small conduits. This method allows for rapid deployment of high fiber counts in limited spaces, making them ideal for applications like data centers, fiber to the home (FTTH), and long-haul networks.

## MicroCable varieties and cable design options: 250, 200, and 190 microns

Fiber miniaturization plays a key role in enabling higher cable density. Standard 250 µm fibers are now complemented by 200 µm and 190 µm options, which maintain the same 125 µm glass core but reduce the outer coating thickness. This reduction, from the conventional 242–250 µm down to 200 µm and 190 µm, results in up to a 40% decrease in cross-sectional area. This means more fibers can be packed inside the cable, enabling smaller, denser cable designs without compromising splicing compatibility or performance.

## Miniaturized fiber

To address increasing bandwidth and capacity demand, MicroCables, including our higher density MiniXtend® cables, can use reduced-diameter fibers, like Corning® SMF-28® Contour (190 µm OD) and SMF-28® Ultra 200 (200 µm OD).



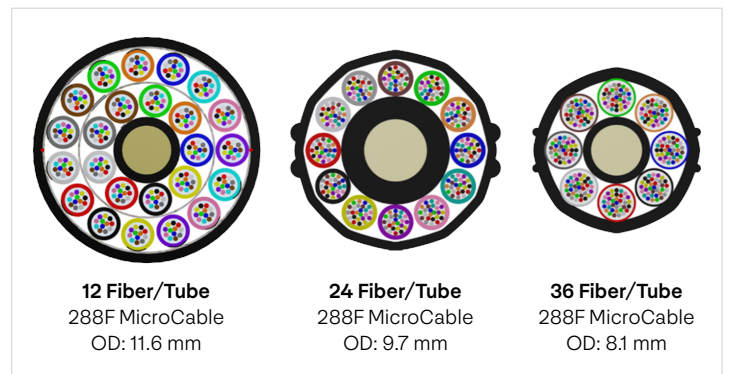
Comparison of conventional G.652.D fiber, Corning SMF-28 Ultra 200 fiber, and Corning Contour 190 µm fiber

## Loose fiber vs Flow Ribbon

Another way to reduce overall cable diameter is by optimizing how fibers are grouped within the cable. Two options are available, loose tube or Flow Ribbon.

### Loose tube

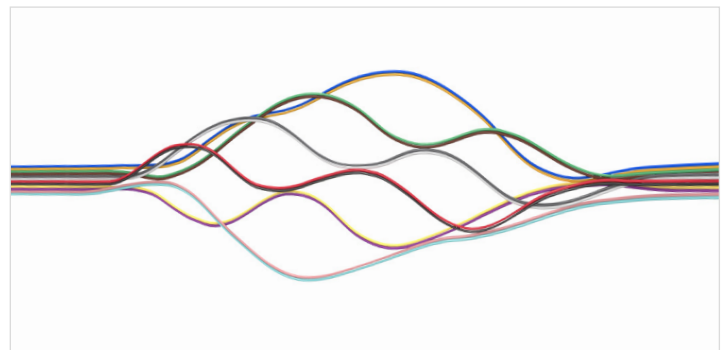
Traditionally, 12 fibers are grouped per buffer tube. By increasing this to 24 or 36 fibers per tube, the number of tubes, and thus the overall cable diameter, can be reduced. For example, a 288F cable using 12F per tube may have an outer diameter of 11.6 mm, while the same fiber count using 36F per tube can shrink to just 8.1 mm. This significantly increases fiber density, enabling more efficient use of duct space.



MicroCable comparison with 12F/tube, 24F/tube, and 36F/tube

### Flow Ribbon

Corning's Flow Ribbons are comprised of 12 intermittently bonded fibers. These form a flexible ribbon structure that can be arranged in cables without the need for buffer tubes. Flow Ribbons enable both single and mass fusion splicing, making them ideal for high-density, compact cable designs.








Flow Ribbon 200 µm

# Corning MiniXtend® MicroCables

Corning offers a comprehensive portfolio of MiniXtend® MicroCables designed to meet the evolving needs of both outside plant (OSP) and inside plant (ISP) environments. These cable varieties are engineered to maximize fiber density, simplify installation, and support scalable network growth.

## MiniXtend cables with loose tube

MiniXtend® Plenum	MiniXtend®	MiniXtend® HD	MiniXtend® XD
Indoor	Outdoor		
			
			
<ul style="list-style-type: none"> <li>• 12 and 24 fibers</li> <li>• SMF-28® Ultra fiber</li> </ul>	<ul style="list-style-type: none"> <li>• 12 to 144 fibers</li> <li>• 12 fibers per buffer tube</li> <li>• 250 µm fiber</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 432 fibers</li> <li>• 12, 24, or 36 fibers per buffer tube</li> <li>• SMF-28 Ultra 200 fiber</li> </ul>	<ul style="list-style-type: none"> <li>• 144, 192, 216, and 288 fibers</li> <li>• 24 fibers per buffer tube</li> <li>• SMF-28® Contour 190 µm fiber</li> </ul>



### Binderless FastAccess® technology

We offer a range of MicroCables for outside plant applications, featuring binderless FastAccess® technology for faster, safer, and easier deployment. This tool-free, peel-away jacket reduces access time by up to 70% or more and minimizes overall risk of cable and fiber damage.

- No ripcords to locate
- No binders to cut
- No blades required, just common hand tools



### High-density MiniXtend® HD & XD cables

These cables (24F and 36F per buffer tube) feature ring-marked fibers that enable easy identification and separation.

- Traditional loose fibers with 200 µm & 190 µm OD.
- No crossover fibers.
- Standard fiber identification scheme follows TIA/EIA-598 “Optical Fiber Cable Color Coding”:

  - Fibers 1–12 have standard colors.
  - Fibers 13–24 repeat the same color identification with black tracer, except for fiber 20 (the second black fiber), which is clear with one black tracer.
  - Fibers 25–36 repeat the same color identification with two black tracers, except for fiber 32 (the third black fiber), which is clear with two black tracers.

# MiniXtend® cable portfolio

## MiniXtend cables with loose tube

Corning offers a wide range of MiniXtend® loose tube MicroCables to suit all your MicroDuct projects.

