Fiber Optic Cable

Application Note

Fiber Optic Cable Installation & Safety Manual

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Abstract

The manual gives some basic safety information applicable to Optical fiber cable installation & storage. Personnel involved in Optical fiber cable installation must be aware of all the applicable Occupational and Health safety regulations, the NESC and local regulations along with the company safety practices. Failure to follow the same can lead to fatal consequences to them as well as people in the vicinity.

Keywords

Fiber Optic Cable, Safety, Handling

Fiber Optic Cable

Application Note

Cable Handling

All optical fiber cables are sensitive to damage during handling & installation. Some of the important parameters that needs special attention during cable installation are:

IMPORTANT: Cable bending radius: Optical fiber cables are designed with particular bending radius & tensile strength. The cable should never be bent below minimum bending radius at any location. Doing so can result in bending losses and/or breaks in the cable. Generally the bending radius of a cable is greater than 20D, where D is the diameter of cable.

IMPORTANT: Cable Pulling Tension: Exceeding the Cable Pulling Tension above the defined value in the Cable Data sheet / Specification, can alter cable's & fiber characteristics.

Laser Precaution

Laser beam used in optical communication is invisible and can seriously damage the eyes. Viewing it directly does not cause any pain and the iris of Eye does not close automatically as it does while viewing the bright light. This can cause serious damage to the retina of eye. Therefore,

- Never look into a fiber having a laser coupled to it.
- If eye is accidentally exposed to LASER beam, immediately rush for medical assistance.

Optical Fiber Handling Precaution

The broken ends of fibers created during termination and splicing can be dangerous. The ends are extremely sharp and can easily penetrate the skin. They invariably break off and are very hard to find and remove. Sometimes pair of tweezers and magnifying glass are needed to take them out. And any delay in taking the fiber out of body could lead to infection, which is dangerous. Hence,

- Be careful while handling the fibers.
- Do not stick the broken ends of fiber into your fingers.
- Do not drop fiber pieces on the floor where they will stick in carpets or shoes and be carried elsewhere-like home.
- Dispose off all scraps properly.
- Do not eat or drink near the installation area.

Material Safety

Fiber optic splicing and termination processes require various chemical cleaners and adhesives. The safety instructions defined for these substances should also be followed. If there is confusion in usage of these products, ask the manufacturer for a MSDS (Material Safety Data Sheet). Remember the following instructions while working with materials.

- Always work in well-ventilated areas.
- Avoid skin contact to materials involved as much as possible.

- Avoid using chemicals that cause allergic reactions.
- Even simple isopropyl alcohol, used as a cleaner, is flammable and should be handled carefully.

Primary treatments if exposed to Isopropanol & Hexane in cleaning fibers

	Hexane		Iso-Propanol	
Type of Exposure	**Effect of exposure**	**Emergency Treatment**	**Effect of exposure**	**Emergency Treatment**
Inhalation	Irritation of respiratory tract, cough	Maintain Respiration, Bed rest.	Irritation of upper respiratory tract	Remove victim to fresh air area, Administer artificial respiration if breathing is regular
Ingestion	Nausea, Vomiting, Headache	Do not induce vomiting, immediately seek, medical advice.	Drunkenness & vomiting	Have a victim drink water and milk, seek medical aid.
Contact with skin	Irritation	Wipe off affected area of skin & wash with soap & water	Harmless to skin	Wipe off affected area of skin & wash with soap & water
Contact with eyes	Irritation	Wash eyes with plenty of water for 15 min.	Irritation	Wash eyes with plenty of water for 15 min.

Fire Safety

- The fusion splices use an electric spark to make splice, so ensure that there are no flammable gases in the space where fusion splicing is done.
- Splicing should never be done in places manholes where gases can accumulate.
- The cables are brought up to the surface into a splicing trailer where all fiber work is done. So the splicing trailer is temperature-controlled and kept spotlessly clean to ensure good splicing.
- Smoking should not be allowed around fiber optic work. The ashes from smoking can contribute to the dust problems in fibers, apart from the danger of explosion posed by them due to presence of combustible substances.

Safety During Duct Installation

Manhole /Underground vaults safety:

- Explosive gases or vapors might be present in manholes due to leaking of nearby gas or liquid pipelines. Before entering any manhole test the manhole atmosphere with an approved test kit for flammable and poisonous gases.
- Avoid usage of any device that produces spark or flame in manhole.

Working safety:

- To minimize the risks of an accident in the work area follow specified rules for setting up barricades, manhole guards and warning signs.
- Before pulling cable directly from figure 8 shape, make sure that the area inside the loop of the cable is clear of personnel and equipment. Failure to do so may result in injury to personnel or damage to the cable due to entanglement.
- Ensure that the tools and equipments used for cable installation are in proper condition. Corrosion of equipments may damage cable or cause injury to personnel. Take care of electric hazards, if electrical lines are passing through the manholes or vaults where installation is being done.

