EnduraSpan™ ADSS All-Dielectric Self-Supporting Cable Installation Guideline

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I. Purpose

This procedure applies to the installation of Superior Essex EnduraSpan™ ADSS All-Dielectric Self-Supporting Fiber Optic Cable into an aerial position. The objectives of this guideline are:

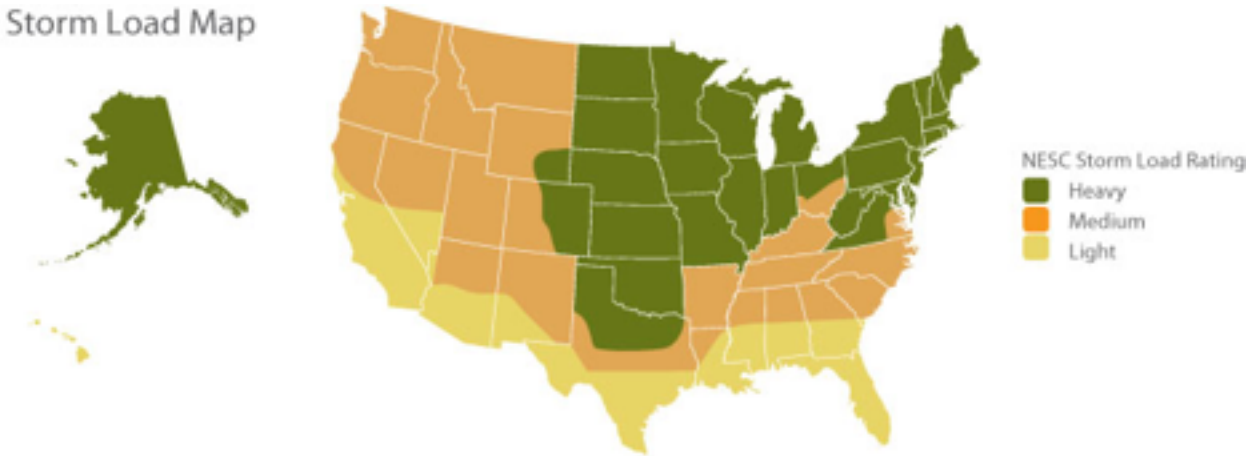
- Provide the cable installer with a general guideline for installing ADSS cable in an outside plant aerial facility. It is assumed that the cable handling crew already has an understanding of planning, engineering and/or placement of ADSS fiber optic cable. (It is not the intent of this procedure to cover all possible installation scenarios or conditions). Special circumstances or questions can be addressed by contacting Superior Essex Technical Support by calling 1-877-263-2818.
- Prevent damage to the OSP cable during the setup, handling, and installation.

It is intended that this guideline be used in conjunction with procedures that describe the detailed operation of handling equipment. Equipment procedures are provided by the equipment suppliers.

II. Introduction & Cable Design Overview

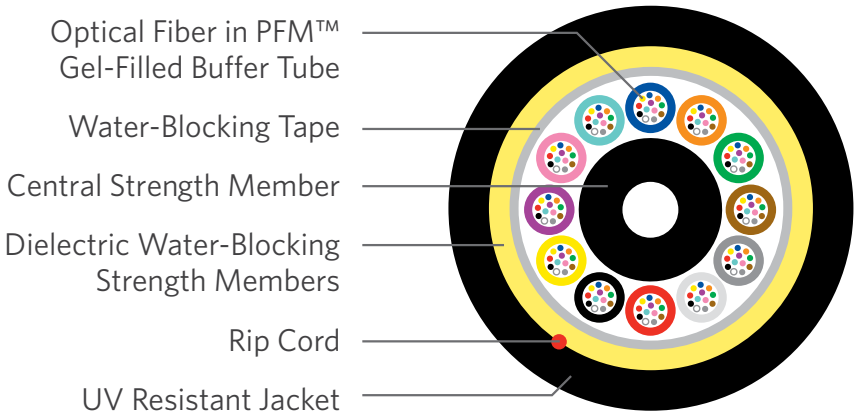
The practice of handling fiber optic cables has become much more common in recent years. Fiber optic cables are designed to withstand all typical mechanical installation and environmental stresses expected in the specific application.

Superior Essex incorporates the National Electric Safety Code requirements for light, medium and heavy loading conditions for the purpose of generating sag & tension charts for EnduraSpan™ADSS cable designs . For customer specific environmental conditions, customer sag and tension tables can be generated. This may include minimum separation and clearance, short term and long term sag requirements and loading conditions.