	MiniXtend® Plenum	MiniXtend®			MiniXtend® HD							MiniXtend® XD		
Fiber Count	12–24F	12–72F	96F	144F	12–72F	144F	192F	216F	288F	288F	432F	192F	216F	288F
Fibers per Buffer Tube	12	12	12	12	12	24	24	24	24	36	36	24	24	24
Cable OD	3.6 mm	5.4 mm	6.3 mm	8.1 mm	4.5 mm	6.3 mm	7.5 mm	8.0 mm	9.7 mm	8.1 mm	10.8 mm	6.2 mm	7.0 mm	8.2 mm
Smallest Duct ID (fill ratio)	6 mm (54%)	8 mm (68%)	8 mm (79%)	10 mm (81%)	6 mm (75%)	8 mm (79%)	10 mm (75%)	10 mm (80%)	12 mm (81%)	10 mm (81%)	14 mm (77%)	8 mm (78%)	10 mm (70%)	10 mm (82%)
Optimal Duct ID (fill ratio)	6 mm (54%)	10 mm (54%)	10 mm (63%)	12 mm (68%)	8 mm (56%)	10 mm (63%)	12 mm (63%)	12 mm (67%)	14 mm (70%)	12 mm (68%)	16 mm (68%)	10 mm (62%)	12 mm (58%)	12 mm (68%)
Fiber Type	SMF-28® Ultra fiber	<ul style="list-style-type: none"> <li>SMF-28® Ultra fiber</li> <li>SMF-28® ULL fiber with advanced bend</li> <li>TXF® fiber</li> <li>LEAF® fiber</li> <li>Vascade® EX2500 fiber</li> </ul>			SMF-28® Contour fibers (190)	<ul style="list-style-type: none"> <li>SMF-28® Ultra fiber (200)</li> <li>SMF-28® ULL fiber with advanced bend (200)</li> </ul>					SMF-28® Contour fibers (190)			

## MiniXtend® cables with Flow Ribbon Technology



SMF-28® Contour fiber, Flow Ribbon 200 μm 190 μm

Corning's cables with Flow Ribbon Technology are engineered to increase density, maximize duct space, reduce cable prep time, and increase installation speed. These cables feature Corning® SMF-28® Contour optical fiber with a reduced 190 μm outer diameter arranged into a flowing ribbon configuration that provides flexibility and smaller, lighter, and more sustainable designs.

- Reduced 190 μm outer diameter for compact and sustainable designs.
- Fibers intermittently bonded with UV droplets for flexibility.
- Improved bend performance and easier hardware routing.

## MiniXtend® ribbon cable 200-flow portfolio

	Plenum				Indoor/Outdoor		OSP		
Fiber Count	24F	48F	72F	96F	288F	864F	144F	288F	864F
Cable OD	3.6 mm	3.8 mm	4.0 mm	4.6	9.1 mm	14.5 mm	6.4 mm	7.9 mm	12.5 mm
Smallest Recommended Duct ID (fill ratio)	6 mm	6 mm	6 mm	6 mm	12 mm (76%)	18 mm (81%)	8 mm (80%)	10 mm (79%)	16 mm (82%)
Fiber Type	SMF-28® Contour fibers (190)								

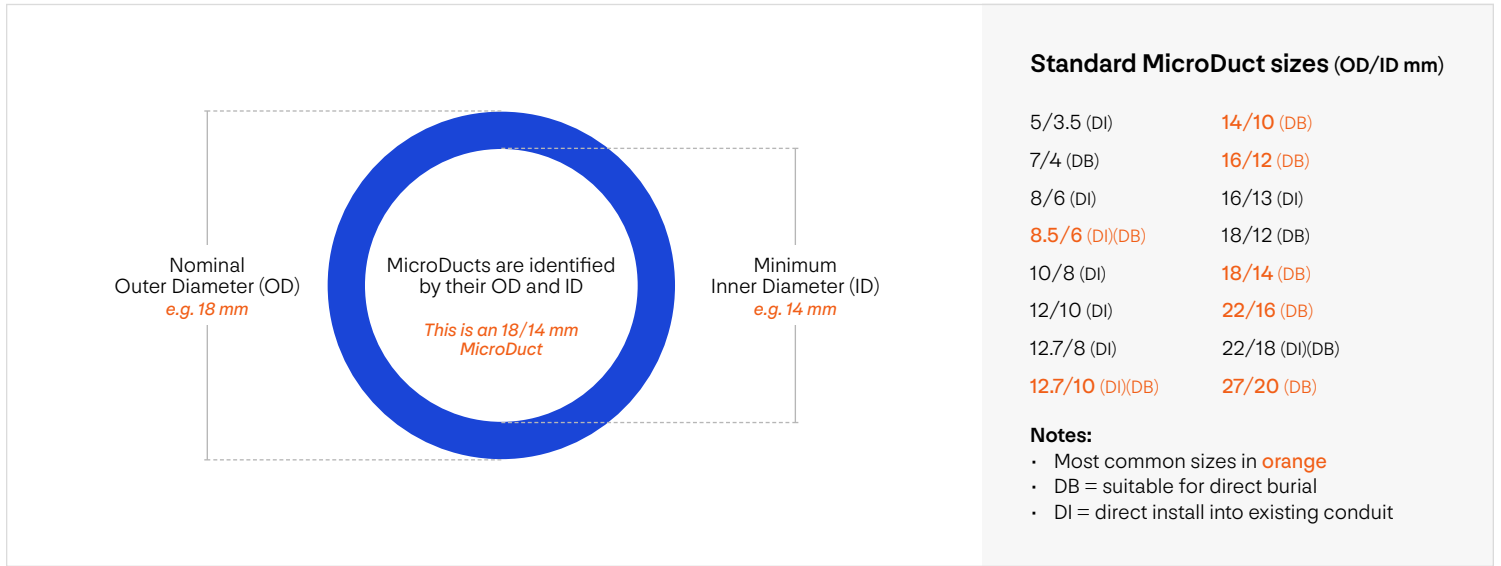
Corning Optical Communications recommends a target range between 50% and 80%

# MicroTechnology components: MicroDucts

## What are MicroDucts?

MicroDucts are miniaturized conduits that provide permanent protective pathways for optical fiber MicroCables. They are made from high-density polyethylene (HDPE), which is a tough, flexible, and proven conduit material. They are also available in Riser and Plenum varieties for in-building deployments.

MicroDuct size is denoted by outer diameter (OD) and inner diameter (ID), e.g. 10/8 mm and standard sizes range from 5 to 27 mm. MicroDucts can be installed into existing conduits or buried underground, though a thicker MicroDuct wall (minimum 2 mm) is recommended for direct burial.



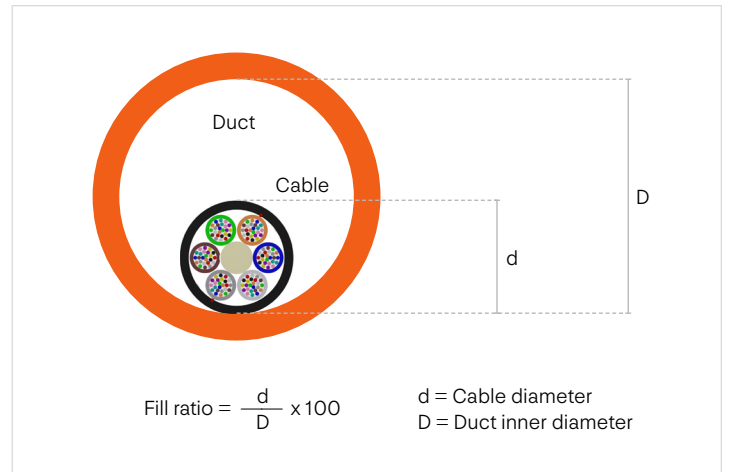
MicroDuct sizing chart and naming convention

## Fill ratio

The appropriate MicroDuct size for a project is determined by cable choice. For optimal jetting installation performance, a fill ratio of 50% to 80% between the outer diameter of the cable and the inner diameter of the MicroDuct is recommended. Fill ratio is calculated as shown in the illustration, right.

