Application Note ADSS Cable

ADSS Cable

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Abstract
ADSS (All Dielectric Self-Supporting) Cable is an optical cable designed so its tensile strength will provide the necessary resistance to aerial plant sag to overcome the effects of its weight, ice and wind loading, and the cable span to remain serviceable, even over very long spans, for its entire lifetime.

Keywords
Electric power industry, Long-span aerial installation, ADSS Fiber Cable.

Sterlite Technologies® ADSS Cable Description

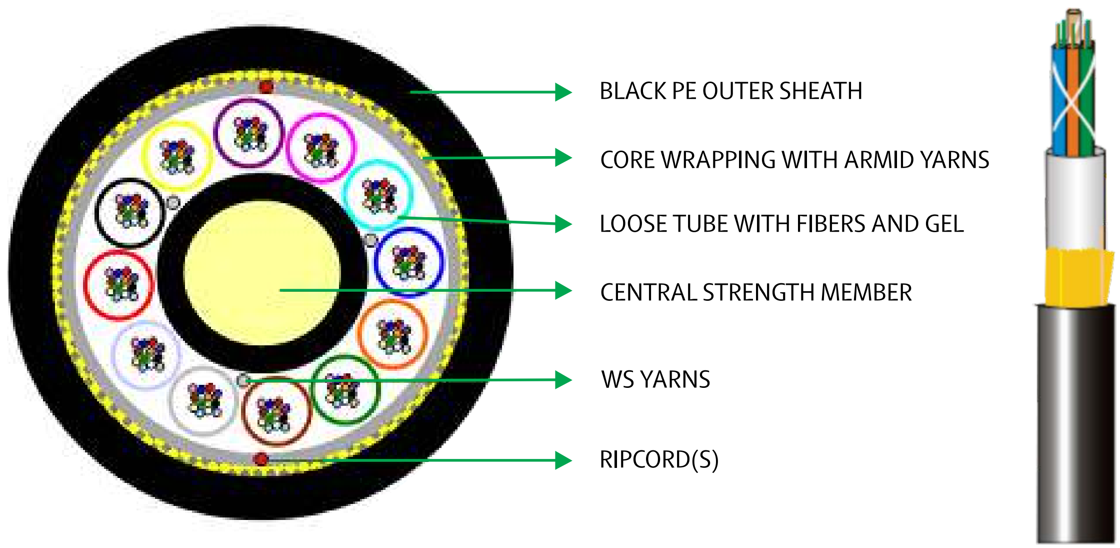

Figure 1- Sterlite Technologies® Single Jacket Multi-tube ADSS Cable

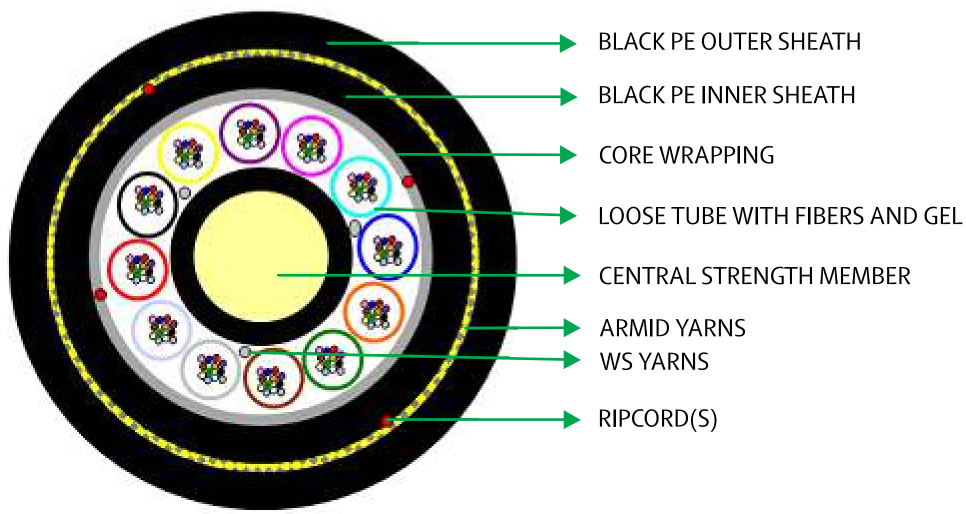

Figure 2- Sterlite Technologies® Dual Jacket Multi-tube ADSS Cable

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 in 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 fibers. The ADSS cable's outer jacket can be either a single or a dual jacket with an embedded non-metallic strength member.

