STL

Dry-Core ADSS Cable Placement

APPLICATION NOTE

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ABSTRACT
ADSS (All Dielectric Self-Supporting) Cable is designed with a tensile strength that will provide the necessary resistance to sag to overcome the effects of its own weight, ice and wind, and the cable span to remain serviceable, even oververy long spans, for its entire lifetime.

Construction of ADSS cable routes require an understanding of how optical s work, the cable structure, experience with the equipment being used, familiarity with the construction method, and good judgment when decisions need to be made. This document is not intended for and should not be used as a comprehensive manual covering the installation of ADSS cables.

This installation practice provides general installation, safety, and handling recommendations about the engineering and placement of an ADSS cable route.

KEYWORDS
ADSS cable, Resistance to sag, equipment & hardware for installation.

Scope and Purpose

ADSS(All Dielectric Self-Supporting) cable is fully dielectric for use in the aerial plant. As compared to typical cables used in the aerial plant, ADSS cable is designed with its strength member and support member to be inherent to its circular cross-section. It is supported by its own inherent strength. Since it uses all non¬metallic materials, it generally can be used without concern about power coupling effects and bonding and grounding issues. This makes ADSS cable popular on electrical utility rights-of-way suspended from poles or towers. It is constructed with a multi-tube cross-section to support either ribbon or loose optical Fibres. The ADSS cable's outer jacket can be either a single or a dual jacket with an embedded non-metallic strength member.

The installation methods for ADSS cables are essentially the same as those used for other aerial optical cables, except ADSS cables are not lashed or supported off a messenger strand. Special care must be taken during installation not to exceed the cable's maximum pulling tension, its minimum bending radius, and other mechanical strength limitations. It is necessary to avoid any jacket damage which can expose strength members within the jacket and reduce the long-term cable performance. The IEEE Guide to the Installation of Overhead Transmission Line Conductors will provide additional relevant information about ADSS installation practices.

Safety

If the cable is to be placed on structures with power transmission lines, the safety practices of the power utility company must be followed in addition to those of the telecommunications company. All national, state, and local requirements, the safety procedures of the power utility and the communications company shall take precedence over information contained in this document.

Leakage current from the phase conductors can produce currents on the ADSS cable or hardware, especially during wet weather. Equipment associated with the ADSS cable and the cable itself must be properly grounded before it is touched. ADSS cable shall not be installed on energized towers during wet weather because current leaking from the phase conductors can produce dangerous currents in damp or wet ADSS cable or its equipment.

The following items need special attention to assure the ADSS cable installation will be safe:

- Never look directly into the end of any Fibre with your eyes. The wavelength of light used to transmit telecommunications information will be invisible to the human eye, but can damage the eye if viewed under magnification or for an extended period of time.
- As with all line operations, use leather gloves to place the cable. In certain circumstances it may be necessary for individuals to wear appropriate rubber gloves rated for power operations.
- Whenever working in the air off towers, poles, or bucket trucks it will be necessary to follow good safety practices such as wearing a safety harness, body belt, or safety strap.
- Only safe structures should be used for anywork activity.
- When cables or winch lines carrying large tensile loads are encountered, workers must be careful not to work or be positioned at a location of danger if any of the tensile loaded membersfail.
- Since rotating hardware will be used, it is important that hands and fingers be kept away from rotating or moving equipment.
- The cable's electrical, mechanical, and environmental limitations shall be fully understood and respected bythe placing crew, see the following section on the Unique Aspects of ADSS Cable.
- Care must betaken to avoid damaging the cable during handling and placing.
- The cable under load shall not be bent to a radius less than 20 times its own diameter. Under no load it shall not be bentto a radius less than 10 times its own diameter.
- When cable is placed it shall be connected to the pulling line with a double ended ball-bearing swivel to relieve all the twist in the cable as it is pulled into place.
- The maximum rated placing load is the maximum tensile load the cable shall be exposed to during cable placement. Normally most optical cables are designed with a maximum rated placing load of 600 lbf (2670 N), although cables are designed with other values depending upon the application.ADSS cable shall have a rated maximum placing tensile load equal to or greater than the tensile load requiredto reach the initial design sag.
- Engineering survey information may change significantly from when it was first recorded. Therefore, all engineering survey information is checked to confirm its current accuracy.
- Cable reels should be stored and transported on both its flanges in an upright position. Cable reels should never be laid on their side, flange flat on the floor or ground.
- The cable needs to be aligned with the pole hardware (travelers, sheaves, and quadrant blocks). The cable should never be allowed to run over the edge of one of the support hardware flanges or rub on the cable reel flange as it is paid out.

Unique Aspects of ADSS Cable

ADSS cables should be installed on support structures in an area of relatively low field voltage. The field voltage can be calculated using computer software designed to provide this information. This field voltage analysis becomes more important for very high voltage lines, greaterthan 35 to 40 kV. STL recommends that an analysis be performed to locate the ADSS cable on the structure in an area of low field voltage. MDPE jackets are recommended for use in ADSS cables exposed to induction up to 12 kV space potentials. For larger space potentials, up to 25 kV, track resistant cable jackets are recommended to resist dry-band arcing that can occur at locations with induction above 12 kV space potentials.

Despite ADSS' popularity for use on power distribution systems, there is no reason to confine its use to only power utility applications. ADSS cable should be considered whenever aerial span spacing is dictated by the geography of the surrounding terrain and is largerthan would be normally used by aerial plant. ADSS cable is designed to accommodate the mechanical and environmental stresses that it will be exposed to during its lifetime. It is unique in that its great strength-to-weight ratio allows it to be used as aerial plant in spans up to 500 meters in length, without the need for a supporting strand. Sufficient aramid Fibre is provided in ADSS cable to allow its installation tension to be adjusted sufficiently to keep the effects of temperature, mechanical loading, ice, and wind from exceeding the tensile limits of the cable or causing excess sag in the cable between supports.

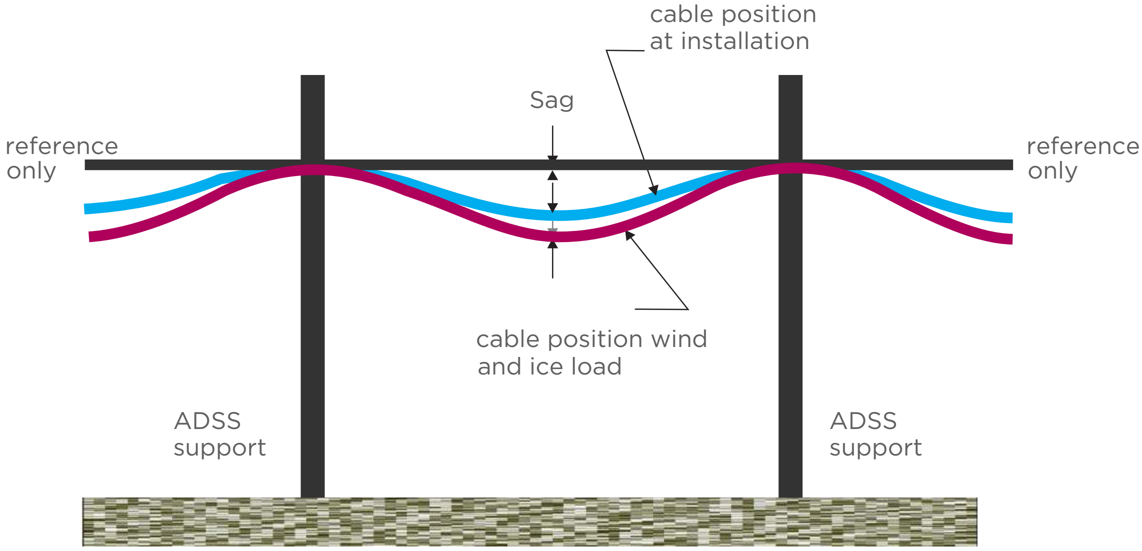


Figure 1- Sag drawing of ADSS catenary cable deflection

STL ADSS Cable meets IEC 60794, EIA/TIA Specifications, ITU-T, and EN 187000 international standards.

