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Conductor Installation Guidelines

WORK INSTRUCTION : AILS/IM/CONV/01
Issue Date : 25.02.2014, Rev.05, Rev Date : 03.04.2026

1. PURPOSE

1.1. The purpose of this document is to provide experienced transmission engineers, field inspectors, utility personnel and linemen with guidelines, recommendations and requirements necessary to safely install the bare overhead conductor.

2. SCOPE

2.1. These guidelines apply to equipment and techniques required to install ACSR, AAC, AAAC, AACSR and AL59 conductor manufactured with round or trapezoidal shaped aluminum or aluminum alloy wires.

3. TRAINING

3.1. APAR strongly recommends that all line personnel, safety inspectors and construction crew attend a APAR sponsored training seminar prior to or in conjunction with the preconstruction meeting, at a time and place agreed to by all parties. Attendance by all Installation Supervisors is mandatory prior to the start of construction. Should a change in crew occur during the course of construction, APAR should be notified as soon as possible so that additional field training and support can be provided in a timely manner. Improper installation techniques are not covered by the APAR Warrantee Program and could result in line failure.

4. ASSOCIATED DOCUMENTS

4.1. IEEE Standard 524™ Guide to the Installation of Overhead Transmission Line Conductors.

5. DEFINITIONS

5.1. **ACSR** is defined as Aluminum conductor, Steel Reinforced.
AAC is defined as All Aluminium conductor
AAAC is defined as All Aluminium Alloy Conductor
AACSR is defined as Aluminium Alloy conductor, steel reinforced
AL59 is defined as Aluminium Alloy with 59% Conductivity
ACSR/AW is defined as Aluminium conductor, Aluminum Clad Steel Reinforced.
GSW – Galvanized Steel Wires
ACS – Aluminum Clad Steel

6. RESPONSIBILITY

6.1 It is the responsibility of the Installation Contractor and Field Inspectors to ensure a safe installation by following the instructions provided in this guideline, as well as customary safe installation practices.

7. TOOLS, GAUGES, FIXTURES

7.1. All equipment shall be maintained in accordance with applicable safety standards.

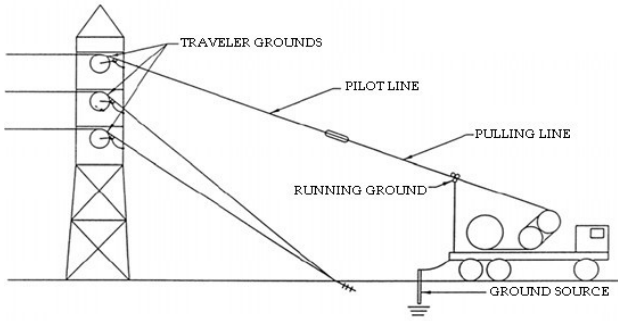
8. SAFETY REQUIREMENTS

8.1. All safety requirements associated with the operation of approved equipment shall be followed.

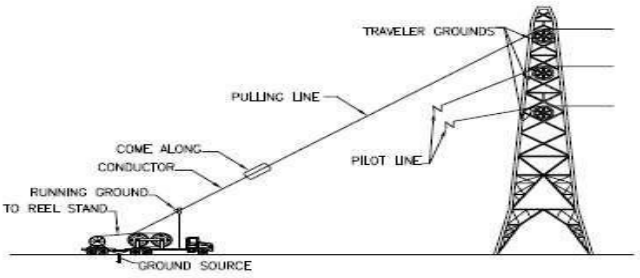
8.2. The conductor can be broken or damaged if bent or handled in a careless manner that exceeds this document recommended bend radiuses.

8.3. Electrical grounds shall be placed on all equipment and conductor per OSHA Regulation must include Equi-potential. First and last traveler shall be grounded along with the running ground at the tensioner. The grounds shall be placed approximately 20 feet (6 meters) out from the insulators during the dead-ending process and likewise the grounds shall be placed 20 feet (6 meters) on each side of the splice during the splicing process. The placement of the grounds at 20 feet (6 meters) helps to eliminate the bird caging process that could occur in Aluminum wire of conductors.