The ROL (reverse oscillating lay) used in the stranding of the cable core make it possible to perform a mid-span access.

Cable access of ADSS cable is generally similar to procedures used for dielectric optical cable used in telecommunications outside plant applications.

Where is ADSS Cable Used?

ADSS cable has traditionally been used by the electric power industry to extract additional revenue from their cable support structures by providing fiber optic service to traditional long-haul carriers and to provide facilities for their own signaling. Fiber optic cables have therefore become a reasonably common part of both the electrical power company's high-voltage feeder and distribution cable plant. As part of the power feeder plant, the ADSS cable is supported on large supporting towers, usually below the level of the power transmission cables with spans of hundreds of meters. Cables are spliced at a lower level on the tower than the high-voltage transport systems. In distribution plant, the ADSS cable is usually supported on utility poles at a level below the power cables. Fibers are spliced at lower levels on the supporting utility pole.

Since utility supporting structures are typically spaced at considerably wider spacing than support poles in telecommunications plant, ADSS cable spans are generally considerably greater than other telecommunications cables used in aerial plant. This is possible because of ADSS cable's light weight, high strength, and robust design. It must, however, be selected by engineers and installed by the line crew to withstand the physical and climatic environment it will experience during its service lifetime.

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.

Application Note ADSS Cable

Despite ADSS' popularity in 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 larger than would be normally used by aerial plant.

Typical Applications

- Long-span aerial installations for either power utility or telecommunications plant
- On power transmission support structures due to its all dielectric structure
- Ideal for rural and urban access areas, such as aerial FTTH networks
- CATV networks
- Traffic signal systems
- Power utility communications and signaling networks

What makes ADSS Attractive to Use?

ADSS cable is designed as a unified cable structure that is circular in cross-section and contains sufficient strength to enable it to support itself and to be placed on either existing aerial support structures or new structures for unsupported spans of up to 500 meters in length. Aramid yarn is used to develop ADSS cable's high strength. Its large strength to weight ratio provides the key to ADSS cable's ability to span such long unsupported lengths. The ADSS cable design is modified to provide sufficient strength to accommodate the specific NESC loading zone matched to the location of the installation and span length required without exceeding a 3% sag in the cable between supports.

ADSS cable provides an all-dielectric system regardless if it is placed with telecommunications or power utility plant. It eliminates bonding and grounding costs and provides a safer working environment for those technicians working around the ADSS plant. In addition, the following installation advantages are provided by ADSS cables:

- Can be used on existing support structures.
- Below ground conditions are not as important as with buried or underground plant.
- Installation of this cable is simpler faster and less expensive as compared to the buried cable.
- Much of the plant has roadside access.

Unique Aspects of ADSS Cable

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 cable in spans up to 500 meters in length, without the need for a supporting strand. Sufficient aramid yarn is provided in ADSS cable to allow its installation tension to be adjusted sufficiently to keep the effects of temperature, mechanical loading, and wind from exceeding the tensile limits of the cable or causing excess sag in the cable between supports.

