



# **ELECTRIC EQUIPMENT JOINT USE STANDARDS**

Revision 1 – 4/19/19



*Every companies*

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# Program Overview

## Introduction

This document shall cover anyone desiring to:

1. Attach to KCP&L or Westar Energy (Evergy Companies), hereafter referred to as 'Company', poles
2. Overlash to existing facilities whether owned by proposing tenant or another tenant on Company poles
3. Occupy conduit(s)

A contractor must first have a structural agreement in place with Company. After the agreement is finalized, the proposed tenant must make application via NJUNS. These requirements shall apply to anyone wanting to attach to or occupy Company facilities including all cable operators or telecommunications carriers, and any affiliate of Company. Throughout this document, all types of attachers and their facilities other than Company's will be referred to as tenants, attachers, communications facilities or attacher's facilities.

The attacher must submit, along with each application for pole attachment, the data contained in items 1-3 of the section below entitled "Pole Attachment and Overlapping Application Procedures." Except as otherwise specified, the provisions of this document shall apply to all attachers. All planning cost associated will be the responsibility of the tenant proposing the attachment or overlap.

## Company Joint Use Engineering and Planning Qualifications

The following items are prerequisites for approval by Company of a contractor ('contractor') to perform planning and engineering work in connection with permit applications to attach to Company facilities.

1. Approval of work experience biography(s) for all personnel who will perform pole loading analysis calculations. The biography(s) shall include work experience related to pole loading analysis and joint use. A signature and stamp by a Professional Engineer in good standing is required for all calculations performed by contractor.
2. Agreement to abide by the Company Standards and rules for attachment to Company poles by foreign entities set forth in this document. Company and contractor shall have an in-person item by item review and discussion of the data, pole loading analysis, construction and other requirements contained in KCPL and Westar Standards.
3. Company may, at its option, visit the office of the attaching entity or contractor.
4. Approval of software to be utilized in performing pole loading analysis. The attaching entity or the Company approved contractor shall provide Company a description of the software to be utilized including the version number. If, at any time, the attaching entity or Company approved contractor seeks to utilize different pole loading analysis software, version or programs, approval by Company must first be obtained.
5. Agreement to utilize Company Pole & Facility Data Sheets. Company will provide a data sheet form to be utilized and completed by the attaching entity or the Company approved contractor in submitting field measurements for poles contained in the attaching entity's applications that are to be reviewed by Company or its agent(s). It is recommended but not required that profile and plan sketches of the poles to be reviewed be provided to avoid ambiguities that may arise from the information provided on the data sheets.
6. Successful completion of sample calculations. Company will provide field data information (as typically collected and documented) for six test pole scenarios. Company will provide a completed Pole & Facility Data Sheet for the first scenario. Company requires the contractor to

complete the Pole & Facility Data Sheets for the other five scenarios and provide the results to Company. The completed Pole & Facility Data Sheets should include the pole loading analysis results and remedies for overloaded poles and clearance violations.

7. Company will provide a document concerning the installation and pole loading analysis of steel reinforced wood poles.
8. Agreement to abide by Field Measurement Requirements. Company and the approved contractor will have an in-person meeting to review and discuss the acceptable methods of measuring and collecting field data including:
  - a. Measuring height of pole attachments at the pole. This includes primary, neutral, secondaries, services, equipment, and existing attachments.
  - b. Measuring span lengths of all conductor and cable facilities on the pole.
  - c. Measuring clearances of all conductor and cable facilities above ground (keeping in mind the clearance requirements above roads, alleys, RR tracks, etc.)
  - d. Measuring heading angle of each conductor or cable facility attached to a pole. Discussion will include measuring devices and methods and the limitations around each device/method.
9. Company will provide the attaching entity or the Company approved contractor with Company's Construction Standards, including KCPL and Westar Standards, Company Material Units (detailing construction units listed in the Construction Standards), and pricing estimates for construction costs of typical make-ready and overloaded pole remedies.
10. Company will provide the following supporting information for performing pole loading analysis:
  - a. Known or assumed horizontal and vertical loading of typical Company facilities and other's facilities with ½" of ice and 4lb./sq.-ft wind.
  - b. Known or assumed tension values of typical Company and other's conductors and cables at final sag with NESC Heavy conditions at 150' span. The Company approved contractor is responsible for determining tensions for these conductors and cables at other spans.
  - c. Pole loading analysis program setup parameters used by Company.
11. Construction planning requirements shall include construction instructions per pole indicating work to be performed and new attachments heights.
12. Company and the approved contractor will review Company's mapping system. Company territory maps are available from Company. Electronic versions with Company facility attributes are available if appropriate license agreements are executed.
13. A summary sheet is required with the permit application. The summary will include the total attachments with no make-ready, total make-ready poles with pole heights, total replacement poles for attaching entity, and total Company replacement poles with pole heights. A cost estimate for each category is to be included. Material lists shall be furnished for attaching entity work and Company work separately.
14. Company engineering or its agent(s) will review pole moment calculations included in the completed application permits.