Too high a fill ratio may limit airflow, causing increased friction between the cable and pathway and limiting jetting distance. Too low a fill ratio may leave too much space around the cable, potentially leading to kinking or buckling.

For more information, read [Corning's Applications Engineering Note 049](#).



Fill ratio formula

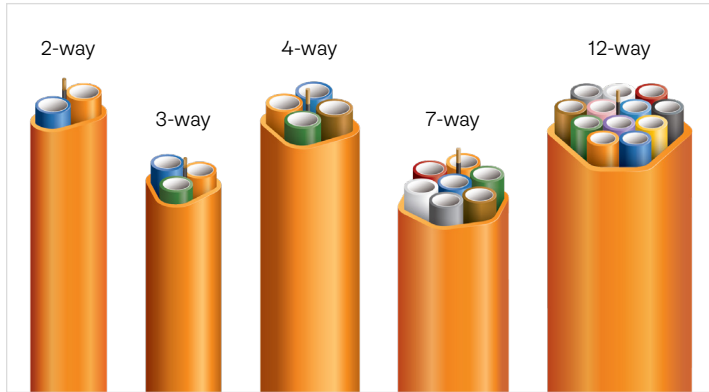


Explore Dura-Line's  
fill ratio calculator here!

# MicroTechnology components: MicroDucts *(continued)*

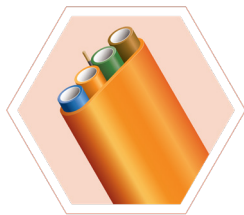
## MicroDuct bundles (FuturePath®)

MicroDucts can be bundled together under an oversheath to deliver multiple pathways in one compact structure. MicroDuct bundles, also known as FuturePath, are available with 2 to 24 pathways in various configurations. The number and size of MicroDucts used in a bundle is determined by total fiber count and network routing requirements. These unique constructions enable rapid deployment of fiber on day one with several vacant pathways in place for future expansion.



Common FuturePath configurations, images courtesy of Dura-Line

Dura-Line offers several unique FuturePath configurations for specific applications, including:



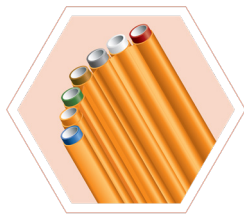
### Flat bundles

MicroDucts in a straight-line configuration. Ideal for MicroTrenching deployments.



### FuturePath® Hybrid

Two or more different sizes of MicroDucts or standard conduit under an oversheath. Enables a mix of standard and MicroCables along same route.



### FuturePath® Flex

MicroDucts joined by a thin web of HDPE for easy separation of individual pathways. Also ideal for MicroTrenching.

## MicroDuct accessories

Dura-Line offers a complete line of accessories to make installation easier, including:



### Micro couplers

Create an air- and watertight connection between two sections of MicroDuct of the same or different dimensions.



### Micro end caps

Create an air- and watertight, debris-free seal on the end of a vacant MicroDuct until it is needed for cable installation.



### Duct cutters

Create clean, straight cuts for successful MicroDuct joining and termination with a variety of task-specific cutters.

## Get field-ready, faster with Dura-Line Academy

Dura-Line Academy offers a range of mini courses on industry products, fiber and power applications, and installation best practices.

Learn in 15 minutes or less with interactive mini courses:

- Intro to Fiber Optic Theory
- Understanding Bend Radius
- Connecting MicroDucts and Splicing FuturePath, and more!

Complete full courses to earn certificates and BICSI CECs:

- Conduit Installation
- MDU Installations
- OverRides and Subdividing Conduits, and more!

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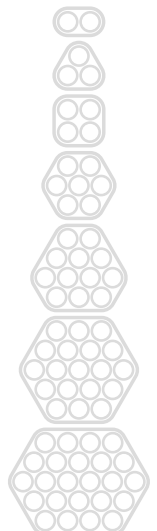
# MicroTechnology components: MicroDucts *(continued)*