Safety During Aerial Installation

Pole Safety:

- Before climbing a pole, inspect it for various safety issues as splintering, insect nests, sharp protrusions
- Use leather gloves when climbing or getting down on pole and when working with sharp instruments or materials.

- Wear rubber gloves when working near exposed electrical circuits to avoid electric shock
- Follow electrical safety rules when working near power lines.

Cable Pulling Safety:

- Personal normally should stay away from the area where a cable is being pulled around a piece of stationary hardware under tension. Appropriate safety measures should be taken while working near the installation site.
- Keep hands free from tools when climbing or getting down on pole or ladder
- Suitable accessories must be used during installation to ensure smooth and safe working.
- Only essential skilled personnel should stay near the installation site during tensioning operation can minimize risk of injury or death. Nobody should allow to climb on intermediate poles, while tensioning . Passerby on ground should be kept away from poles during tensioning. Suitable warning / Safety display board should be put on installation site.

- Ground every metallic components to avoid electric hazards due to spark produced by power lines or any other means.

Safety Summary

- ✓ Keep all food and beverages out of the work area. If fiber particles are ingested they can cause internal hemorrhaging.
- ✓ Wear disposable aprons to minimize fiber particles on your clothing. Fiber particles on your clothing can later get into food, drinks, and/or be ingested by other means.
- ✓ Always wear safety glasses with side shields, suitable safety Helmet , Safety belts and protective gloves. Handle the fiber optic splinters similar to glass splinters.

- ✓ Never look directly through the end of fiber cables till you ensure that there is no light source at the other end. Use a fiber optic power meter to make sure that fiber is dark. When using an optical tracer or continuity checker,look at the fiber from an angle at least 6 inches away from your eye to determine if the visible light is present.
- ✓ Only work in well-ventilated areas.
- ✓ Do not touch your eyes while working with fiber optic systems until they have been thoroughly washed.
- ✓ Keep all combustible materials away from the curing ovens.
- ✓ Dispose the fiber scraps properly.
- ✓ Thoroughly clean your work area after completion of installation
- ✓ Do not smoke while working with fiber optic system

Optical Fiber Cable & Drum Storage & Handling

Introduction

The Manual provides guidelines for storage of Optical fiber cable. These guidelines can apply to all 'outside plant Optical fiber cables'. This document provide information for handling Drum at various places from receiving in stores till shipment to the site for installation. Proper handling of cable Drum decreases probability of accidental damage of cable & personnel.

Cable Handling

All optical fiber cables are sensitive to damage during handling & installation, such damage can degrade cable performance to the extent that replacement is necessary. In Order to avoid damaging cable following precautions should be taken .

a. Cable Unloading

- While unloading truck it is important that drum of cable not to be dropped on tiers of floor. The weight of Drum & cable may cause deflection of Drum flange resulting flattening, deformation or damage of cable.
- The Drum must be rolled from truck on to receiving platform, which should be in same height as the tailgate of truck. An alternate is to use forklift to unload drums from truck.
- If inclined ramps are used roll drums over it and don't allow Drums to roll out off control.
- Roll each Drum away from the bottom of the ramp before handling the next Drum.

b. Cable Wrapping

- Drum wrappers play an important role in protecting cable from damage. All Drums are wrapped by wooden laggings to protect cable from damage by minor impacts resulting from Drum rolling on rough surface. Cable on Drum is wrapped by black polythene gives thermal protection to cable.
- Don't remove complete wrapping from Drum until cable is ready to install.

c. Cable Storage

- The drums should always be stored in an upright position. Storage of drums in an alternative position can lead to winding defects.

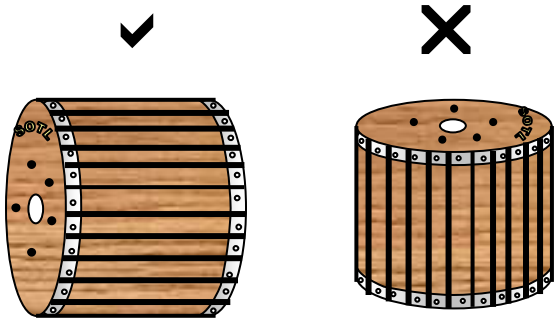

Fig 1. a) drum on flange edge b) drum on Flange side

- If storage place is limited and it becomes necessary to stack. Stack completely wrapped Drums on their flanges edge as shown in fig. 2.

