All Dielectric Self Supporting (ADSS) Fiber Optic Cable Installation
DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITIES

The practices contained herein are designed as a guide. Since there are numerous practices which may be utilized, Prysmian has tested and determined that the practices described herein are effective and efficient. The recommended practices are based on average conditions.

In addition, the materials and hardware referenced herein appear as examples, but in no way reflect the only tools and materials available to perform these evaluations.

Prysmian Communications Cables and Systems USA, makes no representation of nor assumes any responsibility for its accuracy or completeness. Local, State, Federal and Industry Codes and Regulations, as well as manufacturers requirements, must be consulted before proceeding with any project. Prysmian Communications Cables and Systems USA, disclaims any liability arising from any information contained herein or for the absence of same.

For further information or assistance, contact:

Prysmian Communications Cables and Systems USA
Field Services Department
700 Industrial Drive
Lexington, SC 29072-3799
803-951-4800
FAX (803) 957-4628

OR

Prysmian Communications Cables and Systems USA
Applications Engineering Department
710 Industrial Dr.
Lexington, SC 29072-3799
803-951-4800
FAX (803) 951-4044
ALL DIELECTRIC SELF-SUPPORTING (ADSS) FIBER OPTIC CABLE INSTALLATION

CONTENTS

1. General .................................................................................. 3
2. Precautions ............................................................................. 4
3. Installation Equipment ........................................................... 5
4. Pre-survey ................................................................................ 6
5. Installation Methods ............................................................... 7
6. Installation Overview ............................................................... 9
7. Cable Support Hardware .......................................................... 10
8. Sagging and Tensioning ........................................................... 12

LIST OF ILLUSTRATIONS

Figure 1 - The Pull-back Method of Cable Deployment ......................... 7
Figure 2 - The Drive-out Method of Cable Deployment ......................... 8
Figure 3 - Cable Slack Storage .......................................................... 10
Figure 4 - Deadend Assembly ........................................................... 10
Figure 5 - Tangent Support ................................................................ 12

1.0 GENERAL

1.1 The methods described in this procedure for installation of All Dielectric Self-Supporting (ADSS) fiber optic cable are intended to be used as guidelines by design engineers and outside plant construction personnel. This guide is generic enough, and yet contains sufficient specific information, to be applicable for most installations of ADSS cable, however, local conditions, existing engineering and customer procedures and requirements must be considered.

1.2 Prysmian Cables and Systems incorporate National Electric Safety Code (NESC) loading requirements for heavy, medium, and light loading conditions in their sag/tension tables. Special tables can be generated based on specific customer installation requirements, which may include minimum separation and clearance, sag requirements, and loading conditions.

1.3 It is assumed that the personnel using the information presented in this document have prior experience in the planning, engineering or placement of ADSS fiber Optic Cable.

1.4 Prysmian ADSS fiber optic cables meet the P1222 IEEE Standard for All-Dielectric Self-Supporting Fiber Optic Cable (ADSS).
2.0 PRECAUTIONS

2.1 The following are some suggested precautions which should be observed when working with fiber optic cables. Before starting any aerial fiber optic cable installation, all personnel must be thoroughly familiar with Occupational Safety and Health Act (OSHA) regulations. Each individual company’s safety precautions for ADSS fiber optic cable installations should be reviewed before work begins and practiced during the entire installation process.

2.2 Before cable installation begins, the cable reels should be carefully inspected for any imperfections such as nails and broken flanges which might cause damage to the cable as it is payed out. Precautions should be taken to protect stored reels from possible damage by vandals or other sources when left unattended.

2.3 Fiber optic cable is a high capacity transmission medium which can have its transmission characteristics degraded when subjected to excessive pulling force, sharp bends, and crushing forces. These losses may not be immediately revealed after installation. For these reasons extra care must be taken during the entire installation process.

2.4 Whenever cable from the reel is placed on pavement or other surfaces, it should be protected with barricades or cones to prevent possible vehicular or pedestrian traffic damage.

2.5 Fiber optic cables are susceptible to performance degradation due to tight bending. The minimum bend radius of each cable is specified relative to the cable’s diameter. Prysmian requires that during installation a cable not be exposed to a bend radius smaller than 20 times the cable diameter and that after installation a cable should not be exposed to a bend radius smaller than 10 times the cable diameter.

2.6 Whenever cable from the reel is placed on pavement or other surfaces, it should be protected with barricades or cones to prevent possible vehicular or pedestrian traffic damage. A “figure-eight” configuration should be used when the cable is removed from the reel and piled on the ground. This prevents kinking and twisting of the cable which could cause damage. Fiber optic cable should not be coiled in a continuous direction except for lengths of 30 meters (100 ft) or less. The preferred sized for the “figure-eight” is about 4.5 meters (15 ft) in length with each loop 1.5 meters (5 ft) to 2.4 meters (8 ft) in diameter.