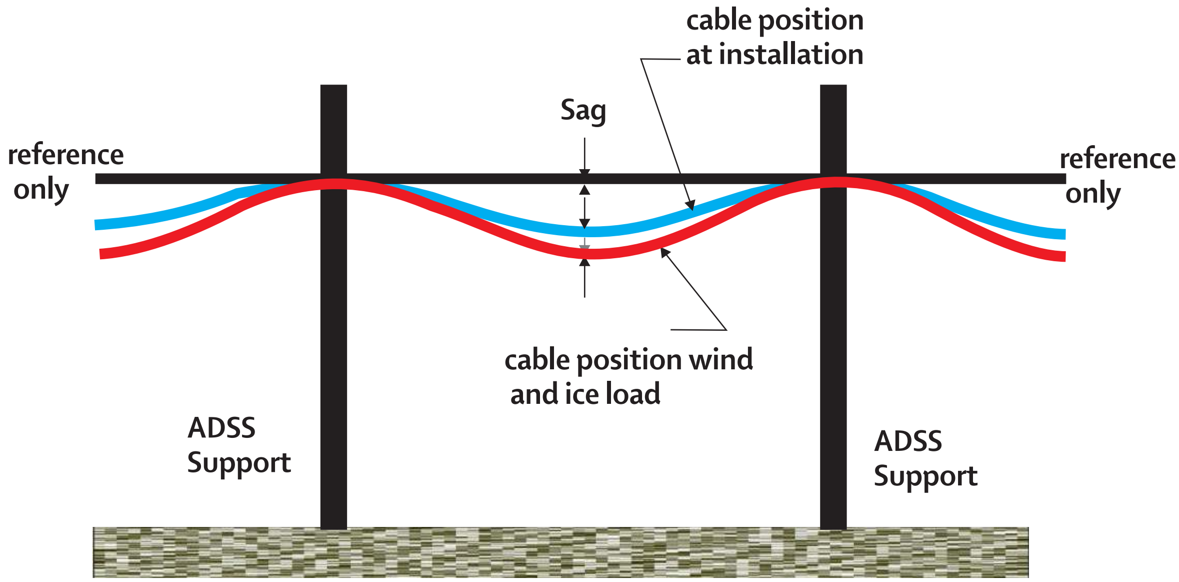

Figure 3 – Sag Drawing of ADSS Catenary Cable Deflection

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

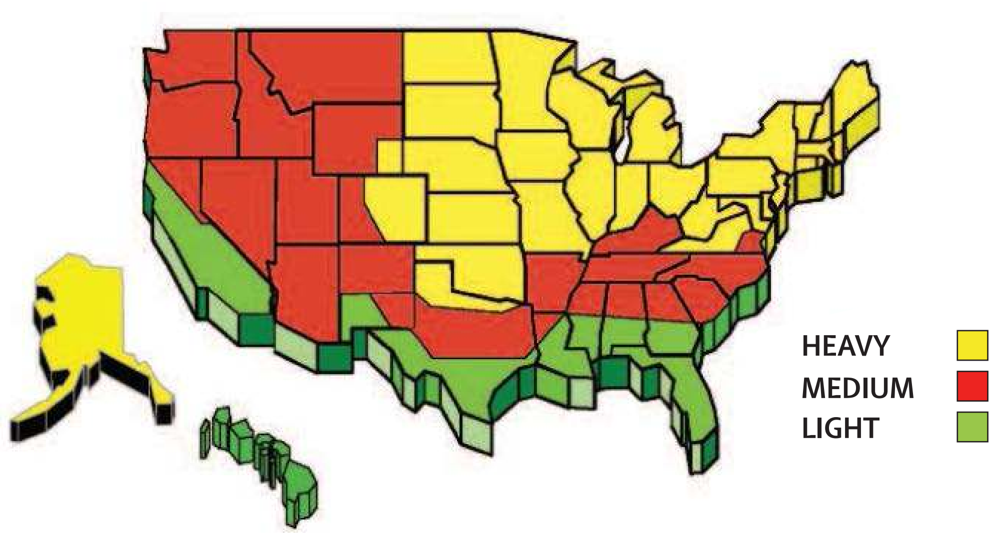

Figure 4 – NESC Environmental Loading Regions for the United States

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Sterlite Technologies® ADSS Cable is designed to perform properly in the following conditions:

Operating and Storage Temperature Range:

- Installation: -30°C to +40°C
- Storage: -40°C to +70°C

Maximum Sag:

Sag Details to be published:

- Installation: ⩽ 1% span length (support to support)
- Long Term: ⩽ 3% span length (support to support)

Sterlite Technologies® ADSS Cable Sizes

Sterlite Technologies® ADSS Cable is designed to perform properly in the following conditions:

The following ADSS cables are examples of those manufactured by Sterlite Technologies® to meet or exceed international specifications and the individual client's specifications and job requirements.

Multi-tube Sterlite Single Sheath ADSS Cable

Fiber Count	Cable Diameter (mm)	Cable Weight (kg/km)	Minimum Bend Radius	
			Full Load (mm)	Installed Load (mm)
12	11.5	90	230	173
24	11.5	90	230	173
36	11.5	90	230	173
48	11.5	90	230	173
60	11.5	90	230	173
72	11.5	90	230	173
96	12.8	134	256	192
144	16.2	192	324	243

Multi-tube Sterlite Dual Sheath ADSS Cable

Fiber Count	Cable Diameter (mm)	Cable Weight (kg/km)	Minimum Bend Radius	
			Full Load (mm)	Installed Load (mm)
12	13	130	260	195
24	13	130	260	195
36	13	130	260	195
48	13	130	260	195
60	13	130	260	195
72	13	130	260	195
96	13	130	260	195
144	13	130	260	195
216	15.4	185	308	231
288	18.8	250	376	282