Items above are basic elements of Company's prerequisites for approval of a contractor to perform planning and engineering work in connection with pole permit applications to attach to Company owned distribution poles. Questions can be addressed to the Company's Joint Use Department at (816) 245-3684 for KCPL territory or (785) 575-8303 for Westar territory.

## Pole Attachment and Overlashing Application Procedures

A pole attachment and/or overlash application shall include:

1. One set of marked up Company map depicting the street level route of the proposed attachment to Company poles. To aid in this effort, Company will provide maps of geographic areas under



consideration to the proposed tenant as requested by the proposed tenant. The costs associated with providing maps to the proposed tenant will be paid by the proposed tenant.

2. If the proposed attachment is a new attachment to any Company pole(s) and includes a conductor(s) or cable(s), the proposed tenant must provide diameter, stringing tension (lbs.), and weight per foot of each conductor or cable along with horizontal loading of conductor or cable with  $\frac{1}{2}$ " of ice and 4lb./sq.-ft. wind. If the proposed attachment is an overlash of the tenant's own facility, the proposed tenant must provide overall diameter and overall weight of the conductor or cable bundle along the horizontal loading of conductor or cable with  $\frac{1}{2}$ " of ice with 4 lb./sq-ft wind.
3. Dimensions (height, width, and depth), weights, power requirements (maximum use watts, VARs, and source voltage) of any devices to support the tenant's facilities.
4. Company or approved vendor shall analyze each pole in the application, including the following, at attacher's sole expense, a listing of all existing and proposed facilities on the pole including actual attachment heights above ground (including top of pole). This shall include, but not be limited to, electric power primaries, secondaries and service drops, as well as trunk lines, laterals, and service drops of communication facilities. This shall include span lengths of each facility on the pole, as well as the heading direction (0 to 360 degrees in 5 degree increments, measured clockwise from magnetic north) of run of the facilities. To clarify, a pole line with a line degree change of 0 to 5 degrees shall be recorded as having a line angle of 0 degrees. Typically, a tangent structure pole line will have a 0 degree line angle. Similarly, if a pole line with a line degree change of 6 to 10 degrees shall be recorded as having a line angle of 5 degrees. Field data collected for each pole in the proposed route must be reported and submitted electronically with each application. For the propose of verifying calculations, Company engineers may require detailed field data on randomly selected poles within the route. The detailed field data must be supplied via the Pole & Facility Data Sheet. All information requested on the Pole & Facility Data sheet must be supplied including, but not limited to, a listing of ALL existing attached equipment. Equipment height must be measured from the base of the pose to the topmost pole attachment point (bolt). Conductors and cables will be measured from the base of the pole to the topmost pole attachment point (bolt).
5. Company or approved vendor shall analyze, at attacher's sole expense, each pole in the application, which would include the following: pole height as measured from the base of the pole, type (species), and class as marked on pole. If a pole is reinforced with a pole truss, the attaching company is responsible for collecting the necessary information for performing pole loading analyses on steel reinforced poles. The information necessary to collect includes:
  - Pre-reinforced pole class
  - Reinforced section pole class
  - Height of reinforcing
6. Results of Company pole loading analysis shall be sealed by a Professional Engineer registered in the state of application for each pole in the application. The analysis, completed by Company, shall include pole loading calculations for the final design including proposed attachment or overlash along with any required pole changes, additions, and make-ready work required to fulfil the pole loading and clearance requirements stated by or referenced in this standard. If the pole loading analysis for this scenario results in an overloaded pole, then the results of a pole loading analysis for the existing configuration shall be provided.