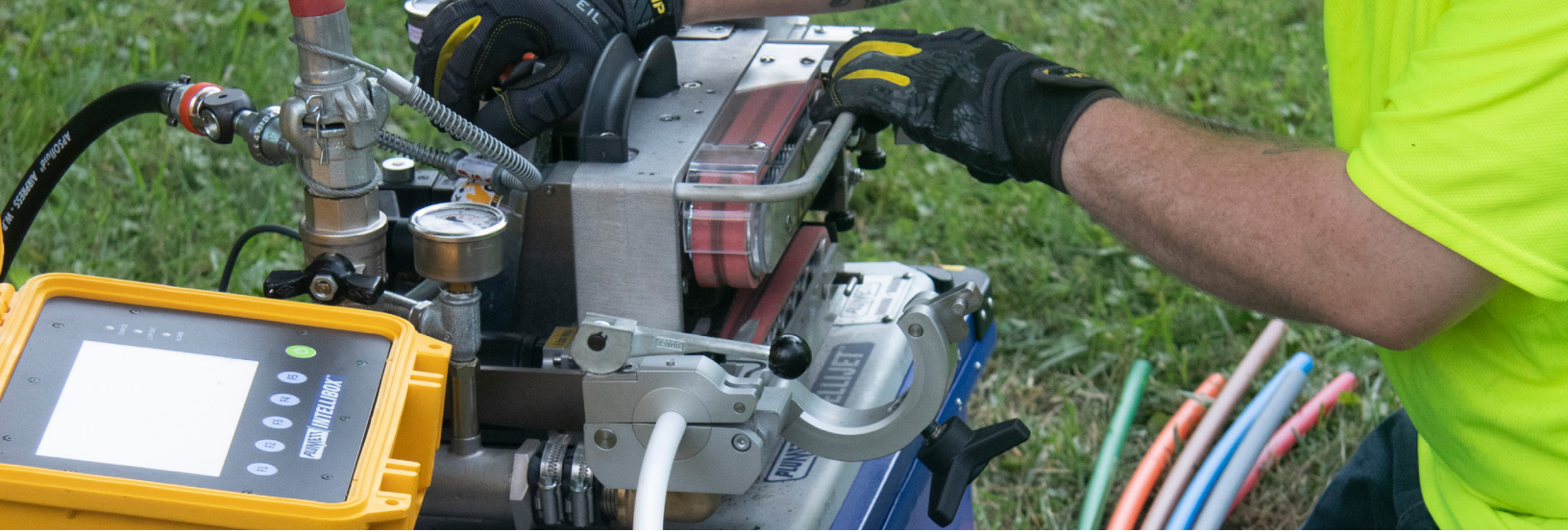
## MicroTechnology

									
	FuturePath®	FuturePath Hybrid	FuturePath Jumbo	FuturePath Flex	FuturePath Armored	FuturePath Aerial	FuturePath Figure-8	MicroDucts	Fire Retardant MicroTechnology
Installation/ Application	Direct Buried, OverRides, Plow, Trench	Direct Buried, Plow, Trench	Direct Buried, Plow, Trench	Direct Buried, MicroTrench	Direct Buried, Plow, Trench	Aerial	Aerial	OverRides, Plow, Subdivided, Trench	Riser, Plenum, Low Smoke Zero Halogen (LSZH™)
Sizes	5–27 mm OD MicroDucts	Standard conduits and MicroDucts under one sheath	Two or more standard conduits under one sheath	12.7/10 mm 18/14 mm	8.5/6 mm 12.7/10 mm	10–22 mm	8.5/6 mm, 12.7/10 mm, 16/13 mm, 18/14 mm	5–27 mm	5–27 mm
Configuration or Wall	2-way to 24-way	2-way to 15-way	2-way to 4-way	2-way, 4-way, 6-way, 8-way	4-way, 7-way, 19-way	2-way, 3-way, 4-way, 7-way	Single, 2-way, 4-way, 7-way	Multiple Options	Single, 2-way to 24-way
Footage Markings	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Packaging	Reels	Reels	Reels	Reels	Reels	Reels	Reels	Reels	Reels
Color/Stripe	Full Color Range Oversheath Color Options	Full Color Range Oversheath Color Options	Full Color Range Oversheath Color Options	Full Color Range Oversheath Color Options	Full Color Range Oversheath Color Options	Full Color Range, Black Oversheath with UV and Thermal Protection	Full Color Range, Black Oversheath with UV and Thermal Protection	Full Color Range	Dull Yellow Opaque White Chalky White
SILICORE ULF	SILICORE® ULF Standard	SILICORE ULF Standard for MicroDucts	SILICORE ULF Standard for MicroDucts	SILICORE ULF Standard	SILICORE ULF Standard	SILICORE ULF Standard	SILICORE ULF Standard	SILICORE ULF Standard	SILICORE Standard, except LSZH
Ribs	Internal Ribs	Internal Ribs for MicroDucts	Internal Ribs for MicroDucts	Internal Ribs	Internal Ribs	Internal and External Ribs	Internal Ribs	Internal Ribs	Internal Ribs except LSZH
Pre-Installed Rope/Tape	No	No	No	No	No	No	No	Pull String Available	Pull String Available
PinPoint/ Locate Wire	Optional Locate Wire Under Sheath	Optional Locate Wire Under Sheath	Optional Locate Wire Under Sheath	No	No	No	No	Locate Wire on Locatable MicroDucts	No
Pre-Installed Cable	No	No	No	No	No	No	No	Pre-installed Cable Available	Single MicroDuct only

OD/ID (mm)	2-way	3-way	4-way	7-way	12-way	19-way	24-way
27/20	●	●	● ●	●			
22/16	● ●	●	● ●	●			
18/14	● ●	●	● ●	● ●			
16/13	● ●	● ●	● ●	● ●			
16/12	●	●	●	●			
14/10	●	●	●	●	●		
12.7/10	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ●	● ●	
10/8	●	●	●	●		●	
8.5/6	● ● ● ●	● ● ● ●	● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●
5/3.5	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●	● ● ● ●

HDPE ● Riser ● Plenum ● LSZH ●






MicroCable Jetting Installation

## Air-jetting

Air-jetting is a highly effective cable installation method which can enable faster fiber placement over longer distances than traditional pulling methods. In the past, installers would push a rod or rope through a conduit and pull a cable back through the pathway. With air-jetting, the cable is propelled through the pathway by a combination of compressed air and a pushing force from a jetting machine.

### The benefits of air-jetting include:

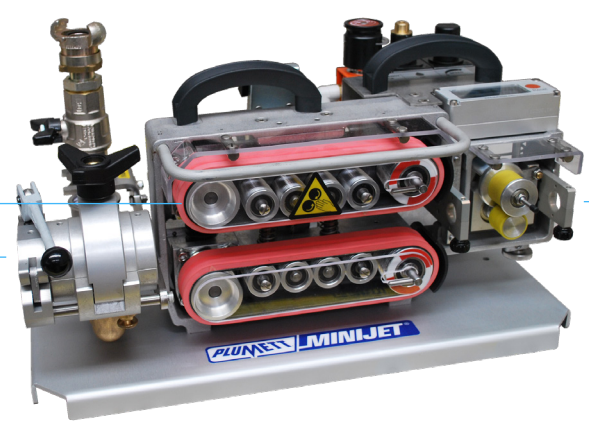
- 
**Distance**  
 Install up to 6,000 ft. (8 km) in a single step.
- 
**Speed**  
 Install 150–300 ft. (45–90 m) per minute.
- 
**Safety**  
 Compressed air overcomes friction for lower cable stress.
- 
**Cost**  
 Speed up project timelines with smaller installation crews.
- 
**Versatility**  
 Standard cables, MicroCables, and MicroDucts can all be installed via air-jetting.

## Jetting machines

The size of machine you'll use differs according to what you're installing, but most have three key features:

**Drive system**  
Provides a pushing force to propel a cable through a conduit or MicroDuct.

**Cable guide**  
Ensures the MicroCable is correctly aligned as it passes through the drive system into the conduit or MicroDuct.



**Seal**  
Secures the conduit or MicroDuct in the machine to prevent compressed air from escaping during jetting. Always use appropriately sized seals and fittings for your cable and conduit.

Image courtesy of Plumettaz



Air compressor

## Air compressors

Compressors provide the high-pressure air that creates a viscous drag force that carries the cable through the conduit with minimal friction. Like jetting machines, compressors vary in size, so compressor choice should be based on the largest conduit or MicroDuct you need to install into.

## Air-jetting (continued)

There are three key considerations when selecting the right air compressor for MicroCable jetting.

Consideration	Description	Guidance
Pressure	The force exerted by the compressed air inside the compressor and conduit, commonly measured in pounds per square inch (PSI), or Bar	Typical pressure range for MicroCable jetting is 150-175 PSI (10–12 Bar) up to a maximum of 230 PSI (16 Bar), based on jetting machine limitations.
Volume	The amount of air a compressor can take in and compress in one minute, typically measured in cubic feet (CFM), cubic meters (CMM), or liters (LPM).	Ideal volume ranges by MicroDuct size: <ul style="list-style-type: none"> <li>• 5.5–14 mm ID: 10–60 CFM (300-1,700 LPM, 0.28–1.7 CMM)</li> <li>• 16–20 mm ID: 100–375 CFM (2,800–10,600 LPM, 2.8–10.6 CMM)</li> </ul>
After-treatment	Mitigation of heat from the air compression process and humidity from the ambient environment that can affect jetting distance and efficiency.	An air cooler and water separator should be used when ambient temperatures exceed 77°F (25°C). These features are built into some compressors, otherwise they can be purchased or hired separately.



