Optical Fiber Cable
ADSS Cable

Installation Safety & Handling Recommendations
1. Scope and Purpose

The installation of optical fiber cable requires expertise, experience and individual judgments about the methods and procedures appropriate to any particular situation. This information is not intended, and should not be used, as an exhaustive or definitive manual for the installation of ADSS (All Dielectric Self-Supporting) fiber optic cables. This guide is intended to provide general installation safety and handling recommendations about its installation.

The installation methods for ADSS cables are essentially the same as those used for installing power utility conductors. However, special care must be taken in order to not exceed the maximum pulling tension, the minimum bending radius, and the maximum crush or impact resistance. It is also essential to avoid all jacket damage, since this can expose the strength elements and significantly reduce the reliability of the cable. A more detailed explanation of these special precautions is discussed in this document. The IEEE Guide to the Installation of Overhead Transmission Line Conductors will provide additional relevant information about installation practices.

2. References

NESC, Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communications Lines.

3. Safety

All safety practices of the local Power Utility and the Installation contractor must be followed. These safety procedures take precedence over any information contained in this document (particularly when installation below live conductors). Leakage current from the phase conductors can produce currents on the ADSS cable or hardware, especially during wet weather. It is important that all personnel and equipment are properly grounded, and that the cable is grounded before touching it. Do not install cables on energized towers during wet weather conditions. Refer to section 43 and 44 of the NESC for maintaining safe distances from the phase conductors.

4. Cable Placement

In order to avoid high field voltages that occur close to the phase conductors, the position of the ADSS cable must be carefully considered before selecting where the cable will be installed on the towers. The most favorable location for installation on support structures is an area of relatively low field voltage, which can be determined by use of an electromagnetic field voltage calculation program.

Placement analysis is very important for very high voltage lines (> 40 kV). For medium voltage lines (<35 kV) the placement is generally not an issue versus field voltage.

5. ADSS Stringing Methods

The “Stationary Reel” method is recommended to install ADSS cable. This method requires the cable reel to be stationed at one end of a pull and a take-up reel at the other end. A pull line is threaded through sheaves/travelers using a p-line of matched weight and diameter. Once the p-line is threaded and all the sheaves are balanced/tied up, the ADSS cable is attached to the p-line using a woven wire pulling eye and the take-up mechanism can start the pull. The ADSS cable must be pulled through the travelers under tension to prevent damage from minimum bending radius violations.

The “Moving Reel” method is not recommended for ADSS installation because pulling tensions and loading on the hardware are uneven. Also, it is difficult to keep constant tension on the cable in the tangent travelers between dead-end points. Uneven tensions can cause damage to the jacket and create minimum bending radius violations.

ADSS cable installation is similar on distribution or on transmission lines. Transmission lines require more precautions; if the line voltage is high, grounding the sheaves may be required. Another concern is the distance between the live conductors and the hardware devices point on the structure. Standard utility precautions must be used if the length of the tension hardware reaches close to the region of the conductor.

6. Precautions

Care must be taken to avoid damage to ADSS cable during handling and placing. It is critical to observe the cable specified minimum bending radius and maximum pulling tensions. Precautions must be taken to avoid sharp bends or exceeding the recommended tensions.

Cable reels should be transported in an upright position, on the flanges only. Never lay the cable reel on its side. Inspect the reel flanges and ensure the inner surfaces do not contain any splinters or nicks that could damage the cable jacket when paying off.

Safety devices such as guard poles or mid-span pulleys need to be installed for protection at all public roadways, utility lines, and railroad crossings. If crossing distribution lines, those lines need to have temporary insulators installed. Survey the cable route before starting to ensure...
it is clear of obstructions, including fences and walls. Do not allow cable to drag over obstructions.
The addition of any cable to an existing tower structure will increase their load. Tower or pole strength or guying requirements should be checked prior to cable installation.

7. Installation Equipment

7.1. Grips and Pulling Eyes
Woven wire mesh (double or triple weave) type pulling grips are recommended to attach the cable to the pulling line. Ensure that the correct size grip is used for the cable. During the pulling of the cable there is a possibility that uncontrollable twisting arise. To avoid damaging of the cable a swivel shall be used. It is not acceptable to use a pulling grip device that damages the cable.