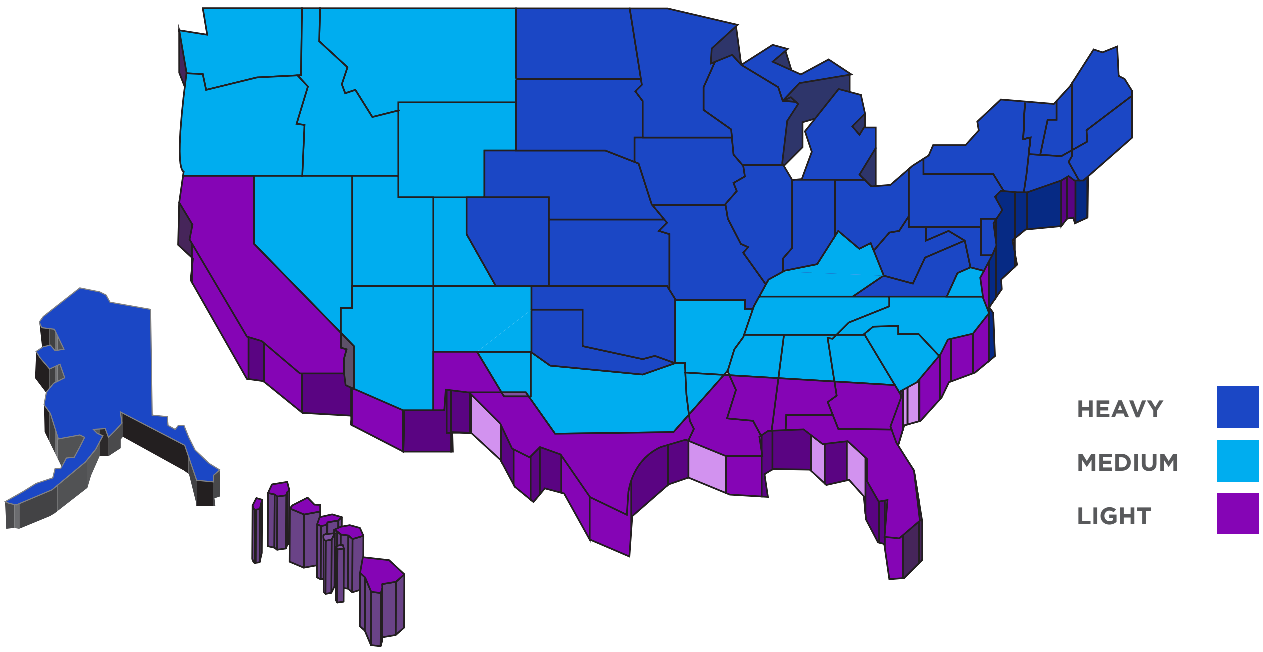


Figure 4 – NESC Environmental Loading Regions for the United States

The following are examples of ADSS cables manufactured by STLto meet or exceed international specifications and the individual client's specifications and job requirements. Other cables are available depending upon span design requirements.

Multi-tube STL Single Sheath Dry-Core ADSS Cable

Fibre Count	Cable Diameter (mm)	Cable Weight lb/kft (kg/km)	Minimum Bend Radius	
			Full Load (mm)	Installed Load (mm)
12	0.45(11.5)	67(100)	9.0(230)	4.5(115)
24	0.45(11.5)	67(100)	9.0(230)	4.5(115)
36	0.45(11.5)	67(100)	9.0(230)	4.5(115)
48	0.45(11.5)	67(100)	9.0(230)	4.5(115)
60	0.45(11.5)	67(100)	9.0(230)	4.5(115)
72	0.45(11.5)	67(100)	9.0(230)	4.5(115)
96	0.51(13.0)	81(120)	10.2(260)	5.1(130)
144	0.64(16.3)	128(190)	12.8(326)	6.4(163)

Multi-tube STL Dual Sheath Dry-Core ADSS Cable

Fibre Count	Cable Diameter (mm)	Cable Weight lb/kft (kg/km)	Minimum Bend Radius	
			Full Load (mm)	Installed Load (mm)
12	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
24	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
36	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
48	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
60	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
72	0.55(13.9)	114 (170)	11.0(278)	5.5(139)
96	0.62(15.7)	151 (225)	10.2(260)	5.1(130)
144	0.76(19.1)	215 (320)	12.8(326)	6.4(163)
216	0.78(19.7)	218 (325)	15.6(394)	7.8(197)
288	0.86(21.9)	262 (390)	17.2(438)	8.6(219)

ADSS Placement Methods

As in all aerial plant, ADSS uses the tensile force and mechanical properties of its strength members to resist sag in its catenary shaped deflection profile as it spans between supports. As is shown in the figure below, the weight of the cable, ice, and wind loading are also resisted by the tensile force that is in the cable. The greaterthe tensile load in the cable, the shallowerthe catenary in the cable and the smaller its sag.

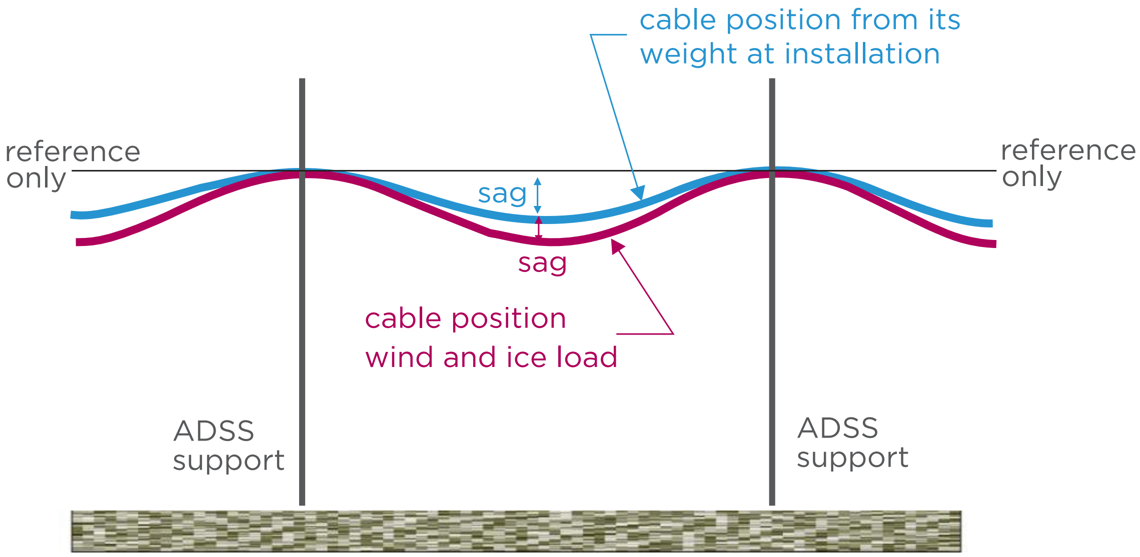


Figure 3 - ADSS Catenary deflection changes sag as load changes

Normally, ADSS cable is placed onto cable support structures such as towers or poles using conventional aerial cable placing techniques, with only minor modifications, to adjust for the fact that ADSS cables do not have a support strand nor are they lashed to one. Moving reel and stationary reel procedures similar to those used with other optical cables are used to position the ADSS cable on its support structures. ADSS cable is only supported at the structure, so it is draped from support to support. Once installed, the cable is tensioned using turn buckles and calibrated dynamometers at dead-ended supports. The cable tension is intended to keep the sag in the cable spans to a level of 1- 2% without any loading on the cable except its own weight.

