OMAN FIBER OPTIC, S.A.O.G.

General Installation Guidelines for ADSS Optical Cables

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ABSTRACT

All Dielectric, Self-Supporting optical cable (ADSS) is a cost-effective and reliable technology that has been used worldwide since the early 1980's. ADSS cable has a number of advantages over other types of aerial fiber optic cable including its small size, low weight, flexibility and fully dielectric construction.

ADSS must be engineered for its particular application. The design of the ADSS must take into consideration a number of key factors including:

- ✓ Maximum span length
- ✓ Desired installation sag
- ✓ Environmental loading (wind & ice)
- ✓ Pollution sources along the ADSS route
- ✓ Proximity to coastal areas
- ✓ The electrical stresses at the cable attachment points

Careful consideration of these key factors will assure a long and reliable service life for the cable. Should there be any doubt that the ADSS is not properly engineered for a particular task, then the installation should not begin until inquiries are made.

ADSS can be used for applications ranging from short span (40-50 meter) distribution lines to long span transmission lines (300-500 meter spans) to extraordinary spans required by some river & canyon crossings exceeding 1800 meters.

DOCUMENT SCOPE

This document applies to both the short span distribution environment as well as the long span transmission environment. Ultra long span river & canyon crossings are not covered in this document.

The information herein is targeted for OSP staff and network design engineers on the installation practices for ADSS optical cable. However, this document is intended as a guideline, not as an exhaustive manual because each installation has different characteristics and is influenced by local environmental conditions, laws, labor constraints and customer work practices requirements.

Installation practices and equipment not shown in this document is not approved by Oman Fiber Optic Co. S.A.O.G for use with its ADSS.

OTHER REFERENCE INFORMATION

Although some differenced do exist, ADSS installation techniques are similar to those used for earth wires, phase conductors or messenger wires. Additional information on these practices is available in the document titled "*ANSI/IEEE Std. 524-1980, IEEE Guide to the Installation of Overhead Transmission Line Conductors*".

SAFETY ISSUES

Safety is the most important aspect of an ADSS installation and OFO strongly recommends assigning the absolute highest priority to safety issues.

These safety recommendations are meant to supplement, not to replace, relevant local & national laws, company-specific safety practices and other codes & regulations - all of which supersede this OFO document.

KEY POINTS:

- ✓ *Fire and safety regulations & laws limit the use of polyethylene-sheathed cables for indoor applications. Local fire codes must be consulted before deployment of cables.*
- ✓ *Although ADSS has a fully dielectric construction, the cable can become conductive because of contaminants or moisture on or in the cable. OFO recommends grounding of installed ADSS and all ADSS fittings before the cable system is touched.*
- ✓ *If the surface of the cable is wet, the ground clamp must be within 2 meters of either side of the point to be touched. This applies to installation, splicing, terminating, testing and maintenance of the cable system.*
- ✓ *Running grounds should be used where needed to eliminate the risk of electrical hazards.*
- ✓ *ADSS should NOT be installed in wet weather.*

- ✓ *The attachment point of the ADSS must be carefully considered during the design stage. The attachment point must be selected to assure that the electrical stresses on the cable do not support destructive electrical surface activity and must also assure that there is no clashing between the ADSS and the phase conductors, earth wires or other suspended cables.*
- ✓ *Traffic control is vital during ADSS installation. Consult local laws and practices before starting traffic control work.*
- ✓ *When placing ADSS on live lines, observe the safety precautions outlined in local laws and end-user procedures.*
- ✓ *If a bucket truck is used during ADSS installation, the bucket truck must be operated in a safe manner consistent with local laws and end-user procedures.*
- ✓ *The installation of ADSS on an overhead line will affect the loading and load balancing conditions on the structures. Careful engineering consideration must be given to this incremental loading and any remedial work that might be needed (such as reinforcement of the structures, adding guy wires, etc.)*

GENERAL GUIDELINES

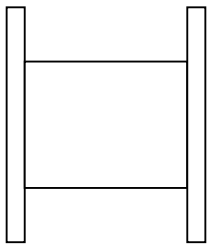
- ✓ OFO strongly recommends a pre-survey of the route for all types of installations. Problem areas should be identified & fixed and an installation plan should be clearly defined prior to the start of the installation.
- ✓ At the terminal points of the ADSS systems the ADSS can be pulled through ducts, if required, OFO recommends that all ducts be inspected prior to cable installation. Damage sections should be repaired and blockages cleared prior to installation.
- ✓ Petrol (gasoline) must NOT be used as a cable cleaner for any type of optical cable, including OFO. OFO recommends the use of Polywater optical cable cleaner (see www.polywater.com) or other effective orange-oil based cleaner.
- ✓ Always seal the end of the cable to prevent ingress of moisture and contaminants.