All pole loading analyses performed on a steel truss reinforced wood pole shall include two analysis runs per loading scenario, one where the pole is modeled at its pre-reinforced class, and the other where the pole is modeled at its reinforced class. The pole will be considered failed if the loading within the section of the pole above the steel bracing exceeds the pre-reinforced strength of the pole or the loading within the reinforced section of the pole exceeds the reinforced strength of the pole. The pole will be considered acceptable if the loading within the section of the pole above the steel bracing is below the pre-reinforced strength of the pole and the loading within the reinforced section of the pole is below the reinforced strength of the pole.

All guyed poles require a pole loading analysis. When Company load analysis is performed an assumed (3% of rated tensile strength) installed guy tension shall be used. The Pole and Facility Data Sheet will be submitted with percent loading of existing and proposed pole and individual guy stress. If pole is overloaded, a remedy shall be determined stating pole size, number of guys, and necessary guy lead lengths and orientation.

Contact Company Joint Use Department for clarification and examples of any of the above items.

Company requires all foreign attachers to utilize **NJUNS** (The National Joint Utilities Notification System) for both permitting and project notification purposes. The NJUNS ticket types are Pole Attachment Tickets (PA) and Pole Transfer Tickets (PT). Please refer to NJUNS.com for specific detail on gaining access and/or training.

Company currently uses a finite element analysis program called PLS-Pole (Power Line Systems Inc., 918 University Bay Drive, Madison, Wisconsin 53705, (608) 238-2171, Fax 238-9241) to calculate pole moments.

Each pole in the analysis shall be checked for class, guying, and length to determine if horizontal loading, vertical loading, and clearances are acceptable per Company Standards. Note that clearances must be checked first and if they do not meet NESC clearance requirements, then PLS-Pole will be run on the new clearances to determine if the pole class is acceptable. If pole loading or height do not meet pole class or clearance standards, the pole shall be changed to the appropriate pole class and/or height. All costs associated with this work will be paid by the tenant proposing the attachment or overlash to ensure that proper pole strengths meet the NESC. It is the responsibility of the tenant proposing the attachment or overlash to obtain all necessary easements for their facilities, and all costs associated with make ready work. Proof of easements shall be provided upon request.

Once the pole loading analysis is completed, the attacher signs an application approving construction costs, Company shall sign the application where designated "Approved for Construction" and provide a copy to the attacher. Thereafter, following completion of make-ready construction. Company shall sign and issue the permit thus authorizing attachment installation, providing a copy to the attacher. The attacher has up to 14 days to approve the estimate and provide payment.

All costs required to adjust facilities shall be paid by the attaching entity.

All costs associated with the application requiring Company clerical, engineering, and crew costs will be paid by the proposing tenant.

Overlapping third parties must have an overlash agreement in place with the tenant(s) being overlashed. Written consent of the overlash agreement must be provided to Company at the time of application. Each tenant shall install identifying tags on its equipment at every pole for easy identification. Tenants shall install tags at the time tenant's facilities are installed. Identifying tags must be installed on existing tenant facilities. The tags shall be located 2 feet away from a pole on the approaching side of poles on

streets. The tags shall be installed with two cable ties. If tenant fails to install identifying tags, Company may deem the attacher in violation of Company Standards.

Tenant tag number(s) will be assigned by Company electronically after a contract is signed. Company will issue tenant tag numbers to current tenants. New tenants will receive a tenant tag number assignment following a signed contractual agreement with Company. New and existing tenants shall have an assigned tenant tag number prior to installation of its facilities on Company poles. Tenants are responsible for obtaining their own tags. Tenants may use a preferred vendor of choice that can provide tenants tags according to the Tenant Tag Material Specifications (see Appendix D).

If a tenant's facilities are acquired by another entity, the acquiring entity must notify Company of said change. And provide maps and/or plats of acquired assets. The acquiring entity will be given one year from the date of acquisition in which to retag the acquired facilities. If the acquiring entity fails or refuses to retag its facilities within the one-year time allotted, Company may deem the attacher in violation of Company Standards.

Attachments to poles owned by other utilities will require an agreement between the proposed attacher and the pole owner.

Any tenant excavating at the base of an existing wood pole shall, prior to closing the excavation, install an Osmose Pole Wrap in accordance with Osmose installation instructions. All cost incurred for Osmose Pole Wrap will be paid by the tenant performing the excavation. Pricing and quantities can be obtained by Osmose Wood Preserving Inc., 980 Ellicott Street, Buffalo, NY 14209, 1-800-877-7653 x254.

