



Fiber Optic Ducts and Microducts

Vladimir Grozdanovic

Underground cable installation in ducts can be done with either standard ducts or microducts. Optical cables are installed in the ducts by pulling or blowing/jetting. Ducts can be characterized into the following types:

- Main PVC (polyvinyl chloride) duct, also called conduit, with a diameter of 100–110 mm, in which smaller ducts for individual cables are installed,
- Standard HDPE (high-density polyethylene) ducts or sub-ducts with diameters ranging from 18 to 63 mm (40 or 50 mm are common sizes),
- Micro HDPE ducts with diameters ranging from 3 to 16 mm
- Microduct Bundles(tight, loose, round or flat ducts).

Ducts can either be directly buried or installed within existing larger-diameter ducts. The main difference between standard ducts/sub-ducts and microducts is their diameter. Over the past 20 years, both ducts and cables have become smaller to allow installing more fibers or cables in the same ducts.

Using microducts reduces construction costs and increases the capacity of underground installations.

Installation

Underground

Ducts and microducts can be installed using most techniques commonly used for underground installation. If conduits are available, they can be pulled into those conduits. They can be installed by trenching, microtrenching or directional boring. They may be mixed with conventional ducts and microducts used for different cables at the same location as shown below where the ducts were installed by trenching and the microducts by directional boring.

Special microducts are available for aerial installation also. See below.



Ducts and microducts in the same handhole

Standard Ducts/Sub-ducts

Standard ducts or sub-ducts have been used for decades for cable installation. Different techniques, such as pulling and blowing, are used for cable installation.



Standard 40 mm HDPE ducts and straight connectors

HDPE ducts are typically manufactured with specially designed inner grooves to reduce friction and facilitate cable pulling or blowing. These ducts are supplied in coils, usually about 250 or 500 meters long, and are connected using straight connectors.

Microducts

Microducts are manufactured with an outer diameter of 3 to 16 mm, allowing for high density of independent ducts. They are defined by the international standard IEC 60794-5-20 and must meet specific requirements for impact resistance, pressure, and bending.



Microducts and microcables ([Duraline](#))

Microducts are made from various materials, come in different colors (it is recommended to use the EIA/TIA-598 standard), and may include special additives. Their interiors are specifically designed to enable efficient cable blowing. Microducts can be extended or branched using appropriate accessories (components). For indoor applications, Anti-Rodent or LSZH variants are commonly used. Outdoors, buried microducts are available with tracer wires for easy location.

Thick-Walled Microducts

This type of microduct is directly buried either as a single microduct or as a bundle of microducts. There are several variants, such as tight, loose, and flat (or flat bundles of microducts).

Tight variant or tight bundles consists of a bundle of thick-walled microducts surrounded by a thin outer sheath. The diameter and number of microducts can vary. This variant offers the most efficient solution for cable installation.



Microducts – tight bundles

Loose variant is a bundle of microducts within a thin sheath that allows for movement, which makes it ideal for installation into existing ducts. Due to the thickness of the microduct walls, the pulling distance is typically limited to a maximum of 300 to 400 meters. Blowing is also limited, so it is mainly used over short distances.

Flat bundles eliminates overlapping of individual microducts and allows for easy connection and branching of the microducts. These can be directly buried or pulled into existing larger ducts.

Thin-Walled Microducts

Thin-walled microducts or protective microducts require installation within larger ducts or buildings due to the lack of necessary protection. They are also available in the same variants as thick-walled microducts.

Tight and loose variants are bundles of microducts that are installed in larger ducts. They can be of different diameters and numbers of ducts, and they are installed by pulling or blowing.

Flat variant is commonly used inside buildings as a standalone LSZH bundle or can be installed in existing ducts. These are very flexible and allow installation in very tight spaces.

Aerial Microducts

Aerial microducts are used for aerial connections to subscribers, typically over a span of less than 50 meters. They are made in the shape of a figure-eight cable (Fig. 8).



Aerial microduct with support messenger ([Clearfield](#))

Microduct Accessories

The basic accessories for microducts include connectors for joining ducts, end caps, reducers, and special branching boxes.

Various types of connectors are used for joining ducts, such as those for thick-walled microducts that are directly buried.



Straight couplers and end caps ([Clearfield](#))

The installation of end caps is crucial to prevent the entry of gas and water. These are typically mounted at the terminal points for subscriber connections, as well as in manholes and buildings during the construction process.

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