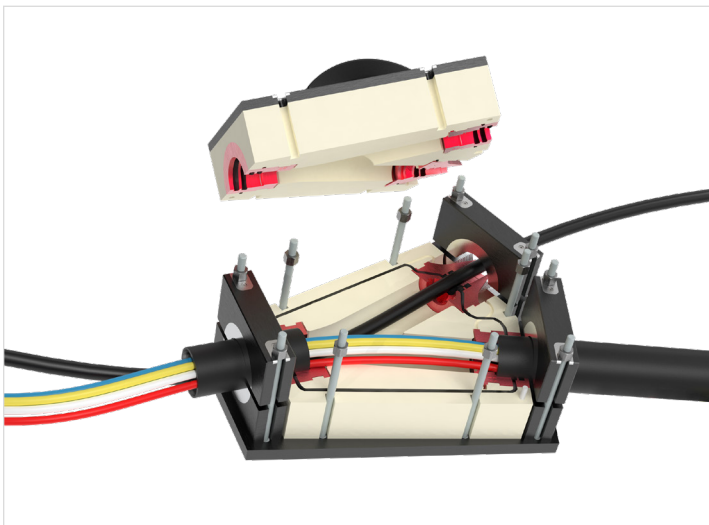
Payoff of a 144-Fiber MiniXtend® Cable

### Payoff system

This mechanism controls the smooth and consistent release of a MicroCable or MicroDuct from a reel. In a jetting installation, it prevents tension or torsion that could damage the cable and limit the success of the procedure. Payoff systems can be manual, ex., a simple reel stand, or more sophisticated, with motorized drive and features that prevent the reel from over-spinning.

### Y-block

This specialized piece of equipment allows MicroDucts to be installed into an existing conduit which already contains at least one cable, in a unique installation method known as an OverRide. The Y-block isolates the existing cable so the existing pathway can be pressurized and one or more MicroDucts can be jetted in. Sitting between the jetting machine and the entrance to the existing conduit, everything in a Y-block is divisible, so it can be installed around the existing assets.



Y-block setup. Image courtesy of Plumettaz.

### Lubrication

Cable lubricants typically come in a range of formulations and formats (gel, creamy gel, and pourable). However, the high-speed compressed air used in cable jetting can rapidly dry out some lubricants and cause stickiness. Therefore, choosing a lubricant which is formulated specifically for use in air-assisted cable installations, such as Dura-Line HydraLube® AT-500, is recommended.

Alternatively, some manufacturers offer conduits that have low-friction inner layers. Dura-Line's SILICORE® ULF, ultra-low friction inner lining is co-extruded with the conduit. This permanent layer boasts a greater than 60% lower coefficient of friction<sup>1</sup> than standard HDPE conduit, enabling up to five times longer jetting distances.

<sup>1</sup> 62.5%. Testing performed on 11/2" SDR 13.5 smoothwall conduit, utilizing an HDPE sheathed cable, with and without SILICORE ULF. Coefficient of friction according to Dura-Line's internal test method: SILICORE ULF 0.07, Silicore 0.1, and non-lubricated HDPE conduit 0.18-0.22.

# MicroTechnology for outside plant (OSP) networks

With so many possible combinations of MicroDucts, bundles, and fiber counts, MicroTechnology offers flexibility and scalability in virtually any OSP application. From high-capacity backhaul links, to private campus environments, and low-density rural FTTH networks, network builders across the globe have standardized on MicroTechnology thanks to the practical and commercial advantages it offers over traditional cable systems.

## MicroTechnology for every OSP



Campus/LAN



Cellular/DAS



Data centers



DOT



FTTH



Long-haul



Middle mile



Power and utility



Rural



Smart cities



Transportation



WISP

## Physical advantages MicroTechnology

MicroTechnology can be easier, faster, and more cost-effective to install, thanks to a series of practical benefits:

- **Size:** More pathways in the same or a smaller footprint than traditional standard conduit systems – more fiber capacity for every deployment dollar.
- **Density:** MicroCables are available with up to 864 fibers – a FuturePath® bundle can house thousands of strands in one compact structure.
- **Installability:** MicroCables are packaged on smaller reels, so they're easier to transport, handle, and install via air-jetting, with lower personnel requirements than traditional cable-pulling.
- **Routability:** Physical separation and color identification of MicroDucts enables efficient fiber management and cable routing to distributed locations, which is increasingly important in fiber-rich OSP networks.
- **Upgradeability:** Install the fiber you need on day one, then enjoy as many dig-free, permit-free future capacity upgrades as there are vacant pathways in your bundle.

## Commercial advantages of MicroTechnology

MicroTechnology enables unique deployment and operating models that can help stretch your funding dollars and accelerate return-on-investment (ROI):

- **Co-investment:** Two or more parties share initial build costs, then share profits or simply run separate networks. MicroDuct bundles make sharing easy since each party can maintain separate infrastructure. Examples include joint ventures and public-private partnerships.
- **Leasing:** Infrastructure owner leases spare ducts or fiber to other organizations. This works well in areas where subscriber demand and cost of deployment are high.
- **Dig once:** Policies or regulation that encourages the synchronous deployment of utility infrastructure (electricity, gas, water, broadband) by numerous asset owners in common trenches to avoid future overbuild.
- **Multi-use infrastructure:** Use spare capacity for other purposes such as wireless backhaul, distributed fiber-optic sensing, or other future-critical applications.

# OSP MicroTechnology installations

Due to their reduced size, MicroCables are inherently less rugged than larger traditional constructions. That's why MicroCables are always installed in MicroDucts. Fortunately, MicroDucts and FuturePath® bundles can be installed via all familiar, traditional installation methods, as well as some that are unique to MicroTechnology.

## Traditional installation methods can be utilized for MicroDucts



### Traditional method 1: direct-burial

MicroDucts and FuturePath® bundles can be installed in a traditional open trench or via trenchless methods, including horizontal directional drill (HDD), bore, and plow, which can be significantly quicker and more cost-effective than typical digging. Long-distance cable jetting means operators can use fewer vaults, placed further apart than in traditional cable systems. These can also be smaller because MicroCables allow for tighter slack loops.

### Traditional method 2: aerial

MicroTechnology can be installed on poles using standard aerial cable installation equipment, with both stranded (figure-8) and lashable MicroDuct options available. When using an aerial bundle, pole-loading calculations can be completed once at the start of the project, instead of with every cable upgrade. Once the pathways are in place, cable jetting can be completed from the ground.

## Optional installation methods unique to MicroDucts



### Unique method 1: subdivision

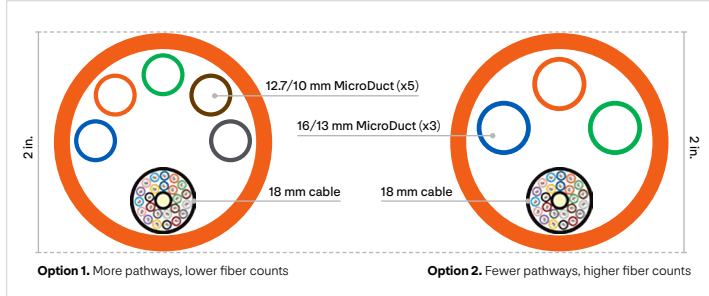
MicroTechnology can create multiple new pathways in larger, empty conduits for optimal utilization of existing space with no digging or permits, lower cost, and faster project timelines. Simply pull or jet loose or bundled MicroDucts into the existing pathway to subdivide the internal capacity, then add MicroCables as needed.

### Unique method 2: OverRides

This approach involves installing one or more MicroDucts into an existing conduit which is already occupied by one or more cables. OverRides are a low-risk, high-reward solution, which can be up to 80 percent faster and more cost effective than traditional network construction. They can also be effective on any scale, from overcoming special engineering difficulties, ex., a busy road crossing, to quickly unlocking capacity on long-haul routes of several hundred miles.

