

IEEE Guide to the Installation of Overhead Transmission Line Conductors

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Abstract: General recommendations for the selection of methods, equipment, and tools that have been found to be practical for the stringing of overhead transmission line conductors and overhead groundwires are provided. The aim is to present in one document sufficient details of present day methods, materials, and equipment to outline the basic considerations necessary to maintain safe and adequate control of conductors during stringing operations.

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IEEE Guide to the Installation of Overhead Transmission Line Conductors

1. Introduction

1.1 Scope

This guide provides general recommendations for the selection of methods, equipment, and tools that have been found to be practical for the stringing of overhead transmission line conductors and overhead groundwires. The guide also includes a comprehensive list of definitions for equipment and tools used in stringing and for stringing terms commonly employed. This guide does not address special conductors such as those used for river and canyon crossing. These conductors may be custom designed and may often require special considerations.

1.2 Purpose

The purpose of this guide is to present in one document sufficient details of present day methods, materials, and equipment to outline the basic considerations necessary for maintaining safe and adequate control of conductors during stringing operations. References are given in Section 2 for those desiring more detailed information. Because the terminology used for many hardware items and for many stringing terms varies from place to place, a list of definitions is included to provide correlation and clarification of the terms most commonly employed.

1.3 Application

This guide is broad enough yet specific enough to be applicable to the stringing of conventional overhead transmission conductors and overhead groundwires (OHGW) of the following types: AAAC, AAC, AACSR, ACAR, ACSR, ACSR/TW, aluminum-clad steel OHGW, and galvanized steel OHGW. Since stringing practices for different projects will be strongly influenced by the magnitude and nature of each project and by local circumstances, alternate methods that have been successfully employed are presented. Information contained in this guide may not be sufficient for certain special cases, such as when stringing extremely long spans, severe line angles, high tensions, or special conductors and overhead ground wires such as T-2, SSAC, SDC, and OPGW. In these cases, the manufacturer should be consulted. The practices that are described in this guide provide for continuous control of the conductor from the initial setup to the ready-

for-service condition. Any legal requirements of national, state, or local regulations must, of course, be observed.

The approach used within this guide is first to describe, in general terms, the stringing methods most commonly employed, then the specific requirements of the various tools and equipment used. Finally, the application of the methods and equipment to the process of stringing is described.

2. References

- [1] IEEE Std 100-1984, IEEE Standard Dictionary of Electrical and Electronics Terms (ANSI).¹
- [2] IEEE P524A/D4, July 1992, *Draft Guide to Grounding During the Installation of Overhead Transmission Line Conductors*.²
- [3] Boner, C. J., *Manufacture and Application of Lubricating Greases*. Robert E. Krieger Publishing Co. Inc., 1971.
- [4] Clayton, J. M. and Powell, R. L., "Application of Arresters for Complete Lightning Protection of Substations," *AIEE Transactions*, vol. 77, pt. 3, 1958.
- [5] "Grounding and Jumpering," Bulletin 9-7208, A. B. Chance Co., 1972.
- [6] Hellstern, V. and Van Name, J. M., "A Study of Effective Temporary Grounding Techniques for Modern Transmission Lines," EEI Pub. No. 62-49.
- [7] "Limitations on Stringing and Sagging Conductors," Paper TP64-146, Working Group of the IEEE Towers, Poles, and Conductors Subcommittee of the Transmission and Distribution Committee of the IEEE Power Engineering Society.
- [8] "Live Line Maintenance Methods," Paper T73 157-5, Towers, Poles, and Conductors Subcommittee of the Transmission and Distribution Committee of the IEEE Power Engineering Society.
- [9] Lummis, J. and Fischer, H. D., Jr., "Practical Application of Sag and Tension Calculations to Transmission Line Design," AIEE 54-501, Jun. 1955.
- [10] Wagner, C. F. and Lloyd, B. L., "Corona Effects on Traveling Waves Determined by Field and Laboratory Tests," *Proceedings of the International Conference on Large Electric High-Voltage Systems (CIGRE)*, Paper No. 408, 1956.
- [11] Winkelman, P. F., "Sag-Tension Computations and Field Measurements of Bonneville Power Administration," AIEE 59-900, 1959.

3. Definitions and Cross Reference of Terminology

Terminology for equipment and procedures associated with the installation of overhead transmission line conductors varies widely throughout the utility industry. Therefore, definitions (see 3.1) and a table of terminology cross references (see 3.1 3.2) have been included to provide a correlation between the terminol-

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ogy used in this guide and industry synonyms. Note that the synonyms are terms that are commonly used, although many are not necessarily good usage and should not be taken as equivalents to the guide terminology.

Many of the terms have additional meanings and usages that are defined in IEEE Std 100-1984 [1]³.

3.1 Definitions and Terminology for Conductor Stringing Equipment

AAAC: Concentric-lay-stranded all aluminum alloy conductor.

AAC: Concentric-lay-stranded all aluminum conductor.

Aerex: See **explosives**.

alive: See **energized**.

all terrain vehicle (ATV): See **off-road vehicle**.

alligator: See **running board**.

aluminum conductor, steel reinforced (ACSR): A composite conductor made up of a combination of aluminum and coated steel wires. In the usual construction, the aluminum wires surround the steel.

aluminum alloy conductor, steel reinforced (AACSR): A composite conductor made up of a combination of aluminum alloy and coated steel wires. In the usual construction, the aluminum wires surround the steel.

aluminum conductor, aluminum alloy reinforced (ACAR): A composite conductor made up of a combination of aluminum and aluminum alloy wires. In the usual construction, the aluminum wires surround the aluminum alloy.

anchor: A device that serves as a reliable support to hold an object firmly in place. The general term “anchor” is normally associated with cone, plate, screw, or concrete anchors. The terms *snub*, *deadman*, and *anchor log* are usually associated with pole stubs or logs set or buried in the ground to serve as temporary anchors. The latter are often used at pull and tension sites. *Syn:* **anchor log**, **deadman**, **snub**.

anchor log: See **anchor**.

