



**SECTION 16100
ELECTRICAL OVERHEAD DISTRIBUTION**

PART 1. GENERAL

- 1.1 These general conditions shall apply to all parts of the Work and are included as part of the Contract or Agreement, unless otherwise noted.
- 1.2 Unless otherwise noted, the OWNER shall furnish the primary materials for the performance of the Contract or Agreement. The OWNER shall provide the CONTRACTOR with written guidance and specifications for the material to be used.
- 1.3 The CONTRACTOR shall furnish all necessary supervision, labor, transportation, equipment, tools, and supplies as required to complete for the performance of the Work.
- 1.4 The Work of CONTRACTOR shall be in accordance with the Contract Documents, Project Plans and Drawings. All Work performed by CONTRACTOR shall be subject to the inspection of OWNER and Resident Project Representative and at the direction of OWNER. A reasonable amount of the Project's total cost will be withheld for any Work not complying with the Contract Documents until defects are corrected.
- 1.5 Wherever and whenever the term "Work" or "Works" is used in the Contract Documents, it shall be understood to include all supervision, supplies, labor, transportation, and equipment. With particular reference to CONTRACTOR, "Work" or "Works" refers to everything that is agreed to be done and furnished by him.
- 1.6 The words, "as directed", "as required", "as permitted", "as allowed", or phrases of the effect or import, as used herein shall mean that the direction, requirement, permission, or allowance of OWNER is intended, and similarly the words "approved", "reasonable", "suitable", "properly", "satisfactorily", or words of like effect and import, unless otherwise particularly specified herein shall mean approved, reasonable, suitable, proper, or satisfactory in the judgment of OWNER.
- 1.7 CONTRACTOR shall in a workmanlike manner furnish all necessary supervision, labor, transportation, equipment, tools, and supplies as required to complete the Overhead Electrical Distribution Work.
- 1.8 CONTRACTOR shall be responsible for attaining all the necessary permits, Tennessee One Calls (TOC), and Traffic Control Plans (TCP) required to complete the Overhead Electrical Distribution Work.

- 1.9 DELIVERY, STORAGE, AND HANDLING: The CONTRACTOR shall visually inspect all materials and electrical equipment before accepting and removing such from the OWNER's warehouse facility. The CONTRACTOR shall alert OWNER's warehouse personnel of any damage or suspected damage to such material before moving or transporting to the Project Site. The CONTRACTOR shall handle and store all material and equipment in a manner, which prohibits damage, defacing, or **theft**. Stored items shall be protected from the environment in accordance with the manufacturer's requirements. Materials and/or equipment damaged, mishandled, or **stolen** by/from the CONTRACTOR personnel shall be replaced at the CONTRACTOR's expense.
- 1.10 The as-built drawings shall be a record of the Work as it is installed by the CONTRACTOR. The drawings shall include all the information as shown on the Project Drawings as well as any deviations, modifications, and changes to the Project Drawings, however minor. CONTRACTOR shall submit one full-sized set of marked up prints fully detailing the as-built conditions.

PART 2. PRODUCTS

- 2.1 All materials, equipment and appurtenances used in Work for the OWNER shall conform to those acceptable by standard publications used in overhead power distribution line construction, and shall supplied new and free from defect. All materials, equipment and appurtenances used in Work for the OWNER shall carry a minimum one (1) year warranty from the Project's completion date.
- 2.2 All items of a given type shall be the products of the same Manufacturer.
- 2.3 Wood Poles shall be pressure treated southern yellow pine and shall meet the specifications for preservatives provided within OWNER Engineering Specification Number B01-209, "Pole, Pressure Treated Southern Yellow Pine – Distribution Type". Wood poles shall be field drilled.
- 2.4 Steel poles shall be hot-dip galvanized, 12 sided structure, consisting of two(2) slip joint components and shall meet the requirements of OWNER equipment specification number, T01-874, "Steel Utility Poles – 2007 NESC Heavy Loading". All steel poles shall be predrilled and conform to hole locations defined within OWNER standard drawing, B-15131, "Steel Pole Specifications – Transmission".
- 2.5 Ductile iron poles shall be centrifugally-cast, seamless ductile iron component and shall meet the requirements of OWNER Engineering Specification Number T01-875. All ductile iron poles shall be predrilled and conform to the hole locations defined within OWNER standard drawing DWG-02580-PDI-D (distribution poles).