REEL HANDLING

OFO cables are normally supplied on wooden reels. These reels must be handled properly to assure optimum payoff control of the cable. Prior to installation, the installation crew must inspect the condition of the reel. If there is any evidence of reel damage, the damage must be repaired prior to installation to avoid damage or over-tensioning of the cable. Special attention must be paid to ensure there are no protruding nails or other sharp objects that can damage the cable sheath during payoff.

Important Points

- ✓ Roll drums only in the direction indicated by the arrow on the flange.
- ✓ For long term storage of reels, it is advisable not to expose the reel to direct sunlight or excessive levels of moisture.
- ✓ Drums must not be laid flat for installation or storage.



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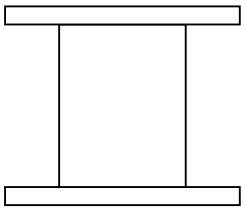


Not acceptable!

- ✓ When lifting the reel from above with a crane or other lifting device, a spreader bar must be used above the reel to prevent inward pressure on the top of the reel flanges. The proper technique is shown in the photo below.

PRELIMINARY WORK GUIDELINES

Site Acceptance Testing

A site inspection of the ADSS cable reels is essential. OFO recommends removal of lagging boards and other packing material and subsequent inspection of the reel and the cable surface. Special attention should be paid to inspection of the inside surface of the reel flanges to verify that there are no nails or other sharp artifacts that might damage the ADSS sheath during installation.

A bi-directional OTDR site acceptance test is also recommended. The data generated in the site acceptance tests is an excellent baseline for comparison to post-installation test data.

ADSS is robust, however there are fundamental constraints that must be followed during handling and installation. Of importance are the following:

- ✓ Like all fiber optic cables, ADSS must not be kinked.

- ✓ ADSS has a minimum bend radius defined by the ADSS manufacturer. Care must be taken during all phases of handling and installation to assure the minimum bend radius is not exceeded.
- ✓ ADSS has a maximum loading tension defined by the ADSS manufacturer. The responsible structural engineer must give careful consideration to this maximum load and assure that the combined installation tension and environmental loading (wind & ice) do not exceed the maximum loading tension provided by the ADSS manufacturer.
- ✓ ADSS must not be subjected to extreme crushing or twisting forces.

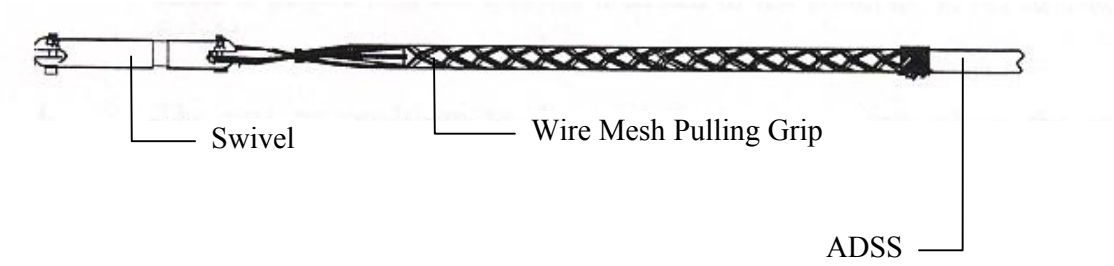
Obstructions

OFO strongly recommends a pre-construction survey to assure there are no obstructions that might cause cable damage. Particular attention should be paid to the presence of fences, other overhead lines, light poles and other possible obstructions and plans be made to avoid those obstructions. If the obstructions cannot be moved, then the installation team should use hold-down blocks to circumvent the obstructions and prevent cable damage.