Baker board: See **platform, lineperson’s**.

basket: See **bucket**; **grip**, **woven wire**.

bicycle: See **cable car**.

binder: See **load**, **binder**.

bird: See **running board**.

birdie: See **running board**.

³The numbers in brackets correspond to those of the references in Section 2.

block: A device designed with one or more single sheaves, a wood or metal shell, and an attachment hook or shackle. When rope is reeved through two of these devices, the assembly is commonly referred to as a *block and tackle*. A *set of fours* refers to a block and tackle arrangement utilizing two 4 in double sheave blocks to obtain four load-bearing lines. Similarly, a *set of fives* or a *set of sixes* refers to the same number of load-bearing lines obtained using two 5 in or two 6 in double sheave blocks, respectively. *Syn:* **set of fours, set of fives, set of sixes.**

block, hold-down: A device designed with one or more single groove sheaves to be placed on the conductor and used as a means of holding it down. This device functions essentially as a traveler used in an inverted position. It is normally used in midspan to control conductor uplift caused by stringing tensions, or at splicing locations to control the conductor as it is allowed to rise after splicing is completed. *Syn:* **block, splice release; roller, hold-down; traveler, hold-down.**

block, splice release: See **block, hold-down.**

block, snatch: A device normally designed with a single sheave, wood or metal shell, and hook. One side of the shell usually opens to eliminate the need for threading of the line. It is commonly used for lifting loads on a single line or as a device to control the position or direction, or both, of a fall line or pulling line. *Syn:* **Skookum, Washington, Western.**

boatswain's chair: A seat designed to be suspended on a line reeved through a block and attached to a pulling device to hoist a workman to an elevated position. *Syn:* **bosun's chair.**

bosun's chair: See **boatswain's chair.**

bonded: The mechanical interconnection of conductive parts to maintain a common electrical potential. *Syn:* **connected.**

boxing glove: See **hook, conductor lifting.**

brake: See **tensioner, bullwheel.**

bucket: A device designed to be attached to the boom tip of a line truck, crane, or aerial lift to support workers in an elevated working position. It is normally constructed of fiberglass to reduce its physical weight, maintain strength, and obtain good dielectric characteristics. *Syn:* **basket.**

buffalo: See **grip, conductor.**

bullet: See **link, connector.**

bull rope: See **line, bull.**

bullwheel: A wheel incorporated as an integral part of a bullwheel puller or tensioner to generate pulling or braking tension on conductors or pulling lines, or both, through friction. A puller or tensioner normally has one or more pairs of wheels arranged in tandem incorporated in its design. The physical size of the wheels will vary for different designs, but 17 in (43 cm) face widths and diameters of 5 ft (150 cm) are common. The wheels are power driven or retarded and lined with single or multiple groove neoprene or urethane linings. Friction is accomplished by reeving the pulling line or conductor around the groove of each pair.

bundle, two-conductor, three-conductor, four-conductor, multiconductor: A circuit phase consisting of more than one conductor. Each conductor of the phase is referred to as a *subconductor*. A two-conductor bundle has two subconductors per phase. These may be arranged in a vertical or horizontal configuration. Similarly, a three-conductor bundle has three subconductors per phase. These usually are arranged in a triangular configuration with the vertex of the triangle up or down. A four-conductor bundle has four subconductors per

phase. These normally are arranged in a square configuration. Although other configurations are possible, those listed are the most common. *Syn:* **twin-bundle, tri-bundle, quad-bundle.**

cable: See **conductor.**

cable buggy: See **conductor car.**

cable car: A seat or basket-shaped device, designed to be suspended by a framework, and two or more sheaves arranged in tandem to enable a workman to ride a single conductor, wire, or cable. *Syn:* **bicycle, cable trolley, conductor car.**

cable trolley: See **cable car.**

cage: See **platform, aerial.**

cat: See **tractor, crawler.**

chain binder: See **load, binder.**

chain hoist: See **hoist.**

chain tugger: See **hoist.**

Chinese finger: See **grip, woven wire.**

choker: See **traveler sling.**

clip: See **clamp, cable.**

clamp, cable: A device designed to clamp cables together. It consists of a “U” bolt threaded on both ends, two nuts, and a base, and is commonly used to make temporary *bend back* eyes on wire rope. *Syn:* **clip, Crosby, Crosby clip.**

clamp, hose: See **clamp, strand restraining.**

clamp, plier: See **clamp, strand restraining.**

clamp, strand restraining: An adjustable circular clamp commonly used to keep the individual strands of a conductor in place and to prevent them from spreading when the conductor is cut. *Syn:* **block, cable binding; clamp, hose; clamp, plier; grip, vise.**

clamping-in: See **clipping-in.**

clearance: (1) The condition in which a circuit has been deenergized to enable work to be performed more safely. A clearance is normally obtained on a circuit presenting a source of hazard prior to starting work. *Syn:* **outage, permit, restriction.**

(2) The minimum separation between two conductors, between conductors and supports or other objects, or between conductors and ground or the clear space between any objects.

clipping: See **clipping-in.**

clipping-in: The transferring of sagged conductors from the travelers to their permanent suspension positions and the installing of the permanent suspension clamps. *Syn:* **clamping-in, clipping.**

clipping offset: A calculated distance, measured along the conductor from the plumb mark to a point on the conductor at which the center of the suspension clamp is to be placed. When stringing in rough terrain, clipping offsets may be required to balance the horizontal forces on each suspension structure.

clock: See **dynamometer**.

Coffing: See **hoist**.