- 2.6 Crossarms: all tangent and deadend crossarms shall be fiberglass, rated for extra heavy-duty. Crossarms shall be predrilled and supplied with crush-resistant sleeves.
- 2.7 Conductors and Appurtenances: overhead conductors that are suitable for use on the overhead distribution and transmission system include:
- A. 1590 kcmil, 61 strand AAC, “Coreopsis”, OWNER item No. 175190
 - B. 795 kcmil, 37 strand AA, “Arbutus”, OWNER item No. 170019.
 - C. 4/0 AWG, 7 strand AA, “Oxlip”, OWNER item No. 171900.
 - D. 1/0 AWG, 6/1 stranding ACSR, “Raven”, OWNER item No. 178293.
 - E. 3/8” utility grade steel, 7 strand, OWNER item No. 174805.
 - F. 4/0 Quadruplex, XLP service conductor, “Oldenberg”, OWNER item No. 142679.
 - G. 1/0 Triplex, XLP service conductor, “Murex”, OWNER item No. 142661.
 - H. All-Dielectric Self Supporting (ADSS), 144 Fibers, OWNER item No. 190256.
 - I. Optical Ground Wire (OPGW), 144 Fibers, Owner item No. 189530.
- 2.8 Miscellaneous conductors: miscellaneous sizes and types as required for jumpers, connectors, ties, etc. and handling, holding, tying, re-tying, sagging, etc. as shown on related Work instructions and drawings.
- 2.9 Armor Rods: Preformed line guard type, single support lengths as required by assemblies, sized to conductors, for all tangent and non-tangent locations.
- 2.10 Splices, AAC and ACSR, shall be all 1 – piece full tension automatic or compression type.
- 2.11 All main line connections of AAC or ACSR shall use bolted connections properly sized for conductors as approved. Miscellaneous sizes and types as required for jumpers, connections, ties, etc.
- 2.12 Conductor clamps for AAC and ACSR shall be post, strain, and suspension type, galvanized, sized to fit conductors.
- 2.13 Horizontal insulators shall be polymer type, deadend suspension, rated 25kV, with corrosion resistant boron free fiberglass core, silicone housing, with tongue and clevis per ANSI 52-4.
- 2.14 Vertical post/pin insulators shall be porcelain type, rated 15kV, groove top, F-neck, ANSI class 55-4, radio free pins with 1” lead head. Insulator shall be threaded EET-NEMA, Sky Gray Color.
- 2.15 Fuse cutouts shall be rated 15kV, 100 Amp loadbreak type with an 8000A Interrupting Capacity. The unit shall have 110kV BIL rating with 200A arc chute, tinned eye bolt connectors for connecting #8 AWG through 2/0 AWG.

- 2.16 Lighting arrestors shall be 10 kV, heavy duty distribution class, metal oxide varistor type, with a maximum continuous operating voltage of 8.4kV. The arresters shall meet all the requirements of ANSI standard C62.11 for heavy duty classification.
- 2.17 Fuses shall be Kearney Type QA and Type KS, or owner approved equal.
- 2.18 All pole line hardware shall be hot-dip galvanized per ASTM standards.
- 2.19 Guys and Anchors
- A. Guy strand shall be 3/8" utility grade or 7/16" high strength steel, 7-strand class A, galvanized.
 - B. Guy bonding clamps for anchor rod eyes shall be malleable iron with hot-dip galvanized steel bolts, sized to the rod eye type and guy strand.
 - C. Grounding jumpers shall be #2 AWG soft drawn copper using suitable split bolt connectors.
 - D. Guy deadends shall be Preformed type or automatic (up to 7/16" guy wire).
 - E. Guy attachments at the pole shall be mounted to the back of the deadend assemblies or at their own separate attachment heights (as shown on the Contract Drawings), and shall be able to withstand loads up to 20,000 lbs per guywire.
 - F. Guy wires shall be installed with at least one 54 inch fiberglass guy strain insulator connected at the guy attachment assembly at the pole. Multiple insulators shall be used to achieve increased clearances between energized and non-energized components.
 - G. Anchors shall be solid hub power installed screw type with single or twin helix, for use with 1" nominal size anchor rods up to 36,000 lb ultimate tension strength. The rod shall be selected for the guy load and installed depth and eye nut is selected for the number of guys.
 - H. Pole ground wire shall be a minimum copper-clad steel conductor, 7#9 stranded, unless otherwise noted on Project Drawings. Solid soft drawn copper wire shall be used for grounding jumpers. All connections for pole grounds shall be mechanical type. Ground rods shall be 5/8" x 8', copper-clad or copper-bond.
- 2.20 Gang operated switches shall be rated 1200 Amp, 15 kV and shall meet the requirements set forth in OWNER Equipment Specifications. Solid blade disconnects shall be rated 900 Amp, 15kV and shall meet the requirements of the OWNER Equipment Specifications.