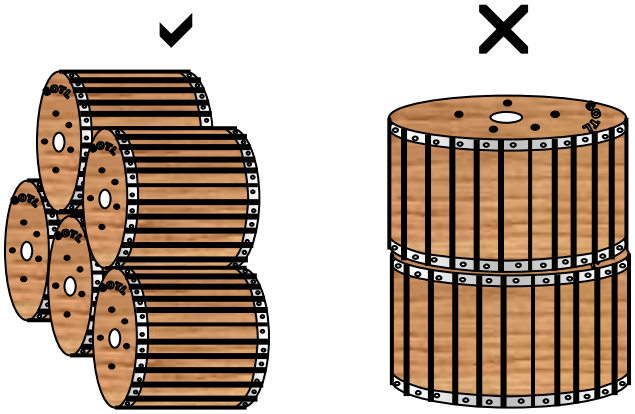

Fig 2. a) Packed drum stacked on their flange b) Wrong Stacking of drums

- If wrapper is removed from drum, their rolling edge should be lined up in rows with the flanges touching each other so that the flanges do not overlap with cable and accidentally damage it as shown in fig. 3.

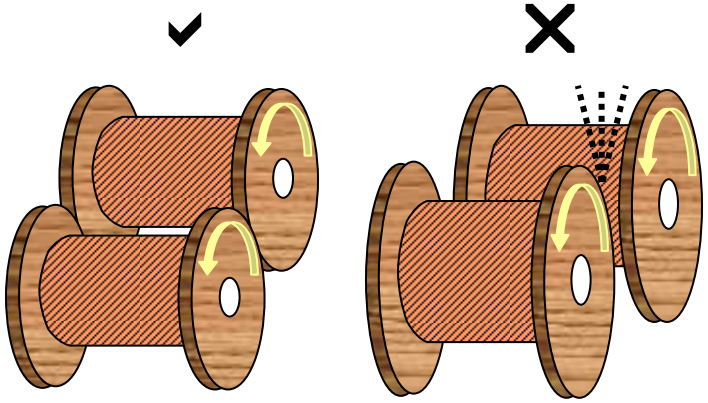

Fig 3. a) Open drums stored by touching flanges b) Wrong storage

d. Cable Storage Environment

Optical fiber cables are wind on wooden drums . Due to environment surrounding drums wood gets degrade over a period of time . To avoid such degrade in wood during its storage period inhouse storage is recommended . if drums are stored outside, storing surface should be hard & no moist soil will be in contact with wood, this avoid generation of harmful insects responsible for wood degradation . During heavy rain close drums by polythene so that Drum moisture content should remain around 18% to 25 %

e. Cable Inspection

Apart from making sure that the correct type and quantity of cable was shipped from factory it is necessary to inspect each Drum for damage. Usually if there is no sign of damage on the lagging or flange then the cable is probably undamaged.

- If there is any doubt remove lagging and examine cable thoroughly.
- If there is any shipping damage inform the supplier.
- Before installing cable test all fibers for their optical continuity & attenuation & length of cable, if any deviation found inform the supplier immediately.

Preparation Of Drum For Installation

- Before taking drum to site test each drum/cable in drum for their optical continuity attenuation & damage due to improper handling of drum.
- Flanges are stenciled for various parameters such as cable Length code, meter marking, manufacturer's name, fiber count and fiber type. Check correct Drum for Drum no, length, fiber count, fiber type as mentioned in Plan before dispatching it for installation site.
- Open drum & inspect Drum for Optical continuity & attenuation before taking drum to the site. If any deviation found inform supplier immediately & plan another drum with matching requirements of Original plan.

a. Opening Drum

- All the Drum are closed by nailing wooden battens on their flanges with the help of aluminum or iron strip to avoid any damage to the cable during transportation. To take out the cable for installation or testing, the battens should be removed carefully without damaging any component of cable.
- First cut iron strip using strip cutter at 4-5 places parallel to the circumference.
- Put the hammer in gap of batten near an iron strip cut & press hammer opposite end so that batten comes out from flange.
- Remove required/all battens from drum. Cautiously bend the straight nails using hammer after removing battens to avoid any injury due to them. After removing these battens remove thermal wrapper applied over cable.

b. Drum Inspection

- Once drum is open make visual inspection for any damage of flattening.
- Locate the inner & outer ends of cable (usually inner end is rounded on Cable guider) and take out the pulling grips & end caps from both the ends.
- Confirm the length & Drum no. embossed in the cable with that in dispatch documents.

- Now prepare ends for optical testing of fibers in the cable for parameters like attenuation & optical continuity of fibers using fusion or Mechanical Splicing & OTDR.

C. Mounting Drum On The Pay Off

To avoid cable rubbing against Drum flanges keep cable Drum level. Orient cable Drum so that natural payoff direction is towards pulling direction. To eliminate possible cable contact with the ground payout the cable from the top of the Drum.