7.2. Sheaves (Travelers or Pulleys)
These must have a soft neoprene or similar material liner to cushion the cable from the bare metal of the traveler. The liner or insert must be smooth and show no signs of wear and tear. It is unacceptable for a traveler to have sections of cushion missing or worn through at the bottom of the groove. The depth of the groove should be at least twice as large as the cable diameter, and must be large enough to accommodate the swivel and pulling grips.

In some areas, it is necessary to use uplift rollers or hold-down blocks. This will keep the cable away from phase conductors and ensure that the cable stays in the sheave groove.

The sheave must be a single wheel construction. Multi-wheel ‘banana’ type sheaves often have shallow grooves that may allow the cable to jump out of the groove, and are therefore not recommended. The proper diameter sheave is specified by the cable diameter for each particular cable design. As a rule of thumb, the sheave radius is equal to or greater than 20 times the cable diameter.

7.3. Pulling Rope
The pulling rope must be well matched to the cable diameter and cable weight. This will better prepare the travelers in the system to balance the load as the cable is pulled and allow the cable to ride in the bottom of the traveler groove.

7.4. Tensioner
It is used to pay off the cable during the installation. A bull wheel tensioner with a brake is recommended for an ADSS installation. This must provide a constant tension and be capable of a smooth acceleration and deceleration without causing the cable reel to overrun.

7.5. Puller with sufficient pull rope capacity
It is used to pull the rope with the cable attached (Take-up machine). The puller should be equipped with a brake to keep constant tension of the cable as it is being installed and with a tension monitoring to avoid exceeding the maximum pulling tension.

8. Cable Hardware

Typical cable hardware will consist of Tangent supports, Armor Grip Suspensions and Dead-end grips. Recommended hardware and suppliers is available upon request. Hardware is designed for specific cable designs. Only use hardware recommended for a given cable design, and never re-use hardware. It is important to carefully install the hardware without any damage to the cable jacket. Any cable jacket damage must be immediately reported, and if necessary, the cable must be replaced.

8.1. Tangent support
A Tangent Clamp is used as cable suspension hardware only on spans less than 100/150 meters when the angle of change, either in direction or elevation, is less than 15°. The tangent support is designed to hold the cable in the air at the pole. There are several different approved suppliers of the tangent hardware, each with different designs (e.g. with or without reinforcing rods depending on the span length, etc.). Please refer to Draka for recommendations of the advantages/disadvantages of each for your application.

8.2. Armor Grip Suspension (AGS)
Armor Grip Suspension (AGS): used for any span length and line angle changes up to 25° (see comments in the paragraph below when vertical difference between structure is greater than 20°).

8.3. Dead-ends grips
Used in several instances:
- For cable splice closure locations,
- Cable start and end points,
- Line angle changes > 25° (result of changes in direction or elevation),
- If the structure are in-line but have a vertical difference greater than 20°, dead-ends shall be used to distribute cable through the incline/decline.
In order to fulfill the cable minimum bending radius specification, an extension link may be mandatory.


9.1. Installation Equipment Sites
It is important to pick the proper location for the pay-off and take-up equipments. The reel of ADSS cable (pay-off) must be located directly in line with the first sheave and must be back from the structure four times the height of the sheave (4:1 distance to height ratio). It is recommended to have at least three structures before the first large angle change. The equipment and ADSS cable reel should be in a safe and secure location, worry-free from vandalism or theft since the equipment could sit overnight.

9.2. Sheave Installation
Each structure in the pulling segment must have a sheave installed and a pulling rope threaded through it. Each sheave must be balanced so that the rope, and later the ADSS cable, rides at the bottom of the neoprene insert’s groove. It is important to tie up the sheave at each angle so the pulling rope and ADSS cable enter and exit the sheave smoothly. If the cable enters at an angle, it increases the chance of jumping from the sheave groove into the space between the sheave and the yoke holding the sheave to the pole. This would cause severe damage to the cable.

9.3. Pulling Lines
Once the sheaves are installed, the pulling rope shall be threaded (reeved) through the system. It is extremely important that the pulling rope and the ADSS cable have the same diameter and approximate weight. This will allow the sheaves to float at the same level with the pulling rope, as they will do when the ADSS cable enters the sheaves. It is important that the cable and sheave are in the same plane, to avoid any cable damage caused by contact with the edges of the sheave. The pulling line should be all dielectric and not be susceptible to internal, electrical static charge build up.

The pulling rope should never be allowed to touch or drape over distribution lines or slump between pole attachments. It should have constant tension throughout the entire pulling operation.