PART 3. EXECUTION

3.1 GENERAL

- A. Electric Line Work will be scheduled only by OWNER's Manager of Electric Overhead Construction, or his designated representative.
- B. CONTRACTOR shall arrange with OWNER's Systems Operation's Dispatching (865/558-2600) for Hold Orders and Caution Orders.
- C. CONTRACTOR shall not "open" or "close" any switch or other device except upon the order of OWNER's Systems Operation's Dispatching.
- D. CONTRACTOR shall notify OWNER's Systems Operation's Dispatching of any abnormal system configurations when terminating work at the end of the work day prior to the CONTRACTOR leaving the Work site. System Operation's Dispatching shall determine whether the abnormal configuration is acceptable under current operating conditions.
- E. CONTRACTOR shall, if possible, notify OWNER's Customer Support Department 3 days in advance of clearances needed.
- F. CONTRACTOR shall not be required to work energized 69kV lines.
- G. CONTRACTOR shall work lines rated 13kV and less when they are energized.
- H. CONTRACTOR shall notify OWNER's Systems Operation's Dispatching immediately of any accident involving CONTRACTOR's work.
- I. CONTRACTOR shall notify OWNER's Systems Operation's Dispatching immediately of any incidental contact with energized equipment resulting in an arc, flash, blown fuse or a momentary interruption of electric service.
- J. CONTRACTOR shall maintain radio communication with OWNER's Systems Operation's Dispatching while performing Work under this Agreement. OWNER will furnish one radio for each of the CONTRACTOR's trucks.

3.2 GENERAL SPECIFICATIONS

- A. The Work shall be completed in a thorough and workmanlike manner and shall conform to the applicable requirements of the National Electric Safety Code. Where local regulations are more stringent or in excess of the NESC minimum requirements the local regulation shall be followed.
- B. The OWNER's Construction Standard Drawings – Overhead Construction Section are intended to establish a standard of construction and to indicate required

clearances. Field installation may vary materially and dimensionally from those shown on the assembly and guide drawings and construction shall be modified, as required, to accommodate the field conditions involved. In these cases, determine the most suitable method of framing while maintaining the general arrangements of circuits and clearances indicated.

3.3 POLES

- A. Handle poles carefully. Do not drop them from transportation vehicles. When spotting poles use large, choice, close-grained poles for transformers, deadends, angles, junctions, crossings, and corner applications. Poles shall be immediately set after hole excavation.
- B. Refer to OWNER Standard drawing DWG-02580-PINFO, "General Pole Setting Information, Distribution and Transmission". The minimum setting depth in soil and rock shall be as defined on the standard drawing.
- C. Setting depth in soil applies where:
 - 1. Poles are set in any type soil.
 - 2. There is a layer of soil more than 2 feet in depth above solid rock.
 - 3. The hole in the solid rock is not substantially vertical or the diameter of the hole at the surface of the rock exceeds approximately twice the diameter of the pole at the same level.
 - 4. On sloping ground, always measure the depth of the hole from the low side of the excavation.
- D. Setting in rock shall apply where:
 - 1. The hole is substantially vertical and approximately uniform in diameter and large enough to permit the use of tamping bars the full depth of the hole.
 - 2. Where there is a layer of soil 2 feet deep or less over solid rock the depth of the hole shall be the depth of the soil plus the rock setting depth.
- E. When setting depths are 6 inches greater than the minimum specified, attention should be given to line grading and clearances.
- F. When backfilling, thoroughly tamp earth around the poles for the full depth of the hole. Manual or mechanical tamping shall be through from the bottom to the top of the hole, and mechanical tamping shall be in maximum 6-inch layers. Bank excess dirt up around the pole and refill to the ground line any settlement that occurs. **On steel poles, do not bank dirt above the protective coating on the pole.**

