Application Notes

Sterlite Tech

Installation of Optical Fiber

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This procedure describes general information for installation of optical fiber cable pulled or blown in HDPE ducts.

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Pre-installation, route survey, blowing / pulling of cable, jointing, termination, data recording

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General

This procedure describes general information for installation of optical fiber cable in HDPE ducts. There are two basic methods of installation of duct cable, i.e. pulling method & blowing method, which should be selected based on route length, site condition & accessibility of required machineries, etc. Planning the actual installation should take place only after a thorough route survey. The installation method to be used will be largely dictated by the cable route. The proper selection of one of these methods at right place can save installation cost & time.

Complete installation of duct cables typically involves the following processes:

- Pre-installation route
- survey Blowing/pulling
- of cable Jointing of
- cables Termination
- Data recording

Pre-Installation Route survey:

Add title The pre-installation survey of route is recommended to identify the problem areas, fix them and define an installation plan prior to the start of installation. Objectives of Pre-installation Route surveys are:

- To determine the locations where each drums of fiber optic cables are to be placed along with the splice locations.

- Cable storage & Blowing/pulling Points requirements must also be considered along with splice locations.

- To determine if any special tools/machineries & Work Permissions required for a particular site and revise preliminary splice locations to ensure installation of cable goes without any intervention.

Pre Installation arrangements:

For smooth operation of installation work, it is very important to make necessary arrangements of tools/ machineries, managing route & manpower etc.

When drum is received at site, inspect it for any physical damage. Test all optical fibers for continuity & attenuation before installation. Upon confirming all fibers are satisfying requirements then only proceed for further processes pulling/blowing.

Properly fix bottom end of cable so that it will not damage & make inconvenience for rolling drum . Load optical fiber cable drum on pay off so that cable can be pulled from top of the drum. Which helps proper straightening of cable when it pays out and prevents it from rubbing in ground?

Connect proper pulling grip with swivel between pulling rope & cable

Before starting installation ensure that all cable pathways are completely & thoroughly cleaned

Installation process

Practically installation of cable starts with the step of pulling /blowing and is the most important step in the installation completion.

Cable can be installed by pulling or blowing technique. Both the cases require special care during installation. Installation guidelines regarding minimum bend radius, tensile loads, twisting, squeezing or pinching of cable must be followed. Violation of any of these parameters causes increased attenuation or permanent damage to the cable or fiber.

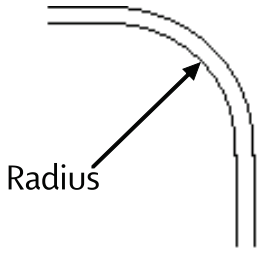
To avoid any damage to the cable, follow the general instructions given below

Cable pulling Tension:

Do not pull the cable above its rated pulling tension. Pull maximum cable length so that it does not exceed its rated tension. The pull length depends on the cable weight, friction between cable & duct, duct cleanliness & bends in duct, etc. Use pulling grips with swivel to attach the pull rope. Use proper lubricants compatible with cable jacket & ducts.
For longer pulls of cable, use “Figure 8” on ground to prevent twisting.

Minimum Bending radius:

Exceeding the bend radius of the cable can cause unseen damage to the fibers of the cable that may not manifest itself for a period of time. This can lead to expensive restoring of cables at the later date.



Cable Twisting:

Use proper anti twisting device. Putting twist in cable greatly increases your chance of breaking the fiber.

Choice of Cable Laying Technique:

1. The Pulling method is used when the blowing machinery is not available. Further, when the route length is very small, this technique is useful. To use this method, it is necessary to have pre installed rope inside the HDPE duct.

2. The Blowing method is used when route length is more & blowing machine can be accessible at duct/chamber points.

Cable pulling method:

The basic approach to pulling optical fiber cable differs a little from techniques used to pull the copper or aluminium power cables. In this method, the Optical Fiber Cable can be pulled by hand or using a cable-pulling winch at every chamber location.

Pulling Procedure

Shift the cable drum at the centre location of pulling the route length so that bi-directional pulls are possible by laying the cable into large figure-8 shapes loops on the ground. Thus it could be fed from both ends for both directions.

Load the cable drum on Jacks/drum pay off so that the cable can be pulled straight from the top of the drum. Check for cable upper layer for any cross winding & before start pulling.
Tighten the cable pulling grip end with anti-twisting device. Connect this pulling grip to preinstalled rope.

While pulling the cable through duct, always watch the cable entry & exit point and ensure that the cable should not bend below specified minimum bending radius, which may create permanent damage to cable & fibers.

If the cable is pulled continuously for its whole length then put a person at every 200 m intervals/ chamber location (or maximum possible length for which cable tension will not increase above its rated load) for pulling cable so that pulling tension will not exceed rated strength .