INSTALLATION WORK GUIDELINES

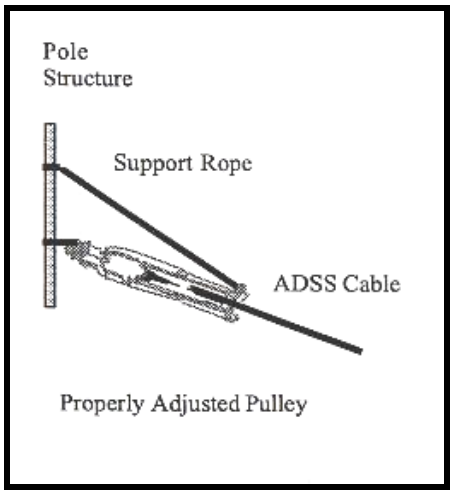
Torsional Considerations

Installation torsion can damage ADSS. It is essential to use a swivel during tension stringing of ADSS. A typical setup is shown below.

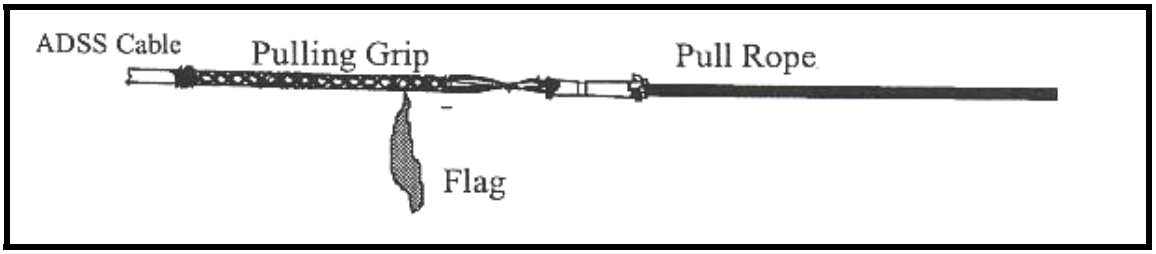


IMPORTANT POINT: The wire mesh pulling grip is to be used only for pulling of the ADSS. It is NOT meant to be used to sag the cable or hold it for long periods of time under high tension.

Pulleys used during installation must be set up properly to avoid torsion damage. Practical experience has shown that a simple support rope used to hold the pulley at an appropriate angle to the pole or tower will serve to reduce the amount of torsion in the cable. An example of the correct pulley setup is shown below.



When a pull begins, it is essential to check for rotation of the ADSS by using a flag or other visual means as shown in the following sketch.



Observe the indication as the cable is pulled, especially as it is pulled through line angle changes. If there is a continuous twist in the cable, then the pull should be halted immediately and the tension on the cable reduced. Efforts should then be made to reposition the pulley and eliminate the source of the torsion.

Tension Considerations

It is important to control the unwinding of the ADSS to prevent over-running. The best method is to apply a small back tensioning force to the support shaft of the ADSS payoff. OFO strongly recommends against applying the back tension force to the reel itself. The back tension applied should be adjusted as the amount of cable on the reel changes.

COMMUNICATIONS

Communications between installation personnel is vital to assure proper cable handling. Installation, splicing & testing crews must be equipped with radios, mobile phones, talk sets, order wires or other communication devices during the entire installation period to avoid accidental over-tensioning or other cable damage.

ADSS INSTALLATION EQUIPMENT

For all types of installation, the equipment in use MUST be capable of installing the cable without exceeding the maximum pulling tension or minimum bend radius.

Reel Payoff Stand

The cable payoff stand must be supported on a straight & sturdy axle through the central (arbor) hole. The payoff stand or payoff trailer must be located on firm & level ground. The payoff equipment must include a suitable back-tensioning device. Back tension pressure must NOT be applied to the drum flange.

The payoff stand must be designed for use with the tensioner employed on the project.

Tensioner

OFO standard reels are not designed to withstand the forced developed by braking during high tension stringing operations and therefore, direct tension stringing from the reel at cable installation stringing tensions should not be attempted. The cable may be pulled directly from the reel stand only when

employing slack stringing methods that allow minimal tension to be applied directly to the reel of the cable.

Pulling Machines

Either bullwheel or reel type pulling machines can be used successfully to install ADSS.

OFO recommends bullwheel pullers with semicircular grooves. The grooves should have a depth equal or greater than 50% more than the cable OD. The grooves should have a flare angle of 5^0 to 15^0 from the vertical centerline reference. The minimum radius at the bottom of the groove should be at least 35 times the cable outside diameter. Tandem bullwheels should be aligned with the offset approximately one-half the groove spacing. bThe material and finish of the grooves should not mar the surface of the cable with elastomer line grooves being highly preferred.