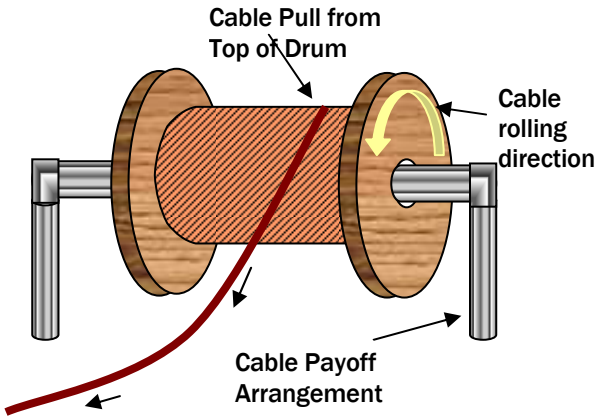

Figure Eighting

- Mark two adjacent circles on floor of 1.5 to 2 meter diameter in such a way that it makes figure eight.
- Put pulled cable from pole or payout trailer over this mark one above other layer, if required put cardboard sheet over each layer. When long lengths & higher weight cables need to be undrummed make more than one figure eight coils. This will be easy to turn over coils for pulling in another direction. Turning figure 8. loop requires minimum three persons one at center & one at each ends of circle.

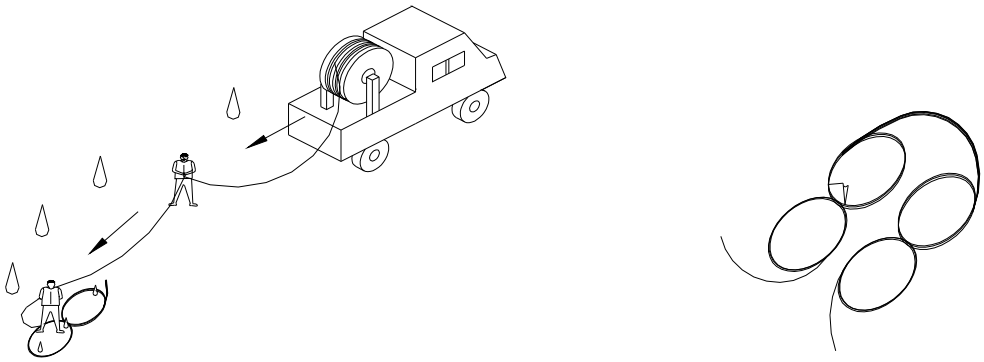

Fig 5 a) Making figure 8 b) Two loops of Fig 8

- Control winding of cable either by hand or with cable Drum brake to avoid free running or jerking of the cable.

Fiber Optic Cable

Application Note

Optical Fiber Cable Loss & Length Measurement

Introduction

Optical fiber cables are tested for attenuation by cut back Method or back reflection method. Cutback method is mainly used in factories . where back reflection method is fully used in field & factories. The instrument used for loss measurement by back reflection light is Optical time Domain reflectometer . (OTDR).

Dummy fibers are used to neglect effect of dead zone created due to connectrisation at OTDR output. .Dummy fibers are Optical fiber connected one end with pigtail & other is free to splice with fiber under testing. These fibers are more useful to find out short distance faults & loss/attenuation measurement in real time mode. This document explain how to use dummy fibers for Length and loss/ attenuation measurement.

Safety

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Block Diagram

This is block diagram for testing optical fibers using dummy fibers.

OTDR O/p Connector	Mechanical or Fusion Splice	OF Cable Drum

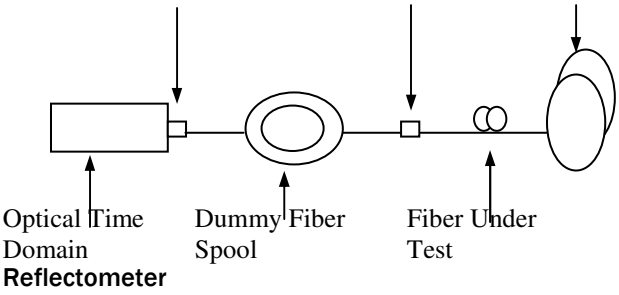


Figure 1

Procedure

1. Connecting Dummy Fibers /pigtails To OTDR :

Clean FCPC connector using Iso-propanol & Butter paper . Connect it to OTDR out put so that you will observe square peak (A Figure 2)at starting of OTDR trace. Next to this peak OTDR Traceshould be smooth & continuous slope.(B Figure 2) Adjust connector so that you will get proper OTDR Trace as shown in Figure 2

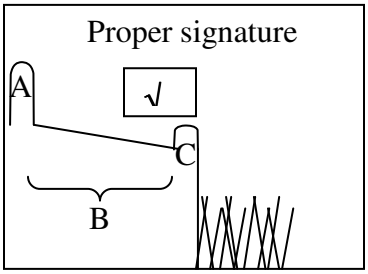


Figure 2

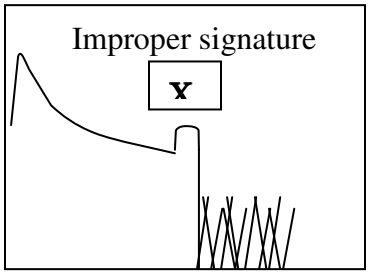


Figure 3

Note : Clean connectors properly & keep closed with connector caps when not in use . Dirty connectors can cause permanent damage of either OTDR or Dummy connector & required to replace.

