

## Manual and Mechanical Cable Pulling

Vladimir Grozdanovic

Optical cables in ducts can be installed by pulling or blowing. One method of installing cables is manual or mechanical pulling into PE ducts. These methods are applicable exclusively for standard cables installed in ducts and are not recommended for microcables or high fiber count cables, as they may be damaged by pulling tension. Manual pulling is suitable only for short sections, with manholes spaced no more than 100 m apart. For longer sections, a powered capstan should be used.

For cable pulling, a fiberglass duct rodder, cable pulling ropes, cable mesh pulling grips, and swivel pulling eyes are used. Fiberglass duct rodders are manufactured in various lengths and diameters. Their leading ends can be equipped with pulling eyes, female rod end, swivel rod end, and locating probes for detecting the exact position of the rod tip.

Cable pulling rope for manual installation is typically made of polyester or aramid fiber, usually with a diameter of approximately 8 mm, while for mechanical pulling it is typically around 12.5 mm.

Pulling eyes with cable mesh pulling grips are generally attached to the cable's strength member or, if the cable design permits, over the outer jacket. Their purpose is to distribute the tensile load evenly and thereby prevent damage to the optical fibers. Mesh pulling grips are available in various sizes to accommodate different cable diameters and may have one or two pulling eyes. To prevent cable twisting during installation, swivel pulling eyes are attached to the cable via its aramid yarn strength members.

Before starting the installation, it is necessary to verify the maximum allowable pulling tension, the minimum bending diameter or radius during and after installation, the cable length, and the required slack to be stored in the manholes. As with cable blowing, the duct must be checked for cleanliness prior to installation using a fiberglass duct rodder, a blowing machine, and specially designed duct brushes.

To ensure an efficient installation process and prevent damage, continuous communication between technicians is essential.

Manual pulling is most commonly performed using a fiberglass duct rodder, which is connected to the cable by means of appropriate pulling eyes and cable mesh pulling grips.



The cable reel should be positioned on a stand near the manhole in the direction of pulling, so that the cable pays off from the top of the reel. A section of the cable is unreeled while the fiberglass duct rodder is simultaneously installed between two manholes. The cable is then attached to the fiberglass duct rodder, and manual pulling begins.

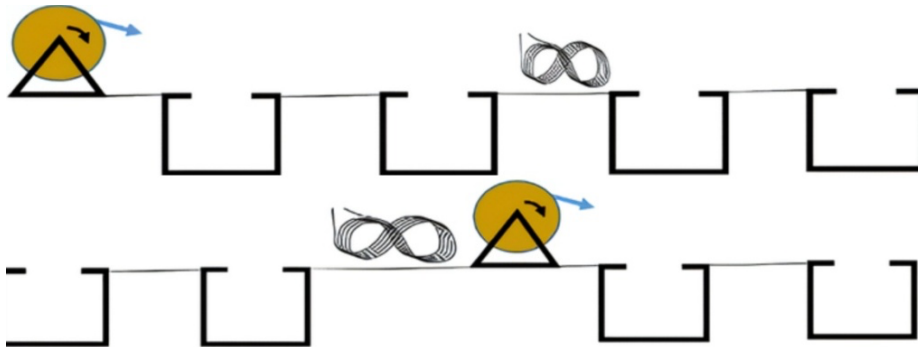
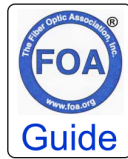
During installation, suitable cable lubricants may be used to reduce friction. For optimal cable installation, the ratio of the cable diameter to the inner duct diameter should not exceed 65%. Installation should begin with careful, controlled pulling, gradually increasing the pulling speed.



### Manual Cable Pulling Using a Fiberglass Duct Rodder

To reduce pulling tension for longer routes, manual pulling from the midpoint of the route may be used. In this case, the cable reel is positioned at the midpoint near a manhole, and one section of the route is installed from the reel using a fiberglass duct rodder, as previously described.

The second section of the route, after determining the required length including slack, requires unreeling the cable into a figure-eight configuration. The cable is then cut from the reel, the stored figure-eight is flipped, and the cable end is installed in the opposite direction until the route is completed. Flipping the figure-eight requires three technicians: two at the ends and one in the middle.



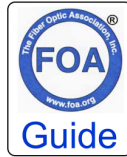
Manual Cable Installation (source: FOA)

For splicing and future restoration, sufficient cable slack length should be stored in manholes at the beginning and end of the route (15–20 m), as well as at intermediate points along the route for mid-span access (15–20 m) and for future repairs (approximately 40–50 m). All cables should be labeled in the manholes using plastic identification tags.



Use of a Cable Pulling Capstan Machine (source: FOA)

For more efficient cable installation, pulling machines are used. These may be manually or motor driven and are equipped with a dynamometer and a tension control system to prevent exceeding the maximum allowable pulling load. The machine is positioned in



the direction of the pull. In the case of riser or vertical duct installations, the equipment should be located at the lowest point of the route. To prevent cable damage, various cable guides and sheaves are used to reduce friction and excessive bending. Pulling machines utilize pulling rope, cable mesh pulling grips, and swivel pulling eyes to attach and pull the cable.

*Vladimir Grozdanovic is a graduate electrical engineer for telecommunications with more than 10 years of experience in access networks (HFC and FTTH) in large cable operators in Serbia (SBB and Jotel).*

*(C)2026, The Fiber Optic Association, Inc.*