PULLING RECOMMENDATIONS

The pulling and braking system should be coordinated to prevent rapid increase or decrease in tension. All parts of the pulling system should be controllable and maintain a constant and even pulling tension. Both the puller and the tensioner must be equipped with a tension indicator and a fail-safe device to prevent over tensioning. The puller and tensioner should be selected to provide an adequate stringing tension considering the mass and length of the cable to be installed. Retarding of the tensioner bullwheels is advisable to maintain constant hold-

back tension at various pulling speeds. A positive fail-safe braking system is required for pullers and tensioners so that tension is maintained when pulling is stopped.

PULLEYS

Pulley Groove Diameter for Tension Stringing

Condition	Pulley Diameter Recommendations
Mid span	≥ 30 cm
Line angle change of > 25°	25 times cable OD
First tower in pull section	25 times cable OD
Last tower in pull section	25 times cable OD

Sheave diameters that are larger than those specified are acceptable, and offer some advantages by reducing the load applied to the cable.

Pulley Parameters for Tension Stringing

Parameter	Recommendation
Radius of pulley groove	At least 55% greater than the cable OD
Depth of pulley groove	At least 25% greater than the cable OD
Pulley groove flare	15° to 20° from vertical
Pulley material	Heat treated aluminum or aluminum alloy
Safe working load	2 times maximum loading tension of ADSS
Groove lining	Elastomer, neoprene or urethane lining (unlined pulleys are not recommended!)

The pulley must be maintained properly, including lubrication according to the recommendations of the pulley manufacturer. The pulley should rotate freely and the cable release should work well. The liner should be in good condition with no tears, or exposed areas.

Grounding

Pulleys must be grounded whenever ADSS is installed under live line conditions. In addition, a running ground must be used on the first and last pulleys in a pull span.

Uplift and Hold Down Blocks

Whenever the possibility of uplift is present, uplift rollers or hold down blocks must be used. The uplift and hold down blocks must follow the size recommendations for pulleys as shown above. A cable breakaway feature is recommended.

Running Grounds

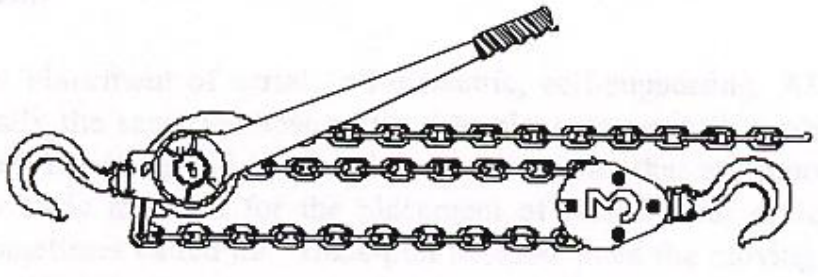
For safety reasons, it is vital to use a running ground system when installing ADSS under live line conditions. The running ground system must maintain continuous and intimate contact with the moving cable and should do so without imparting excessive tension on the cable. The running ground must be adjustable and be properly sized for the cable diameter

Running ground systems must be located prior to the first tower in the pull section. Careful attention must be paid to the adjustment of the running ground tension.

Chain Hoist

OFO recommends the use of a chain hoists to sag each installation span. The hoist must be capable of handling at least 2 time the maximum loading tension of the cable.

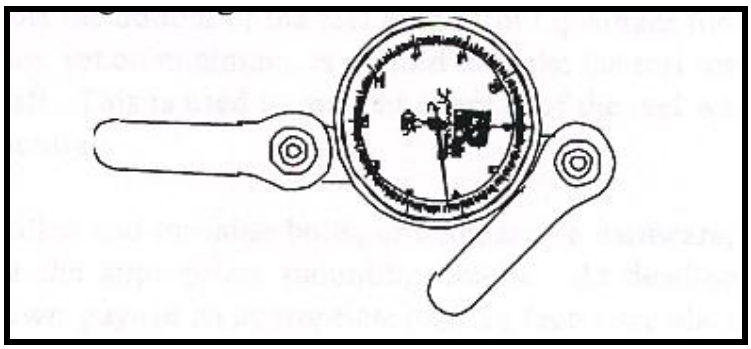
Be sure the chain hoist is properly maintained including lubrication according to the chain hoist manufacturer.