Note: An alternative to the manual figure-eight is the “figure-eight” machine. This equipment will “figure-eight” cable much faster than manual methods saving time and manpower. Using a “figure-eight” machine the remaining cable on the reel is wound on the machine’s drum. Once the inside cable end is accessible, the machine is reversed and the cable is pulled from the machine through the duct. The machine’s drum and rollers are designed to keep the cable at a bend radius that exceeds the minimum bend radius of the cable.
2.7 Never, during the pull-in process, should the fiber optic cable experience sags, bends or twists that produce in the cable a bend whose radius is smaller than that specified as the minimum bend radius for the cable being installed. Failure to observe proper cable handling procedures during cable placement can void Prysmian’s cable warranty and result in permanent damage to the transmission characteristics of the cable.

2.8 Do not cut the Cable under any circumstances without prior approval of the engineer responsible for the project. Splice locations are determined in the initial system design by the project engineer. Introducing new splices can potentially degrade the transmission characteristics of the system.

2.9 Temporary or permanent guys should be installed at any location where the self-supporting cable is tensioned to avoid placing an unbalanced load on the support poles.

2.10 Wire mesh grips are intended for pulling the cable into place and are not intended for tensioning the cable in place. Do not use split wire mesh grips to tension or to hold cable under tension.

3.0 INSTALLATION EQUIPMENT

3.1 The type and construction of the reel support determines the method and tools for handling. Reel construction requires that they be mounted on an axle or be supported by the reel flange. The equipment used must be rated for the maximum load and be able to lift the reel. When the reel stand is not self-loading, a crane, forklift or some other method of lifting must be available to lift the reel onto its stand.

3.2 The reel support design employed must incorporate an adjustable brake to supply the necessary hold-back tension needed to properly tension the cable. The cable may be pulled directly from the reel support when employing slack stringing methods that apply minimal tension to the reel of cable.

3.3 Capstan and reel type pulling machines with approved adjustable tensioners may be used to install the ADSS fiber optic cable.

3.4 The pulling and braking system employed should operate smoothly to prevent any jerking or bouncing of the cable during placement. The system should be controllable and able to maintain a constant and even tension on the cable during the installation process. Pullers and tensioner should be equipped with tension indicator and limiting devices. Tensioner wheels should be controlled so that a constant hold-back tension is maintained at all pulling speeds. A braking system to maintain cable tension when pulling is stopped is required.
3.5 Sheave diameters larger than those specified in Paragraph 2.5 are suggested, especially at the payoff reel position and the take-up or winch location. A larger diameter than the minimum diameter required offers the advantage of reducing the load applied to the cable.

3.6 The depth and flare of grooves in wheels used during the placing process are not critical, but there are some recommended guidelines that should be followed. The sheave grooves should have depth of 25% greater than the cable diameter with a flare angle of 15 to 20 degrees from vertical. This will facilitate the passage of grips, swivels, etc. and contain the cable within the groove. The material and finish of the grooves should be such that it does not mar the surface of the cable.

3.7 Traveler, sheave, or quadrant blocks used should be in good working order and properly lubricated. The cable release should work smoothly with minimal pressure. These should be lined so that they do not cause any abrasion of the cable jacket. A plastic lining of neoprene or urethane are acceptable.

3.8 Tangent supports made of metal with a protective pad can be used as a replacement for stringing blocks. These supports are mounted directly on the pole and open from the top. The protective pads can be removed and the top closed and secured for stringing.

3.9 At places where an uplift may occur, it is recommended that uplift rollers or hold down blocks be used.

3.10 Wire mesh grips or pulling eyes can be used to pull the cable into place through the travelers, sheaves, or quadrant blocks. The mesh grip or pulling eye must be used in conjunction with a swivel link which will minimize cable twisting that can be introduced by the pull rope. The load rating of the swivel link shall not exceed the maximum pulling tension rating of the cable.

4.0 PRE-SURVEY

4.1 A pre-survey of the fiber cable route is very important in planning for an aerial optical fiber cable project. During the pre-survey the nature and extent of work required along the proposed route should be determined before cable placement begins. Each section of the route must be prepared properly before cable installation begins.

4.2 One of the objectives of the pre-survey is to determine where each reel of fiber optic cable is to be placed. Slack locations and cable storage requirements must also be considered along with splice locations. The pre-survey will verify construction methods, special tools required, or possibly require a revision of preliminary splice locations.
4.3 Grade changes or line angle changes from straight and horizontal should be noted in order to plan ordering of proper installation hardware.

4.4 The characteristic of the ground along the route needs to be investigated. Trees or other obstructions which could hinder placing operation should be noted. Clearance issues over roadway, driveways, etc. need to be taken into account before cable placement begins.