8.4. Conductor Grounds Must Be Placed Directly On The Aluminum Strands.



Puller equipped with pulling line connected to pilot line



Tensioner with conductor connected to pulling line and ground
Connection between conductor, tensioner and reel

8.5. We at APAR are always committed to the health and safety of the people who produce and work with our conductor in the field. Our MSDS makes accurate recommendations on how personnel should protect themselves from the dust that is created by cutting conductor. While the amount of dust that is created is very small, appropriate protections such as a dust mask are recommended to filter out dust particles and the use of appropriate skin protection (gloves) should be considered by the people working with the conductor when installing the conductors to minimize the irritation that could be caused by the dust resulting from cutting or sanding.

9. SHIPPING AND REEL HANDLING REQUIREMENTS

9.1. Aluminum conductors are shipped in sturdy, carefully designed containers or reels that safeguard the conductor from damage in transit, storage, and at the point of installation. The conductor is carefully

inspected during all stages of fabrication; packaging is inspected prior to shipment, and only properly packaged material is delivered to the carrier. The reel shall have a spindle hole diameter as per the project specific approved drum drawing.

9.2. **Reel Handlin**g. Reels are constructed so that they must be supported either on an axle through the arbor hold or by the reel flange. Returnable metal reels may be supported by a singletree arrangement that clamps to the flange and is lifted from above. When an axle supported from above lifts the reels, a spreader bar must be employed to prevent damage to the conductor or reel, or both, by inward pressure on the reel flange. Proper equipment must be available to lift the reels.

9.2.1. Reel stands are designed to be used with tensioners to supply the necessary back tension to the conductor. The stand(s) are selected to accommodate the conductor (or ground wire) reel dimensions and weight.

9.2.2. Some reels are not designed to withstand the forces developed by breaking during tension stringing operations. Direct tension stringing from the reel at transmission line should not be attempted. The conductor may be pulled directly from the reel stand when employing slack stringing methods.

9.2.3. If the reel stand is not self-loading, a crane, forklift or other suitable equipment is used to load the reel into the stand.

9.3. Reels should be properly controlled during the loading, unloading and staging processes.

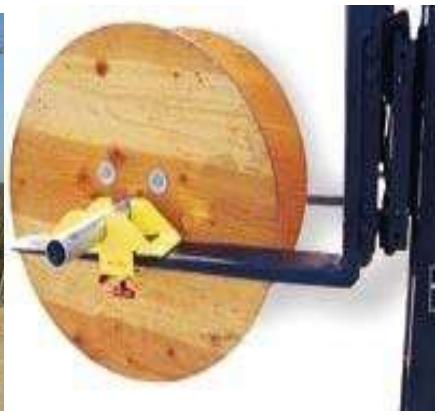
9.4. Cranes or other equipment of adequate capacity should be used to avoid damage and to avoid safety hazards.

9.5. It is important that reels of conductor are not lifted by placing the forks of the forklift directly under the drum area of the reel which would allow the forks to come in direct contact with the conductor or its wrapping material. Slings, winch lines, nylon straps or other types of lifting devices shall never be placed around the conductor to lift the reel. The conductor could be damaged if such devices are used.

9.6. Lift reel by approaching from the side and placing forks under flanges.

9.7. A spreader bar with slings or chains attached directly to the reel is the preferred method of unloading.

9.8. At no time should the reel be laid on its side either during unloading or storage.



9.9. If the conductor is to be rewound on the existing reel or onto another reel, extreme caution shall be exercised. The conductor must have backpressure applied at all times. Personnel must ensure that the conductor doesn't cross over itself during the rewinding process.

9.10 The emphasis should be placed on normal precautions to avoiding damage to the conductor surface. Conductor should not be dragged across the bare ground, over rocks, fences or guard structures.

NOTE: PREVENTING CONDUCTOR CROSS-OVER ON THE REELS AND KEEPING BACK PRESSURE WHILE REWINDING HELPS TO ENSURE THAT THE CONDUCTOR REMAIN INTACT.

10. STORAGE

10.1. If the conductor is to be stored for an extended period of time before use, the reel containing the conductor should be kept off of the ground and otherwise protected from possible damage. It is recommended that steel reels be used for storage of backup conductor.

10.2. Identification tags and other markings should be retained on all packages until such time as the conductor is to be used. Identification tags should be protected from weather to retain information.

10.3. The reels are delivered from the factory with a wooden lagging cover held down with steel bands over the outermost layer of conductor. It is recommended that the cover be left on the reels if they are going to be stored for an extended period of time.