NESC STORM LOADING DISTRICT SPECIFICS					
	Radial Ice in (mm)	Wind Pressure lbs/ft^2 (Pa)	MPH	Temperature °F (°C)	Safety Factor lb/ft (N/m)
	0 (0)	Hawaii 16.4 (786) Puerto Rico 23.1 (1106)	110 130	60 (15)	0 (0)
Light	0 (0)	9 (430)	60	30 (-1)	0.05 (0.7)
Medium	0.25 (6.4)	4 (190)	40	15 (-10)	0.2 (2.5)
Heavy	0.5 (12.7)	4 (190)	40	0 (-20)	0.3 (4.4)

Superior Essex ADSS fiber optic cables meets or exceeds mechanical, environmental, and electrical performance specifications as detailed in the "IEEE 1222-2011 Standard for Testing and Performance for All-Dielectric Self-Supporting (ADSS) Fiber Optic Cable for Use on Electric Utility Power Lines". See cable design cross section below.



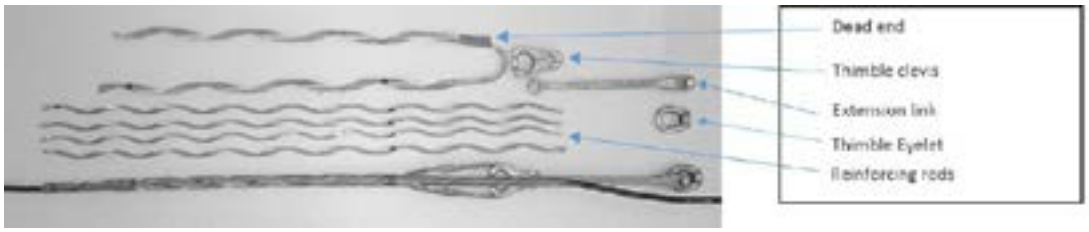
Superior Essex ADSS cables are suitable for installation on structures for both distribution and transmission lines. Standard jacket materials have a space potential exposure compatibility up to 12 kV. If the cable is installed on structures with medium to high voltage transmission lines, it is recommended that electrical stress analysis be performed to determine the appropriate cable placement on the structure to insure that the e-field space potential is <12kV.

Recommended Dead Ends and Tangent Support Hardware

Dead End Assembly – formed wire with or without reinforcing rods

- Cable tension relief
- Used for cable start and end points
- Splice points, cable slack locations
- Used where line angles exceed tangent hardware ratings i.e., 20 degrees for tangent supports or 30 degrees for tangent suspensions.

Dead Assemblies with Reinforcing Rods



- Maximum tensile ratings at short term loading
  - PLP - Tension to 2500 lbs. (1140 kg)
  - PLP - Tension to 4000 lbs. (1814 kg)
  - PLP - Tension to 7500 lbs. (3402 kg)

Dead End Assembly without Reinforcing Rods

- Maximum tensile ratings at short term loading - ≤ 800lbs

Dead End Assembly Components without Reinforcing Rods for ≤ 800 lbs

Dead end

Thimble Clevis

Thimble Eylet

Tangent Support Hardware

- For maximum spans up to 600 feet
- For Line angle changes due to changes in elevation or direction up to 20°
- Mounted to the pole as fixed attachment
- Not recommended for use as a stringing block
  (Note: This applies to the tangent suspension only and does NOT apply to the tangent support)

Tangent Support (Preformed Line Products FIBERLIGN Aluminum support). Rated up to 20 degree line angles and can be used as a stringing block up to 10 degree line angles.

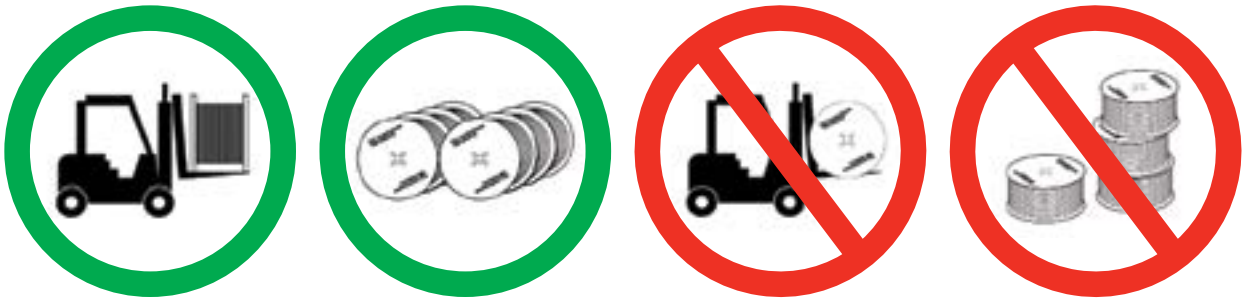
Tangent Suspension (Preformed Line Products FIBERLIGN Aluminum Suspension). Rated at 30 degree line angles and should not be used as a stringing block.

Fiber optic cables can be damaged if not handled properly during the installation process. Adherence to the cable's design limits of maximum installation tension, long term sag tension, minimum cable bend radius/diameter, and crush force during installation will ensure that the cable will perform properly throughout its full design lifetime. The greatest mistake when handling fiber optic cable is assuming that all outside plant (OSP) handling equipment is suitable for use - it is not. If in doubt prior to or during any cable installation, contact Superior Essex Technical Support by calling 1-877-263-2818

III. General and Safety Precautions

The following precautions always apply when handing fiber optic cables.