4.5 The setup locations for reels and vehicles should be looked at and ease of vehicle accessibility to the cable route considered.

4.6 A good pre-survey will reveal clearances and separations on poles which will be in joint use eliminating the need to clear up these issues when the cable is being placed with crews standing by. It will also qualify the condition and size of the existing poles to be used, the condition and size of the existing pole’s anchors and reveal the need for any new poles before placement operations begin.

5.0 INSTALLATION METHODS

There are two primary method used for placing ADSS cable. Both these methods are very similar to those methods used to place most aerial cables. The first method is called the stationary reel, or the “Pull-back Method,” and the second is called the moving reel, or the “Drive-out Method.”

5.1 The Pull-back Method is illustrated in Figure 1 below.

5.1.1 Holes are drilled in all poles along the cable run and line pole hardware is attached to the poles at the engineered height. At dead-end and tangent locations, down guys are placed at the correct position according to local engineering practices.

5.1.2 Travelers, sheaves, or quadrant block are placed just above or just below the location of the installed pole line hardware at each pole location. The diameter of these supports must meet the minimum bend radius specs for the cable in any location where the cable will be bent more than 20 degrees. The cable warranty is void if these limits are not observed.
Please note that if tension is let off the cable during a pull, the natural sag of the cable will usually produce angles larger than 20 degrees at each support point. Thus, extreme caution must be used if pulling through small diameter supports.

5.1.3 The pulling line is then pulled through each traveler, sheave, or quadrant block. After the pulling line is in place, it is attached to the ADSS cable with a break-away swivel and a factory installed pulling eye. A wire mesh grip may be used when a pulling eye has not been installed.

5.1.4 The ADSS cable is then pulled in through the entire section using the puller and the tensioner. Care must be taken to avoid over tensioning the cable and to avoid sagging of the cable that may introduce bends that are smaller than the minimum bending radius of the cable. Several pulling stages may be required to place the cable through the entire system.

5.1.5 When the entire cable has been pulled into place, starting at an end location, each dead-end to dead-end cable length can be sagged and tensioned and support hardware applied according to the installation requirements.

5.2 The Drive-out method is illustrated in Figure 2 below:

5.2.1 The Drive-out method of cable placement is primarily used during the construction of new lines where there is a clear right-of-way and with no obstructions to vehicles.

5.2.3 The reel of cable is placed on a reel trailer or a truck equipped with a reel carrier. The cable should play off the top of the reel for reel trailers and the bottom of the reel for trucks equipped with a reel carrier. The reel trailer or reel equipped truck should have a braking device, set on minimum. The brake is used to prevent overrun of the reel when stopping at the support poles.

5.2.4 Holes will have to be drilled at the poles to mount the support hardware. At dead-end and tensioning locations, down-guys of the correct loading factor at to be placed according to local engineering practices.

5.2.5 Travelers, sheaves, or quadrant blocks are placed above or below the pole mounting hardware at each pole location.
5.2.6 With the cable deadended at the starting location and minimum tension applied to the reel brake, the reel of cable is transported along the construction route while the cable is played out.

5.2.7 As the reel passes a pole location, the trailer or truck must be stopped while the cable is placed into the traveler, sheave, or quadrant block attached to the pole.

5.2.8 The reel then travels on to the next pole where the process is repeated over again. This continues until the cable is completely deployed or a deadend is reached.

5.2.9 With the cable deployed, each span must be sagged and tensioned with supporting hardware installed. Each span is started at the deadend and slack worked back towards the opposite end. An alternative method is to sag and tension each span and install permanent hardware as the cable is being deployed.

6.0 INSTALLATION OVERVIEW

6.1 The location of the tensioner and puller relative to the structure must be selected so that the pole is not overloaded. Where possible, a pulling slope of 75° to 80° is considered good practice. This ratio will minimize the load on the cable, traveler, sheave, or quadrant block, and pole. It may be necessary to place temporary guys to prevent overloading support poles. The reel must be placed in-line with the first two poles of the run to prevent twisting of the cable or any damage to the cable caused by rubbing the sides of the traveler, sheave, or quadrant block groove.

6.2 Anchors and pole hardware must be rated above the expected environmental load of the cable, plus a safety factor. In installations where aeolian vibration could be an issue, the safety factor should be increased. At locations where the cable is tensioned to achieve proper sag, the pole may require a temporary down-guy and anchor to prevent overloading the pole.

6.3 Travelers, sheaves, or quadrant blocks are normally attached directly to the support pole. The pole attachment, used to support the traveler, sheave, or quadrant block must be consistent with the working load and rating of the traveler, sheave, or quadrant block.