9.4. Pulling the ADSS Cable
The ADSS cable shall be attached to the pulling rope using a double swivel eye and woven wire grip. Special attention must be paid to the grip and swivel as they pass through the sheaves and near the towers. The double swivel eye insures the ADSS cable will not see an induced torsion as the pulling line enters and exits each sheave. A ‘flag’ shall be attached just behind the swivel eye on the ADSS cable jacket. This flag should stay straight through each sheave. If the flag starts to flip over the cable, it shows the swivel eye is not working properly and the pulling operation should be stopped and oil or fix the swivel.

The woven wire grip shall be of a proper diameter and of sufficient length on the cable jacket to insure even loading of the cable strength members. The edges of the woven wire grip should be taped smooth so the grip does not damage the neoprene inserts of the sheaves as it is passing through.

The cable tension must not exceed the maximum installation tension recommended by Draka. Special attention must be paid to maintaining an even tension and speed. The wire mesh grips are designed to pull the cable, not to hold it under final tension. Do not use the wire mesh grips to apply the final tension to the cable.

9.5. Sagging
The ADSS cable shall be sagged from the pay-off (cable reel) end towards the take-up equipment, starting with the dead-end at the first structure near the cable reel. The sag can be adjusted using several methods. The recommended method is the ‘line of sight’ method. This requires the sag distance to be determined ahead of time for each particular span length. One or more spans between dead-end locations should be checked using this method. After placing the cable under tension, it may be necessary to wait for approximately 24 hours for the cable to creep before making the final sag measurements.

The ‘Line of Sight’ sagging method requires climbing both structures on either side of a span to be checked. The structure closest to the pay-off end of the system is tensioned. Then the next structure is marked using bright colored tape with the appropriate mid-span sag distance from the attachment height. The lineman returns to the pay-off end structure and measures down the mid-span sag distance and places his line of sight at that same height. This person should have radio contact with the take-up operator and give instructions of how much to tighten the cable in the system so that the belly of the sag of this particular span rises to match the bright colored tape mark on the opposite structure. Once the sag matches the requirement, the take-up side tension structure can be climbed and clipped in. The belly of the sag shall always be brought up the proper sag, not loosened or brought down to the correct sag.
9.6. Clipping-in and Tensioning
The system segment shall first be sagged and dead-ended at the appropriate structures. Dead-ends shall have a sufficient drip loop between two dead-ends on a structure to allow free movement. Dead-ends shall be attached to the structure using an extension link in order to get proper distance from the structure to allow the drip loop. The drip loop should be positioned downward and at least 30 cm deep.
Next the AGS Suspensions and/or Tangents supports can be installed (extreme caution must be exercised when transferring the cable from travelers to the suspension). The installing of the ADSS hardware (Dead-end, Tangents and AGS Suspensions) shall be prompt. The ADSS cable shall not be allowed to sit in the sheaves more than one week (or less in bad weather) without approval from Draka. Grounding the tension hardware (dead-end and suspension) is the choice and responsibility of the owner.

9.7. Damper Installation
If the system requires Aeolian vibration dampers, they can be installed after the ADSS hardware is in place at each individual structure.

10. Splicing
Splicing should be performed on the ground. The splice closure can then be stored aerially, at ground level in a pedestal or cabinet, or underground in a hand hole or manhole. Sufficient length of cable ends should allow the cable to descend the structure and enter in a splicing vehicle or splicing area. Six meters of cable shall be discarded from each pulling grip end to remove damaged or stressed cable. Then typically, each cable end should have at least 30 meters or more from the dead-end attachment, depending on the tower or pole size. Be sure to account for at least 3 meters of cable for the splicing operation and for an extra length to loop/coil (minimum 4 turns - special care must be taken in order to not exceed the minimum bending radius defined in cable data sheet), between the each dead-end and the splice closure. This will be done to stock the extra cable length when installing definitely the closure and to avoid thermal effect. Tubes containing fibers are indeed made of thermoplastic material and are accordingly subject to thermal effect. The cable shall reach the splice closure by the bottom.

In splicing closures, cables are disassembled. Consequently cable splicing procedures (standard splicing or mid span access) have to be approved by the splicing closure supplier. Inside the closure, the length of the individual thermoplastic tube should be kept to the minimum. Cable Down Guides should be used to attach the ADSS cable to the structure along the entire height. The number of clamps, type of clamps, and distance between clamps should be sufficient to prevent any cable movement that could damage the cable. The clamp type must not cause any damage to the cable jacket.
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