10.4 Please refer APAR's instruction manual for **"Handling, Loading, Unloading and Storage Guide of Conductor Drums"**.

11. STRINGING METHODS

APAR and IEEE Standard 524™ recommend the tension method for the installation of conductor. However, in special situations especially smaller spans/sections where tension method couldn't be employed, other installation method (slack stringing) may be required provided special care must be used when hoisting the conductor to always respect the minimum allowable bending diameter.

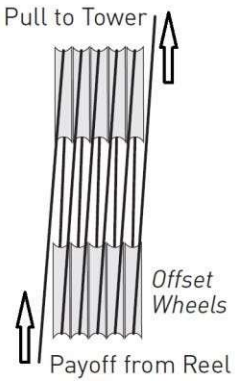
Note : Slack stringing situations must be especially careful of dropping or pulling the conductor over obstacles or edges which are of smaller effective diameter than minimum allowable. Paid-out conductor must be kept clean until it is hoisted into place. Do not drag or drop the new conductor in dirt or mud.

11.1 TENSIONER TYPES

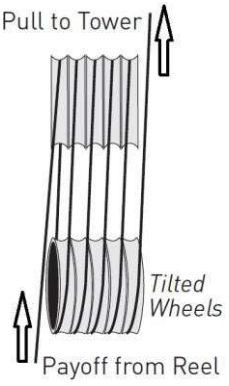
Dual drum Multi groove bull wheel tensioners are recommended to be used. The bull wheel drums may be offset or tilted so that the offset will be approximately one-half the groove spacing.

Tensioners with at least two bullwheels are used, with minimum three or more grooves for every subconductor on each wheel. Each subconductor shall have an adequate number of grooves (at least three wraps of the conductor around the bull wheel) to prevent the outer layers of wires slipping over the layers underneath in the case of multi-layered conductors.

V - Groove type bull wheels shall not be used for conductor. The conductor doesn't ride in the groove properly and will break.



Offset Bullwheel Tensioner



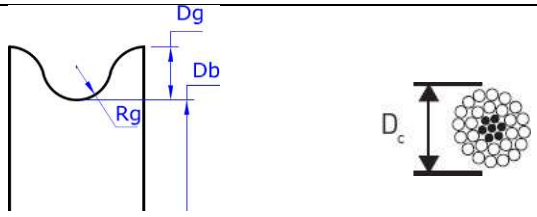
Tilted Bullwheel Tensioner

Dual drum Multi-groove bull wheel Tensioner

11.2 BULL WHEEL TENSIONER DIMENSIONS

The dimensions recommended by IEEE Standard 524™ shall be in accordance with Table A.

Table A - Recommended Bull wheel Tensioner Dimensions



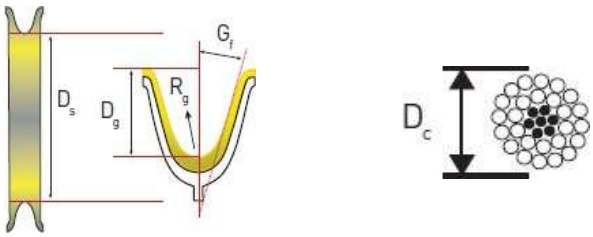
D_C is defined as the conductor outside diameter.

Minimum Bullwheel Diameter at Bottom of Groove: D_b	D_b = 39 DC- 4 (in) D_b = 39 DC - 100 (mm)	
Radius of Groove: R_g	Minimum R_g	Maximum Rg
Layer(s) of Aluminium: 1-2 layers	= 0.55 D_C R_g	= 1.10 DC Rg =
3 layers	= 0.55 D_C R_g	0.750 DC Rg =
> 3 layers	= 0.55 D_C	0.625 DC
Minimum Groove Depth: D_g	D_g = 0.5 D_C	

11.3 STRINGING SHEAVES DIMENSIONS

The dimensions recommended by IEEE Standard 524™ shall be in accordance with Table B

Table B - Recommended Stringing Sheave Dimensions



D_C is defined as the conductor outside diameter.

Minimum Diameter at Bottom of Groove: D_S	$D_S = 20\ D_C$	
Radius of Groove: R_g	Minimum	Maximum
Layer(s) of Aluminium: 1-2 layers	$R_g = 0.55\ D_C$	Rg = 1.10 DC
3 layers	$R_g = 0.55\ D_C$	Rg = 0.750 DC
> 3 layers	$R_g = 0.55\ D_C$	Rg = 0.625 DC
Minimum Groove Depth: D_g	$D_g = 1.25\ D_C$	
Groove Flare Angle: G_f	$15° < G_f < 20°$	

11.3.1 Always use Neoprene or Urethane lined dollies, sheaves, rollers, blocks, etc. when stringing conductor.

11.3.2 Precautions should be taken to keep pulling lines and stringing sheaves free from dirt and foreign debris that would cling to the conductor as it passes through the sheaves.