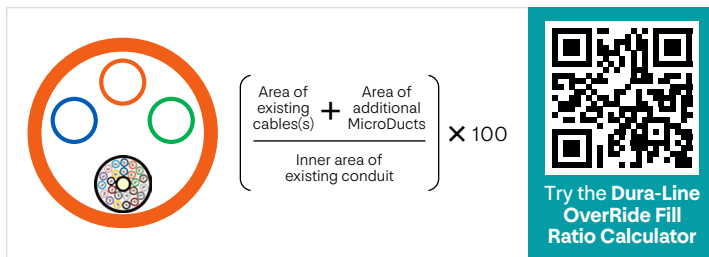
# OSP MicroTechnology installations *(continued)*

The number and sizes of MicroDucts used in an OverRide is determined by the fiber count and routing requirements. MicroDucts should be installed at the same time via air-jetting using a specialized piece of equipment called a **Y-block** (see page 13).



MicroDuct OverRide options

The main limiting factor for this method is the **OverRide Fill Ratio Calculator**. The combined cross-sectional area of the MicroDucts and any existing cables should not exceed 55 percent. The ratio can be calculated as follows:



Fill ratio for MicroDucts in existing ducts (including OverRides)

## Unique method 3: MicroTrenching

Unlike traditional trenching methods that often require wide and deep excavations, MicroTrenching involves cutting a narrow, shallow slot in the asphalt or earth with a rotary blade and installing a flat MicroDuct bundle. With less material to displace and backfill, MicroTrenching can result in less damage to roads, sidewalks, and landscaping, while yielding several hundred meters of fiber laid per day.



MicroTrenching

## MicroTrenching facts<sup>2</sup>

### MicroTrench dimensions

**Width**  
0.5–5 inches (15–130 mm)

**Depth**  
16–24 inches (400–600 mm)

### Daily yield

**Average**  
1,200 feet (365 m)

**Maximum**  
Up to 2,000 feet (600 m)

**Depth**  
16–24 inches (400–600 mm)

### Cost

Approximately \$12 per ft.

### Ideal uses



Urban environments with high deployment costs



FTTH distribution within neighborhoods



Rural backhaul projects



Long, straight runs along highways

### Common terms

MicroTrench, narrow trench, nanotrench, saw cut

## Not recommended: cable overlays

For additional fiber capacity on an existing route, it's been common practice to overlay traditional cables via rodding, either by hand or with a rodding machine. However, this can be risky because:



Cables and ducts can be damaged due to friction and tangling.



Installations will become shorter and more difficult with each cable added.



Diminishing space will limit the number of fibers that can be installed.

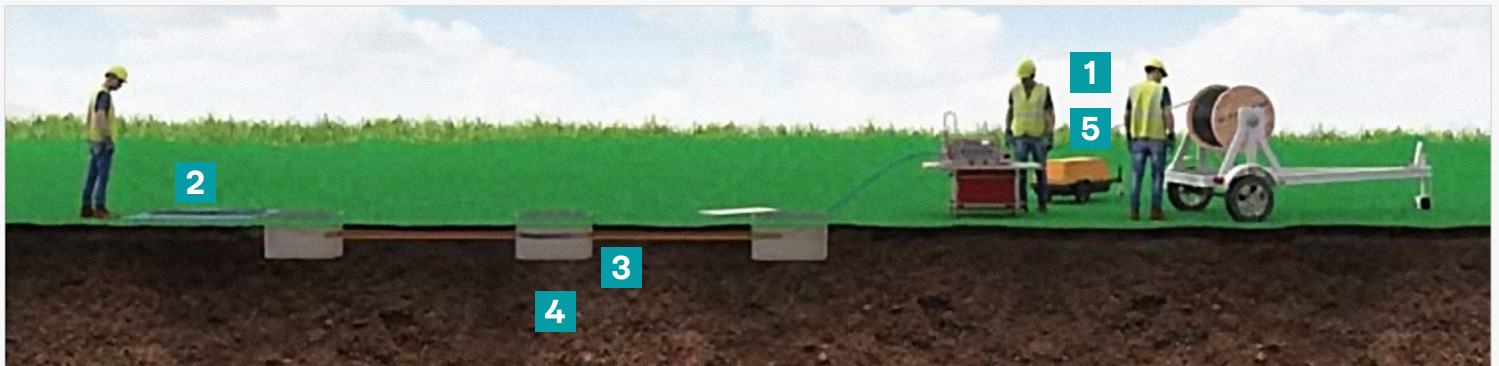
<sup>2</sup> In many cases, without MicroTrenching as an option, some cable installation projects would be impossible due to access issues. However, MicroTrenching is not always permitted by local regulatory bodies. We recommend contacting your local permitting agency before planning a MicroTrenching installation.

# 8 steps to OSP MicroTechnology installation

- 1. Choose cable:** Clarify the installation environment, define day-one fiber count requirements, and identify any existing cable design preferences (ex., loose tube or ribbon).
- 2. Choose pathway:** Depending on the deployment scenario and future capacity requirements, choose either loose MicroDucts or a FuturePath® bundle. Ensure a 50–80 percent fill ratio between the inner diameter of the MicroDuct and the outer diameter of the cable.
- 3. Install pathway:** Choose between sub-ducting and direct burial, ensuring any trenches or MicroTrenches are clear of debris before placing pathway. Pay MicroDucts off the bottom of the reel to prevent twisting or kinking. Ensure they lay flat in the ground and minimize bends and turns in the route. Join sections of MicroDuct with an appropriately sized coupler.
- 4. Choose jetting equipment:** Ensure your jetting machine is compatible with your MicroCable and MicroDuct size, and that you have correct-sized seals and fittings. Select a compressor capable of providing the requisite pressure and volume for MicroCable jetting and use a dryer and cooler if ambient temperature exceeds 77°F (25°C).
- 5. Plan jetting installation:** Double-check your jetting equipment compatibility and fill ratio, mitigate any environmental factors that could impact jetting performance, and estimate how far you will be able to install without stopping.

Consider these factors when creating a performance mitigation plan:

- Estimate how far you'll be able to jet without stopping.
  - Maximum installation distance depends on factors like ambient temperature, precipitation and humidity, cable cleanliness.
- 6. Proof MicroDuct:** Seal the MicroDuct with an end cap, gradually pressurize the pathway to 100 psi, and maintain for one minute to ensure the system is airtight. Then, jet a BB through the MicroDuct at 30 to 40 psi to rule out blockages or kinks. If lubrication is required, pour lubricant into the MicroDuct and jet a sponge to spread it throughout the pathway.
  - 7. Jet cable:** Place a protective metallic jetting tip on the end of the cable, then insert into the jetting machine with an appropriately sized seal. Start the drive belt to begin the installation and gradually add compressed air to maintain installation speed until the cable reaches the end of the route. Install an additional 50 to 75 ft., if mid-span access is required.
  - 8. Terminate and store cable:** Remove the jetting tip and route the cable into a splice enclosure. Alternatively, coil the cable and store in a handhole for future use.



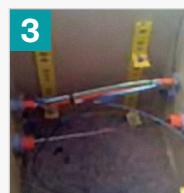
**Installer 1** is dedicated to operating blowing machine.