Tensiometer (also called dynamometer)

Tensiometers must be used to measure the tension in each installation span. The tensiometer should be accurate and must be rated no more than 20% above the maximum installation load of the ADSS

When a high degree of measurement accuracy is required, two tensiometers can be used in series. If there is significant difference between the two, then investigations must be made to determine if accurate measurements are possible. If the measurements are similar, then the average of the two readings can be used.



Wire Mesh Grips

OFO recommends a wire mesh grip to fix the ADSS to the pulling line. The grip should be a high-quality double or triple weave grip and be properly selected for the cable size and diameter.

The load rating must be at least 2 times the maximum load that will be applied to the cable during installation.

The grip must have a swivel link to reduce cable twist during pulling.

Important note: do not use wire grips to tension the cable during sagging and do not use the grip to hold the cable under tension.

Grips can be banded or un-banded and shall be applied per the manufacturer's instructions. DO

Come Along Grip

A come along grip must be used to temporarily grip the cable during saggings. This grip can be a dead end specified for the cable but the dead end cannot be used more than 3 times.

INSTALLATION METHODS

Methods used for stringing ADSS are similar to those utilized to place phase conductors. However, the installation team must be aware of the special handling and bend radius requirements for ADSS.

The two basic methods for the placement of ADSS fiber optic cable are:

- ✓ Tension Stringing
- ✓ Drive Off Method

The drive-off method is acceptable but the back-pull method has historically been shown to be more effective.

DRIVE-OFF METHOD

The drive off method and its variations are appropriate for new line construction and where installation takes place on level, obstacle-free terrain.

Step #	Recommendation
1	Mount the cable reel on a trailer or truck equipped with a reel carrier. Be sure the reel is mounted so the cable pays off from the top of the reel for trailers and from the bottom to the quadrant for line trucks.
2	Set the brake to minimum. The brake should apply tension to the arbor shaft, not to the reel or cable.
3	Determine the correct attachment point for dead ends and suspensions and pre-install the necessary attachment hardware, if desired.
4	Place pulleys at each point along the route. Position the pulleys just above or just below the desired attachment point. The pulleys must be sized properly.
5	Dead end the cable at the first structure
6	Drive the truck along the route and pay off the cable under minimum possible tension. Adjust the tension periodically to compensate for the reduced weight of the reel.
7	When moving past a structure, stop the vehicle and place the cable in the pulley. Alternatively, the cable can be laid on the ground for a number of structures then the cable is lifted into the pulleys.
8	Repeat steps 5 & 6 until the last structure*
9	Go to the first tensioning point from the start point and tension the cable.
10	Install dead ends and suspensions according to the instructions provided by the fitting manufacturer.

* Alternatively, the cable can be tensioned & sagged at the first tensioning point.

Key points:

Assure good communication between the vehicle driver and the person positioned near the cable reel. Where traffic control is needed a flagman must also be able to communicate with the other installation personnel.

TENSION STRINGING

This is the best overall method for installing ADSS particularly for spans exceeding 100 meters. It is also the best method to use where obstacles (such as branches, other power lines, etc) exist.

OFO strongly recommends that the installation team develop a pull plan before the work begins. The pull plan should lay out the pull incept & termination points, the line angle changes, tension vs suspension towers, the pulling speed, the pulling tension, methods of communications, personnel allocations and all other critical information.

Step #	Recommendation
1	Place the cable reel on a suitable reel payoff stand or reel payoff trailer. The cable must be supported by the arbor holes and an effective back tensioning devise must be present and in good working order.
2	Place the tensioner in-line between the payoff stand and the first structure. Feed the cable through the tensioner in the precise manner recommended by the installation equipment manufacturer. This step is very important and OFO recommends careful reading of the payoff & tensioner manual.
3	Determine the correct attachment point for dead ends and suspensions and pre-install the necessary attachment hardware, if desired.
4	Place pulleys at each point along the route. Position the pulleys just above or just below the desired attachment point. The pulleys must be sized properly.
5	Run a small pilot line through the pulleys at each support structure
6	Use the pilot line to pull the installation rope through the pulleys starting at the planned pulling point.
7	Attach the ADSS to the wire pulling grip and the swivel link. The swivel link MUST be used for all ADSS installations.
8	Use the puller and tensioner to pull the cable through the pulleys according to the pull plan. Good communication between the personnel at the puller and tension is absolutely vital to the success of tension stringing. In addition, positioning of personnel at key points such as road crossings, obstacles, crossing power lines, bodies of water, pipeline crossings, rail line crossings, etc is strongly recommended. The puller and tensioner MUST be operated according to the equipment manufacturer. The ADSS must be kept under minimum load to complete the pull.
9	Once the cable is installed, each tensioning span can be sagged and the support hardware installed. All hardware must be installed according to the hardware manufacturer's instructions.