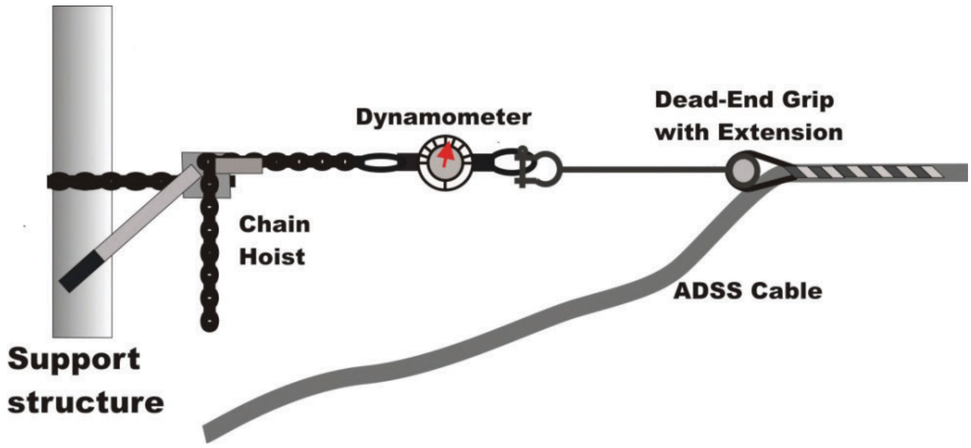


Figure 4 - Cable tensioning setup using dead-end grip and calibrated dynamometer attached to dead-ended support structure.

There are two main types of methods for placing aerial plant: stationary reel and moving reel method.

Stationary-Reel Method

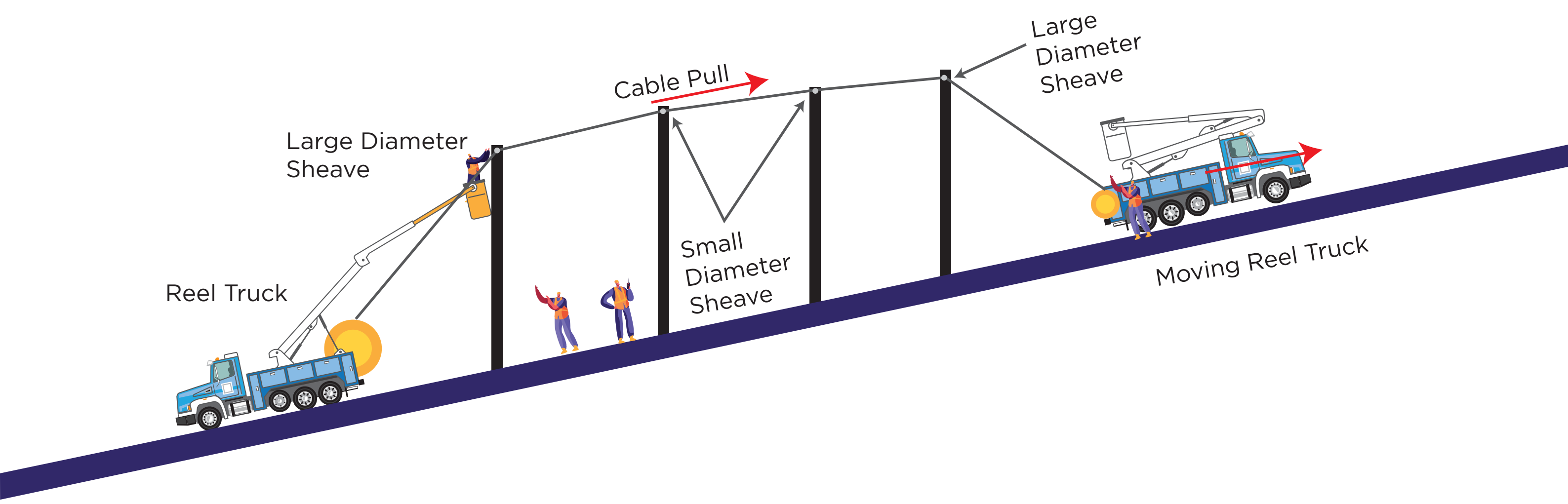


Figure 5 - Stationary Reel ADSS cable placing method

This is the most widely used method to place all types of aerial cable. For ADSS cable, the stationary reel method is often slower and more costly than the moving reel method, but can be used anywhere since it does not require an unobstructed right-of-way or vehicular access to the pole line. Higher costs often results from the effort to coordinate the pulling operation.

In this procedure, the cable reel is positioned at the starting end of the cable placement and parked at least 50 to 60 feet from the first support to provide clear and unobstructed passage of the cable from the cable reel to the first sheave, traveler, or quadrant block on the first cable support structure. The first sheave or traveler should have a radius at least 15-20 times the diameter of the cable being placed. A sheave shall be positioned on each support structure. Misalignments of 20° or more should be addressed with a sheave having a radius at least 20 times the diameter of the cable being placed. Those supports in better alignment with the cable route should be equipped with a sheave having a radius at least 10 times the diameter of the cable being placed. The cable end shall be attached to a winch line of similar unit weight and diameter to the cable with a double rotating ball-bearing swivel that has been threaded through the support sheave on each support structure.

A standard Fibre optic cable tension measuring and tension limiting cable winch shall be used to pull the cable into place through all supports. It shall be positioned to provide clear and unobstructed passage for the winch line as it passes through the large diameter sheaves on the first and final cable support structures. It is best to keep the winch positioned at least 50 feet from the last support.

After the cable has been pulled into position, transfer it from the sheaves to the permanent cable supports as it is tensioned to the dead-end supports at the tensions or sag specified by STL Engineering to meet the expected maximum loading for its cable weight and span length. STL recommends the use of the stationary reel method to place ADSS cable.

Moving Reel with an Aerial Lift

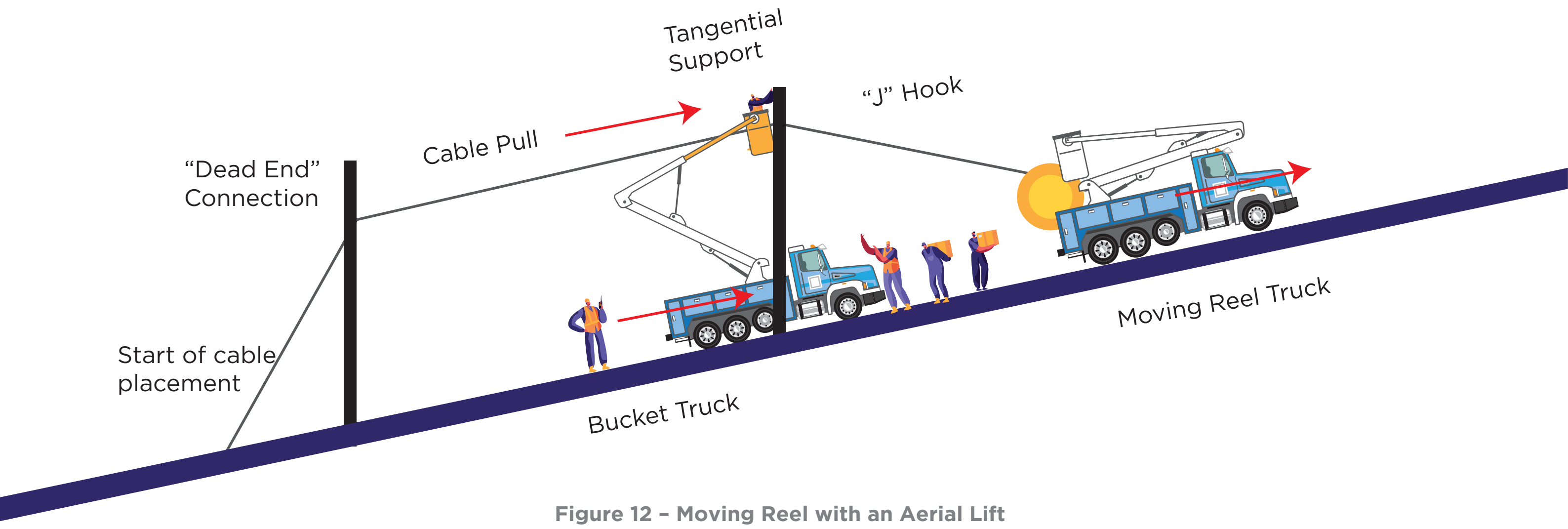


Figure 12 – Moving Reel with an Aerial Lift

In the moving reel or drive-off method, the cable is paid off the top of the cable reel carried by a moving vehicle as it drives along the pole line.