- DO NOT exceed the cable's stated **maximum installation tension.**
- DO NOT exceed the cable's stated **minimum bending radius.**
- DO NOT exceed the cable's **maximum crush load.**
- NEVER set a cable reel on a flange side (to prevent cable crossings during payoff).



- DO adhere to local personnel safety practices.
- DO review and follow equipment safety practices.
- ALWAYS apply caps over free cable ends to prevent water intrusion.

NOTE: These installation instructions have been written for qualified, experienced personnel. Please read them thoroughly before starting assembly work. Superior Essex disclaims any liability or responsibility for the result of improper or unsafe installation practices.

WARNING: When working with overhead conductors and facilities, ensure that all personnel are aware and trained on the applicable safety requirements of the Occupational Safety and Health Act (OSHA) and the National Electric Safety Code (NESC), or the appropriate local safety regulations.

Use of gloves, eye protection, hard hat and boots are required to safely complete installation of cable. When working aloft also include the use of insulated gloves, body belt, harness/lanyard and protective clothing.

Inspect all personal safety gear as well as equipment prior to use. It is important to replace any worn or defective tools and equipment. Failure to comply with safety regulations can result in bodily injury or death.

Additional general safety precautions exist when working with overhead facilities or in areas of traffic congestion.

- Ensure adequate clearances between the cable being installed and all existing cables. Follow the current NESC requirements, local ordinances and company standards.
- Ensure cables are properly grounded during installation in overhead facilities near power lines. Fiber cables with metallic components can accumulate an electric potential when near power lines.

- Proper safety cones and traffic control devices should always be used. The project manager should coordinate his work with local traffic officials. Safety zones utilizing traffic signs and cones should be placed at all working locations.

Please note that safety precautions listed in this guide for The Stationary Reel Method and Moving Reel Installation Methods must be followed to avoid bodily injury.

CAUTION: When working in road right of way, wear proper safety vests and hard hats as required by state Department of Transportation (DOT) and OSHA. Use of proper signage and cones will protect workers and the general public. Use strobe lights on equipped vehicles while stationary or in motion while paying off cable.

IV. Reference Documents

- ICEA S-87-640: Standard for Optical Fiber Outside Plant Communications Cable
- IEEE 1222: Standard for Testing and Performance for All-Dielectric Self-Supporting (ADSS) Fiber Optic Cable for Use on Electric Utility Power Lines
- Bellcore TR-NWT-001121, (General Requirements for Self-Supporting Optical Fiber Cable)
- Bellcore GR-20-CORE, (General Requirements for Optical Fiber and Fiber Cable)
- IEEE 524, (Installation of Overhead Conductors)
- IEEE Std 1591.2, Testing and Performance of Hardware for ADSS Fiber Optic Cable

V. Installation Overview

A. Construction Planning

Perform a detailed site survey of the aerial cable route to identify potential issues, determine accessibility, and create an installation plan. The survey should include a representative from each agency with an interest in the route or associated location. Site survey should include analysis of the following:

- Route accessibility for installation equipment
- Right of way/permitting issues
- Determination of installation technique
- Condition of poles and guying support
- Location of fiber cable splice points
- Locations for equipment setup
- Clearances to existing power lines and other cables

Cable splice locations must be selected with consideration of splice vehicle accessibility. For fiber cable(s), slack must be added to both cable ends at each splice location to allow for splicing. Cable slack must allow the cables to reach ground level and into a splice truck plus 30 feet (9 meters) minimum. These added slack lengths must be considered when ordering the cable.

Engineering activities will be required to evaluate the sag and tension performance of the installed cable. Sag and tension evaluation will be dependent on environmental design conditions and will be used to determine the long term installation tension and sag for the cable.

Engineering must also examine the temporary loads that will be exerted on dead-end poles during installation and final cable sag and tensioning. Temporary guy wires may be required.

Engineering analysis is also required to evaluate the final installed sag and tension relative to environmental conditions. Wind loading can produce high and low frequency vibration and its effect on cable and hardware fatigue needs to be considered. A vibration dampening system may need to be considered based on local conditions.

After completing the above planning activities, create an overall installation plan as the formal guide for the installation crew or contractors.

B. Limitations and Precautions

The procedural installation of aerial fiber optic cable is essentially the same as for copper cable or coaxial cables. However, fiber cable performance can be more easily degraded if the rigors of installation are too excessive. Installation crews must be sensitive to the limitations of the fiber cable regarding **maximum installation tension, minimum bend radius, and crush resistance**, and take action throughout the installation process to prevent exceeding these limits.

Whenever supporting a cable in the air, ensure the curvature of the support device is greater than the minimum bend radius of the cable to prevent damaging the cable.