THE IMPORTANCE OF PRE-PLANNING

When installing ADSS it is vital to pre-plan. A pre-planning meeting or meetings should be held to discuss the survey results, the optimum pulling sites & segments, the limitations of the cable (a critical item!), installation speeds, operation of installation equipment, proper assembly of line fittings, logistics, splice point location, limitations of structures, anticipated terrain and other vital installation topics.

Of particular importance is the positioning of the payoff and tensioner relative to the first structure and the positioning of the puller relative to the last structure. The follow ratio should be observed:

- ✓ *Distance from tensioner to the first structure = minimum of 4 times the height of the pulley on the first structure.*

- ✓ *Distance from puller to the last structure = minimum of 4 times the height of the pulley on the last structure.*

ANSI/IEEE-524 has formulas for calculation of structural loads based on this practice. Temporary guying may be necessary in some cases.

Another important point: always be sure the payoff and tensioner are in a straight line with respect to the first two structures, otherwise damaging twist can occur to the ADSS.

FITTINGS

Dead ends and suspension grips ***must*** be rated above the maximum loading tension of the cable plus a reasonable safety factor according to local practices and regulations. OFO recommends a very conservative safety factor in areas where laminar wind flow is present because of the affect of Aeolian vibration on the integrity of the fittings.

CROSSING STRUCTURES

When the ADSS cable is installed over a street, railroad, highway, other power lines, pipelines, etc it may be necessary to provide supplemental support to

maintain minimum clearances. The use of H-frames, nets and other types of bracing is recommended. It is also possible to use pulleys on temporary ropes or guys at the crossing point. Placing a person at these sites and equipping that person with communications to the rest of the installation team is recommended.

PULLEYS

Pulleys are an absolutely vital component for a successful ADSS installation and careful consideration must be given to each and every pulley in use. Pulleys are typically attached directly to the structure, although in some case (poles) a standoff may be needed to allow free movement of the travelers.

The socket eyes that support the pulley and shackles shall accommodate the maximum loading tension of the cable and the rating force of the pulley itself.

When installing on live lines, be sure to use pulley grounds that is assembled according to local practices and codes, especially on the first and last structure.

Pulling Grip Installation

The wire pulling grip that is used to attach the ADSS to the pulling line must be rated above the maximum loading tension of the cable. Because wire pulling grips are different from one manufacturer to the next, the grip must be installed according to the manufacturers recommendation.

OFO recommends application of vinyl tape over the wire grip to prevent damage to the pulley groove lining.

A suitable swivel is vital to help reduce cable twist. Again, the swivel must be able to accommodate the maximum loading tension of the ADSS plus a reasonable safety factor.

When removing the pulling grip, 3-5 meters of adjacent cable must be cut off and discarded.

Pulling Rates & Tensions

OFO recommends a conservative approach to pulling to reduce the risk of cable damage. Rates of 2-3 km per hour are suitable. An important point is the smoothness of the pull and it is absolutely vital to avoid cable jerking at all times. With thorough pre-planning, stoppages will be unnecessary.

A good thumb-rule is to keep the pulling tension to 0.5 of the initial sagging tension. When circumstances require a higher tension, the installers must give consideration to the fact that the tension at the pulling end will exceed the tension at the tensioner by a large margin.

Aeolian Vibration

Aeolian vibration can occur in areas prone to low speed laminar wind flows. This vibration MUST be controlled because its presence is a threat to the long-term integrity of the ADSS fittings. Fortunately, effective vibration dampers are available from a number of suppliers.