Make Figure 8 at every 200 m intervals/chamber location. Take extreme care while making Figure 8 & pulling it for next span. This is the most sensitive place for cable bending. Always pull the cable in straight direction.

Ensure that the pulling force is kept below the specified limit and also be kept uniform. Whenever the cable is pulled by cable-pulling winch, tension monitoring equipment must used to monitor uniform tension.

Blowing Method

Cable blowing is an advance technique for cable installation in duct. This process is very fast comparative to traditional pulling and very effective for longer distance route.

Cable blowing is the process of blowing optical fiber cable through a duct while simultaneously pushing the cable into the duct. Compressed air is injected at the duct inlet and flows through the duct and along the cable at high speed.

Blowing Procedure

Load cable drum on Jacks so that the cable can be blown from top of the drum. Properly fix bottom end of the cable so that it will not damage & make inconvenience for rolling drum before pulling cable. Check any cross winding of cable present if it is there remove it & then proceed for further blowing.

Start blowing very slowly to avoid whipping up & jerks on drum. The blowing speed can be gradually and steadily increased.

Set blowing pressure as per requirements of machine, cable & ducts.
While blowing cables threw duct always watch the cable entry point so that cable should not bend below its bending diameter .this may cause permanent damage to cable & fibers. Set machine for proper pressure so that no cable or duct component will damage. While pulling cable may get stuck due to bending of ducts and /or couplers joint. Don't increase rated pressure. Find out cable stuck point in duct. Take cable out at these points make figure 8 for further blowing from these points. Take extreme care to avoid bending while blowing next to these ducts.

Jointing and Termination

The optical fiber cables are joined by Fusion splicing process by following color code or sequence of buffer tubes and fibers in the cable and secure it in joint closure box at every joint location.

Optical fibers may be connected to each other by connectors or by splicing, i.e. joining two fibers together to form a continuous optical waveguide. The generally accepted splicing method is arc fusion splicing, which melts the fiber ends together with an electric arc.

Fusion splicing is done with a specialized instrument that typically operates as follows: The two cable ends are fastened inside a splice enclosure that will protect the splices, and the fiber ends are stripped of their protective polymer coating. The ends are cleaved (cut) with a precision cleaver to make them perpendicular, and are placed into special holders in the splicer. The splice is usually inspected via a magnified viewing screen to check the cleaves before and after the splice. The splicer uses small motors to align the end faces together, and emits a small spark between electrodes at the gap to burn off dust and moisture. Then the splicer generates a larger spark that raises the temperature above the melting point of the glass, fusing the ends together permanently. The location and energy of the spark is carefully controlled so that the molten core and cladding do not mix, and this minimizes optical loss. A splice loss estimate is measured by the splicer, by directing light through the cladding on one side and measuring the light leaking from the cladding on the other side. A splice loss under 0.1 dB is typical. The complexity of this process makes fiber splicing much more difficult than splicing copper wire.

Mechanical fiber splices are designed to be quicker and easier to install, but there is still the need for stripping, careful cleaning and precision cleaving. The fiber ends are aligned and held together by a precision-made sleeve, often using a clear index-matching gel that enhances the transmission of light across the joint. Such joints typically have higher optical loss and are less robust than fusion splices,

especially if the gel is used. All splicing techniques involve installing an enclosure that protects the splice. At both end of link, the fibers of the cable are terminated in connectors that hold the fiber end precisely and securely and fixed in FDMS (Fiber Distribution Management System) or ODF (Optical Distribution Frame)

Data Recording:

This is very important activity during and after completion of any optical fiber cable project Optical fiber cable life is more than 25 years but is sensitive to damage in Open environment. Proper selection of cable for aerial installation reduces chances of cable damage during its lifetime. Installation Data helps to find out Fault location of cable very easily. Data recording saves time of cable maintenance & restoration. This document explains how to select cable & record data.

During operation condition of the cable, due to external factors cable can get damaged or faults may occur. To attend such faults, permanent documentation of cable route is required. This document must record following data.

Geographical map of cable Route
Table with following information
Area name
Permanent sign at different places
Cable code Number
Joint, Termination, Dropping details Events on
OTDR (at the time of Acceptance Test)
Manhole/Pole number & location Meter marking
at each manhole/pole/joint/termination
Miscellaneous information. Typical Example:

Area	Location	Cable Number	Joint or Termination	Event Details	Pole Number	Meter Marking	Remark
Mumbai A	Exch A	0001	Termination	Nil	Nil	1	Main Exchange
	Bldng XYZ	0001	Nil	Nil	1	35	
	Petrol Pump A	0001	1,2,3,4 Mid Span	Loss	2	100	Drop to Bldg B
	A1	0001	Nil	Nil	3	200	
	A2	0001	Nil	Nil	4	256	
	A3	0002	5-12 Branch & Joint	Loss	5	0500-0025	Branch to Exch B

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