This method, when conditions are suitable, makes it potentially possible to increase productivity. It is not as labor-intensive as the stationary reel method, in that it is not necessary to handle large numbers of cable blocks or sheaves. Heavy tree conditions, however, significantly slow progress for this method. Also, there is a fundamental need to maintain alignment of the reel and the cable chute. This alignment must be continuously monitored to prevent excessive bending or sheath abrasion atthis critical point.

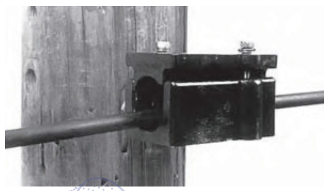
As the vehicle passes each support, the cable is raised into place by a technician in a lift bucket and into a "J" hook or blockfitting bolted to the support structure for temporary support. This procedure continues as the cable reel moves along the cable line until a dead-end pole is reached. A dead-end pole is either a start or ending support or a support in which the cable route is misaligned by 20° or more.

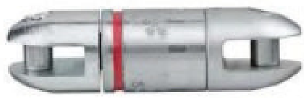
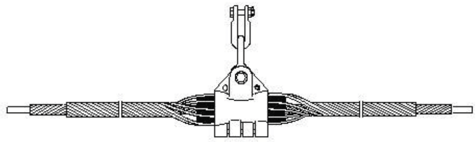
At this point, the cable is tensioned and terminated into dead-end fittings. The cable between dead-end fittings is transferred from the "J" hooks at each of the intermediate poles and placed in permanent tangent assemblies.

The moving-reel method is potentially the fastest and least expensive method to install ADSS cable. Polemounted "J" hooks are the only temporary support devices required. In addition, fewer OSP technicians are required than for the stationary reel method. The moving-reel method does require vehicular access to the cable side of the support structures and a right-of-way clear of tree limbs and other obstructions.

Equipment and Hardware Used to Place ADSS Cable

The following equipment is typical of that used to place ADSS cable:

Grips and Pulling eyes: Woven wire compression grips that slip over the cable sheath at the end of the cable. As the pull force increases the grip shrinks in diameter gripping the cable with greater compression force.	
Sheaves, Travelers, or Quadrant Blocks: Cable guides with rolling hardware covered with a soft durable material to protect the cables. Used to guide the cable from support to support without causing misalignment that can damage the cable.	
Winch Line: Line used to place the cable. If it is matched in weight and size to cable, it will provide for easier tension control. Winch line connected to cable with double swivel and connector hardware (figure-eight clip or sister hooks).	
Cable Brake: Brake used to control the “back” tension on the cable reel feeding cable to the placing operation.	
Pulling Winch with Tension Limiter: Equipment used to provide the tensile force to pull the cable into place on the support structure for the Stationary Reel Method. Can be stand alone or an attachment to a telecommunications truck.	
Tangent Support: A double funnel shaped support to hold the cable to its support structure at a well aligned point in the cable route (mating cable misaligned ≤ 15°).	 

Cable Placing Hardware: Ancillary hardware, such as an inline swivel, tension fuses, and connector clips.	 
Armor Grip Suspension (AGS): Grip that is used at support points where the misaligned angular offset is ≤ 25° and ≤ 40°.	
Dead-end Grips: Grips used at the end of the cable at splice locations and points where the angular misalignment is ≤ 20°.	
Bucket Truck: The line truck used to access the cable hardware on the support structure and used to handle operations in the air for both cable placing operations. The moving reel operation uses a bucket truck with a cable reel as the moving reel vehicle.	
Reel Truck: Line truck equipped with a cable reel support off its rear bed. Truck used to support the cable reel during the placing operation.	
Hand-Held Radio: Used by the installation crew to coordinate the placing operation. Communications is a key component of a successful ADSS placing operation.	

ADSS Placement Survey

The bulk of the information for a cable placing operation will be obtained by the examination of past records on the same support structures and the visit to the job site on the route survey. The overall condition of the support structures should be determined as well as a location on the structures for the new plant should be confirmed. A staging area should be located and the right-of-way evaluated for access and the ability to complete the cable placement as planned. The hardware setup on the support structure should be determined and the guying system that exists must be evaluated for suitability with the new cable. Any vegetation issues need to be determined and if possible corrected. Traffic problems need to be determined and any other situations that may require special action need to be determined. Select splice locations that fit the cable logistics, and provide a safe and convenient location for placing, splicing, and repair operations. The equipment and ADSS cable reels should be stored in a safe and secure location, safe from vandalism or theft.

Each splice point should be provided with sufficient cable slack to enable the splice to be made on the ground following the company's normal splicing procedures. After cable placement, approximately 3-6 meters of cable will be cut off the end of each cable to be assured that no Fibres were damaged from the placing operation. Normally an additional 15 to 30 meters of cable are required on the ground to make the splice. If this distance is to be determined more precisely, it shall equal the height of the cable on the support structure plus the distance from the support structure to the location of the splice in its vehicle or tent. In addition, at least 5 meters of Fibre must be provided to make the splice. Company policy shall be followed to determine the amount of extra cable to store as slack cable to enable maintenance operations on the cable route. Cable should be ordered with sufficient length to provide the slack required to make splices and to repair any cable that is damaged in the future.

It is important to pick the proper location for the cable reel and winch during construction. The ADSS cable reel (Stationary Reel Method) must be carefully aligned with the first sheave and back about 50 to 60 feet from the first support structure. For cable mounted higher than 15 feet in the air, the cable reel shall be positioned approximately four times the distance back from the support as its height on the structure. As a rule of thumb, when possible, ADSS cable should have at least three aligned support structures before the first large misalignment is encountered.

The cable needs to be dead ended to the support structure at each of the following points:

- At its ends
- Cable line misalignments 20°

Otherwise, if the cable line misalignment is less than 20° a tangent support can be used.

Stationary-Reel Method

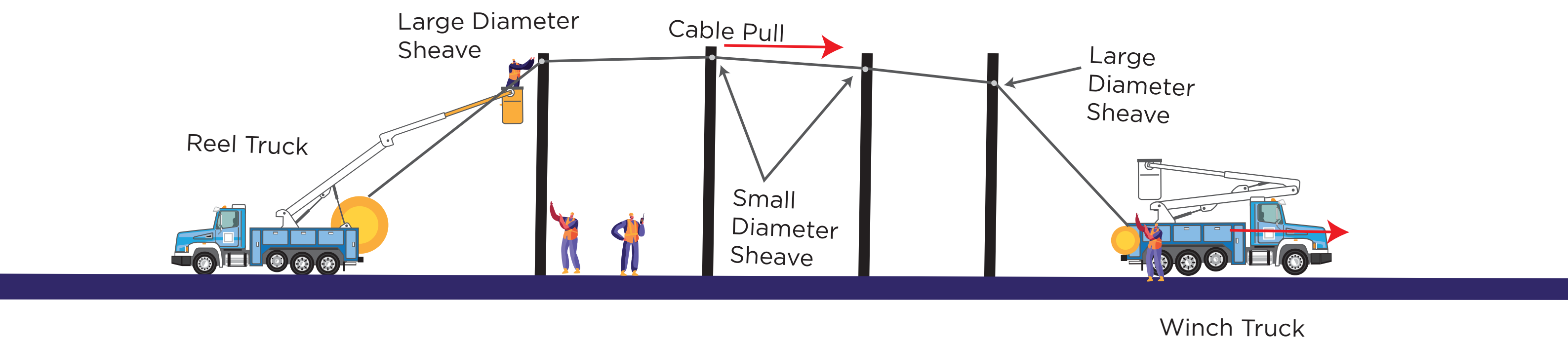


Figure 7 - Stationary Reel schematic view

- The stationary reel method uses a placing procedure that can be compared to underground cable placing, but instead of placing cable underground into conduit, it is placed in the air suspended off supports at each support structure. The cable is pulled from support to support using a winch line similar in weight to the cable using a tension monitoring winch at the far end of the cable route. During the placing operation, the cable is supported by temporary supports once it is in place. The cable supports consist of travelers, sheaves, and quadrant blocks.