<u>**ADSS cables can be provided with the following fibers:**</u>

- Multi-mode Fiber (G.651)
- Single-mode Fiber (G.652.b)
- Single-mode Fiber, full spectrum (G.652.d)
- Non-Dispersion Shifted Fiber (G.655)

Mounting Hardware for ADSS Cable

ADSS cable is mounted on its support structure at a level below any power utility plant. It is attached to the support structure with hardware that provides an efficient system for the ADSS cable to transfer loads to its supporting structure to enable it to function properly. The support hardware needs to be capable of carrying the installation and operating loads transferred from the cable along its entire span. The hardware must also be sized to match the cable's diameter.

Three types of hardware are commonly used:

- **Dead-end supports** – Provides a transfer of tensile load from the end of a cable to the ADSS support structure. These connections can also be used where there is considerable offset in cable alignment at a support structure.

Figure 5 – Dead-Ended ADSS Assembly

Figure 6 – ADSS Tangent Drop Cable Support

- **Support and Suspension**– Provides vertical support to the cable. The support hardware is usually either bolted to the support structure or supported with metallic bands around the support structure. A suspension holder has the same intended function as a support except it hangs off an eye-bolt which is attached to the ADSS support structure.

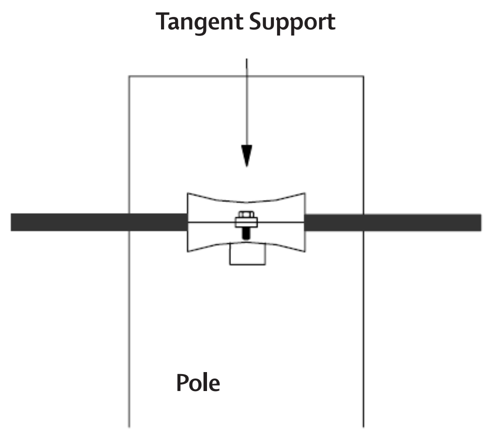

Figure 7 – Tangent Support for ADSS cable when there is a small offset in the cable at a support.

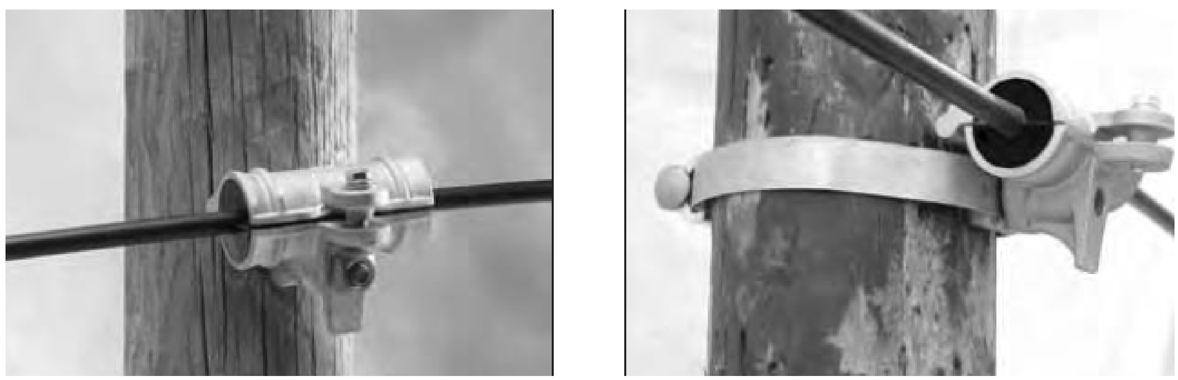

Figure 8 – PLP® ADSS Tangent Cable Support, Through Bolt and Band Mounted

- **Vibration Dampers** – Used at the end of DSS cables to reduce the dynamic effect of wind and vibrations on the cable.

Figure 9 – Vibration damper for ADSS cable.

ADSS-CORONA coils are intended to reduce electrical stress resulting on ends of ADSS cable when it is exposed to high voltage electrical fields.