CAUTION :

- Sheave diameters (Ds) smaller than recommended and/or high stringing tensions may cause a build-up of torsional stress into the conductor.
- Rough handling of sheaves can result in inadequate performance, so make sure all sheaves are in proper working order before use.
- It is very important to inspect the stringing sheave lining condition, as worn or torn linings, any unlined should not be used. Unlined sheaves of any kind should never be used in accordance with IEEE Standard 524™. Worn or damaged sheave groove lining can cause improper conductor tracking and uneven pressure, leading to conductor damage. Sheaves shall rotate smoothly during stringing. If any sheave shows jerking, bouncing, or irregular rotation, it indicates defective bearings. In such cases, pulling shall be stopped and the defective sheave shall be replaced.

12. CONDUCTOR STRINGING AND SAGGING

To avoid damaging the conductor, tension stringing is recommended. The maximum recommended pulling tension during the stringing operation should not exceed that necessary to maintain clearances above

obstructions on the ground or safety structures. Recommended stringing tensions are between 5 - 10% of the rated breaking strength of the conductor and should not exceed 50% of sagging tensions.
Typical pulling speeds are between 3 to 5 Km/h in hilly terrain and 3 to 8 Km/h in plain terrain. These speeds usually provide a smooth passage of the running board or connecting hardware, or both, over the travelers; whereas slower speeds may cause significant swinging of the traveler and insulator-hardware assemblies. Higher speeds create a potential hazard of greater damage in case of a malfunction.

12.1 Conductor Grips

There is a wide variety of conductor grip styles and tie-down products available in the industry. Always consult with the grip manufacturer for the correct selection so that the grip type and configuration is sized for the diameter and type of conductor being installed and is capable of holding the conductor to the highest tension that is anticipated during the sagging operation.

All grips used for conductor must be of the transmission grade. The jaws of transmission grade grips are longer to ensure more gripping area on the conductor. Grip jaws may be round or oval but not V-shaped. Grips must be properly sized for the conductor type, conductor diameter, and tensions to be installed.

12.1.1 For Pulling

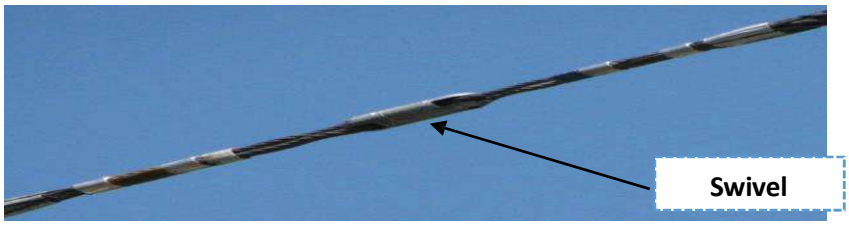
Standard Kellem grips, also known as sock splices, basket grips, or wire mesh can be used to pull conductor. The Kellem grips should be double banded at the end of the grip. The banding accomplishes two things:

1. The bands force the Kellem grip to apply pressure on the strands allowing for a tighter grip on the core during the pulling process.
2. When using back to back Kellem grips, the grip closest to the pulling rope or old conductor could possibly catch the block; thus, releasing the conductor if the two bands were not on the end of the Kellem grip. There may be times when two reels of conductor can be successfully installed using two sets of back to back Kellem grips. APAR engineering will assist the installation crew in analyzing how many reels can be connected together for the pull.

Basket-type grips: A basket grip must only be used for pulling conductor. Basket grips must be double-banded on the ends to prevent slipping.

Single Woven wire grip (Basket-type grips)

Anti Rotational Device (Swivel): A swivel is required between the basket grip and pull line or between grips if multiple reels are tied together (double socked) for longer pulls. The swivel will allow the conductor to rotate freely during the pulling process.



Anti Rotational device (Swivel)

Swivel links used during tension stringing are required to have adequate rated working load capacity for the intended application. Selection of appropriate swivel links, including their compatibility with travelers, grips, and pulling lines, shall be the responsibility of the stringing contractor / equipment supplier. It is recommended that all such accessories are verified for compatibility and safe operation prior to use.