- All of the key points for the stationary reel placing method that were selected during the survey should be verified as satisfactory at the time of setup for the cable placing operation. Locations for the cable reel and the cable winch shall be checked and all intermediate points shall be verified.

- Several key issues will prove helpful during placement

- For routes with significant change in elevation, it is easierto place the cable downhill.

- The entire operation will require clear and constant communication between all participants. A good twoway radio system is recommended. Communication needs to be established between the cable reel, the winch, and observers located at key points along the cable route.

- The cable reel needs to be located in an accessible area that is not encumbered with either pedestrian orvehiculartraffic.

- If an intermediate feed point is required for long, or difficult, placements, use a figure-eight coil to store the cable for the second part of the pull. The figure-eight coil must be done carefully and should be 5 to 10 meters in size.

- Tryto use the same reel location fortwo adjacent cable placing operations.

- Cable alignment is absolutely necessary during the cable placing operation. The cable cannot be allowed to run over the edge or flange of any of the sheaves, travelers, or quadrant block frames. It also must not be allowed to rub on any of its cable reel flanges.

- Smooth passage between support structures and the cable/winch line shall be provided by carefully aligned travelers, sheaves, and quadrant blocks at each support.

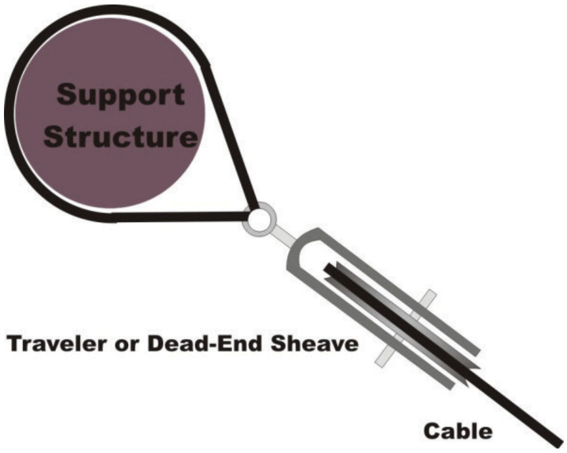


Figure 8 - Supported traveler or sheave at down-feed from end support structure

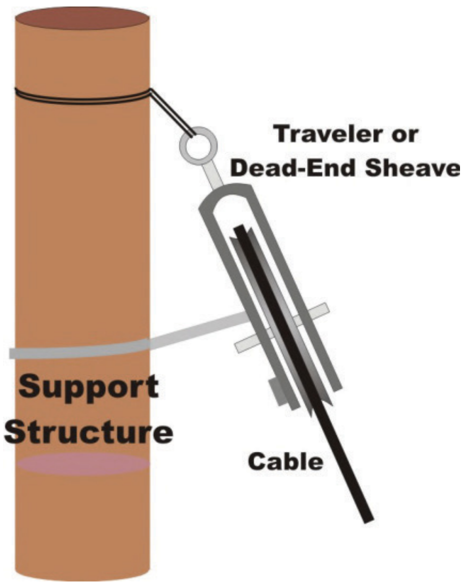


Figure 9 - Supported traveler or sheave at feed-end support structure

- The connection between cable and winch line shall be made with a ball bearing type wivel. Vinyl tape shall be used to smooth the transitions along the surface of the pulling array. Care should be taken to assure that the tape does not prevent the swivel from operating during the placing operation.

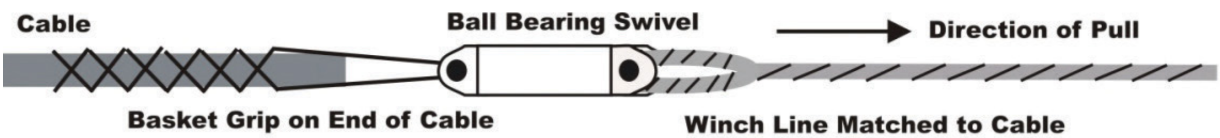


Figure 10 - Cable placement array using ball-bearing swivel to connect winch line to cable

- The cable shall be pulled off the top of its reel during placement. Sufficient people shall be available to monitor the cable placing operation. A person is required to monitor the cable reel, winch, all dead-end locations, and all intermediate support points.

- The winch line shall be carefully fed through all the support hardware. The reel and the winch shall be positioned on opposite ends of the cable placing operation, approximately 50 to 60 feet from the support structure with which they respectively interact.

- Before any placing operation is started between any two dead-end points, the cable shall be affixed to the support structure atthe start of the pull using the dead-end hardware.

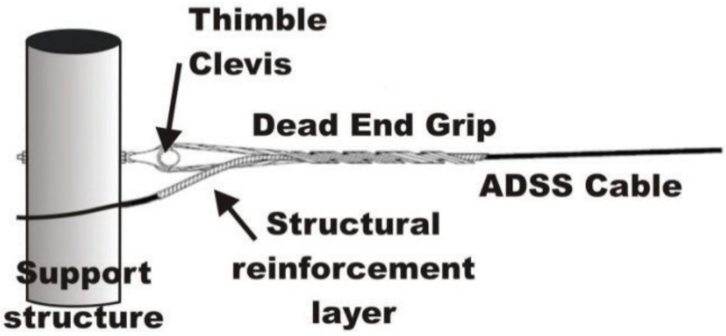


Figure 11 - Dead-End Grip at start of cable placing operation.

- Once everyone is in position and given a “ready to start” indication, the pull can be started at a very slow rate. Each observer shall be sure that the cable passing their position is moving smoothly, unencumbered, and not rubbing on any hardware that could damage its jacket.

- The cable payoff its reel shall be controlled by the reel brake. The brake will be used to keep the cable from free-reeling off the drum or from jerky payout that causes spikes in the cable tension or in the worst case, from throwing a cable loop. The cable payout should always be under slight braking. Care must be taken not to provide excessive braking, because it is possible to cause the cable’s rated tensile load to be exceeded with too much braking.

- After the pull starts, once the cable is determined to be moving without any misalignment with its support hardware, the speed of the placing operation can be gradually increased to 150 feet per minute. All observers need to continue to be vigilant for any problems. If a misalignment of the sheath or rubbing between the cable and support hardware occurs, the pull should be stopped and the problem corrected.

- The placing tension forthe cable shall be kept belowthe maximum rated placing tension stated by STL for that particular cable. If a winch line of matched weight to the cable is used, the placing tension at the cable winch will approximately equal the maximum tension at the cable. It may be necessary to separate the cable placement into several pulling stages to keep the placing load less than the rated cable tensile load.

- Placing the cable continues until it is completely deployed or a dead-end is reached.

- When the entire cable is in place, starting at an end location, each dead-end to dead-end cable segment can be sagged and tensioned and affixed to each dead-end structure. Cable tensioning proceeds from one dead-end segment to the next until the entire cable has been tensioned and affixed to its support structures.

- Sufficient slack shall be provided at each dead-end support to enable a 12-inch deep drip loop to be formed in the cable as it passes around the support.

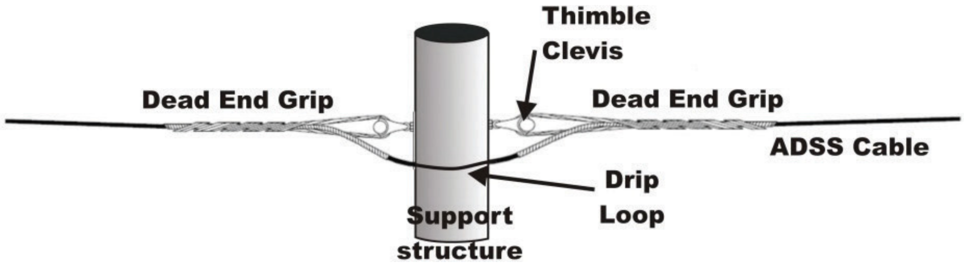


Figure 12 - Dead-ended cable with drip loop.

- Once the cable has been tensioned to its initial tension and dead ended, it shall be removed from each of its intermediate supports (sheaves) and transferred to the tangent clamps that will serve as its permanent support.