Coffing hoist: See **hoist**.

come-along: See **grip, conductor**.

conductor: A wire, or combination of wires not insulated from one another, suitable for carrying an electric current. It may be, however, bare or insulated. *Syn:* **cable, wire**.

conductor car: A device designed to carry workmen and ride on sagged bundle conductors, thus enabling them to inspect the conductors for damage and install spacers and dampers where required. These devices may be manual or powered. *Syn:* **cable buggy, cable car, spacer buggy, spacer cart, spacing bicycle**.

conductor hook: See **hook, conductor lifting**.

conductor payout station: See **site, tension**.

conductor splice: See **joint, compression**.

connected: See **bonded**.

connector: See **link, connector**.

connector, rope: A special high strength steel link used to join two lengths of pulling rope by means of the eye splice at each end. Although designed to pass easily through the grooves of the bullwheels on the puller, it should not be passed under full load. *Syn:* **peanut**.

control span: See **sag span**.

counterpoise: See **ground grid**.

crawler: See **tractor, crawler**.

Crescent: See **grip, conductor**.

Crosby: See **clamp, cable**.

Crosby clip: See **clamp, cable**.

crossing structure: A structure built of poles and, sometimes, rope nets. It is used whenever conductors are being strung over roads, power lines, communications circuits, highways, or railroads, and is normally constructed in such a way as to prevent the conductor from falling onto or into any of these facilities in the event of equipment failure, broken pulling lines, loss of tension, etc. *Syn:* **guard structure, H-frame, rider structure, temporary structure**.

current carrying: See **energized**.

D-board: See **platform, lineperson's**.

dead: See **deenergized**.

deadend board: See **platform, lineperson's**.

deadend loop: See **jumper**.

deadend platform: See **platform, lineperson's**.

deadman: See **anchor**.

deenergized: Free from any electric connection to a source of potential difference and from electric charge; not having a potential different from that of the ground. The term is used only with reference to current-carrying parts that are sometimes alive (energized). To state that a circuit has been deenergized means that the circuit has been disconnected from all intended electrical sources. However, it could be electrically charged through induction from energized circuits in proximity to it, particularly if the circuits are parallel. *Syn:* **dead**.

diving board: See **platform, lineperson's**.

dolly: See **traveler**.

dolly car: See **rack, traveler**.

dynamite: See **explosives**.

dynamometer: A device designed to measure loads or tension on conductors. Various models of these devices are used to tension guys or sag conductors. *Syn:* **clock, load cell**.

earth wire: See **overhead groundwire**.

energized: Electrically connected to a source of potential difference, or electrically charged so as to have a potential different from that of the ground. *Syn:* **alive, current carrying, hot, live**.

equipotential: An identical state of electrical potential for two or more items.

explosives: Mixtures of solids, liquids, or a combination of the two that, upon detonation, transform almost instantaneously into other products that are mostly gaseous and that occupy much greater volume than the original mixtures. This transformation generates heat, which rapidly expands the gases, causing them to exert enormous pressure. Dynamite and Primacord are explosives as manufactured. Aerex, Triex, and Quadrex are manufactured in two components and are not true explosives until mixed. Explosives are commonly used to build construction roads, blast holes for anchors, structure footings, etc. *Syn:* **Aerex, dynamite, fertilizer, powder, Primacord, Quadrex, Triex**.

fertilizer: See **explosives**.

finger rope: See **line, finger**.

four bolt: See **grip, conductor**.

grip: See **grip, conductor**.

grip, Chicago: See **grip, conductor**.

grip, conductor: A device designed to permit the pulling of conductor without splicing on fittings, eyes, etc. It permits the pulling of a *continuous* conductor where threading is not possible. The designs of these grips

vary considerably. Grips such as the Klein (Chicago) and Crescent utilize an open-sided rigid body with opposing jaws and swing latch. In addition to pulling conductors, this type is commonly used to tension guys and, in some cases, pull wire rope. The design of the come-along (pocket-book, suitcase, four bolt, etc.) incorporates a bail attached to the body of a clamp that folds to completely surround and envelope the conductor. Bolts are then used to close the clamp and obtain a grip. *Syn:* **buffalo; come-along; Crescent; four bolt; grip; grip, Chicago; Kellem; Klein; pocketbook; seven bolt; six bolt; slip-grip; suitcase.**

grip, vise: See **clamp, strand restraining.**

grip, wire mesh: See **grip, woven wire.**

grip, woven wire: A device designed to permit the temporary joining or pulling of conductors without the need of special eyes, links, or grips. *Syn:* **basket; Chinese finger; grip, wire mesh; Kellem; sock.**

ground, block: See **ground, traveler.**

ground, butt: See **ground, structure base.**

ground chain: See **ground, structure base.**

grounded: Connected to earth or to some extended conducting body that serves instead of the earth, whether the connection is intentional or accidental.

ground electrode: See **ground rod.**

ground grid: A system of interconnected bare conductors arranged in a pattern over a specified area either on or buried below the surface of the earth. Normally, it is bonded to ground rods driven around and within its perimeter to increase its grounding capabilities and provide convenient connection points for grounding devices. The primary purpose of the grid is to provide safety for workmen by limiting potential differences within its perimeter to safe levels in case of high currents that could flow if the circuit being worked became energized for any reason or if an adjacent energized circuit faulted. Metallic surface mats and gratings are sometimes utilized for this same purpose. When used, these grids are employed at pull, tension, and midspan splice sites. *Syn:* **counterpoise, ground gradient mat, ground mat.**

ground gradient mat: See **ground grid.**

ground, master: A portable device designed to short circuit and connect (bond) a deenergized circuit or piece of equipment, or both, to an electrical ground. Normally located remote from, and on both sides of, the immediate work site. Primarily used to provide safety for personnel during construction, reconstruction, or maintenance operations. *Syn:* **ground set, ground stick.**

ground mat: See **ground grid.**

ground, moving: See **ground, running.**

ground, personal: A portable device designed to connect (bond) a deenergized conductor or piece of equipment, or both, to an electrical ground. It is distinguished from a master ground in that it is utilized at the immediate site when work is to be performed on a conductor or piece of equipment that could accidentally become energized. *Syn:* **ground stick; ground, working; red head.**

ground rod: A rod that is driven into the ground to serve as a ground terminal, such as a copper-clad rod, solid copper rod, galvanized iron rod, or galvanized iron pipe. Copper-clad steel rods are commonly used during conductor stringing operations to provide a means of obtaining an electrical ground using portable grounding devices. *Syn:* **ground electrode.**

ground roller: See **ground, running**.