2. Length Measurement:

Once proper Trace is observed on OTDR . Cut small piece (1 to 2 mm) of fiber at another end of Dummy spool using sharp nipper & you will observe square peak on OTDR .(C figure 2) . Place "Cursor 1" at beginning of peak ensure that it is on the linear portion of trace . Note down "Cursor 1" reading .Now connect Fiber under Test to dummy fiber using Mechanical Or Fusion Spicer. You will find trace as shown in figure 5 . Set "Cursor 2" at starting of extreme square peak & note down reading. Subtract " Cursor 1" reading from "Cursor 2' & you will get *Optical length of Fiber in Cable.*

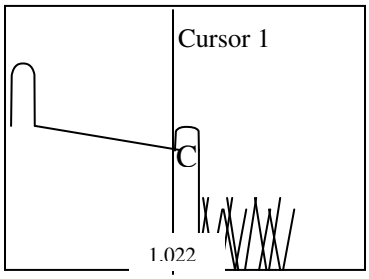


Figure 4

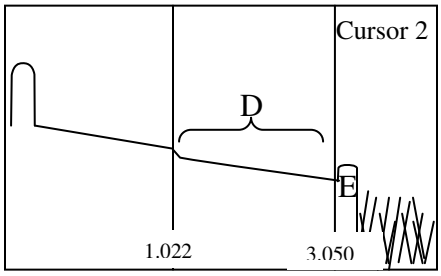


Figure 5

Note : *If you are not getting End peak (E Figure 5) take out another end from Drum & cut particular fiber (1 to 2 mm) & observe OTDR trace for Peak*

3. **Loss/attenuation Measurement:**

To measure Attenuation dB/Km of fiber under Test Connect fiber using Mechanical or Fusion splicer to Dummy Fiber . you will observe trace as shown in figure 6. This Trace is showing splice location (C figure 6) & slope down trace (D Figure 6). To measure fiber attenuation move "cursor 1" to right of splice location ensure that it is on the linear portion of trace and not within splice slope.as shown in Figure 6
Note down LSA attenuation reading for fiber under test at both wave lengths (1310 & 1550)

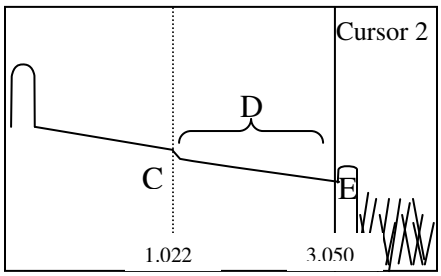


Figure 6

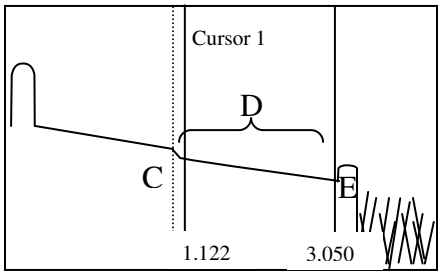


Figure 7

Note *: Place marker right to splice location around 100-150 meters & splice dummy & under test fibers so that minimum splice slope will observe at splice location to get better reading.*

Technical Terms

1. OTDR Optical Time Domain Reflectometer : This is used to measure Attenuation & length Of Optical fiber . OTDR sends high Power Pulse of invisible laser down the fiber & captures the light that is reflected back .by measuring timing & power levels of the return pulse. By analyzing this information instrument display a trace that shows optical power verses Distance. This trace gives information about distance, Attenuation & location of faults.

2. Attenuation Coefficient : This is measure of the loss of optical signal power per kilometer expressed in dB/km .Attenuation of fiber is displayed as a slope of the trace

3. Splice : A permanent or temporary joint between two optical fibers . Sudden decrease in optical power is Splice location. Splice loss is measured by estimating loss of connection from both ends & taking average of this values.

4. Event : Interruptions such as splices, connectors ,bends, breaks or flaws in the fiber appear as transitions called as events that represent their nature & locations .

5. Dead Zone :
Event dead Zone : The minimum distance after an event that the OTDR can accurately measure the distance to the next reflective event is called dead Zone if a second event occurs within the dead zone of preceding event ,the OTDR will not be able to detect it dead zones vary with pulse width –narrower pulses produce shorter dead zone.