  Sufficient cable must be provided at each splice point to enable the splice to be made and to provide for any cable maintenance. After cable placement, approximately 3-6 meters of cable will be cut off the end of each cable to be assured that no Fibres were damaged from the placing operation. Splicing slack shall be provided equal the height of the cable on the support structure plus the distance from the support structure to the location of the splice in its vehicle or tent. In addition, at least 5 meters of Fibre must be provided to make the splice. Company policy shall be followed to determine the amount of extra cable to store as slack cable to enable maintenance operations on the cable route. When the splice has been completed, the splice closure shall be safely mounted on the support structure and the excess cable shall be wrapped either around special storage frames or in neat coils and mounted on the existing cable near the splice point. Special care is required to assure that the cable's minimum bend radius is observed during this process.

Moving Reel with an Aerial Lift

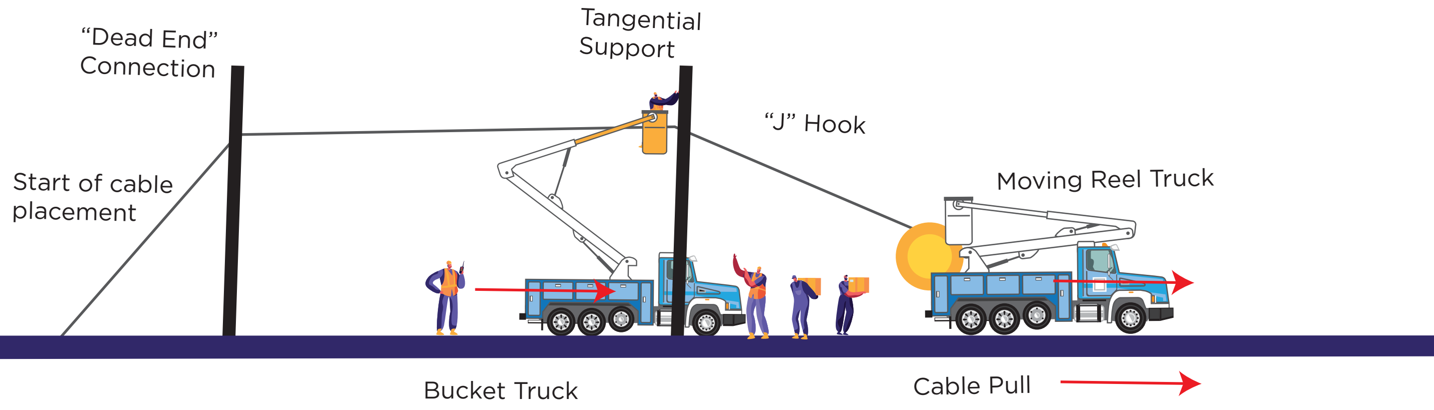


Figure 13 - Moving Reel Method schematic view

- Many companies do not recommend the "Moving Reel" method for ADSS installation because pulling tensions and loading on the hardware can be uneven. It is difficult to keep constant tension on the cable in the tangent sheaves between the dead-end points. Uneven tensions at these intermediate points can cause damage to the cable sheath.

- ADSS cable installation is similar on distribution and transmission lines. Transmission lines require more precautions because the line voltage is high; grounding the sheaves may be required to assure safety. Another concern is the distance between the live conductors and the Fibre hardware devices on the structure. Standard utility precautions must be used if the tension hardware is close to the power conductors.

- The vehicle with the cable reel should be positioned approximately 50-60 feet from the first dead-end support structure. The reel shall be aligned with the section of the cable being placed, to assure that it will pass smoothly and safely to its support without rubbing on the cable reel flange. The cable must be paid offthe top of the cable reel.

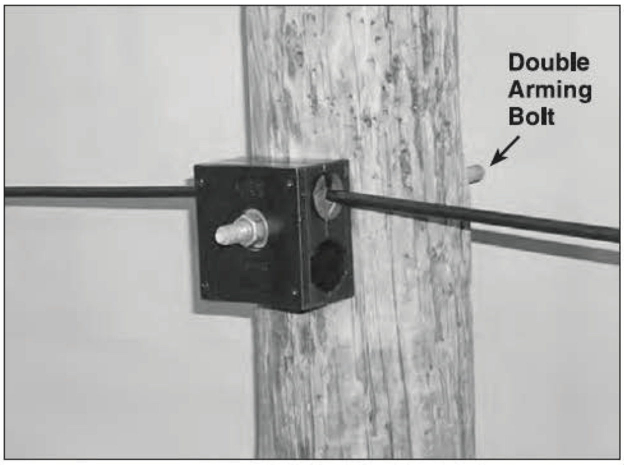
- Once the initial splice slack has been provided, the cable shall be dead-ended on the first support structure in preparation for cable placement. The placing technician working off a bucket truck that is also carrying the cable reel shall prepare the dead-end on the first support.

- Two placing vehicles are generally used to implement the moving reel method. The prime vehicle is a bucket truck that also has a cable reel handler as its tailgate orthat tows a cable trailer. Regardless of the reel support apparatus, it shall possess a reel brake to maintain control over the cable payout. A placing technician in the first truck works from itsbucket placing the cable over its temporary support, often a "J" hook that is bolted to the support structure. The first truck also has a driver plus a technician to tend the cable reel and operate the cable reel brake during cable payout. A second bucket truck is also required to tend cable already placed in the air. The operation of tending the cable is done by a technician in a bucket. This technician checks the position of the cable in the last "J" hook installed as the technician in the first bucket truck places the cable in the next "J" hook. The technician in the second truck also will continuously check the previously installed cable to be sure that it is in place on its supports.

- As the first truck reaches the next support, the cable is raised to the bucket truck technician who places it in its temporary "J" hook support. The procedure continues at each support structure until it reaches the dead end-support.

- Once a cable span from one temporary dead end support to the next temporary dead-end support is installed, that section of cable can be tensioned to the tension level specified by STL for the cable size and weight, the span length, and the NESC loading area. The cable is then transferred from the “J” hook supports to permanent tangent supports. Optionally the cable tensioning can wait until the full cable length is placed. That procedure follows the steps described for the Stationary Reel Method cable tensioning.

Figure 14 - “J” Hook used as a temporary support for ADSS Cable Moving Reel placing method. It is usually bolted to the support structure.



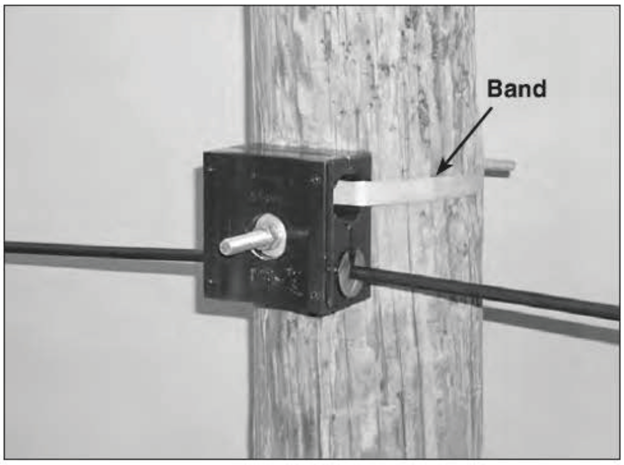


Figure 15 - FibreLIGN® Lite Supports bolt mounted and band mounted.

- Sufficient slack must be provided at each splice point to enable the splice to be made and to provide for any cable maintenance. This slack length shall equal the height of the cable on the support structure plus the distance from the support structure to the location of the splice in its vehicle or tent. In addition, at least 5 meters of Fibre must be provided to make the splice. Company policy shall be followed to determine the amount of extra cable to store as slack cable to enable maintenance operations on the cable route. When the splice has been completed, the splice closure shall be safely mounted on the support structure and the excess cable shall be wrapped either around special storage frames or in neat coils and mounted on the existing cable near the splice point. Special care is required to assure that the cable’s minimum bend radius is observed during this process.