6.4 The pulling grip shall be rated above the maximum pulling tension anticipated. Use the manufacturer’s instructions for the proper application. When properly installed, no special preparation of the cable end, or aramid yarns, are required. A matching clevis type swivel should be used to help prevent twisting of the cable during pull-in. The swivel should be of the type that has a break-away tension...
less than or equal to the cable’s rated maximum pulling tension to prevent over tensioning the cable.

6.5 Aeolian vibration is a resonant vibration caused by low velocity wind blowing across a cylindrical cable that is under tension. This vibration can cause severe degradation of the cable support hardware. Vibration dampers can be very effective in controlling aeolian vibrations when used on ADSS cable. Both resonant and interference type vibration control systems will work when properly applied.

6.6 Splice locations require additional cable be provided to accommodate lowering the cable to the ground with enough slack to allow splicing inside a splicing van or trailer.

6.7 All slack cable storage locations require the installation of slack cable storage brackets. The strand cable storage bracket insures a proper bending radius for the stored fiber optic cable and provides for horizontal storage and tiering for storage of multiple cables and loops. Figure 3 below illustrates slack cable storage.

![Figure 3 - Cable Slack Storage](image)

7.0 CABLE SUPPORT HARDWARE

There are two general types of ADSS cable support hardware: dead ends and tangent assemblies.

7.1 Deadend assemblies are used at the point of cable termination, or where the cable angle is greater than 20°. See Figure 4 below for illustration of a Deadend Assembly.
The Structural Reinforcement Layer (SRL) is a subset of armor rod that is the first layer applied to the ADSS cable. They are spiraled in a precise twist lay to match the diameter and load of a specific cable. They are normally grouped together in a sub-set of four to five rods, with grit applied to the inside for slip resistance.

The Deadend Grip itself is a set of armor rods that have been formed in a double spiral with a loop at one end. Its precise twist is designed to perfectly match the diameter of the SRL as it lay over the cable. The length of the deadend grip is dependent upon the maximum load. It too has grit applied to the inside for slip resistance.

The Thimble Clevis is made of cast aluminum or steel and is used to maintain the seat diameter of the deadend loop.

The deadend hardware is assembled in the following manner:

1. The SRL rod is assembled on the cable first. The end with the color band is assembled towards the end of the span. Wind on one set of rods at a time. The rods should be placed close together so that there is enough room for them all.

2. The tips of the SRL rods should align at the end. Do not force the rods or use tools to install them. Forcing the rods or using tools may damage the cable jacket.

3. Align the color band on the deadend with the color band on the SRL and wind one leg of the deadend on approximately two feet.

4. Insert the thimble clevis into the loop.

5. Align the color band on the second deadend leg with the color band on the first deadend. Wind the second deadend leg over the SRL for approximately two feet. Continue winding the deadend legs over the SRL until both legs are snapped in place.
6. Connect the thimble clevis to the hardware (or to the extension link and then the hardware) mounted on the pole.

7.6 Tangent hardware is normally installed after the span has been tensioned. Figure 5 below illustrates a front and side view of a Tangent Support. To install the cable, open the hinged top and insert the bottom pad. Then place the cable on the pad, place the top pad over the cable, close the top and tighten the bolt to hold the cable in place.

![Figure 5 - Tangent Support](image)

8.0 SAGGING AND TENSIONING

8.1 Upon completion of placing the entire run of cable, sagging and tensioning can now be started. Sagging and tensioning the run is worked progressively from one end of the run towards the opposite end. Normally the slack is worked back in the direction of the reel in order to recover as much cable as possible. Sagging and tensioning should be conducted according to the cable manufacturer’s recommendations for the cable just installed.

8.2 The cable run is broken down into subsections for sagging and tensioning purposes. The last structure at each end of a section being sagged and tensioned is a deadend assembly. Remove all excess slack cable out of the section of the run being prepared for sagging and tensioning. To remove the slack, reverse the tensioner and pull the cable back towards the reel, being careful not to exceed the minimum bending radius for the cable under tension.

8.3 Once the slack is out of the cable, install a temporary deadend on the cable approximately 2 deadend assembly lengths away from the support pole. This deadend will be used as a tensioning grip to achieve proper span sag and tension, prior to installing the permanent deadend assembly.

8.4 Attach the tensioning device: a chain hoist or power winch and a dynamometer between the pole and the temporary deadend. Begin to apply tension to the span.
8.5 The cable is normally tensioned from deadend to deadend along the span back to the reel. Once the spans are properly sagged and deadends attached, the suspension or tangent hardware is installed and attached to the poles by working back to the deadend one span at a time.

8.6 With a span’s permanent deadend installed and the hardware attached to the poles, the pulling device can now have its tension released and the temporary deadends removed from the cable. When the next permanent deadend is installed on the adjacent span, make sure that the loop formed between the two deadends maintains the minimum bend radius for the cable. Repeat this operation until all spans are sagged and tensioned.