ground, rolling.: See **ground, running**; **ground, traveler**.

ground, running: A portable device designed to connect a moving conductor or wire rope, or both, to an electrical ground. These devices are normally placed on the conductor or wire rope adjacent to the pulling and tensioning equipment located at either end of a sag section. They are primarily used to provide safety for personnel during construction or reconstruction operations. *Syn:* **ground, moving**; **ground roller**; **ground, rolling**; **ground, traveling**.

ground, sheave: See **ground, traveler**.

ground stick: See **ground, personal**.

ground, structure: See **ground structure base**.

ground, structure base: A portable device designed to connect (bond) a metal structure to an electrical ground. It is primarily used to provide safety for personnel during construction, reconstruction, or maintenance operations. *Syn:* **ground, butt**; **ground chain**; **ground, structure**; **ground, tower**.

ground, tower: See **ground, structure base**.

ground, traveler: A portable device designed to connect a moving conductor or wire rope, or both, to an electrical ground. It is primarily used to provide safety for personnel during construction or reconstruction operations. This device is placed on the traveler (sheave, block, etc.) at a strategic location where an electrical ground is required. *Syn:* **ground, block**; **ground, rolling**; **ground, sheave**.

ground, traveling.: See **ground, running**.

ground, working : See **ground, personal**.

guard structure: See **crossing structure**.

H-frame: See **crossing structure**.

hoist: An apparatus for moving a load by the application of a pulling force and not including a car or platform running in guides. These devices are normally designed using roller or link chain and built-in leverage to enable heavy loads to be lifted or pulled. They are often used to deadend a conductor during sagging and clipping-in operations and during the tensioning of guys. *Syn:* **chain hoist**; **chain tugger**; **Coffing**; **Coffing hoist**; **puller, drum**.

hoist, double drum: See **puller, two drum, three drum**.

hoist, single drum: See **puller, drum**.

hoist, triple drum: See **puller, two drum, three drum**.

hook, conductor lifting: A device resembling an open boxing glove designed to permit the lifting of conductors from a position above them. It is normally used during clipping-in operations. Suspension clamps are sometimes used for this purpose. *Syn:* **boxing glove**, **conductor hook**, **lifting shoe**, **lip**.

hose clamp: See **clamp, strand restraining**.

hot: See **energized**.

hub: A reference point established through a land survey. A hub or point on tangent (POT) is a reference point for use during construction of a line. The number of such points that are established will vary with the job requirements. Monuments, however, are usually associated with state or federal surveys and are intended to be permanent reference points. Any of these points may be used as a reference point for transit sagging operations, provided that all necessary data pertaining to them is known. It is quite common to establish additional temporary hubs as required for this purpose. *Syn:* **monument, point on tangent.**

insulator saddle: See **lifter, insulator.**

isolated: (1) Physically separated, electrically and mechanically, from all sources of electrical energy. Such separation may not eliminate the effects of electrical induction.

(2) An object that is not readily accessible to persons unless special means for access are used.

Jacob's ladder: See **ladder, rope.**

joint, compression: A tubular compression fitting designed and fabricated from aluminum, copper, or steel to join conductors or overhead groundwires. It is usually applied through the use of hydraulic or mechanical presses. However, in some cases, automatic, wedge, and explosive-type joints are utilized. *Syn:* **conductor splice, sleeve, splice.**

joint, protector: A split sleeve that fits over a conductor compression joint used to protect the joint from bending or damage if the joint must pass through travelers. The joint protector usually has split rubber collars at each end to protect the conductor from damage where it exits at each end of the sleeve.

jumper: (1) The conductor that connects the conductors on opposite sides of a deadend structure. *Syn:* **deadend loop.**

(2) A conductor placed across the clear space between the ends of two conductors or metal pulling lines that are being spliced together. Its purpose, then, is to act as a shunt to prevent workers from accidentally placing themselves in series between the two conductors.

Kellem: See **grip, conductor; grip, woven wire.**

Klein: See **grip, conductor.**

ladder, hook: See **ladder, tower.**

ladder, rope: A ladder having vertical synthetic or manila suspension members and wood, fiberglass, or metal rungs. The ladder is suspended from the arm or bridge of a structure to enable workers to work at the conductor level, hang travelers, perform clipping-in operations, etc. *Syn:* **Jacob's ladder.**

ladder, tower: A ladder complete with hooks and safety chains attached to one end of the side rails. These units are normally fabricated from fiberglass, wood, or metal. The ladder is suspended from the arm or bridge of a structure to enable workers to work at the conductor level, to hang travelers, perform clipping-in operations, etc. In some cases, these ladders are also used as lineperson's platforms. *Syn:* **ladder, hook.**

leader: See **line, pilot.**

leader cone: A tapered cone made of rubber, neoprene, or polyurethane that is used to lead a conductor splice through the travelers, thus making a smooth transition from the smaller diameter conductor to the larger diameter splice. It is also used at the connection point of the pulling line and running board to assist in a smooth transition of the running board over the travelers, thus significantly reducing the shock loads. *Syn:* **nose cone, tapered hose.**

level: See **transit**.

lifter, insulator: A device designed to permit insulators to be lifted in a *string* to their intended position on a structure. *Syn:* **insulator saddle, potty seat**.

lifting shoe: See **hook, conductor lifting**.

line, bull: A high-strength line, normally synthetic fiber rope, used for pulling and hoisting large loads. *Syn:* **bull rope; line, pulling; line, threading**.