**Installer 2** is responsible for paying off cable from reel to prevent additional force on the blowing machine.

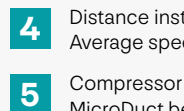


**Installer 3** is responsible for monitoring cable as it exits MicroDuct and managing cable slack.

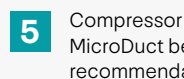
On intermediate pull points, place tarps under the cable where it will be figure-eighted.



Use couplers designed for your specific MicroDuct to join section together in handholes.



Distance installation up to 6,000 ft/1.8 km in one step. Average speed is 200 ft/60 m per minute.



Compressor requirements will depend on MicroCable and MicroDuct being used. Check with blowing equipment maker for recommendations.

# MicroTechnology for inside plant (ISP) networks

Fiber-enabled connectivity is increasingly part of our everyday lives, enabling business operations, security, or simply subscriber broadband. When it's necessary to bring fiber indoors, MicroTechnology can make it easier, faster, and more cost-effective.

## MicroTechnology for every ISP



Healthcare



Higher education



Data centers



Government



Airports



Military/defense



Corporate campuses



Commercial real estate



Industrial and manufacturing



Entertainment venues



Rail and other transportation



Broadcast studios

## MicroTechnology in the ISP: fire ratings

When communications equipment, including cables and MicroDucts, is installed in buildings, it must be “fire-rated,” meaning it has been tested and certified to resist fire for a certain period of time and under specific conditions. MicroTechnology solutions are available for various indoor use cases:

- **Low-Smoke Zero-Halogen (LSZH):** Cables that emit minimal smoke and no toxic halogen gases when burned, making it safer for people and equipment in enclosed spaces.
- **Riser:** MicroCables and MicroDucts suitable for use in vertical shafts between floors in a building, but not suitable for air-handling spaces.
- **Plenum:** MicroCables and MicroDucts suitable for use in air-handling spaces, such as heating, ventilation, and air conditioning (HVAC) shafts.
- **Indoor/Outdoor:** MicroCables which are both fire-rated and suitable for outdoor use to eliminate transition splicing at building entry points. Ideal for ISP networks with outdoor sections (connections between buildings on a data center campus), terminals within an airport, or apartment blocks on a real estate development.



Corning MiniXtend® Plenum MicroCable

## Advantages of MicroTechnology

A full MicroTechnology solution (cable, MicroDucts, and air-jetting) offers significant advantages over direct-installed cable without a pathway. That's because ISP MicroTechnology is:

### Flexible

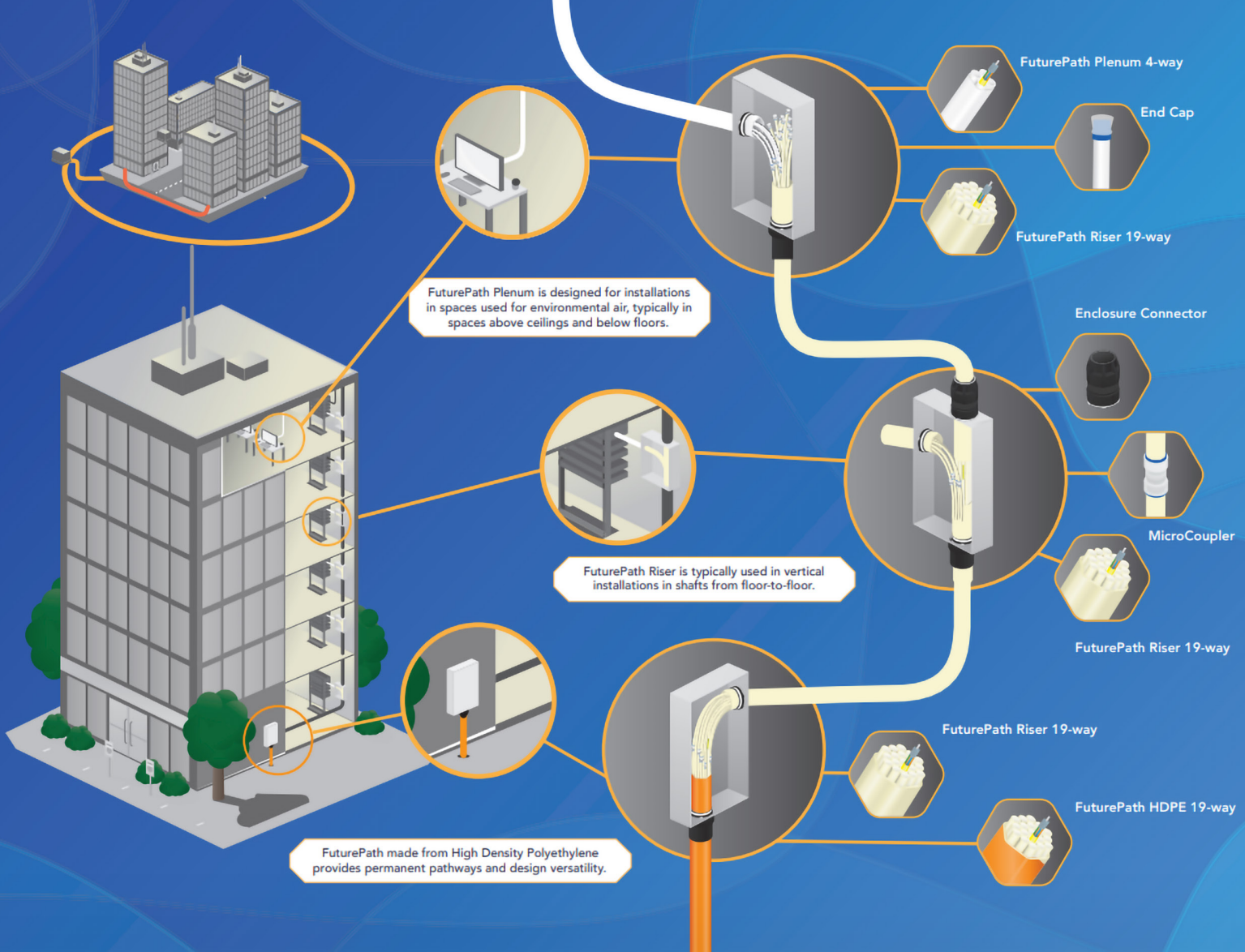
- Easy routing to distributed network locations, like an individual apartment in a multidwelling unit (MDU), specific racks within a data center, or an operating theater in a hospital.
- Moves, adds, and changes (MACs) can be accommodated simply and cost-effectively by re-routing cables through the MicroDuct system, rather than re-accessing awkward rights-of-way and performing tricky mid-span fiber splicing.

### Scalable

- Initial capital investment can be limited by deploying MicroDucts throughout the building and installing only the fiber you need on day one.
- Avoid potentially unnecessary installation, termination, and testing of dark fiber.
- Choose the very latest in fiber and cable technology when more capacity is required.

### Smart

- ISP MicroTechnology is a permanent, protective living system.
- MACs can be completed without disrupting normal building operations, via reconfigurable pathways and end-to-end jetting.
- Ideal solution for challenging, 24/7 environments, including manufacturing, healthcare, and transport hubs.