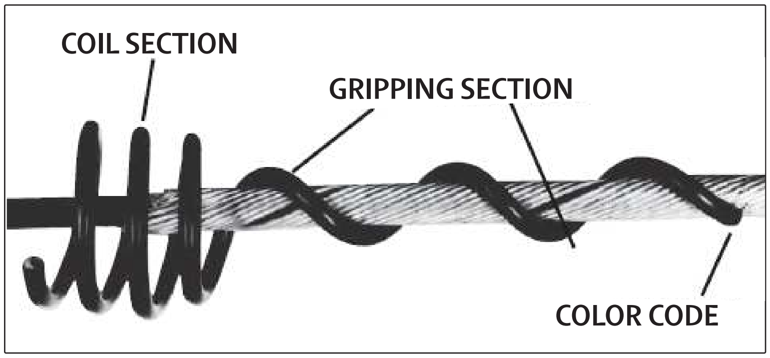

Figure 10 – PLP® ADSS CORONA Coil.

ADSS Cable Placement Procedures

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 resisted by the tensile force that is in the cable. The greater the tensile load in the cable, the shallower the catenary in the cable and the smaller the sag in the cable.

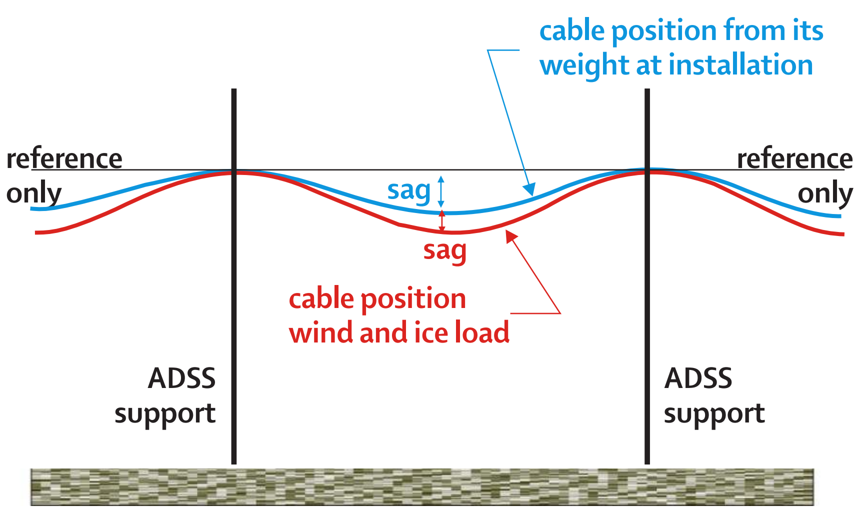

Figure 11 – ADSS Catenary Deflection Changes Sag as Load Changes

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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 and are not lashed to a support strand. Moving reel and stationary reel procedures similar to that 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 to 1.5% without any loading on the cable except its own weight. The actual tension in the cable (or sag in the span) is determined by Sterlite Technologies' engineering department to:

- Provide a cable that will provide sufficient tensile strength to resist the maximum in-service cable loading for the NESC load zone in which it will be used.
- Assure that the sag for the cable selected at maximum loading will not exceed allowable limits.

Secondary temperature affects that can become an issue during the service life may result if the installation temperature differs greatly from the expected installation temperature. The following table provides a summary of the conditions that can develop if the actual installation temperature differs greatly from the expected installation temperature.

Temperature Effects on ADSS Cable

Summer ADSS Installation: Hotter than expected at installation. • Cable longer than expected at installation. • More sag than expected during installation. • Less tension than expected at installation. • Tension shouldn't be a problem at max load. • Sag could be a problem at max load.	**Summer ADSS Installation: Colder than expected at installation.** • Cable shorter than expected at installation. • Less sag than expected during installation. • More tension than expected at installation. • Tension could be a problem at max load. • Sag shouldn't be a problem at max load.
Winter ADSS Installation: Colder than expected at installation. • Cable shorter than expected at installation. • Less sag than expected during installation. • More tension than expected at installation. • Tension could be a problem at max load. • Sag shouldn't be a problem at max load.	**Winter ADSS Installation: Warmer than expected at installation.** • Cable longer than expected at installation. • More sag than expected during installation. • Less tension than expected at installation. • Tension shouldn't be a problem at max load. • Sag could be a problem at max load.

Installation Methods Summary

Only a general overview of aerial optical cable placing will be presented in this section. Detailed instructions of ADSS cable placing procedures should be obtained from Sterlite Technologies.