line, finger: A lightweight line, normally sisal, manila, or synthetic fiber rope, that is placed over the traveler when it is hung. It usually extends from the ground and passes through the traveler and back to the ground. It is used to thread the end of the pilot line or pulling line over the traveler and eliminates the need for workmen on the structure. These lines are not required if pilot lines are installed when the travelers are hung. *Syn:* **finger rope**.

line, hard: See **line, pulling**.

line, lead: See **line, pilot**.

line, life: See **line, safety life**.

line, light: See **line, pulling**.

line, pilot: A lightweight line, normally synthetic fiber rope, used to pull heavier pulling lines that, in turn, are used to pull the conductor. Pilot lines may be installed with the aid of finger lines or by helicopter when the insulators and travelers are hung. *Syn:* **leader; line, lead; line, straw; P-line; pilot rope**.

line, pulling: A high-strength line, normally synthetic fiber rope or wire rope, used to pull the conductor. However, on reconstruction jobs in which a conductor is being replaced, the old conductor often serves as the pulling line for the new conductor. In such cases, the old conductor must be closely examined for any damage prior to the pulling operations. *Syn:* **line, bull; line, hard; line, light; line, sock; pulling rope**.

line, safety: See **line, safety life**.

line, safety life: A safety device normally constructed from synthetic fiber rope and designed to be connected between a fixed object and the body belt of a worker working in an elevated position when his/her regular safety strap cannot be utilized. *Syn:* **line, life; line, safety; scare rope**.

line, sock: See **line, pulling**.

line, straw: See **line, pilot**.

line, tag: A control line, normally manila or synthetic fiber rope, attached to a suspended load to enable a worker to control its movement. *Syn:* **tag rope**.

line, threading: A lightweight flexible line, normally manila or synthetic fiber rope, used to lead a conductor through the bullwheels of a tensioner or pulling line through a bull wheel puller. *Syn:* **line, bull; threading rope**.

link: See **link, connector**.

link, connector: A rigid link designed to connect pulling lines and conductors together in series. It will not spin and relieve torsional forces. *Syn:* **bullet, connector, link, slug**.

link, swivel: A swivel device designed to connect pulling lines and conductors together in series or to connect one pulling line to the drawbar of a pulling vehicle. The device will spin and help relieve the torsional forces that build up in the line or conductor under tension. *Syn:* **swivel**.

lip: See **hook, conductor lifting**.

live: See **energized**.

load binder: A toggle device designed to secure loads in a desired position. It is normally used to secure loads on mobile equipment. *Syn:* **binder, chain binder**.

load cell: See **dynamometer**.

logger: See **tractor, wheel**.

marker: See **pole, plumb marker**.

monkey tail: See **running board**.

monument: See **hub**.

nose cone: See **leader cone**.

O structure: See **snub structure**.

off-road vehicle: A vehicle specifically designed and equipped to traverse sand, swamps, muddy tundra, or rough mountainous terrain. Vehicles falling into this category are usually all wheel drive or tracked units. In some cases, units equipped with special air bag rollers having a soft footprint are utilized. *Syn:* **all terrain vehicle (ATV), swamp buggy**.

offset marker (pole): See **pole, plumb marker**.

OPGW: Concentric-lay-stranded composite conductor for use as overhead groundwire with telecommunication capability. The conductor is constructed with a central optical fiber core surrounded by helically laid aluminum-clad wires, aluminum alloy wires, galvanized steel wires, or combinations thereof.

outage: See **clearance**.

overhead groundwire (OHGW)(lightning protection): Multiple grounded wire or wires placed above phase conductors for the purpose of intercepting direct strokes in order to protect the phase conductors from the direct strokes. *Syn:* **earth wire, shield wire, skywire, static wire**.

P-line: See **line, pilot**.

payout site: See **site, tension**.

peanut: See **connector, rope**.

permit: See **clearance**.

pilot rope: See **line, pilot**.

platform: See **platform, aerial**.

platform, aerial: A device designed to be attached to the boom tip of a crane or aerial lift and support a worker in an elevated working position. Platforms may be constructed with surrounding railings that are fabricated from aluminum, steel, or fiber reinforced plastic. Occasionally, a platform is suspended from the load line of a large crane. *Syn:* **cage, platform.**

platform, lineperson's: A device designed to be attached to a wood pole or metal structure, or both, to serve as a supporting surface for workers engaged in deadending operations, clipping-in, insulator work, etc. The designs of these devices vary considerably. Some resemble short cantilever beams, others resemble swimming pool diving boards, and still others as long as 40 ft (12 m) are truss structures resembling bridges. Materials commonly used for fabrication are wood, fiberglass, and metal. *Syn:* **Baker board, D-board, deadend board, deadend platform, diving board.**

plumb mark: A mark placed on the conductor located vertically below the insulator point of support for steel structures and vertically above the pole center line at ground level for wood pole structures used as a reference to locate the center of the suspension clamp.

pocketbook: See **grip, conductor.**

point on tangent: See **hub.**

pole, plumb marker: A small diameter, lightweight pole with a marking device attached to one end, having sufficient length to enable a worker to mark the conductor directly below him/her from a position on the bridge or arm of the structure. This device is utilized to mark the conductor immediately after completion of sagging. *Syn:* **marker, offset marker (pole).**

potty seat: See **lifter, insulator.**

powder: See **explosives.**

primacord: See **explosives.**

puller: See **puller, bullwheel.**

puller, bullwheel: A device designed to pull pulling lines and conductors during stringing operations. It normally incorporates one or more pairs of urethane or neoprene-lined, power-driven, single or multiple groove bullwheels in which each pair is arranged in tandem. Pulling is accomplished by friction generated against the pulling line that is reeved around the grooves of a pair of the bullwheels. The puller is usually equipped with its own engine, which drives the bullwheels mechanically, hydraulically, or through a combination of both. Some of these devices function as either a puller or tensioner. *Syn:* **puller.**