- G. Dig all holes approximately 8 inches larger than the butt diameter of the pole and at least as large at the bottom as at the top of the hole.
- H. Where rocks, gravel, sand, swampy or mucky type soils are encountered in hole digging, it shall not be used as backfill. Only soil of suitable compactable bearing shall be used. Do not use sod or grassy soil or place foreign objects in the backfill.
- I. Poles shall be set in alignment and plumb with and across the line. Poles set at vertical angles where suspension construction is used shall be offset on the bisector of the angle so that conductors will hang directly over the point of intersection and in line with the tangent in both directions.
- J. When raking is required for angle poles, they shall be raked 1 inch for each 10 feet of pole length.
- K. Where tall poles are used to clear buildings, foreign wire crossings, railroads, and other obstacles, grade the line each way to prevent up strain on pin type insulators. Where practical, set poles in line with existing poles and do not set in locations, which will restrict passage of pedestrians or vehicles.
- L. When drilling of concrete poles is required, drill new holes parallel to existing holes, or in other locations so as to avoid damaging supporting cables in pole.
- M. When drilling ductile iron or steel poles, drill new holes parallel to existing holes. Repair damage to the exterior coating of the pole with a spray on, zinc-rich, cold galvanizing compound.
- N. Any damage to the exterior coating of a ductile iron or steel pole during transport and/or installation shall be corrected with a spray on, zinc-rich, cold galvanizing compound. Any damage to the below grade coating of a ductile iron or steel pole shall be corrected by application of the Manufacturer recommended epoxy or polyurethane compounds. See OWNER's warehouse facility for guidance and resources.

3.4 POLE TOP ASSEMBLIES

- A. Pole top assemblies shall be framed and holes bored so that alternate cross arms face in opposite directions, except at deadends where the cross arms of the last two poles on either side of the deadend shall be on the side facing the deadend. On unusually long spans the cross arms shall be on the side of the pole away from the long span.
- B. Pole top assemblies shall be constructed as per OWNER's Construction Standard Drawings. The top most hole on the pole shall not be used for anything other than support for ridgetop pin assemblies.

- C. Level all cross arms. Those on tangent and deadend construction shall be at right angles or square to the conductors they support. Balance the conductor loading equally between the supports.
- D. Carefully select bolts for proper length. Through-bolts, when installed in a structure, shall extend at least one-half (1/2) inch and not more than two and one-half (2 1/2) inches beyond the nuts.
- E. Eyebolts shall be in line with the strain for all deadends. They shall bisect the line angle for all angles except for deadends. All boltholes shall be in a plane level with the attached hardware.
- F. Do not cut off bolts that are too long. Replace them with proper length bolts.

3.5 INSULATORS

- A. Exercise care in assembling suspension units, in handling and installing insulators. Align suspension units with the bisector of the line angle on vertical construction. Ensure that all cotter keys are in place.
- B. Install horizontal-mounted insulator brackets at right angles to the conductors they support. Adjust insulator with metal shims when located on uneven pole surfaces.
- C. On pin-type insulators, ensure that the insulator has “bottomed out” on the pin threads. In no case shall the insulator be unscrewed so that the conductor will lay in proper alignment inside the groove. Instead, realign the pin on the crossarm. The conductors shall be tied in the top groove of the insulator on tangent poles and on the side of the insulator away from the direction of the strain at angles.