Leave the lagging or other protective wrap on the cable reel until the reel is delivered to the installation site to prevent handling damage. When lagging or wrap is removed, carefully inspect the reel for integrity and to ensure the inside flanges are smooth and nail-free. Correct any conditions that may cause unstable cable payout during the installation. Always detach start end of the cable from the reel flange to avoid cable creep. See Technical Guide TG08 for more details.

Communications must be established at key control functions along the route to coordinate cable travel and tensioning.

Avoid surges in cable tension during reel payout.

To avoid damage to the cable jacket, do not drag the cable over fixed surfaces.
Note: Tangent supports may be used as a stringing block up to 10 degree line angles.

Slack coils may be assembled in a continuous direction loop configuration or a “figure eight”. “Figure eight” configuration is best to minimize torsion and stress build-up in fiber cables over long lengths and is preferred over single direction coiling. Single direction coiling should only be used for lengths less than 100 feet (30 meters). Do not exceed minimum bend radius of cable.

Slack coils should be secured in a location to prevent damage. Fix the coils securely in place with suitable cable ties to prevent rubbing and long-term abrasion on the cable. **NOTE: Do not use cable spoolers or other equipment designed to replace manual "figure eight" on ADSS fiber optic cable. Doing so risks damage to the cable and will void the warranty.**

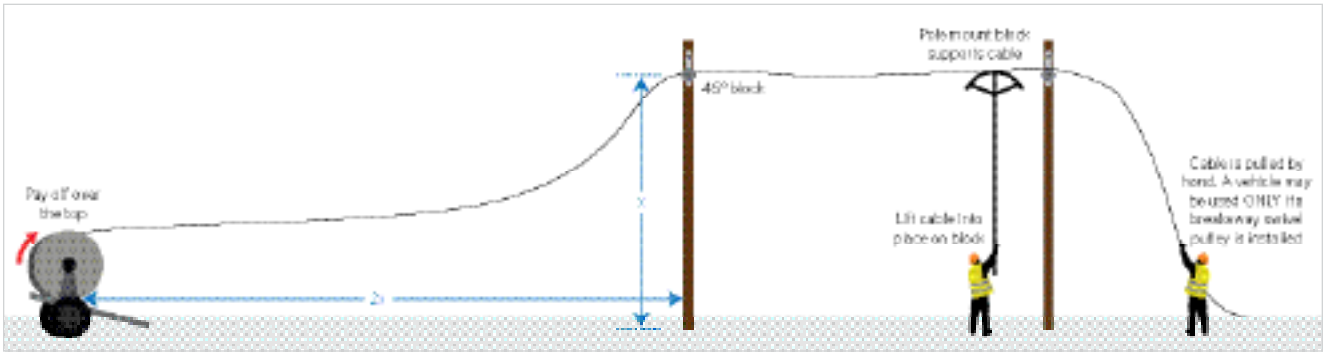
If a "figure eight" is used during the installation to accumulate a significant length of cable, protect the cable crossover point by using cardboard shims or consider multiple "figure eights." If cable is on the ground, always use barricades to prevent inadvertent access to the area.

C. Applications and Installation Methods

EnduraSpan™ ADSS is suitable for aerial applications for joint use on electric utility distribution lines and for installation on electric utility transmission lines where e-field space potential is <12kV with span lengths from 25 meters to 400 meters. This black, polyethylene jacketed cable is UV-stabilized and water blocked for outdoor aerial applications. The high modulus aramid yarns provide high tensile strength and long-term reliability.

Installation Methods

- The Stationary Reel Method is the most widely used method for the installation of ADSS cable designs. Two methods will be discussed in this document. The first is where a pulling rope is installed from point to point supported by stringing blocks of the correct size to meet the minimum bend diameter for the cable design being placed. Once the pulling rope is placed the cable is then attached to the pulling rope and the cable is pulled through each structure from the stationary reel to the end point in the route or the first splice point location. The second method is where the cable is pulled from the stationary reel from pole to pole and supported by stringing blocks (of the correct size) for the cable being placed. In both methods once the cable is installed, the cable is sagged to the correct long term tension and the permanent support hardware is installed at each pole location.
- The Moving Reel (or "Drive Off") Method is used when the entire route is accessible by support vehicles. The route must be free of trees, limbs, and guy wires to allow full vehicle access. Support vehicles are used to pay off and raise the fiber cable to temporary support hardware. Once the cable is in position, it is transferred to the permanent support hardware.



VI. Installation Using a Stationary Reel Method

A. Equipment and Materials

Pulling grips are required and must be sized for the cable outside diameter. Pulling grips for fiber optic cable are made of galvanized steel strand. They feature a multi-weave mesh for holding strength. Make sure to select a pulling grip with a sufficient tensile rating for installation to be completed. It is recommended that the tensile rating for the pulling grip have at least at 30% safety factor relative to the short term tensile rating for the ADSS cable design being installed. A flexible eye provides easy attachment of a swivel.