puller, drum: A device designed to pull a conductor during stringing operations. It is normally equipped with its own engine, which drives the drum mechanically, hydraulically, or through a combination of both. It may be equipped with synthetic fiber rope or wire rope to be used as the pulling line. The pulling line is payed out from the unit, pulled through the travelers in the sag section, and attached to the conductor. The conductor is then pulled in by winding the pulling line back onto the drum. This unit is sometimes used with synthetic fiber rope acting as a pilot line to pull heavier pulling lines across canyons, rivers, etc. *Syn:* **hoist; hoist, single drum; tugger; winch, single drum.**

puller, reel: A device designed to pull a conductor during stringing operations. It is normally equipped with its own engine, which drives the supporting shaft for the reel mechanically, hydraulically, or through a combination of both. The shaft, in turn, drives the reel. The application of this unit is essentially the same as that for the drum puller. Some of these devices function as either a puller or tensioner. (See **puller, drum.**)

puller, two drum, three drum: The definition and application for this unit is essentially the same as that for

the drum puller. It differs in that this unit is equipped with two or three drums and thus can pull one, two, or three conductors individually or simultaneously. (See **puller, drum**.) *Syn:* **hoist, double drum; hoist, triple drum; winch, double drum; winch, three drum; winch, triple drum; winch, two drum; tugger**.

pulley: See **sheave**.

pulling rope: See **line, pulling**.

pulling vehicle: Any piece of mobile ground equipment capable of pulling pilot lines, pulling lines, or conductors. However, helicopters may be considered as a pulling vehicle when utilized for the same purpose.

pull setting: See **sag section**.

Quadrex: See **explosives**.

rack, traveler: A device designed to protect, store, and transport travelers. It is normally designed to permit efficient use of transporting vehicles, spotting by helicopters on the line, and stacking during storage to utilize space. The exact design of each rack is dependent upon the specific travelers to be stored. *Syn:* **dolly car**.

reel setup: See **site, pull; site, tension**.

reel stand: A device designed to support one or more conductor or groundwire reels having the possibility of being skid, trailer, or truck mounted. These devices may accommodate rope or conductor reels of varying sizes and are usually equipped with reel brakes to prevent the reels from turning when pulling is stopped. They are used for either slack or tension stringing. The designation of reel trailer or reel truck implies that the trailer or truck has been equipped with a reel stand (jacks) and may serve as a reel transport or *payout* unit, or both, for stringing operations. Depending upon the sizes of the reels to be carried, the transporting vehicles may range from single-axle trailers to semitrucks with trailers having multiple axles. *Syn:* **reel trailer, reel transporter, reel truck**.

reel trailer: See **reel stand**.

reel transporter: See **reel stand**.

reel truck: See **reel stand**.

red head: See **ground, personal**.

restriction: See **clearance**.

retarder: See **tensioner, bullwheel**.

rider structure: See **crossing structure**.

roller: See **sheave**.

roller, hold-down: See **block, hold-down**.

ruling span: A *calculated span length* that will have the same changes in conductor tension due to changes of temperature and conductor loading as will be found in a series of spans of varying lengths between dead-ends.

running board: A pulling device designed to permit stringing more than one conductor simultaneously with a single pulling line. For distribution stringing, it is usually made of lightweight tubing with the forward end

curved gently upward to provide smooth transition over pole crossarm rollers. For transmission stringing, the device is either made of sections hinged transversely to the direction of pull or of a hard nose rigid design, both having a flexible pendulum tail suspended from the rear. This configuration stops the conductors from twisting together and permits smooth transition over the sheaves of bundle travelers. *Syn:* **alligator, bird, birdie, monkey tail, sled.**

safety, conductor: A sling arranged in a vertical basket configuration, with both ends attached to the supporting structure and passed under the clipped-in conductor(s). These devices, when used, are normally utilized with bundled conductors to act as a safety device in case of insulator failure while workers in conductor cars are installing spacers between the subconductors, or as an added safety measure when crossing above energized circuits. These devices may be fabricated from synthetic fiber rope or wire rope.

sag: The distance measured vertically from a conductor to the straight line joining two points of support. Unless otherwise stated, the sag referred to is at the midpoint of the span.

sag board: See **target sag.**

sagger: See **tractor, wheel.**

sag section: The section of line between snub structures. More than one sag section may be required in order to sag properly the actual length of conductor that has been strung. *Syn:* **pull setting, stringing section.**

sag span: A span selected within a sag section and used as a control to determine the proper sag of the conductor, thus establishing the proper conductor level and tension. A minimum of two, but normally three, sag spans are required within a sag section in order to sag properly. In mountainous terrain or where span lengths vary radically, more than three sag spans could be required within a sag section. *Syn:* **control span.**

scare rope: See **line, safety life.**

scope: See **transit.**

self-damping conductor (SDC): ACSR that is designed to control aeolian vibration by integral damping. Trapezoidal aluminum wires and annular gaps are utilized.

set of fives: See **block.**

set if fours: See **block.**

set of sixes: . See **block.**

seven bolt: See **grip, conductor.**

shaped wire compact conductor (TW): ACSR or AAC that is designed to increase the aluminum area for a given diameter of conductor by the use of trapezoidal shaped aluminum wires.

sheave: (1) The grooved wheel of a traveler or rigging block. Travelers are frequently referred to as sheaves. *Syn:* **pulley, roller, wheel, traveler.**

(2) A shaft-mounted wheel used to transmit power by means of a belt, chain, band, etc.