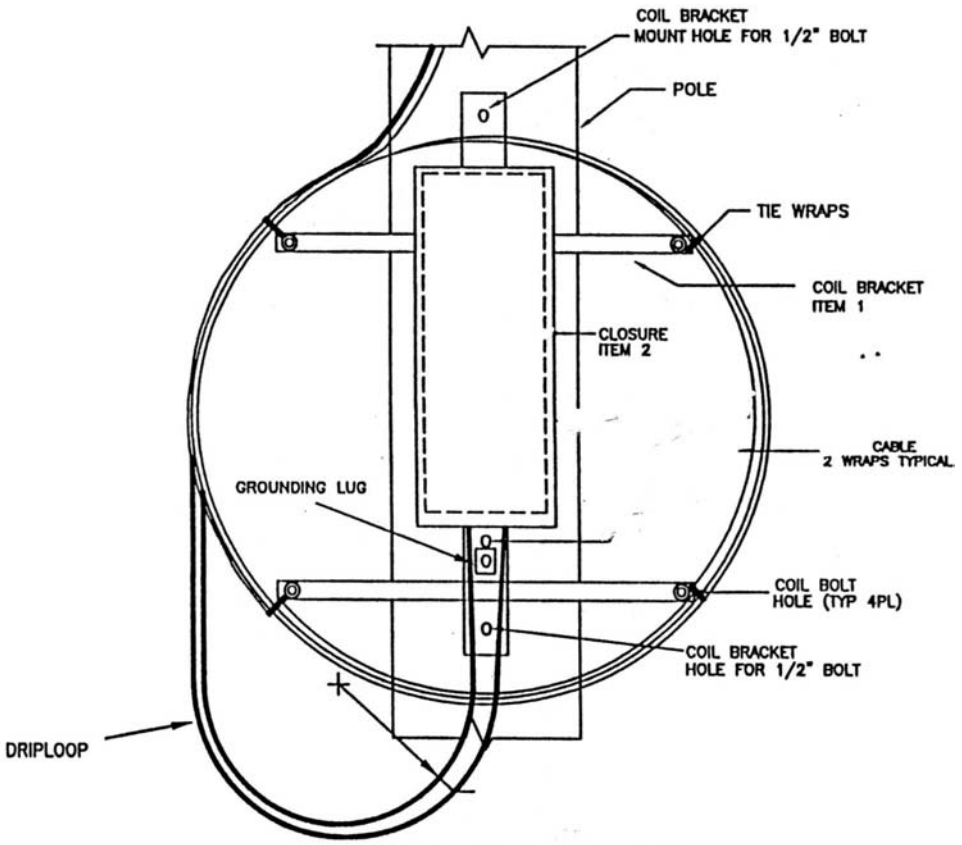
OFO recommends vibration dampers for all cable spans exceeding 100 meters. For specific recommendations please consult OFO.

Splice Points

OFO recommends the use of high-quality splice closures that are suitable for aerial or underground deployment. Enough slack cable should be provided at the splice point to allow splicing and maintenance at ground level.

For fusion splicing a vehicle or tent must be used to provide a suitable environment for the splicing operation.

Following is a diagram of a suitable splice closure & slack cable arrangement.



SAGGING AND TENSIONING

Sagging and tensioning are a critical operation in the installation process. Sagging should take place progressively from one end of the cable to the other (i.e. not starting in the middle and progressing towards the ends). If the sagging operation takes place from the pulling end back to the payoff end, then the maximum amount of cable can be recovered.

When beginning the sagging operation, the first step is to remove excess slack out of all spans. This action is needed to allow proper positioning of a temporary sagging grip. The tensioner can be run in reverse to remove the slack but care must be taken not to over tension the cable.

When the slack is removed, apply the temporary sagging grip about 2 meters from the structure. Attach the chain hoist, dynamometer and other fittings to

the structure and then to the sagging grip. Apply the load necessary to achieve the desired sag & tension.

Typically, the cable is worked dead-end to dead-end segment back to the payoff reel. After the spans are at proper sag and the dead-ends attached, the suspension or tangent hardware is installed and attached to the structure by working back to the dead-end, a span at a time.

Once the permanent dead-end is installed and the hardware is attached to the structure, the tension can be released on the tensioning rig and the temporary dead-end removed. As the next permanent dead-end is installed on the adjacent span, make sure that the expansion loop under the dead-ends is properly formed, maintaining minimum bend radius. This means the cable is typically 14 inches lower than the cable framing location. This process is repeated until all spans are sagged and tensioned for the complete system.