A low-elasticity, torqued balance pull rope/line, is recommended to minimize elastic-induced surges and twisting during the pulling process.

A pulling swivel between the pulling and pulling rope is recommended. Pulling swivels should have the appropriate tensile rating, not to exceed the maximum installation tension of the cable. **Break away swivels are not recommended due to safety issues.**

Mid Span blocks: Used to support cable in mid span over all roadways, parking lots, driveways, and other obstructions.

Cable string blocks: Used at each pole location to support the pulling rope and cable during installation.

Take up equipment: Pulling may be performed by hand or by a pulling winch. Take up equipment is used to pull the rope with the cable attached through the stringing blocks. The take up should have tension and speed controls to ensure proper installation. It may also be used for the sag & tension procedure. The take up equipment to be used should have an accurate means of monitoring the line tension in pounds. This will insure

compliance with the recommended maximum installation tensions and corresponding stringing block sizes in use.

Cable reel carriers for paying off cable during installations are readily available and common for the aerial installation of cable. Typically payoff equipment utilize an over spin break to control the back tension on the cable drum to control installation cable sagging and tension during the installation process. This type of breaking control is more common on distribution line applications where span lengths and generally <500 feet and installation tensions are lower, typically <600lbs. For longer span lengths with higher installation tensions bull wheel tensioners are used. The bull wheel payoff tensioners provide a more consistent level of back tension to control sag and cable surging during the installation process. See photos below.

Pay Off Carrier w[illegible]ver [illegible]in Break

Bull Wheel Tensioner for Payoff Control

Cable pullers are also readily available for most cable installation contractors and utility companies. Equipment can be rented or purchase from a number of different manufacturers. Generally, pullers are equipped with tension and speed controls.

Cable Puller with Tension and Speed Controls

Cable sheaves, rollers, stringing blocks, or capstan pulling winches or drums used during the installation process must maintain the cable's minimum bend radius/bend diameter. The minimum bend radius during tensioned installation (dynamic) is 20 times the cable's outer diameter (O.D.). The minimum bend radius during zero tension (static) cable handling is 10 times the cable's O.D. Blocks suspended under the cable for tangent support may have a groove diameter of 10 times the cable's O.D. if block spacing is 50 feet (15 meters) maximum.

Radio communication must be established between the cable reel, the pulling device, and all intermediate locations during the pulling process. This link can be provided by two-way radios or cell phones and is maintained to ensure safe conditions for the cable exist throughout the installation.

Follow steps in section "VIII. General Installation Procedures" for Moving Reel Methods.

Follow steps in section "VII. General Installation Procedures" for Stationary Reel Methods

VII. General Installation Procedures

The most common method for installing ADSS cable is by the stationary reel method. Installation of the cable using a pre-installed pulling rope will be discussed.

A. Initial Conditions

Prior to commencing the cable installation event, the following actions must be accomplished:

- System prints are obtained and thoroughly reviewed
- Job area survey is complete
- Installation plan and equipment setup locations are defined
- Limitations of the cable are reviewed with the handling crew
- Installation equipment is reviewed for adequacy
- Detailed setup and operating instructions for all equipment have been reviewed
- Cable reels are inspected to verify no damage and good flange surfaces
- Perform acceptance testing to verify optical attenuation is acceptable
- The event is reviewed and briefed, at least one day prior, with install crew
- All required equipment is on site the day of the installation event

B. Make Ready Work – completed prior to the cable installation

- Includes framing the poles, installation of pole line hardware, installation of the stringing blocks, and installation of the pulling rope.
- Placing appropriate hardware for the structure type to support the ADSS cable suspension hardware, installation of stringing blocks, and installation of pulling rope can be accomplished in one pass throughout the installation route.
- Stringing Blocks: Single wheel type stringing blocks (Sherman Reilly type) are recommended for all applications. Multiple wheel quadrant blocks are not recommended. This type of block is often referred to as a "3 block". Cable Stringing Blocks - the sheave (wheel) diameter of the stringing block is determined by the minimum cable bend diameter. EnduraSpan™ ADSS loose tube cable minimum bend diameter is 40 times the outer diameter during installation and 20 times the cable outer diameter after the installation has been completed. Select stringing blocks for your applications accordingly. Use of permanent attachment hardware as a substitute for stringing blocks is not recommended. However please note that FIBERLIGN(R) AluminumSupport (FAS) or Tangent Support product can be used for stringing up to 10 degree line angles
- Stringing block selection for any structure along the route is based on the cable outer diameter for minimum bend, line angle changes to due to changes in elevation or direction between structures, and the installation tension.
- When selecting a stringing block, be aware that the outside diameter given by the manufacturer does not reflect the actual O.D. of the stringing block. Most manufacturers measure the diameter from the flanges of the stringing block and not the groove. The bottom groove diameter of the stringing block should be used when selecting the correct stringing block for the stringing blocks relative to the manufactured cable outer diameter and line angle. Check the manufacture's specifications for the correct groove diameter of the stringing blocks to be used.