Typical Placing Operations Procedures

Sheave Installation

It is imperative that each support structure in the placing segment being performed have a sheave or “J” hook installed on it at the final height of the support point on that structure. The winch line (pulling rope) shall be carefully threaded through each sheave. Every sheave must be positioned so that the pull line, and later the ADSS cable, rides at the bottom of its groove on the neoprene insert. It is important to rig the sheave at an angle so the pulling rope and ADSS cable enter and exit the sheave smoothly during the placing operation. If the cable enters the sheave at an angle, it increases the chance of it jumping from the sheave groove into the space between the sheave and the yoke. This would cause severe damage to the cable.

Figure 16 - Traveler supported at dead-end point to provide smooth feed of ADSS cable.

Winch Line

After the travelers, sheaves, and quadrant blocks are installed, a matched winch line shall be threaded through the system of supports. It is important that the pulling rope and the ADSS cable have the same diameter and approximate weight. This will allow the maximum tension to remain steady during the placement and occur at the tension limiting winch. The pulling line should be all dielectric and not be susceptible to internal, electrical static charge build up.

Pulling the ADSS Cable

The ADSS cable shall be attached to the pulling line using a double ended, ball-bearing swivel and woven wire grip. Special attention must be paid to the grip and swivel as they pass through the sheaves and near the support structures. The swivel insures that the ADSS cable will not experience an induced twist as the pulling line enters and exits each sheave. A ‘flag’ (strip of red cloth taped to the cable jacket) can be attached just behind the swivel on the ADSS cable jacket. This flag will remain stationary during placement if the swivel is relieving the torsion in the cable assembly. If the flag rotates around the cable as pulling progresses, the pull should be stopped and the torsion relieved. As torsion is relieved, the flag will rotate in reverse. The swivel should be checked to be assured it is rotating as designed.

The size (diameter and length) ofthe woven wire grip shall be matchedto the cable to insure even loading of the cable’s strength members. The edges of the woven wire grip should be taped to the cable jacket with vinyl electrical tape so the grip does not damage the neoprene inserts of the sheaves as it is passing through.

The cable tension must not exceed STL’s maximum rated installation tension. Special attention must be paid to maintaining an even tension and speed for the placing operation. 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.

Adjustment of Cable Sag

With the Stationary Reel Method, the ADSS cable shall be sagged from the cable reel end towards the winch end of the route, starting with the dead-end structure at the cable reel end.

The "line of sight" method is recommended for this activity. The sag in the first cable segment (cable between dead-end points) must be determined for each component span length. One or more spans between deadend locations should be checked with this method. After placing the cable under the recommended installation tension, it may be necessary to wait approximately 1 day for the cable to reposition itself before making the final sag measurements.

The "line of sight" method to determine sag requires a technician to climb both structures on either side of the span being checked. The structure closest to the reel end of the system is tensioned. Then the next structure is marked using bright colored tape with the objective mid-span sag value from the height of the attachment. The technician returns to the reel end structure and measures down the support the mid-span sag value and places his line of sight at that same height. This technician should be in radio contact with the take-up operator and give instructions of how much excess sag is in the cable. The tension in the dead end segment shall be adjusted so the sag in all the spans is equal or less than the design installation sag. The technician that tensions the cable will look up the increase in tension required to make the final sag adjustment. The technician on the support structure will monitor the change in sag and alert the technician applying tension when the sag is acceptable. At the correct sag, the cable catenary rises to match the bright colored tape mark on the opposite structure. Once the sag matches the objective value, the take-up side tension structure can be climbed and cable support fastened down. The maximum sag shall always be brought up to the proper sag, not loosened and brought down to the objective sag.

Clipping-in and Tensioning

The system dead-end segment shall first be adjusted for sag and dead-ended at the appropriate structures. Dead-ends shall have a drip loop between the two dead-ends on a structure. An extension link will be required to get sufficient distance from the support structure to allow the drip loop to be made at the dead-end point. The drip loop should be positioned downward and at least 12 inches deep.

At spans that are in line, tangent supports should be carefully installed.

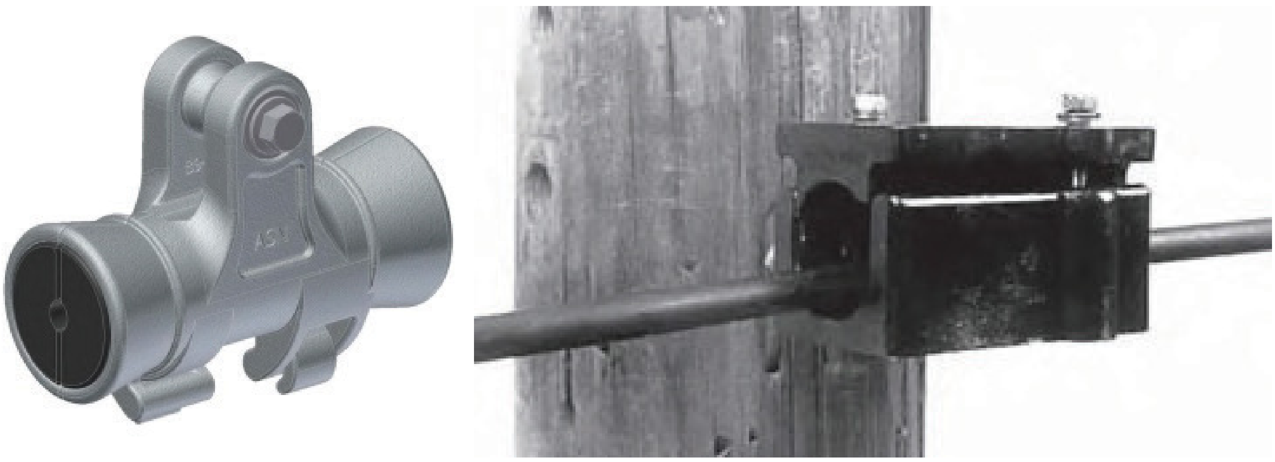


Figure 17 - Tangent Support: A double funnel shaped support to hold the cable to it support structure on a well aligned point in the cable route (mating cable misaligned ->- 15°).

For spans with large misalignments, AGS Supports can be used with extreme caution being exercised during the transfer of the cable from traveler to the AGS. The transfer of the cable to permanent support hardware shall proceed as rapidly as can be safely done following the AGS Support manufacturer's instructions.

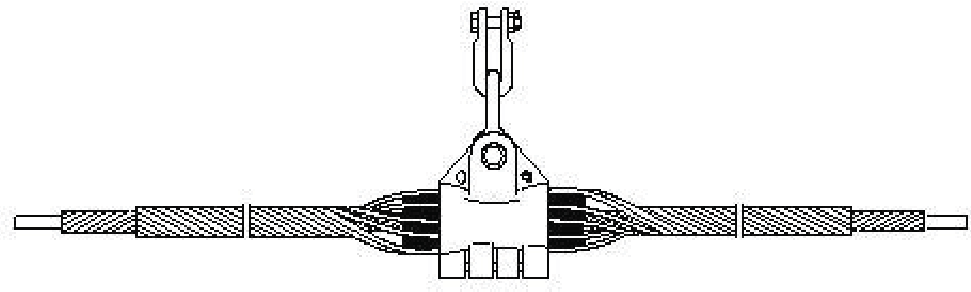


Figure 18 - Armor Grip Suspension (AGS): Grip that is used at support points where the misaligned angular offset is ->- 25° and < 40°.

The ADSS cable shall not be kept in the sheaves more than one week without approval from STL. In bad weatherthis time should be reduced. Local bonding and grounding practices need to be used to grounding the support hardware (dead-end, tangential, and AGS).

Damper Installation

If the system requires dampers to control Aeolian vibration, they should be installed after the permanent support hardware is in place on each individual structure.

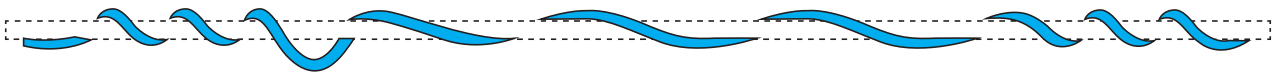


Figure 19 - Aeolian Vibration Damper used to induce a higher order of cable vibration.