Loss dead Zone : Loss dead zone is minimum distance after an event that the OTDR can measure the loss due to non reflective event. The loss dead zone is related to effect of reflected pulse on OTDR detector .The detector can become saturated by large reflected pulses and takes time before it can recover to detect the next loss event.

Summary:

Dead zone at OTDR connector is minimized using Dummy fiber of length minimum 300 to 400 meters this is depend on pulse width of OTDR used for testing. For longer pulse width use longer dummy fiber . Note that this dummy fiber is not a reference fiber & will not affect on length & attenuation measurement of fiber under test.

Optical Fiber Splice loss Measurement

Introduction

This document help to understand how OTDR works & calculate splice loss . In this document you can find answers to the questions Why OTDR showing gain event on trace ? How to calculate splice loss? Why to take bi-directional reading for calculate splice loss?

How OTDR Works ?

Unlike sources and power meters, which measure the loss of the fiber optic cable link directly, the OTDR works indirectly. The source and meter duplicate the transmitter and receiver of the fiber optic transmission link, so the measurement correlates well with actual system loss. The OTDR, however, uses unique phenomena of fiber to express loss.

The biggest factor in optical fiber loss is scattering. In the fiber, light is scattered in all directions, including back toward the source. The OTDR uses this "backscattered light" to make its measurements. It sends out a very high power pulse and measures the light coming back. At any point in time, the OTDR sees the light scattered from the pulse passing through a region of the fiber.

Since it is possible to calibrate the speed of the pulse as it passes down the fiber, the OTDR can correlate what it sees in backscattered light with an actual location in the fiber. Thus it can create a display of the amount of backscattered light at any point in the fiber.

The amount of light scattered back to the OTDR is proportional to the backscatter of the fiber, peak power of the OTDR test pulse and the length of the pulse sent out.

Backscatter Coefficient

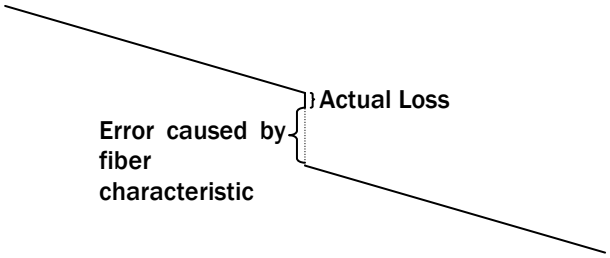
A big term which simply means the amount of light from the outgoing test pulse that is scattered back toward the OTDR. The OTDR looks at the returning signal and calculates loss based on the declining amount of light it sees coming back.

How OTDR Measure Splice Loss ?

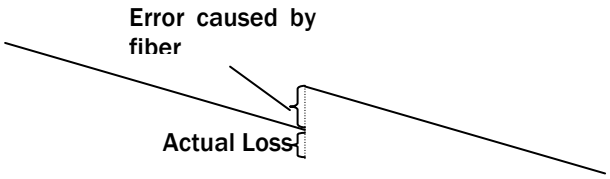
Only about one-millionth of the light is scattered back for measurement, and that amount is not a constant. The backscattered light is a function of the attenuation of the fiber and the diameter of the core of the fiber. If you look at two different fibers connected together in an OTDR and try to measure splice or connector loss, you have a major source of error, the difference in backscattering from each fiber.

To more easily understand this problem, consider Figure 1 showing two fibers connected.

1. Low MFD fibers spliced to High MFD fibers



2. High MFD fibers spliced to Low MFD fibers



However, if the fibers are different, the backscatter coefficients will cause a different percentage of light to be sent back to the OTDR. If the first fiber has less MFD than the one after the connection, the percentage of light from the OTDR test pulse will go down, so the measured loss on the OTDR will include the actual loss plus a loss error caused by the lower backscatter level, making the displayed loss greater than actual.

Looking the opposite way, from a Higher MFD fiber to Lower MFD Fiber, we find the backscatter goes up, making the measured loss less than actual. In fact, this often shows a "gainer", a major confusion to OTDR users.

This error source is always present, it can be practically eliminated by measuring from both direction and averaging the measurements. The errors in each direction cancel out, and the average value is close to the true value of the splice or connector loss. This is the only way to test inline splices for loss and get accurate results. you can't change the laws of physics.

Formula For Splice Loss Calculation

$$\text{Splice Loss} = \frac{\left|\text{Splice loss}_{(\text{A to B})} + \text{Splice loss}_{(\text{B to A})}\right|}{2}$$

Fiber Optic Cable

Application Note

Aerial Cable installation

Introduction

This manual provides general GUIDELINES for installation of ADSS cable on high voltage power line. Actual installation process is influenced by local conditions, customer's existing procedure & requirements. ADSS cable installation procedure is essentially same as installation of conductor on tower .Safety is main concern for working near High voltage power lines. Do not void any safety rules either given by NESC or your local regulation. Use convenient way of installation as per the rules & regulations.