- Secure the proper size stringing block on the pole at the correct attachment height. Take into consideration grade changes between structures so that the cable will stay centered and down in the rollers during installation. Installation of the pulling rope during this process will provide an indication that the cable will be in the proper position in the rollers during the cable pulling process.
- When selecting stringing blocks and support hardware for each structure due to changes in elevation or direction, the total line angle change is determined by the position of the previous structure in the back span and the position of the next structure in the route. The maximum line angle for either side of the structure must not exceed 10° for tangent hardware for line angles up to 20° and 15° for tangent hardware for line angles up to 30°.

- When large diameter stringing blocks are placed (i.e. > 16 inches), secure the block on the structure in such a way that remains close to parallel to the ground during cable placement. Depending on the amount of sag during installation, some adjustment in position may be necessary. Securing the block will prevent excessive movement during cable placement, which in turn will prevent the cable from riding up or "jumping" out of the stringing block groove. It is the responsibility of the installer to make sure the stringing blocks are placed on the structure in a manner that will facilitate the cable installation without causing mechanical damage to the cable. Prior to use, inspect stringing block surfaces to insure that there are no burrs or defects in the surface area that will cause mechanical damage to the cable during the installation.
- Once the stringing block is set in the correct position on the structure, place the pulling rope in the stringing block and proceed to the next structure in the route.
- Use mid span when necessary to clear roadways, drive ways, parking lots, and other obstructions between structures.
- The tables below outline the recommended stringing block sizes based on the cable outer diameter, the estimated maximum pulling tension for the installation, and changes in elevation or direction.

Stringing Blocks

STINGING BLOCK SIZES FOR INSTALLATION TENSIONS ≤600 LBS			
Cable Outer Diamete (in)	Block Sizes for Line Angles 0° to 20° (in)	Block Sizes for Line Angles 21° to 45° (in)	Block Sizes for Line Angles 46° to 90° (in)
1.00	8	18	30
0.95	6	18	30
0.90	6	16	30
0.85	6	14	30
0.80	6	14	30
0.75	6	14	24
0.70	6	12	24
0.65	4	12	24
0.60	4	12	18
0.55	4	8	16
0.50	4	8	16
0.45	4	8	16
0.40	4	8	16

Note: The use of unlined rollers is recommended whenever possible. If lined rollers are to be used, urethane lined rollers are recommended over neoprene lined rollers.

STINGING BLOCK SIZES FOR INSTALLATION TENSIONS FROM 600 TO 1000 LBS			
Cable Outer Diameter (in)	Block Sizes for Line Angles 0° to 20° (in)	Block Sizes for Line Angles 21° to 45° (in)	Block Sizes for Line Angles 46° to 90° (in)
1.00	18	24	30
0.95	18	24	30
0.90	16	24	30
0.85	14	24	30
0.80	14	24	30
0.75	14	18	24
0.70	12	18	24
0.65	12	18	24
0.60	12	16	18
0.55	8	12	16
0.50	8	12	16
0.45	8	12	16
0.40	8	12	16

SHERMAN REILLY STRINGING BLOCK DIAMETER VS. GROOVE DIAMETER TYPICAL STRING BLOCK SIZES	
Outside Block Diameter (in)	Bottom of Groove Diameter (in)
7	4.8
10	7.5
12	9.5
14	12
16	14
20	16
22	18
28	24
35	30.5
42	36

C. Installation

Prior to installation, all traffic safety zones, barricades, and flagmen must be in place. Observe all local safety ordinances and practices.

Cable payoff set up:

Visually inspect each cable reel for physical damage. Ensure the cable reel inner flanges are smooth and nail-free to allow free payoff of the cable. Set up the reel and reel trailer at the predetermined location per the installation plan. Pay off the cable from the top of the reel. Detach opposite end of the cable from the reel flange and manage any excess slack.

Position the cable trailer at a distance of 3x the attachment height of the cable whenever possible to maintain the minimum bend for the cable at the structure. Select the correct size stringing block based on the line angle at the structure. The line angle is dependent on the distance from the pole and the attachment height for the cable/ stringing block.

Align the center of the cable reel with the center of the stringing block. This will enable the cable to run close in the center of the stringing block during installation.

Set up winches, monitoring devices, and stringing blocks per the installation plan. Establish communication between the cable payoff, cable puller, and all key intermediate locations (road crossings, intersections or other key locations where obstructions are present).

Attaching the Pulling Grip (for Stationary Reel Method) Apply the correct sized pulling grip over the cable. Continue to push the grip onto the cable until the cable extends about ¼ to ½ inch (6 to 13 mm) beyond the grip mesh.

Figure 4: Pulling Grip

Tighten the grip onto the cable by pulling on the eye.

Tightly wrap over the grip with a vinyl tape. Begin the tape wrap about 1 inch (25 mm) past the cable component cutoff point and wrap towards the pulling eye to about 1 inch (25 mm) above the mesh.