NOTE : To prevent conductor rotation during pay-off or sheave passage, consider using an Anti-Rotational Device (ARD). The ARD employs weighted attachments to keep it vertical, halting cable rotation, facilitating easy travel of conductors over pulling blocks with the collapsible attachments.

12.1.2 For Sagging:

Klein "Chicago" grips or an approved equal grip may be used to grip the conductor when tensioning the conductor. The grips shall be designed for the exact size of conductor installed.

12.1.2.1 The grips must be properly sized to match the conductor diameter in order to minimize strand distortion and maximize gripping power.

12.1.2.2 The jaw length for these grips must be the long body type with smooth finish.

12.1.2.3 Do not use grips designed to fit a large number of conductor sizes, or with the short length jaws.

12.1.2.4 Consult with the grip manufacturer for the correct sizing and the recommended installation Procedure.

12.1.2.5 All of the conductor grips must be clean, properly sized, and load tested prior to use to ensure that they will exceed the intended maximum installation tension(s).

Klein "Chicago-type" grip

12.1.2.6 Certain high-tension applications require the use of tandem grips. If the required tension exceeds the safe load of a single grip, two grips must be used in tandem.

Note : Tandem grips do not provide double the gripping power. Consult with the equipment manufacturer as to the rating system they apply for tandem grips

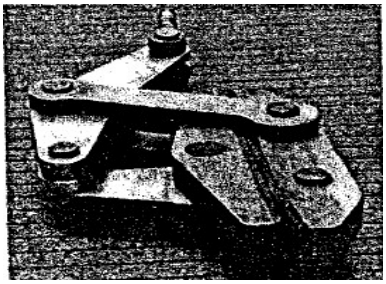
Prior to use, grips must be inspected to ensure they are in good operating condition and tested for holding strength on the conductor to be installed. Prior to pulling any conductor, it is advisable to test the gripping method at ground level to demonstrate the grips provide the required performance. During testing, grips should not slip when subjected to a minimum tension of 110% of the working tension during installation.

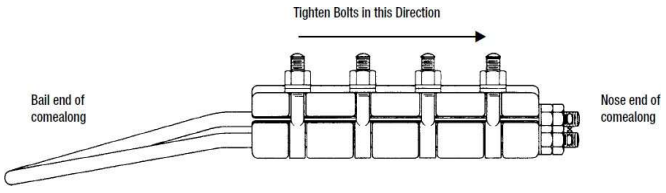
12.1.2.7 Grips must be rated for conductor strength. Ensure that tape is placed on any rough edges on the outside of the grip near the pulling eye(s) and swivel to help the grips and swivel pass smoothly through the blocks (sheaves). The tape also helps protect the lining on the blocks as the grip pass through the sheaves.

12.1.2.8 Never bend the conductor less than the recommended minimum bend diameter of conductor. We at APAR recommend the minimum bend diameter of conductor as 20 times the diameter of conductor.