3.6 CONDUCTORS AND APPURTENANCES

- A. Stringing:
 - 1. All poles shall be plumb after stringing conductors.
 - 2. Carefully handle conductor. Do not drag it over sharp objects nor allow it to be stepped upon or run over by vehicles. Avoid kinking, twisting or abrading the conductors in any manner. Inspect the conductor, as it is unreeled, for cuts, abrasions, and other injuries. Remove any faulty sections of conductor and splice the conductor as required.
 - 3. Install the conductor and accessories in accordance with the manufacturer’s recommendation. Pull the conductors over suitable rollers or stringing blocks properly mounted on the pole or cross arm to prevent binding while stringing. All poles shall be plumb before stringing.

4. Conductors shall be strung by controlled-tension method using proper stringing blocks. Conductors larger than 1.0 inches in diameter and ACSR conductors of multiple stranded steel cores shall be strung using neoprene-lined or similar type double bull wheel type blocks. The stringing equipment shall have groove sizes that will in no way damage the conductor, and capable of maintaining preset tensions and pulling speed. Maintain sufficient continuous tension to keep conductors clear of the ground or obstructions that could cause damage to or by the conductor.
5. The tension on any conductor during stringing shall not exceed 50 percent of the ultimate strength of the conductor.
6. When, during the stringing operation, a conductor contacts another conductor, the ground, or some other object which might cause damage, the conductor shall be lowered, wiped clean, and closely inspected by the Resident Project Representative to determine the extent of damage. Depending on the extent of the damage and the length of the damaged section, repairs shall be made by smoothing of the conductor with fine sandpaper or by cutting out the damaged section and splicing.
7. Locate the cable pullers, tensioners, and pulling machines as near midspan as possible. In no case shall the slope of the conductor between the machine and the stringing block at the first structure be steeper than three horizontals to one vertical.
8. When pulling OPGW or ADSS cable the CONTRACTOR shall follow the Manufacturer's instructions and recommendations for pulling blocks, equipment, and cable tensions. 100% of the optical fibers shall be measured by optical time-domain reflectometer (OTDR) technique to characterize attenuation in the fibers prior to initial installation and final termination.

B. Sag Operations and Tests

1. The length of the conductor sagged in one operation shall be limited to the length that can be sagged satisfactorily, or as approved by the Resident Project Representative.
2. Sag in as level and as average a ground span as possible.
3. Sag all conductors in accordance with Sag tables, which will be furnished by OWNER. Where new and existing conductors are strung together, sag both conductors with the sag tables, unless otherwise specified by the Resident Project Representative.

4. The CONTRACTOR shall sag conductors using the Dynamometer Method, by inserting a dynamometer in line with the sagging equipment to verify actual tension of the line.
5. In sagging one reel length, the sag of two spans shall be checked. In sagging lengths of more than one reel, the sag of three or more spans near each end and the middle of the length being sagged shall be checked. The length of the spans used for checking shall be approximately equal to the ruling span. It is OWNER's option to require all spans which exceed the ruling span by 25 percent or more to be checked for sag; and, at sharp vertical angles, the sag shall be checked on both sides of the angle. The following spans are unacceptable for sagging test: Inclined spans, tangent to vertical configurations, deadends, tangent to angles, spans with splices.
6. Sagging shall not be performed when wind and adverse weather conditions prevent satisfactory sagging. Sagging shall not be performed at temperatures below 20 degrees Fahrenheit.
7. The air temperature at the time and place of sagging shall be determined by a certified etched-glass or a highly accurate bimetal thermometer. Record the temperature at which the conductor is sagged and the spans in which sags are measured and furnish this information to OWNER Engineering department.
8. The CONTRACTOR shall verify the electrical clearances to foreign wire crossings or other supports after sagging operations are complete. Record clearances and submit to OWNER Engineering.