Attach appropriately rated swivel to pulling grip eye.

Figure 5: Swivel

Attach the swivel to the pre-installed pulling rope.

Check communication between the reel, pulling device, and all intermediate locations as appropriate.

Start the take up device and pull the cable at a speed of no more than 40 meters per minute (130 ft. per minute).

Ensure that the brake at the payoff reel is engaged to maintain adequate back tension on the cable. The breaking mechanism will keep the cable from back lashing when sudden stops occur as well as controlling the cable sag during the installation to maintain clearances.

The construction foreman shall follow the cable installation to monitor the back tension and pulling speed while maintaining constant communication between the payoff and the take up point. Adjustments in back tension and installation speed can be made as the cable is pulled in. As the cable passes through each stringing block at each pole the foreman needs to insure that the cable is sitting down in the stringing block to maintain a smooth transition through the stringing block from one structure to the next. If the stringing blocks are not properly set, the installation should stop and adjustments to the position of the stringing blocks completed before continuing the installation.

Do not exceed the cable's maximum installation tension. The maximum installation tension can be found in the EnduraSpan™ ADSS sag and tension table.

Note: Once the pull is started, try to maintain a constant and steady pull until the installation pull is completed.

When the cable installation is complete, be sure enough excess cable is available at both ends for cable termination.

It is recommended that additional linemen be used to monitor the cable at critical points in the route. These critical points are generally major intersections, hard corners or locations where the cable sag be must monitored due to clearance issues. These additional linemen should also have to capability to communicate with the cable take up and pay off locations.

D. Sag and Tensioning Methods Hardware Installation

Two methods of tensioning cable are described in this procedure for final cable installed sag. Before sagging the cable, the appropriate sagging tension should be determined by referring to the EnduraSpan™ADSS cable design sag and tension table. From the sag and tension table the tensions required to meet sag requirements for each span can be determined. Because sag and tension tables may be different for each EnduraSpan™ADSS cable design, the appropriate sag and tension tables for the EnduraSpan™ADSS cable being utilized should be obtained from Superior Essex.

Method 1 – Tensioning Cable between Dead End Locations

- Once the installation of the cable has been completed, secure the installed cable end to the structure with the dead end assembly. Follow the manufacturer's recommended assembly procedures. Be sure that sufficient slack has been provided at the finish end to access a splice point or a conduit system.
- The number of line angles exceeding 20 or 30 degrees, (depending upon the hardware selected) in an installation run plus one, shall determine the number of times that the cable shall be tensioned.
- The cable should be sagged starting at the finished end working your way back to the reel from one dead end location to the next dead end location. The cable can be sagged with any number of tangent supports (structures where line angles are < 20° or 30°), depending upon hardware selected between each dead end. The tangent supports can be installed after the installation of the dead end hardware.

- If maintenance slack cable is to be placed at specific double dead end locations, cable slack for that purpose must be pulled from the cable reel prior to placing the second dead end.

  Note: Do not cut the cable at the reel end until sag and tensioning and allocating slack cable has been completed.

- At the finished end make sure adequate cable slack has been pulled through for a splice point or access to the termination location. Once sufficient cable slack is accounted for, install the dead end hardware at the end structure.
- At the first dead end location from the finished end, attach a temporary dead end for sagging. Make sure the temporary dead end is installed far enough out from the structure to take up all of the slack required for final sag and tension.
- Depending upon the structure type, the span lengths and the final tension, it may be necessary to secure the cable on the opposite side of the structure to maintain the clearance in the adjacent span, or to provide slack for configuration of the cable and hardware on the structure.

  Note: A temporary dead end is a dead end that is partially installed for use as a pulling device. This is the only recommended device used for pulling the EnduraSpan™ADSS cable at mid span during sagging.

- A tensioning device should be attached to the structure where the first dead end is to be placed.

  Note: There are several tensioning devices available from your local distributor. The most common type used is a cable/chain hoist. If a hydraulic tensioner (Puller) is used, care should be taken to insure that the minimum bend diameter of the cable is not compromised by using too small of a stringing block at the dead end or intermediate attachment locations. Tensioning method 2 covers general precautions when using a hydraulic tensioner/puller.

- Once the tensioning device has been secured it should then be attached to the temporary dead end.

  Note: If the exact sagging tension is desired or over tensioning is a possibility, a dynamometer should be placed between the chain hoist and the temporary dead end to measure the sagging tension.

- Use the tensioning device to pull the cable to the desired sag or tension. Use a dynamometer for the first section between dead ends to insure that the maximum cable load is not exceeded. Check the sag in this section and insure proper clearances are being maintained and adjust sag and tension if necessary. The location of the permanent dead on the cable can now be determined using the extension link and heliformed dead end. Once this location is determined install the permanent dead on the cable at this location and attach it to the structure. If during this process the tension is less than the maximum installation tension and sag requirements and clearances are correct, the dynamometer may not be required for subsequent sections between dead ends with similar span lengths and clearance requirements.
- Once the permanent dead end has been placed release the tension on the temporary dead end and remove it from the cable. The cable should now be at the preferred sag and tension.