12.1.2.9 Damage to the conductor can occur if it is over bent. Below are possible ways the conductor can be over bent.

12.1.2.10 Use of incorrect conductor grips.

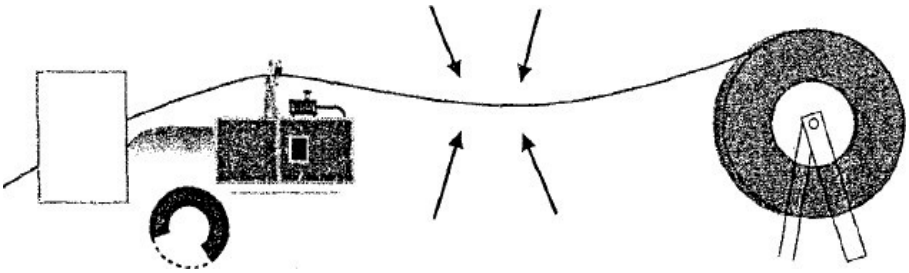




12.1.2.11 Incorrect conductor suspension after gripping.

12.1.2.12 Incorrect positioning of the brake tensioner

12.1.2.13 Allowing the conductor to "bounce" up and down from the pay-off reel.

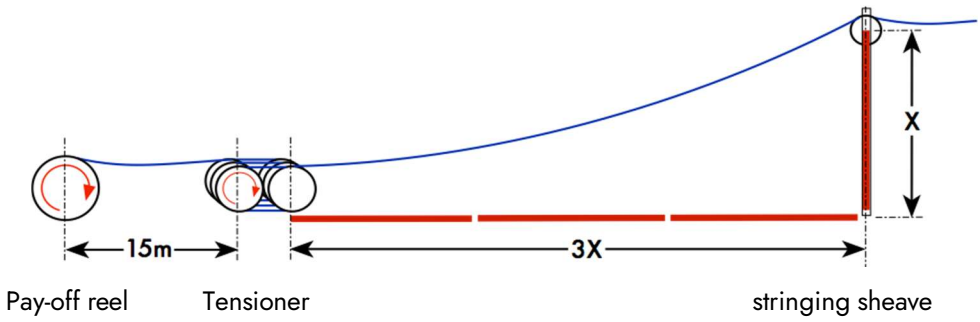


12.2 Bottom-End Conductor attachment to Reel

The bottom end of the conductor on the reel must be secured to the reel to provide a stationary attachment point during manufacture and pay-off of the conductor. The end attachment must never be relied upon as an anchor point for the conductor. When paying out the conductor, the stringing operation must be stopped before the reel completely empties, and any required back tension must be transferred from the conductor on the reel to some other anchor point. The conductor end that is attached to the reel must never be considered as a brake or end-stop, as it is not capable of withstanding a conductor "run out" situation.

12.3 Tension Stringing Setup

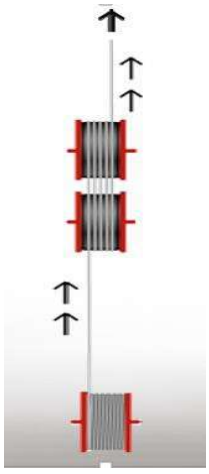
12.3.1 It is critical that a minimum of 3 to 1 ratio be used between the tensioner and the traveler on the first structure and between the puller and traveler on the last structure during the stringing pull in order to avoid bending the conductor at severe angles. The tensioner must be right hand lay, meaning the conductor coming off of the wire reel goes into the left side of the tensioner, and the conductor going to the first structure will be coming out of the right side of the tensioner. Stringing equipment and sheave wheels must be in good alignment at all times.
Minimum 15 meters is required between the tensioner and pay-off reel to avoid loosening of the strands between tensioner and pay-off reel.



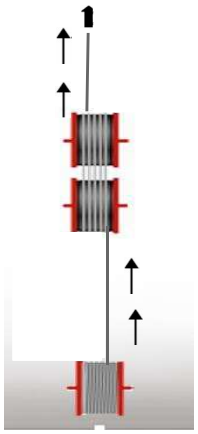
Stringing Setup Equipment Alignment

A sheave (meeting the minimum working diameter requirements) is required between the pay-off reel and the tensioner. Position the sheave to guide the conductor into the centre of the tensioner fairlead.

As recommended by IEEE Standard 524™, for conductors having a right-hand direction of lay for the outer wires, tensioner bullwheels should be arranged so that, when facing in the direction of pull, the conductor will enter the bullwheel on the left and pull off from the right side. For any conductors having a left-hand direction of lay for the outer wires, the conductor should enter on the right and pull off from the left. This arrangement is necessary to avoid any tendency to loosen the outer layer of strands as the conductor passes over the bull wheels.



Left to Right
(Right - hand lay wire)



Right to Left
(Left - hand lay wire)

CAUTION:
There may be times when the 3 to 1 distance to height ratio can't be maintained. In this case, APAR engineering personnel may be able to provide an alternative-stringing plan using larger blocks or double blocks (tandem block).

12.3.2 Brakes on the reel trailer need to be used diligently in order to avoid any unnecessary "slack" occurring between the pay-off reel and the tensioner. This slack can cause the conductor to jump out of the tensioner sheave and become damaged or broken. The reel brake operator, tensioner operator and puller operator must be experienced with the equipment being used to pull in conductor. Good radio contact must be maintained between the operators and lines people watching the conductor being pulled in.

12.4 Pay-off Brake Tension

As recommended by IEEE Standard 524, the brake tension on the pay-off reel should only be set high enough to prevent over-run when pulled into the tensioner.
Pay-off brake tension needs to be monitored throughout the conductor pull. As the reel empties down, it is important to lower the brake tension to reduce the tension force being applied to the conductor as it is pulled off the reel. Excessive brake tension can cause distortion of the reel flanges and lead to permanent reel damage. It can also pull the conductor down between the underlying wraps of conductor, where it could get wedged and damaged. The conductor drums shall be positioned in a way that it will rotate in the same direction as the bull wheels.