Complete installation of Aerial Cables typically involves the following processes:

- Pre-Installation Route survey
- Pulling of cable
- Tensioning
- Termination and Clamping
- Data Recording

Pre-Installation Route Survey:

A 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. During pre installation route survey it is required to consider all major & minor aspects of safety, durability of cable ,cost & time .

Installation Considerations:

Optical fiber cable installation over high voltage power line is influenced by many mechanical, environmental & electrical parameters. Before installing cable over tower it is very important to consider all these parameters in cable design & installation.

For safety & durability of cable plan installation as per data sheet given by cable manufacturer.

To fulfill installation objective following considerations should be incorporate in pre survey.

Splicing & Grounding Location:

Most accessible & convenient place for splicing & earthling the cable is Power line tower locations. Plan cable lengths so that all splicing locations should come on the tower lines with cable extra slack 25-30 meters . In power distribution utility Span length is very high ranging from 250-500 mts . Improper planning of length not reaching to towers will be huge scrap which is not cost effective.

Pulling Locations :

Cable can installed either by moving or stationary reel method over power lines . Most of ADSS cables are located at center of tower . for which Stationary reel method is the suitable method of installation. In this method cable required to pull in several segments . these segment lengths are dependent on allowable splice accessibility of sites for vehicles & workman's ,capability of installation equipment, obstacles in right of way (like tress & houses) & cable drum lengths .

Considering above factors find out location where “figure Eighting” is easy to avoid damage to cable. Easy access for further pull.

Tower Safety :
While pulling cables it is required to take care of tower strength . select location of puller machine so that tower structure will not overloaded . Select pulling location so that pulling slope will remain four to five horizontal to one vertical . This slope makes angle between vertical of pole structure & pulling greater than 75 degree . if required put temporary guys .

Crossing Structures :
From the point of safety it is important to put extra support when crossing rail tracks, highways, & other structures. During pre installations such locations to be identified & required protections to be judged . One of the type is to construct ‘H’ structure frame on both sides of crossing point .with theses guard posts cable can maintain above minimum height . Another way is to put rope nets between two structures to provide protection.

Cable Fixing Location On Tower :
To minimize electric field effect on cable minimum distance between cable & conductor should be determine for fixing cable on tower. It is recommended that cable position on tower should be such that there will be no contact between cable & conductor during installation & under maximum load conditions.

It is required to analyze electric field potential around conductors . so that cable can be put at minimum field strength location . it is also required to calculate load ,Sag & wind effects on cable so that cable can be installed with required sag in respect to phase conductor so that with maximum tension conductor & cable will not come in contact.

Installation Procedure :
Preparation On Site :
Pr inspection: After receiving drums from stores. Handle drum as per the guidelines given in DRUM HANDALING manual. Unload the drums at different locations given in Installation plan. Make drums ready for installation only after confirming optical parameters as per specifications (mainly Length & loss). Record all these parameters. This will helpful to compare the cable characteristics after installation.

Practically installation of cable starts with the step of pulling and is the most important step in the installation completion. Pulling involves taking off cable from drum and placing it on temporary supports before tensioning and clamping could be done.

Choice Of Pulling Technique:
The stationary Drum method : is used when drum-carrying vehicles cannot drive the majority of the cable route. It is also the best method to use where obstacles (such as branches, other power lines, etc) exist.

The moving drum method : is used in locations where a cable drum trailer or aerial lift truck can be moved along the pole line and there are no obstructions between the drum and the

suspension strand. It is one of the faster and cheaper of the two, which requires less number of personnel and temporary hardwares.

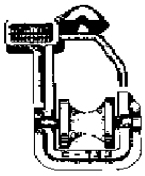
Stationary Drum Pulling:
In this method the cable is pulled along the cable route through temporary support hardware installed for avoiding bending & rubbing of cable during the pull. After completion of pulling, the cable is tensioned at each dead end pole along route.

Pulling Procedure:
Cable can be pulled directly from the payout trailer for a uni-directional pull or by making figure eight for a pull in both directions.

Load the drum on drum trailer so that cable is fed from the top of drum, which helps proper straightening of cable when it pays out and prevents it from rubbing in ground.
Once payout trailer is set, center of drum should be positioned so that the cable pulls from center of drum directly in first roller of chute & along line of sight of strand as shown in Figure 1 & 2.

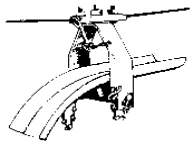
Start the pull very slowly to avoid whipping up & jerks on drum. The pulling speed can be gradually and steadily increased. The pull can be accomplished by hand or using a cable-pulling winch.