RECORDS

General

Records are an integral part of the equipment required to maintain and restore a fiber optic system. During an outage condition, having a records package readily available eliminates unnecessary delays locating and accumulating information required for the restoration process.

Coordination

Due to the number of departments involved in the design, construction, turn-up and maintenance of fiber optic systems, records can be lost or misplaced after the initial installation of the fiber optic system. This can be a catastrophe during a system outage, because this information is necessary for comparison against trouble-shooting information.

Documentation

OFO recommends that for each fiber optic system the following information be included in a records documentation package.

Key Map

The key map is a geographical map showing the system route in relation to roads and highways. Its purpose is to provide general bearings to quickly access key areas of the system, such as field splice points and major road crossings. Sheath meter marks should be indicated on the map for splice points, road crossings, river crossings, etc.

Composite Schematic

The composite schematic is a straight line schematic identifying the construction sequence of cable reels by reel number, meter markings to major construction points such as splice points, and major road crossings. The cable reel section length and a cumulative cable length should be marked at each of these points. Also, the cable and fiber type and count shall be identified for each reel selection.

As-Built Construction Sheets

The construction sheets identify the actual apparatus units at each structure. Other information such as the structure type and dimensions, cumulative distance to each termination point from the structure, any grounding or bonding detail, etc. These sheets are typically the construction detail sheets that have been corrected to reflect any changes during construction.

Circuit Diagram

The circuit diagram is a schematic that identifies the actual fiber circuits, system number, working and protect fibers, fiber/buffer colors, priority sequence during restoration and other pertinent information such as transposed fibers.

Test Acceptance Sheets

The test acceptance sheets are the recorded values of the transmitted output power, receiver input power, and measured attenuation levels at the receiver. Other information to be included in the test acceptance package are the Optical

Time Domain Reflectometer (OTDR) plots or photographs of each fiber and its terminated pigtail, shot in both directions at both 1300nm and 1550nm. Other recommended documentation include the bi-directional average of the loss of each splice, including pigtail splices with connector insertion loss.

Manufacturer Provided Documentation

The manufacturer provided documentation would include, cable data sheets of each cable reel, documentation provided on the fiber, results of calculations of the field strength levels relative to different structure types

The original copy should be maintained by the engineering group and a copy distributed to the maintenance group. One copy of the records package should be placed at each end of the termination points to the fiber optic system. When changes in the system are required due to supplemental construction or emergency restoration, the records package should be revised and redistributed.

Annual System Check

Periodically, the system attenuation level shall be verified against the baseline attenuation measurement. If this attenuation level has changed more than 1 db, it is recommended that the cause be investigated and corrective action taken.

OFO ADSS CABLE PRE-CONSTRUCTION CHECKLIST

Right of Way	Yes	No
Has the right-of-way been secured for the cable route?		
Is the right-of-way clear, and permits obtained for installation?		
Is enough room available at start and end of pull (4:1 lead / height ratio)?		

Poles		
Are all poles structurally sound and can accept the cable tensions?		

Clearances		
Will all clearances meet NESC code (line/line, electrical stress, ground)?		

Installation Equipment		
Is equipment available to load cable onto trailer or payout?		
Is the reel trailer/cable payout shaft appropriate for the reel arbor hole?		
Is the reel trailer/cable payout large enough for the cable?		
Does the reel trailer/cable payout have a brake?		
Are all bucket trucks (if used) in working order?		
Is equipment available to drill holes into poles for hardware?		
Is a chain hoise available?		
Are all pulleys/sheaves greater than 12" in diameter (dead end pulleys 20")?		
Is a method available to pull the rope/cable?		
Is a dynamometer available and accurate?		
Is equipment available to provide cable back tension control?		

Tools		
Are the following tools available?		
Temporary Tensioning Grip		
Formed Wire Installation Tools (FIT)		

Cable		
Has the cable undergone a satisfactory incoming inspection by OTDR?		

Pull Rope/Cable Grip

If a pull rope is to be used, can it support the expected installation tensions?		
Is a double-clevis swivel available?		
Is an appropriate cable grip available to attach to the pull rope?		

Hardware

Is all hardware available and inspected?

Dead Ends		
Tangents		
Suspensions		
Tower Guide Clamps		
Splice Boxes		
Vibration Dampers		
Bolts, Nuts, Washers		

Crew Training

Has crew training been performed		