Loosening of outer strands between the conductor drum and tensioner bull wheels is primarily caused by conductor coil memory. As the conductor is unwound and straightened, outer strands tend to loosen, especially in large diameter conductors. When the conductor enters the bull wheel groove, contact pressure pushes these loose strands back toward the drum, where the looseness accumulates and may result in bird caging. If not controlled, this can lead to strand damage requiring removal of the affected conductor length.

To minimize bird caging, adequate distance shall be maintained between the conductor drum and the tensioner to allow strand looseness to redistribute along the conductor length. Simultaneously, sufficient back tension shall be applied on the reel to stretch the core and inner strands, thereby tightening the outer strands.
It is recommended that the back tension or braking tension of the conductor reel not exceed 4.5 kN (1000 lbs), since drawing down of the conductor into the lower layers on the reel may cause surface damage. For smaller diameters and wooden reels, the back tension should be considerably less. A possible outcome of excessive brake tension is crushing down of the bottom layer conductor and distorting the underlying conductor strands.

CAUTION :
A reel brake mechanism must be utilized in a straight line with tensioner at all times to avoid spring action or uncoiling. Adequate back-tension must be applied at all times during the pulling operation to prevent the conductor from unraveling, binding or jumping out of alignment with tensioning or stringing equipment.
In all cases, the reel stand shall be anchored before pulling any conductor.

12.5 Conductor Sagging

12.5.1 Standard sight, return wave, transit and dynamometer methods are applicable for installing conductor.

12.6 Clipping

IEEE 524™ recommends that conductors be 'sagged' and 'clipped' in place within 24 - 48hours of installation.

IEEE Standard 524™ states that the total time for conductors sitting in the sheaves, from initial installation until clipping, should never be more than 72 hours.

If this time is exceeded, damage may occur to the conductor and/or sheaves. The installation of dampers, spacers and spacer-dampers should be completed as soon as possible after sagging to prevent damage to the conductors.

13. STRINGING PRECAUTIONS

13.1. Conductor reel placement

13.1.1 Conductor reels should be loaded into their pay-off cradles prior to the removal of protective covering After the removal of the covering, all reels must be examined for sharp objects that may damage the conductor (Nails in case of wooden reels), as it is unreeled. Reel trailer mandrels shall match the size of reel or correctly sized collars shall be used to maintain control of the reel. If the mandrels are too small, the conductor has a tendency to bounce and could damage. Additionally, brakes will not work properly if the reel isn't controlled properly.

13.1.2 Prior to dead ending, it is critical that the grip/hoist and any grounds be placed as far out on the line as possible, preferably 10 feet (3 meters) or more.

13.1.3 If at any time during the installation process the conductor is bent at a sharp angle, and if this portion of the conductor is going to be put up under tension or non-tension, this section of conductor must be cut out and a full splice installed. Sharp angles can be avoided by proper sheave placement and attention to back tension and reel pay-off.

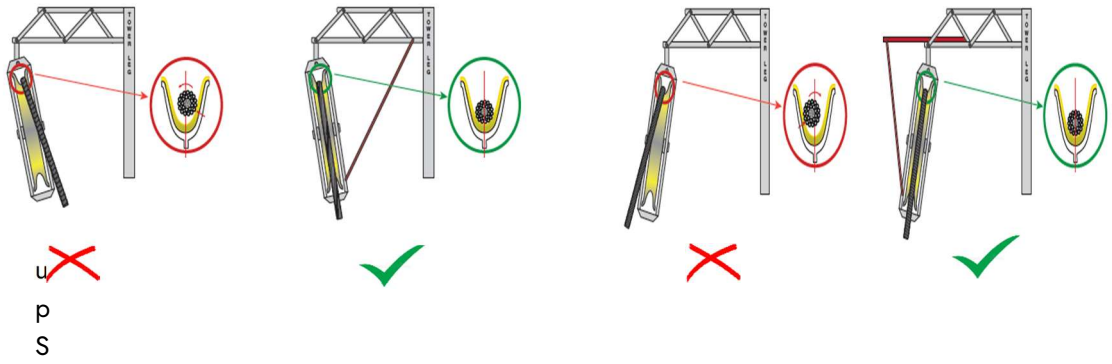
13.2 Uplift or down pull on the conductor

13.2.1 Where there is a severe uplift or down pull on the conductor at any structure or tower, it is critical to use double blocks **or larger for each block.** This is measured to the inside of the sheave wheel and not the overall size of the block.