Route planning and cable selection are technical considerations that are engineering responsibilities, but the selection of the method used to place the cable is usually left to the construction forces. Selection of the placing method is just as important as any phase of the job. The objective is to select the method that imposes the least physical stress on the cable. Some of the factors that must be considered are cable type, experience of the placing crew with the specific type of equipment that will be provided to them, availability of that equipment, terrain through which the cable will be routed (trees, other obstructions), location of right-of-way (on road side or field side of support structure, construction on public or private right-of-way, accessibility of vehicle to supports), unusual power hazards, and traffic density.

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

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Stationary-Reel Method

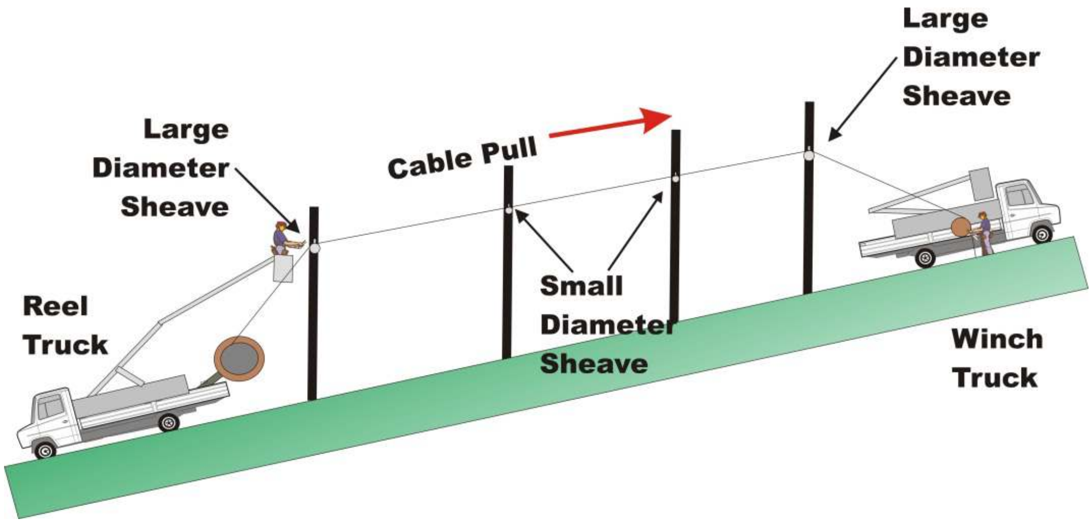

Figure 12 – Stationary Reel ADSS Cable Placing Method

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 are imposed by the difficulty of coordinating the pulling operation over the length of the cable route.

In this procedure, the cable reel is positioned at the starting end of the cable placement and positioned 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 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 provided 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 to the cable with a double rotating swivel that has been threaded thought the support sheave on each support structure.

A standard fiber 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 levels specified by Sterlite Engineering to meet the expected maximum loading for its cable weight and span length.

Moving Reel with an Aerial Lift

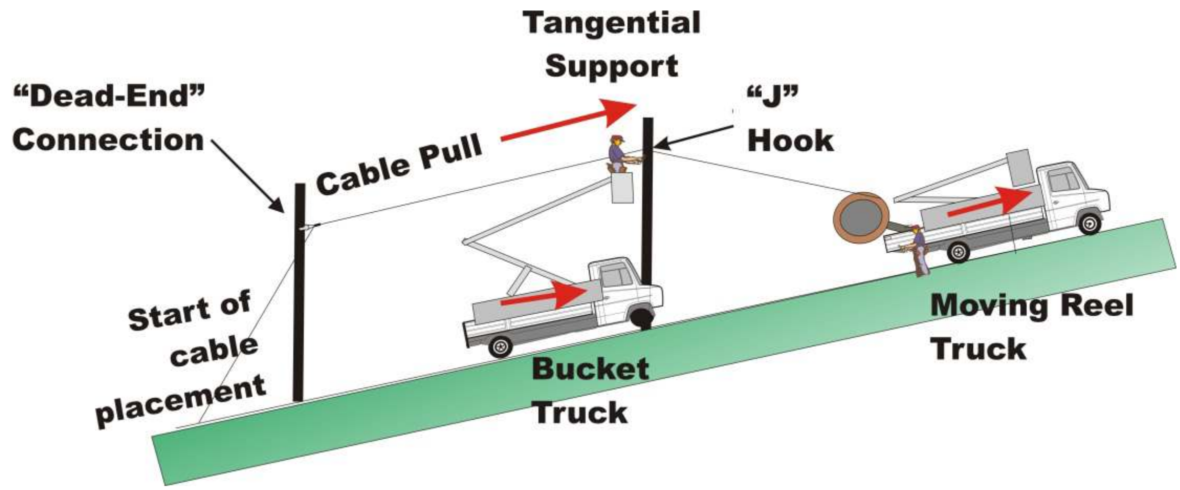

Figure 13 – Moving Reel ADSS Cable Placing Method

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 at this critical point.