shield were: See **overhead groundwire.**

site marker: See **transit.**

site, pull: The location on the line where the puller, reel winder, and anchors (snubs) are located. This site may also serve as the pull or tension site for the next sag section. *Syn:* **reel setup, tugger setup.**

site, tension: The location on the line where the tensioner, reel stands, and anchors (snubs) are located. This site may also serve as the pull or tension site for the next sag section. *Syn:* **conductor payout station, payout site, reel setup.**

six bolt: See **grip, conductor.**

skidder: See **tractor, wheel.**

Skookum: See **block, snatch.**

skywire: See **overhead groundwire.**

sled: See **running board.**

sleeve: See **joint, compression.**

sleeving trailer: See **splicing cart.**

slip-grip: See **grip, conductor.**

slug: See **link, connector.**

snub: See **anchor.**

snub structure: A structure located at one end of a sag section and considered as a *zero* point for sagging and clipping offset calculations. The section of line between two such structures is the sag section, but more than one sag section may be required in order to sag properly the actual length of conductor that has been strung. *Syn:* **O structure, zero structure.**

sock: See **grip, woven wire.**

spacer buggy: See **conductor car.**

spacer cart: See **conductor car.**

spacing bicycle: See **conductor car.**

splice: See **joint, compression.**

splice, wire rope: The point at which two wire ropes are joined together. The various methods of joining (splicing) wire ropes together include *hand tucked* woven splices, compression splices that utilize compression fittings but do not incorporate loops (eyes) in the ends of the ropes, and mechanical splices that are made through the use of loops (eyes) in the ends of the ropes held in place by either compression fittings or wire rope clips. The latter are joined together with connector links or steel bobs and, in some cases, are rigged *eye to eye*. Woven splices are often classified as short or long. A short splice varies in length from 7 to 17 ft (2 to 5 m) for 0.25 to 1.5 in (6 to 38 mm) diameter ropes, respectively, while a long splice varies from 15 to 45 ft (4 to 14 m) for the same size ropes.

splicing cart: A unit that is equipped with a hydraulic compressor (press) and all other necessary equipment for performing splicing operations on conductor. *Syn:* **sleeving trailer, splicing trailer, splicing truck.**

splicing trailer: See **splicing cart**.

splicing truck: See **splicing cart**.

static wire: See **overhead groundwire**.

steel supported aluminum conductor (SSAC): ACSR with the aluminum wires annealed.

step potential: See **step voltage**.

step voltage: The potential difference between two points on the earth's surface separated by a distance of one pace (assumed to be 1 m) in the direction of maximum potential gradient. This potential difference could be dangerous when current flows through the earth or material upon which a worker is standing, particularly under fault conditions. *Syn:* **step potential**.

stringing: The pulling of pilot lines, pulling lines, and conductors over travelers supported on structures of overhead transmission lines. Quite often, the entire job of stringing conductors is referred to as *stringing operations*, beginning with the planning phase and terminating after the conductors have been installed in the suspension clamps.

stringing block: See **traveler**.

stringing section: See **sag section**.

stringing sheave : See **traveler**.

stringing, slack: The method of stringing conductor slack without the use of a tensioner. The conductor is pulled off the reel by a pulling vehicle and is dragged along the ground, or the reel is carried along the line on a vehicle and the conductor is deposited on the ground. As the conductor is dragged to, or past, each supporting structure, the conductor is placed in the travelers, normally with the aid of finger lines.

stringing, tension: The use of pullers and tensioners to keep the conductor under tension and positive control during the stringing phase, thus keeping it clear of the earth and other obstacles that could cause damage.

stringing traveler: See **traveler**.

suitcase: See **grip, conductor**.

swamp buggy: See **off-road vehicle**.

switching surge: A transient wave of overvoltage in an electrical circuit caused by a switching operation. When this occurs, a momentary voltage surge could be induced in a circuit adjacent and parallel to the switched circuit in excess of the voltage induced normally during steady state conditions. If the adjacent circuit is under construction, switching operations should be minimized to reduce the possibility of hazards to the workmen.

swivel: See **link, swivel**.

T-2^{TM4}: A two-conductor twisted construction designed to control wind-induced motion.

tag rope: See **line, tag**.

⁴T-2 Conductor is a registered trademark of CPI, Consumer Products, Inc., a wholly owned subsidiary of Reynolds Metals Company.

takeup reel: See **winder, reel**.

tapered hose: See **leader cone**.

target: See **target sag**.

target, sag: A device used as a reference point to sag conductors. It is placed on one structure of the sag span. The sagger, on the other structure of the sag span, can use it as a reference to determine the proper conductor sag. *Syn:* **sag board, target**.

threading rope: See **line, threading**.

temporary structure: See **crossing structure**.

tensioner: See **tensioner, bullwheel**.

tensioner, bullwheel: A device designed to hold tension against a pulling line or conductor during the stringing phase. Normally, it consists of one or more pairs of urethane or neoprene-lined, power-braked, single or multiple groove bullwheels in which each pair is arranged in tandem. Tension is accomplished by friction generated against the conductor that is reeved around the grooves of a pair of the bullwheels. Some tensioners are equipped with their own engines, which retard the bullwheels mechanically, hydraulically, or through a combination of both. Some of these devices function as either a puller or tensioner. Other tensioners are only equipped with friction type retardation. *Syn:* **brake, retarder, tensioner**.

touch potential: See **touch voltage**.

touch voltage: The potential difference between a grounded metallic structure and a point on the earth's surface separated by a distance equal to the normal maximum horizontal reach, approximately 3 ft (1 m). This potential difference could be dangerous and could result from induction or fault conditions, or both. *Syn:* **touch potential**.

tractor: See **tractor, crawler; tractor, wheel**.

tractor, crawler: A tracked unit employed to pull pulling lines, sag conductor, level or clear pull and tension sites, and miscellaneous other work. It is also frequently used as a temporary anchor. Sagging winches on this unit are usually arranged in a vertical configuration. *Syn:* **cat, crawler, tractor**.

tractor, wheel: A wheeled unit employed to pull pulling lines, sag conductor, and miscellaneous other work. Sagging winches on this unit are usually arranged in a horizontal configuration. It has some advantages over crawler tractors in that it has a softer footprint, travels faster, and is more maneuverable. *Syn:* **logger, sagger, skidder, tractor**.

transit: An instrument primarily used during construction of a line to survey the route, to set hubs and point on tangent (POT) locations, to plumb structures, to determine downstrain angles for locations of anchors at the pull and tension sites, and to sag conductors. *Syn:* **level, scope, site marker**.