Splicing

Splicing should be performed on the ground in a controlled environment such as a tent, van, or trailer. The splice closure can then be stored aerially, at ground level in a pedestal or cabinet, or underground in a handhole or manhole. Sufficient cable should be provided to allow the cable to descend the structure and enter in a splicing vehicle or splicing area. Three to six meters of cable shall be discarded after placement from under each pulling grip end to eliminate the possibility of encountering damaged Fibres. Then typically, each cable end should have at least 30 meters or more cable slack for splicing from the dead end attachment, depending on the height of the support structure. When determining the correct amount of extra cable, be sure to account for any future maintenance operations, at least 5 meters of cable shall be coiled as an extra length to loop/coil between the each dead-end section and the dead-end and splice closure (minimum 4 turns - care must be taken in order to not exceed the minimum bending radius recommended by STL).

In splice closures, cables are disassembled. The splice preparation, cable preparation, and splicing procedures are fully covered by the STL Applications Notes. Please refer to these notes for more detailed information on these subjects.

STL Dry-Core ADSS Cable Tension Versus Sag Tables

The tables that follow are the tension and sag tables for some of STL's Single and Dual Sheath ADSS cables. They can be used to assure that the cable selected will be properly tensioned for the cable span and allowed sag for either the moving reel or stationary reel installation method.

Dual Jacket, 2023 lbf (9 kN) Tensile Strength - NESC Light Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2023 (9)	12-72	0.52 (13.3)	85 (126)	60 (97)	0 (0)	2	722 (220)	2.5	886 (270)	3	1050 (320)
2	2023 (9)	96	0.58 (14.8)	104 (155)	60 (97)	0 (0)	2	722 (220)	2.5	771 (235)	3	951 (290)
3	2023 (9)	144	0.72 (18.2)	161 (240)	60 (97)	0 (0)	2	722 (220)	2.5	623 (754)	3	(230)

Dual Jacket, 2023 lbf (9 kN) Tensile Strength - NESC Medium Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2023 (9)	12-72	0.52 (13.3)	85 (126)	40 (65)	0.25 (6.35)	2	590 (180)	, c --’	738 (220)	3	885 (270)
2	2023 (9)	96	0.58 (14.8)	104 (155)	40 (65)	0.25 (6.35)	2	558 (170)	, c --’	689 (190)	3	820 (250)
3	2023 (9)	144	0.72 (18.2)	161 (240)	40 (65)	0.25 (6.35)	2	459 (140)	, c --’	574 (160)	3	689 (210)

Dual Jacket, 2023 lbf (9 kN) Tensile Strength - NESC Heavy Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2023 (9)	12-72	0.52 (13.3)	85 (126)	40 (65)	0.5 (12.7)	2	328 (100)	2.5	410 (125)	3	492 (150)
2	2023 (9)	96	0.58 (14.8)	104 (155)	40 (65)	0.5 (12.7)	2	312 (95)	2.5	377 (115)	3	459 (140)
3	2023 (9)	144	0.72 (18.2)	161 (240)	40 (65)	0.5 (12.7)	2	262 (80)	2.5	328 (100)	3	394 (120)

Dual Jacket, 2437 lbf (11 kN) Tensile Strength - NESC Light Loadin

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2437 (11)	12-72	0.52 (13.3)	85 (126)	60 (97)	0 (0)	2	835 (260)	2.5	1066 (325)	3	1279 (390)
2	2437 (11)	96	0.58 (14.8)	104 (155)	60 (97)	0 (0)	2	755 (230)	2.5	951 (290)	3	1017 (350)
3	2437 (11)	144	0.72 (18.2)	161 (240)	60 (97)	0 (0)	2	623 (190)	2.5	771 (235)	3	919 (280)

Dual Jacket, 2437 lbf (11 kN) Tensile Strength - NESC Medium Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2437 (11)	12-72	0.52 (13.3)	85 (126)	40 (65)	0.25 (6.35)	2	738 (225)	2.5	919 (280)	3	1099 (335)
2	2437 (11)	96	0.58 (14.8)	104 (155)	40 (65)	0.25 (6.35)	2	672 (205)	2.5	837 (255)	3	1017 (310)
3	2437 (11)	144	0.72 (18.2)	161 (240)	40 (65)	0.25 (6.35)	2	574 (175)	2.5	705 (215)	3	853 (260)

Dual Jacket, 2437 lbf (11 kN) Tensile Strength - NESC Heavy Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	2437 (11)	12-72	0.53 (13.3)	85 (126)	40 (65)	0.53 (13.3)	2	394 (120)	2.5	492 (150)	3	590 (180)
2	2437 (11)	96	0.59 (14.8)	104 (155)	40 (65)	0.59 (15.1)	2	377 (115)	2.5	459 (140)	3	558 (170)
3	2437 (11)	144	0.72 (18.2)	161 (240)	40 (65)	0.72 (18.4)	2	328 (100)	2.5	410 (125)	3	492 (150)

Single Jacket, 1349 lbf (6 kN) Tensile Strength - NESC Light Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	1349 (6)	12-72	0.52 (13.3)	85 (126)	60 (97)	0 (0)	2	558 (170)	2.5	705 (215)	3	853 (260)
2	1349 (6)	96	0.58 (14.8)	104 (155)	60 (97)	0 (0)	2	508 (155)	2.5	623 (190)	3	754 (230)
3	1349 (6)	144	0.72 (18.2)	161 (240)	60 (97)	0 (0)	2	394 (145)	2.5	476 (145)	3	590 (180)

Single Jacket, 1349 lbf (6 kN) Tensile Strength - NESC Medium Loading

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	1349 (6)	12-72	0.45 (11.5)	67 (100)	40 (65)	0.25 (6.35)	2	459 (140)	2.5	558 (170)	3	672 (205)
2	1349 (6)	96	0.51 (13.0)	81 (120)	40 (65)	0.25 (6.35)	2	410 (125)	2.5	525 (160)	3	623 (190)
3	1349 (6)	144	0.64 (16.3)	128 (190)	40 (65)	0.25 (6.35)	2	492 (150)	2.5	426 (130)	3	525 (160)

Sin le Jacket, 1349 lbf 6 kN) Tensile Strength - NESC Heavy Loadin

Sr.No	Tens Load lbf (kN)	Fibre Size	Cable Diam In (mm)	Cable Wt lb/kft (kg/km)	Wind Speed m/hr (km/hr)	Ice Load In (mm)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)	Final Sag (%)	Max Span ft (m)
1	1349 (6)	12-72	0.45 (11.5)	67 (100)	40 (65)	0.50 (12.7)	2	230 (70)	2.5	295 (90)	3	361 (110)
2	1349 (6)	96	0.51 (13.0)	81 (120)	40 (65)	0.50 (12.7)	2	230 (70)	2.5	279 (85)	3	328 (100)
3	1349 (6)	144	0.64 (16.3)	128 (190)	40 (65)	0.50 (12.7)	2	197 (60)	2.5	246 (75)	3	295 (90)

References

IEEE Standard 524-1992, Guide to the Installation of Overhead Transmission Line Conductors, IEEE 1993 National Electrical Safety Code.

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

beyond tomorrow

About STL - Sterlite Technologies Ltd

STL is an industry-leading integrator of digital networks.

We design and integrate these digital networks for our customers. With core capabilities in Optical Interconnect, Virtualized Access Solutions, Network Software and System Integration, we are the industry's leading end-to-end solutions provider for global digital networks. We partner with global telecom companies, cloud companies, citizen networks and large enterprises to deliver solutions for their fixed and wireless networks for current and future needs.We believe in harnessing technology to create a world with next generation connected experiences that transform everyday living. With intense focus on end-to-end network solutions development, we conduct fundamental research in next-generation network applications at our Centre of Excellence. STL has a strong global presence with next-gen optical preform, fibre and cable manufacturing facilities in India, Italy, China and Brazil, optical interconnect capabilities in Italy, along with two software-development centres across India and one data centre design facility in the UK