As the vehicle passes each pole, the cable is raised into place by a technician in a lift bucket and into a "J" hook or block fitting 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.

Generally, the moving-reel method is potentially the fastest and least expensive method to install ADSS cable. Pole-mounted "J" hooks are the only temporary support devices required and 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.

The tables that follow are the tension and sag tables for some of Sterlite Single and Dual Sheath ADSS cable design. Other designs are available upon request. The tables 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.

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Multi-tube Sterlite Single Sheath ADSS Cable

Sr.No	Tensile Load	Fiber Count	Cable Diameter	Cable Weight	Wind Speed	Ice Load	Final Sag	Max Span	Final Sag	Max Span	Final Sag	Max Span
Loading Condition - NESC Light												
1	3 kN	12-72	11.5 mm	90 Kg/Km	97 Km/Hr	0 mm	2 %	60	2.5 %	70	3 %	80
2	4 kN	96	12.8 mm	134 Kg/Km	97 Km/Hr	0 mm	2 %	60	2.5 %	70	3 %	80
3	5 kN	144	16.2 mm	192 Kg/Km	97 Km/Hr	0 mm	2 %	60	2.5 %	70	3 %	80
Loading Condition - NESC Medium												
1	3 kN	12-72	11.5 mm	90 Kg/Km	65 Km/Hr	6.35 mm	2 %	50	2.5 %	60	3 %	70
2	4 kN	96	12.8 mm	134 Kg/Km	65 Km/Hr	6.35 mm	2 %	50	2.5 %	60	3 %	70
3	5 kN	144	16.2 mm	192 Kg/Km	65 Km/Hr	6.35 mm	2 %	50	2.5 %	60	3 %	70
Loading Condition - NESC Heavy												
1	3 kN	12-72	11.5 mm	90 Kg/Km	65 Km/Hr	12.7 mm	2 %	30	2.5 %	35	3 %	45
2	4 kN	96	12.8 mm	134 Kg/Km	65 Km/Hr	12.7 mm	2 %	30	2.5 %	35	3 %	45
3	5 kN	144	16.2 mm	192 Kg/Km	65 Km/Hr	12.7 mm	2 %	30	2.5 %	35	3 %	45

Multi-tube Sterlite Dual Sheath ADSS Cable

Sr.No	Tensile Load	Fiber Count	Cable Diameter	Cable Weight	Wind Speed	Ice Load	Final Sag	Max Span	Final Sag	Max Span	Final Sag	Max Span
Loading Condition - NESC Light												
1	4.5 kN	12-72	13.0 mm	130 Kg/Km	97 Km/Hr	0 mm	2 %	100	2.5 %	125	3 %	150
2	5.2 kN	96	15.4 mm	185 Kg/Km	97 Km/Hr	0 mm	2 %	100	2.5 %	125	3 %	150
3	6.9 kN	144	18.8 mm	250 Kg/Km	97 Km/Hr	0 mm	2 %	100	2.5 %	125	3 %	150
Loading Condition - NESC Medium												
1	4.5 kN	12-72	13.0 mm	130 Kg/Km	65 Km/Hr	6.35 mm	2 %	80	2.5 %	100	3 %	120
2	5.2 kN	96	15.4 mm	185 Kg/Km	65 Km/Hr	6.35 mm	2 %	80	2.5 %	100	3 %	120
3	6.9 kN	144	18.8 mm	250 Kg/Km	65 Km/Hr	6.35 mm	2 %	80	2.5 %	100	3 %	120
Loading Condition - NESC Heavy												
1	4.5 kN	12-72	13.0 mm	130 Kg/Km	65 Km/Hr	12.7 mm	2 %	45	2.5 %	55	3 %	70
2	5.2 kN	96	15.4 mm	185 Kg/Km	65 Km/Hr	12.7 mm	2 %	45	2.5 %	55	3 %	70
3	6.9 kN	144	18.8 mm	250 Kg/Km	65 Km/Hr	12.7 mm	2 %	45	2.5 %	55	3 %	70

Additional Information

If there are additional questions on this topic or other fiber optic issues, please contact Sterlite Technologies at:

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