Temporary Support Hardwares:



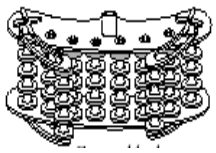
Select temporary support hardware so that cable does not bend below its minimum bend radius through out the route. To prevent cable from rubbing & blocking in the way of Cable chute, Cable block, Corner block, following are some of the temporary hardwares used.

Cable Chute Guide:



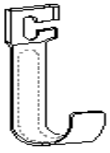
Purpose of Chute Guide is to guide the cable paying off from the drum on to the cable block or roller. It has a low friction coefficient, which reduces back tension when cable is pulled.

Cable Blocks Or Rollers:



Cable blocks or rollers are placed on every pole to support cable & reduce pulling tension. It keeps the cable straight & reduces safety hazards such as cable dropping down when pulling is stopped or whipping up of cable when pulling starts abruptly.

Corner Blocks:



As the cable is pulled along the strand, 450 or 900 turns might be required. To pull the cable through these turns without damage, Corner blocks of 45 & 90

are needed. They should be positioned in such a way that the cable is tangent to bend.

Moving Drum Installation Method:
In this method, cable is paid-off from a moving vehicle as it drives along the pole line as vehicle passes each pole; the cable is raised into place and into a J-hook or temporary support. This procedure is repeated down the pole until dead end pole is reached. At dead end cable is tensioned and terminated into dead end fitting. The cable between dead ends is then lifted out of the temporary fitting at each of the intermediate poles and placed in permanent tangent.

Begin the installation with the drum carrying vehicle about 15 mts from the pole and facing away it down the pole line. The cable must pay off the top of the drum towards the rear of the vehicle.

Pull off the necessary amount of cable for joining and lifting cable to pole. Install dead end and lift the dead end to the top of the pole and mount on the pole fixture. Slowly drive the drum-carrying vehicle down the placement side of the pole line as shown in Figure 3 & 4
Once the drum is approximately 15 meters ahead from each pole, lift cable and place it in temporary hardware. Once the cable reaches the end of the span, lift the cable to its assigned position on the dead end pole

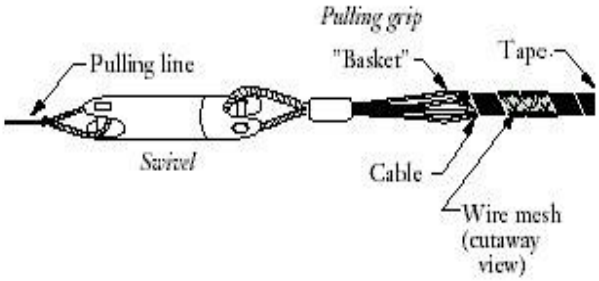
Tension the cable as described in the section below. Once tensioning is completed lift the cable out of temporary hardware & fit in tangent assembly on each pole.

Following care should be taken in moving drum installation:

- Vehicle Speed & cable Take- off speed should be in synchronous to avoid excess tension on cable & pole.
- Be sure that there should not be any overhead wire obstacle between pole & Drum carrying vehicle.
- Pull off necessary amount of slack when lifting cable to hold in Temporary hardware.

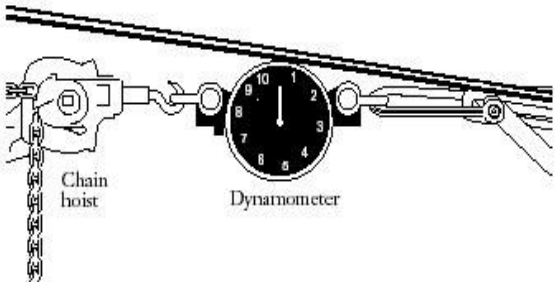
Tensioning:
When cable has been pulled as per specified plan, dead end is installed at one end and cable is tensioned by further pulling the opposite free end chain hoist or the cable pulling winch. While tensioning care must be taken not to exceed the cables rated pulling strength. This can be accomplished with the help of:
Tension Monitoring or limiting winch: It is a device, which controls the force applied for pulling operation, and hence prevents the pulling force to exceed the cable pulling strength.

Break Away Swivel:
It is a device used for installation which bears the tension while pulling of cable and so designed that it breaks when the tension of cable goes above the maximum pulling strength of cable as shown in Figure



Dynamometer:

It is a device used to monitor the tension at the dead end pole during the tensioning operation. The tension is initially monitored at the dead-end poles and this process is carried further with mid-span dynamometer. It is necessary to tension the cable from intermediate poles if required tension is not observed throughout the cable span as shown in Figure



Clamping And Termination Of ADSS Cable:

Once the cable sections are under required tension, terminate free dead end using proper hardware. Remove temporary hardware supports and fix cable using tangent assembly Apply Protection Helix over cable & then put dead end helix over this protection for termination & clamping at false dead end as shown in Figure

Fiber Optic Cable

Application Note

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