Complete indoor/outdoor solution, image courtesy of Dura-Line

## ISP MicroTechnology installations

Just like in the outside plant (OSP), different MicroDucts sizes and FuturePath® bundle combinations are available for ISP networks, depending on fiber count and routing requirements. ISP MicroTechnology installation methods can differ from OSP in the two main ISP applications, enterprise networks and multidwelling units (MDUs).

### Enterprise networks

Enterprise networks are private networks that provide connectivity in settings such as data centers, office buildings, universities, airports, entertainment venues, and many more. In these networks, fiber may pass from building to building, as well as throughout the inside of each building.

To accommodate these different spaces, the MicroDuct system handles the transition from standard HDPE outdoors, to riser and plenum within the building, via MicroDuct distribution boxes. The same indoor/outdoor MicroCable can then be jetted throughout the entire system, with no need to splice OSP fiber to ISP fiber.

Installation options for ISP MicroTechnology in enterprise networks include:

- **Direct-burial**
- **Sub-ducting**
- **Behind walls**
- **Underneath floors**
- **In ceilings**
- **In HVAC shafts**
- **Cable trays or racks**
- **Internal or external raceways**



MicroTechnology for multidwelling unit (MDU) networks

## MicroDucts or bundles?

Single MicroDucts typically provide the most stringent engineering and fire performance, though this can mean busier raceways. FuturePath® bundles can also be used, particularly for distribution between floors. This consolidates infrastructure but also means more breakouts from the bundle. In either case, optimal MicroDuct installation methods differ from newly constructed to existing apartment buildings.

### New buildings

In greenfield deployments, MicroDuct pathways should be placed prior to drywall installation for a more aesthetically pleasing appearance and to avoid having to re-access confined spaces. The transition from OSP to ISP can be made in the basement or at ground level, with pathways and fiber run vertically and horizontally throughout the building.

### Existing buildings

In brownfield scenarios, the building construction will dictate the best installation method. Often, MicroTechnology must be installed vertically in a protective raceway attached to the façade of the building, before entering via the attic or top floor. Pathways and fiber can then be run throughout the building, ideally behind walls, although surface-mount installations are also common.

## Multidwelling unit (MDU) networks

MDUs represent around a third of all households. MDU owners and renters are typically some of the most demanding broadband users and apartments often see regular resident churn. MicroTechnology makes it easier to serve this market segment with permanent protective pathways and end-to-end fiber jetting, all the way to the each living unit. Because of its inherent flexibility, MicroTechnology allows several Internet Service Providers (ISPs) to serve a building, while maintaining physical separation between their physical assets.



MicroCables for enterprise solutions

## Jetting in ISP networks

The MicroCables and MicroDucts used in ISP networks are typically smaller than those seen in OSP deployments. MicroDucts of 8.5/6 mm are commonplace, as are cables with relatively low fiber counts of 12F to 432F. In many cases, these cables can be installed with small, handheld jetting machines, operated with a power drill.

Despite their small size, these units can air-jet cable up to 3,000 ft. (900 m) in a single step, at typical speeds of 150–200 ft. (25–60 m) per minute. In some cases, cables can be installed over shorter distances of 200 ft. (60 m) or less without air, using the machine's pushing force alone. In a well-designed system, MicroCables can be jetted all the way from the basement or communications room to individual apartments, rooms, or facilities in a building.



Jetting in ISP Networks. Image courtesy of Plumettaz.

### Recommendations

Corning recommends installing 12–96F MiniXtend® Plenum MicroCables in 6 mm inner diameter MicroDucts. Single duct and bundled MicroDuct products are available for flexibility, providing additional pathways for future expansion of the network. Riser or plenum rated ducts may be installed within buildings.

Find more details in Corning's Applications Engineering Note: **MiniXtend Plenum Jettable Microcable Installation Considerations.**

# MiniXtend® components selection

## A complete solution: MicroCables, MicroDucts, and accessories

Deployed together, our MiniXtend® Micro Cable Portfolio, Dura-Line MicroDucts, and accessories are a comprehensive solution for speed, flexibility, and cost-efficiency. Careful planning is necessary to leverage flexibility and scalability. Design your system to scale hardware, closures and connectivity to support future fiber densities. Products are available to provide flexibility and scalability for a growing network.



BPEO



2178

### Splice closures

- Determine if multiple MiniXtend cables will be spliced into a single closure or segregated into separate closures, using proper slack storage and protection with either a communications hut, a vault, or individual hand holes.
- Ensure proper sealing and cable entry for smaller diameter MicroCables by using closures with correct grommets or sealing and select splice trays designed for MicroCables or approved methods for securing MicroCable buffer tubes.
- Corning offers closures compatible with MiniXtend cable portfolio.



CCH



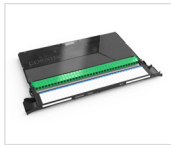
Centrix

### Hardware

- Designed to provide outstanding flexibility and scalability for wall-mounted and rack-mounted MicroCable installations.
- Available in a range of formats for above-ground applications.
- Hardware solutions such as Corning's Centrix™ or rack-mounted Closet Connector Housings (CCH) can provide flexibility and scalability.



Pigtailed



Centrix

### Splice cassettes

- Factory assembled and tested.
- Available in CCH and pigtailed formats.
- Reduce deployment time by up to 40% and hardware and cabling preparation by 50-75% vs. traditional splice housing solutions.



FuseLite 2

### Corning FuseLite® 2 connectors

- Factory-polished end face for consistent optical performance.
- SC, LC and ST® compatible.
- Splice protection within connector body – no splice trays required.
- The FuseLite 2 connector eliminates the need for splice trays and is compatible with leading fusion splicers in the market.



Universal routing kit 24F & 36F

### Corning universal routing kit 24F & 36F

- Enable quick separation of fibers into 2x12 or 3x12 fiber sets with a furcation tube that protects the fibers from sharp edges in closures and cassettes.
- Provides the ultimate solution users who want to route 24- or 36-fiber tubes down to 12 fibers for fusion splicing or direct termination.

For more detailed technical information:

[MicroCable installation](#)

[MicroDuct cable air-assisted installation considerations](#)

[Air-assisted cable installation techniques](#)

[Where to buy?](#)

[Contact our customer operations team for any other questions](#)



## Corning offers many resources to aid in the design and construction of your MicroCable/MicroDuct system.

Our Engineering Services organization is here to help you every step of the way, from network design to implementation.

We offer many services, including some at no cost to our customers. These services include:

- [Network design and site survey](#)
- [On-site technical assistance](#)
- [Splicing, termination, and testing](#)
- [Troubleshooting and restoration](#)

[Click here for more information on our Engineering Services offerings.](#)

For more information, call [\(800\) 743-2671 \(U.S. & Canada\)](#) or [\(828\) 301-5000 \(international\)](#), and ask for Field Engineering.

For more information on MiniXtend® MicroCables, [visit our product page.](#)

To learn more about how MicroCables and MicroDucts are revolutionizing smart highways, [download our free e-book.](#)

## We're here to help

Our dedicated team of experts understand the unique requirements behind your build. Contact your Corning rep to start planning today.



[Scan or click for the Dura-Line Solutions Guide](#)

## CORNING

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