C. Clipping In

1. Clipping may begin as soon as the conductor has been sagged. Tape or mark a reference point on the conductor measured from the center of the stringing block location. After clipping-in, verify that the conductor has not moved from its sagging point. Clipping should progress so as to avoid trapping uneven sags between clipped sections.
2. Long spans, inclined spans, and deadend spans shall be clipped in first, so as to minimize conductor movement. At the option of the Resident Project Representative, the CONTRACTOR may be directed to also clip in at the mid-point and one-quarter points of sagging operation.
3. Lifting of the conductors shall be done with a hoist and lifting hook that will not notch or severely bend the conductors. The conductor lifting hook should have the elastomer cover so as to not damage the surface of the conductors. The conductor will creep in adjacent spans.

4. Bundled conductors may be lifted simultaneously by the use of a yoke arrangement supporting the hooks and a single method of lifting.
 5. Conductors shall NOT remain in lifting blocks for more than 72 hours to avoid damage to the conductors or sheaves.
 6. If shown on the Contract Drawings, dampers shall be installed immediately after clipping to prevent possible wind vibration damage.
 7. CONTRACTOR shall remove all facilities and guy attachments down to the first communication line, to include anchors and rods, which are no longer being used as part of the Overhead Distribution System when performing work on existing infrastructure.
- D. Conductors shall be cut out and spliced in any location where damage on the cable occurred. Repair sleeves may be used to repair damaged conductor when the damage is concentrated in a small area or when the number of broken strands is less than 10% of the strands on the outer layer. Any damaged location shall be reported to and reviewed by the Resident Project Representative, prior to repair.

3.7 ANCHORS

- A. Locate anchors as far as practical from street crossings, driveways, crosswalks and footpaths. Provide an anchor of proper holding capacity for load involved. More than one guy may be attached to one rod, provided that the proper size twin or triple eye rod is used and that the guy tensions do not exceed rod or anchor rating.
- B. Install all anchor rods in line with the strain, or guy slope. Do not install anchor rods vertically and then bend or trench them into line. Leave approximately 6 inches of rod exposed above ground, and no more than 12 inches of rod exposed above ground in cultivated fields or distributed soil where rod eye might become covered.
- C. Power-installed screw anchors shall be installed to a predetermined value of torque, which gives a positive indication of the holding capacity required. Each anchor shall be installed such that a holding capacity of 20,000 lbs. is achieved. If not able to achieve this capacity with a 10 inch, double helix screw anchor, the Resident Project Representative shall be consulted to provide a resolution.

3.8 TRANSFORMERS AND LINE PROTECTIVE EQUIPMENT

- A. Handle all equipment carefully. Equipment placed temporarily on the ground shall be on a solid level surface and isolated to prevent injury to equipment and the public.
- B. Install all equipment in accordance with construction drawings and the NESC. Transformers and other equipment shall be installed in a quadrant on the pole that

will not conflict with climbing and working space and maintain a practical position to facilitate services.

- C. Install proper size and type of leads, jumpers and fuses. When changing out an existing transformer, insure the adequacy of existing leads and jumpers. Install the proper fusing as required for the new unit.
- D. CONTRACTOR shall immediately notify OWNER's Systems Operation's Dispatching of any damage to equipment containing oils and/or spills at the Work site.

3.9 HOT LINE CLAMPS, JUMPERS, AND CONNECTORS

- A. Use proper size connectors and only those approved which will cause no galvanic action where conductors are of dissimilar metals. The contact surfaces of clamps and conductors shall be clean and bright. A steel brush shall be the principal cleaning medium. Bolts shall be brought down hard, but the threads shall not be overstressed.
- B. Install hot-line clamps so that they are to the load side of the line, allowing the jumper to be de-energized when the clamp is disconnected from the supply line. Stirrups are to be used on copper wire only.
- C. Allow sufficient, but not excessive slack in jumpers and other leads. The installation shall be neat and uniform in appearance, and in general the jumpers and leads shall run in horizontal and vertical planes with rounded turns. Support all jumpers to prevent excessive movement between supports and to clear all conflicts as required by the NESC.
- D. Install jumper conductors in such a manner as to only require one wedge connection to complete the bridging of conductors on deadend assemblies.
- E. Install connectors in such a manner as to avoid birdcaging of the conductors.