13.3. Angles larger than 30 degrees

13.3.1 At no time may the conductor be pulled or sagged to an angle greater than 30 degrees. If the angle is greater than 30 degrees, double or oversized blocks must be used to reduce the angle below 30 degrees. If the angle is too great for the double or oversized blocks to reduce the angle below 30 degrees, then the conductor shall be dead-ended at that structure.

13.3.2 When the conductor is pulled at an angle, the line tension causes it to move away from the center of the sheave and ride along the sides, inducing torsional rotation (clockwise or counterclockwise depending on the direction of displacement).
To prevent this, the sheave shall be properly supported and aligned to ensure the conductor remains centered in the groove. In case of tandem sheaves, all units shall be securely fastened together and supported in the same manner as a single sheave arrangement.



Supporting of Stringing Sheaves at Angles

Photo of Tandem as alternate solution

13.4 The following precautions shall be taken while conductor end Preparation before paying out:

a) Ensure proper securing of the conductor end with a hose clamp/metal band.
b) Use an electric abrasive cutter/ring cutter exclusively for conductor cutting. Before cutting, ensure that the conductor is securely tied and fastened in accordance with the instructions in point a) above.

13.5 Conductor must be continuously inspected as it is fed into the stringing equipment for dirt, bits of foreign material, nicks or abrasions in the conductor.

13.6 The conductor must not be pulled across the ground or underlying structure (such as a fence) as that could damage the aluminum strands causing electrical discharge or corona when energized.
It is recommended that the protective paper wrap that is removed from the reels be placed on the ground to protect the conductor during set up and splicing operations.

13.7 Should the conductor unintentionally come in contact with the ground, any dirt or debris build up should be cleaned off.

EXCEPTION:
Some of the countries overseas use plain metallic sheaves for the stringing process. If metallic, non-lined sheaves are used it is critical that all of the sheaves are examined for abrasiveness, debris or marks on the rollers and removed so that no damage is caused to the conductor.

13.8 When pulling in conductor, it is important to maintain enough tension in order to avoid excessive bending around travelers.

13.9 Consult with the equipment supplier to ensure the attachment device is suitable for the conductor and for the intended load rating.

13.10 **Hoists**

13.10.1 Hoists used for dead-ending or lifting - The hoist shall be large enough to safely handle the conductor being installed.

13.11 **Safety grounds**

13.11.1 Grounds shall be sized to interrupt fault current that could be seen on the installed conductor. It is preferred that the inside of the ground clamp be smooth to ensure it does not damage the aluminum.

13.11.2 Ground clamps shall be placed on the outside of the grip dead-ending the conductor towards the next structure. This is to prevent any unnecessary bird caging.

14. DEAD-END & MID SPAN INSTALLATION INSTRUCTIONS

APAR does not recommend, nor take responsibility, for the use of any conductor hardware. All dead-ends and splices must first be approved by the hardware manufacturer for use with Conductors.
Check with your hardware manufacturer for a recommendation on the use of these types of hardware on Conductors.

15. ANCILLARY HARDWARE

15.1 For assistance with appropriate ancillary hardware selection, such as dampers, suspension clamps, and armor-rod, please consult the hardware manufacturer for more information on proper application.

16. LEGAL NOTICES

PLEASE READ THESE LEGAL NOTICES CAREFULLY.

Disclaimer: This guide provides suggestions for methods, equipment and tools that have been found practical based on field-testing. These guidelines are meant to provide procedures that will help provide a high quality, trouble-free installation so that the conductor once installed, will perform its intended function.
Failure to follow these guidelines may cause a hazardous condition or result in premature line failure.
The information contained herein or related hereto is intended for evaluation by technically skilled persons, with any use thereof to be at their independent discretion and risk. Such information is believed to be reliable, but the accuracy or completeness thereof is not guaranteed. The user assumes all risks and liability whatsoever in connection with such use.

This document is provided for guidance purposes only and shall not be considered a legally binding document.

WARNING: A potential for electrical shock exists when using Conductors energized with electrical power. Use appropriate safety procedures.

*** END ***