- Mark the cable on the other side of the structure where the second dead end is to be attached.

  Note: When installing a double dead end (two dead end assemblies on one pole) enough cable slack should be provided so that the cable assumes a gentle and uniform curvature between the two dead ends without contacting any obstructions. A double dead end should be placed at each splice location, locations where maintenance slack will be accumulated or when line angles exceeding 20 or 30 degrees due to changes in direction or elevation are encountered.

- Once the double dead end is completed, move to the next location requiring dead end assemblies and repeat the tensioning procedure for each location requiring dead end assemblies until the entire installation run is complete.
- When sagging has been completed secure the cable at each tangent (intermediate pole) location with the appropriate hardware based on changes in direction or elevation.

Method 2 – Sag & Tensioning Cable Using a Hydraulic Tensioner Puller

This method utilizes the tensioner/puller to tension the cable for the entire length of cable installed.

- Once the entire length of cable has been installed, cable slack from the reel must be pulled to the necessary locations. Once the necessary cable slack has been pulled, secure the cable on the structure with the appropriate dead end assembly.
- Consult the Superior Essex sag and tension table for the appropriate long term tension for the section of cable between dead end locations.
- Using the tensioner/puller and an in line dynamometer, pull the cable to the desired long term tension per the Superior Essex sag and tension tables.
- After the cable tension has been reached, the stringing block must be removed at the first double dead end location before the dead end assembly can be installed. The cable will be under final tension. Do not exceed the minimum bend radius for the cable design when removing the cable from the stringing block. Once the cable has been removed from the stringing block the dead end assembly may be installed per the manufacturer's recommendations.
- Once the first dead end has been installed, release the tension on the cable with the puller tensioner.
- It may be necessary to use a temporary dead end to pull enough slack to configure the cable from the first dead end on the structure to the second.
- Once an adequate amount of slack has been pulled, install the second dead per the manufacturer's recommendations.
- Move to the next double dead location and repeat steps for Method 2.
- For a double dead end on a structure where cable slack will be coiled for maintenance or future access, the cable slack must be pulled back before the second dead end is installed. The tension on the cable when the slack cable is pulled back should be minimal. Maintain only enough tension to clear obstructions during this process. Utilize proper equipment during this process to maintain cable minimum bend radius.
- Once the cable slack has been pulled in, secure the second dead.

Note: If the sagging tensions are > 600lbs the cable should not be left in the stringing blocks for an extended amount of time (i.e. 24 hours), reduce the tension on the cable to a minimum to maintain clearances over obstructions until the remaining hardware can be installed.

Note: Tangent supports between dead ends can be placed as soon as the span sag between dead end points has been set and the dead ends installed. If the installation crew has the man power and equipment, one team can install tangent supports while another team is sagging and installing dead ends for the next section. This procedure can significantly speed up the installation process.

VIII. Installation Using a Moving Reel Method

Figure 1: Moving reel method

General: Installation by using the moving reel method is fairly rare for distribution networks. It is very unlikely that this method will be an option on distribution joint use poles where both phone and CATV and electric utilities have installed drops for both commercial and residential applications. The possibility for the drive off installation method will most likely occur in rural environments where the EnduraSpan™ADSS cable will be installed below existing facilities or cases where there are limited number of drops along the route.

A. Equipment and Materials

Vehicles selected for use using this method must provide full accessibility on the placement side of the poles along the entire section run.

Note: Fewer materials are required for the moving reel method. Since cable payoff is direct from the vehicle to the temporary supports, no pulling grips or swivels are required.

Radio communication must be established between the cable reel payoff unit and the ground crew. Fewer communication points are required for the moving reel method. Links can be provided by two-way radios or cell phones and is maintained to ensure safe conditions for the line crew and cable being installed throughout the installation.

When placing ADSS fiber optic cable using the moving reel method, the cable is payed off of the reel while vehicle is moving along the pole line.

During set up ensure that cable pays off over the top of the reel as shown in Figure 1. When beginning, pull off needed cable for slack and position truck a minimum of 50 feet (15 meters) away from starting pole. Install cable blocks or J hooks that have a minimum of a 1.5 inches (3.75 cm) radius for use on intermediate poles as temporary supports. Lift the cable into place via a layup stick or another line truck.

Continue placing cable while driving slowly towards dead-end pole. If splices or slack storage is required along the route, be sure to dead-end the cable and follow the instructions in the stationary reel cable installation instructions noted above. The final cable installation will need to be tensioned, removed from temporary hardware and secured in permanent hardware.

For questions or additional information please contact Superior Essex Technical Support by calling 1-877-263-2818 or by email – Techsupport@spsx.com.