3.10 SPLICES AND TIES

- A. Do not locate a splice within 10 feet of any conductor support. Cut out and re-splice improperly located splices, injured portions, crooked or imperfect splices. Do not leave bent or curved splices in the conductor. There should not be more than 2 splice connections per span of conductor.
- B. Where existing conductors are reworked, splices may be located less than 10 feet from a support or hardware, if sufficient distance is provided for future maintenance; but in no case shall a splice be located within 2 feet of the conductor hardware or supports.

- C. Clean the contact surfaces thoroughly before splicing and carefully follow manufacturer's recommendation. Ensure that the proper die and crimping tool is used and that the proper numbers of crimps are made. Use a suitable inhibitor when splicing or installing connector over aluminum conductor.
- D. Use the Manufacturer's recommended inhibitor when splicing and installing connectors to aluminum conductors. Use a pressure gun with tapered nozzle to inject the inhibitor into splicing sleeves.
- E. Splices and compression connectors on conductors larger than 0.60 inches diameter shall be hydraulically crimped. Automatic splices maybe used, as approved, but only in full tension conductors.
- F. When a bow (non-hex) die is used, the crimping tool is to be rotated 90 degrees between crimps in order to avoid banana bowing of the splice. If a connector bows it shall be cut out and replaced. It shall not be repaired by hammering on it.
- G. Ties shall be of the type and configuration as required for the conductor and the support used, in accordance with the Contract Drawings. Tie wire shall be tightly drawn around the conductor support and armor rod so that no slack space occurs. Tie wires around insulators shall not be criss-crossed.
- H. Pre-formed conductor ties may be used for reworking of energized conductors if approved. Hot line ties shall not be used.

3.11 GROUNDS

- A. Drive ground rods the full length in undisturbed earth a minimum of 8"-10" from the surface of the pole with the top covered at least 3"- 6". Install ground rods at all transformer and equipment locations and at other locations required by the electrical system. Install ground rods with all concrete, steel and ductile iron pole installations.
- B. Interconnect all system and equipment grounds, neutral wires, and lightning protective equipment and attach to a common ground wire. Make at least two continuous connections on all equipment from the frame, case or tank to the multi-grounded system neutral conductor.
- C. On transmission lines where distribution underbuild is present the underbuild system neutral shall be interconnected with the transmission line pole ground wire. In cases where separate pole ground wires are used for the two systems they shall be interconnected both above and below ground.

- D. Sufficiently tighten offset downlead wires to make a secure assembly of uniform appearance. Maintain evenly spaced distance between the offset downlead wire and the adjacent phase conductors.
- E. All pole mounted equipment (lightning arresters, transformers, reclosers, switches, etc.) shall be installed with a #2 Bare Copper (min. size) attachment to the pole ground wire (7#9 Copper-clad conductor).

3.12 GUYS

- A. Provide guys at all points of unbalanced strain in conductor and structures, and at corners, junctions, and deadends. Attach guys to poles at load centers and in accordance with the assembly drawings.
- B. Provide span guys at all locations where down guys cannot be used, at all unbalances on crossarms, and use stub poles where required to obtain proper guying and clearances.
- C. Install each guy centered on the pole without pulling to either side or causing an unequal strain on guy hooks, clamps, or sections of the guy. Neatly sever or clip all guy tails.
- D. Guys shall be bonded to the pole grounding system with minimum #2 copper conductivity jumpers.
- E. Guy wires shall be installed with at least one 54 inch fiberglass guy strain insulator connected at the guy attachment assembly at the pole.

3.13 PHASING CONDUCTORS

- A. Phasing shall be in accordance with the Contract Drawings where indicated. Where phasing is not indicated, the phasing placement and connection shall be as approved by OWNER.
- B. Verify phasing, whether indicated or not, by site review of each source connection at substation. Final phase rotation and placement is the responsibility of the CONTRACTOR.



3.14 AREA RESTORATION

- A. CONTRACTOR shall provide all additional equipment, incidentals, material, and labor required to restore all right-of-way and/or OWNER's customer's properties disturbed by the performance of the Work upon completion of the Work.

END OF SECTION