traveler: A sheave complete with suspension arm or frame used separately or in groups and suspended from structures to permit the stringing of conductors. These devices are sometimes bundled with a center drum or sheave and another traveler, and are used to string more than one conductor simultaneously. For protection of conductors that should not be nicked or scratched, the sheaves are often lined with nonconductive or semi-conductive neoprene or nonconductive urethane. Any one of these materials acts as a padding or cushion for the conductor as it passes over the sheave. Traveler grounds must be used with lined travelers in order to establish an electrical ground. *Syn:* **block, dolly, sheave, stringing block, stringing sheave, stringing traveler**.

traveler, hold-down: See **block, hold-down**.

traveler sling: A sling of wire rope, sometimes utilized in place of insulators, to support the traveler during stringing operations. Normally, it is used when insulators are not readily available or when adverse stringing conditions might impose severe downstrains and cause damage or complete failure of the insulators. *Syn:* **choker**.

tri-bundle: See **Bundle, two-conductor, three-conductor, four-conductor, multiconductor**.

Triex: See **explosives**.

tugger: See **puller, drum; puller, two drum, three drum**.

tugger setup: See **site, pull**.

twin-bundle: See **Bundle, two-conductor, three-conductor, four-conductor, multiconductor**.

quad-bundle: See **Bundle, two-conductor, three-conductor, four-conductor, multiconductor**.

uplift roller: A small single-grooved wheel designed to fit in or immediately above the throat of the traveler and keep the pulling line in the traveler groove when uplift occurs due to stringing tensions.

Washington: See **block, snatch**.

Western: See **block, snatch**.

wheel: See **sheave**.

winch, double drum: See **puller, two drum, three drum**.

winch, single drum: See **puller, drum**.

winch, three drum: See **puller, two drum, three drum**.

winch, triple drum: See **puller, two drum, three drum**.

winch, two drum: See **puller, two drum, three drum**.

winder, pilot line: A device designed to payout and rewind pilot lines during stringing operations. It is normally equipped with its own engine, which drives a drum or a supporting shaft for a reel mechanically, hydraulically, or through a combination of both. These units are usually equipped with multiple drums or reels, depending upon the number of pilot lines required. The pilot line is paid out from the drum or reel, pulled through the travelers in the sag section, and attached to the pulling line on the reel stand or drum puller. It is then rewound to pull the pulling line through the travelers. A pilot line winder can be a unit similar to a bull-wheel puller and often has the reelwinder as an integral part of the machine.

winder, reel: A device designed to serve as a recovery unit for a pulling line. It is normally equipped with its own engine, which drives a supporting shaft for a reel mechanically, hydraulically, or through a combination of both. The shaft, in turn, drives the reel. It is normally used to rewind a pulling line as it leaves the bullwheel puller during stringing operations. This unit is not intended to serve as a puller, but sometimes serves this function where only low tensions are involved. *Syn:* **takeup reel**.

wire: See **conductor**.

zero structure: See **snub structure**.

3.2 Cross Reference of Terminology

Common Terminology	Guide Terminology	Common Terminology	Guide Terminology
Aerex	explosives	chain tugger	hoist
alive	energized	Chicago grip	conductor grip
alligator	running board	Chinese finger	woven wire grip
all terrain vehicle (ATV)	off road vehicle	choker	traveler sling
anchor log	anchor	clamping-in	clipping-in
Baker board	lineperson's platform	clip	cable clamp
basket	bucket	clipping	clipping-in
basket	woven wire grip	clock	dynamometer
bicycle	cable car	Coffing	hoist
binder	load binder	Coffing hoist	hoist
bird	running board	come-along	conductor grip
birdie	running board	conductor hook	conductor lifting hook
block	traveler	conductor payout station	tension site
block ground	traveler ground	conductor splice	compression joint
bosun's chair	boatswain's chair	connected	bonded
boxing glove	conductor lifting hook	connector	connector link
brake	bullwheel tensioner	control span	sag span
buffalo	conductor grip	counterpoise	ground grid
bullet	connector link	crawler	crawler tractor
bull line	pulling line	Crescent	conductor grip
bull line	threading line	Crosby	cable clamp
bull rope	bull line	Crosby clip	cable clamp
butt ground	structure base ground	current carrying	energized
cable	conductor	D-board	lineperson's platform
cable binding block	strand restraining clamp	dead	deenergized

Common Terminology	Guide Terminology	Common Terminology	Guide Terminology
cable buggy	conductor car	deadend board	lineperson's platform
cable car	conductor car	deadend loop	jumper
cable trolley	cable car	deadend platform	lineperson's platform
cage	aerial platform	deadman	anchor
cat	crawler tractor	diving board	lineperson's platform
chain binder	load binder	dolly car	traveler rack
chain hoist	hoist	dolly	traveler
double drum hoist	two drum puller	platform	aerial platform
double drum winch	two drum puller	pocketbook	conductor grip
dynamite	explosives	POT	hub
earthwire	overhead groundwire	potty seat	insulator lifter
fertilizer	explosives	powder	explosives
finger rope	finger line	Primacord	explosives
four bolt	conductor grip	pull	sag section
grip	conductor grip	puller	bullwheel puller
ground chain	structure base ground	pulley	sheave
ground electrode	ground rod	pulling rope	pulling line
ground gradient mat	ground grid	quad-bundle	four conductor bundle
ground mat	ground grid	Quadrex	explosives
ground roller	running ground	red head	personal ground
ground set	master ground	reel setup	pull site
ground stick	master ground	reel setup	tension site
ground stick	personal ground	reel trailer	reel stand
guard structure	crossing structure	reel transporter	reel stand
H-frame	crossing structure	reel truck	reel stand
hard line	pulling line	restriction	clearance
hold-down roller	hold-down block	retarder	bullwheel tensioner
hold-down traveler	hold-down block	rider structure	crossing structure