All tenants on Company poles are assigned a positioning order on Company poles. Any new tenant will have a Company assigned position. The position order is from the bottom-up in the communications space on a pole. A physical area on a pole cannot be left unoccupied or reserved by a tenant. Therefore, if a proposing tenant is prepared to make an attachment and its assigned position is currently occupied by another tenant, the proposing tenants would be obligated to pay required make-ready costs necessitated by its proposed attachment, including the cost of rearrangement of existing tenant(s) so that all tenants are in the correct assigned positioning order.

## Clearances

The vertical clearance from supply conductors or equipment to the communications conductors or equipment at the pole shall be 40 inches, up to 8.7 kV line to ground supply voltage.

On all new attachments, the vertical clearance of communications attachments from luminaires and traffic signal brackets shall be 40 inches, whether the bracket is effectively grounded or not. An exception will be made for overlashing attachments meeting all of the following criteria:

- An existing attachment is in place.
- The luminaire or traffic signal bracket is effectively grounded.
- The effectively grounded bracket is 20 inches from the existing communications attachments.
- The PLA indicates the overlashing will not cause the pole to go above capacity.

The vertical clearance from drip loops associated with luminaires and traffic signals shall be 12 inches at the pole.

The vertical clearance from communication to communication at the pole shall be 12 inches.

The vertical clearance from communication to communication midspan shall maintain the clearance at the pole.

The above-ground clearance under NESC Heavy loading for the Kansas City Terminal Railroad shall be 36 ft.

All other communications clearances shall be 6 inches beyond what is required by NESC or other applicable codes.

These clearance requirements shall apply to installations by a tenant or by Company. Any work performed by Company or by the tenant after the initial installation of facilities shall preserve required clearances of all parties on the pole. If at any time after installation of facilities, a tenant becomes aware that one or more of its facilities is not a compliance with applicable clearance requirements, the tenant shall notify Company of the clearance violations and make all reasonable efforts to immediately bring its facilities into compliance. Tenant shall notify Company following its correction of the clearance violations. Tenant shall notify Company if the tenant has reason to believe that the noncompliance has been caused by the action of some party other than the tenant. However, such a belief will not excuse tenant from its obligation to remedy the clearance violations. Company shall also inform the tenant if Company becomes aware that the tenant's facilities are not in compliance with applicable clearance requirements. The tenant will have thirty (30) days to bring its facilities within compliance or Company may deem the attachment in violation of Company Standards.

Any new cable shall be attached to each pole currently in the cable's route and be sagged consistently with other existing facilities in the span to prevent damage to either the cable or the pole by wind displacement of the cable. During construction or deconstruction contractors or companies shall not directly or indirectly influence the sag and tension of Company wire or cause a pole to lean, thus jeopardizing the structural integrity and reliability of its distribution systems.

Poles shall not be boxed in and communication cables shall not be installed on both sides of a pole. Use of equipment brackets, standoffs, crossarms, extension arms, and davit arms are not permitted by attaching entities.

Maximum permissible pole height and class is limited to 65' class 1 poles, standard practice is to move up one pole height and class if additional clearance is needed.

## Guys and Anchors

Tenants are responsible for their own down guys and anchors which shall be installed prior to communication conductors being pulled in. Attachments to Company's anchors is prohibited and will not be allowed. Proof of easements shall be provided upon request.

Insulators are to be installed in all down guys except down guys used for holding insulated head guys.

## Wireless Attachment Devices

Company Joint Use application procedures and specifications apply to installation of wireless attachment devices and antenna.

Information required for wireless attachment applications:

1. Pole identification number
2. Address/ location
3. Plat of proposed work



4. Photo of proposed pole
5. Radio frequency information form
6. RF power output
7. Direction of antenna
8. Aerial construction details. (dimension, weight, connectivity)
9. Maximum power consumption

Only one wireless device (receiver, transmitter, or combination unit) less than 6x12x4 inches will be allowed per pole. Multiple wireless attachers are not permitted on a single pole.

A wireless unit may be attached to a streetlight bracket arm (Appendix C). If attached to the street light bracket arm, the wireless unit must be no more than 3 feet and no less than 6 inches from the pole the bracket arm is mounted to. Maximum weight of communication equipment shall not exceed 15 lbs. when installed on existing street light bracket arm.

Wireless devices must be installed by Company or a Company approved contractor that is approved to work in the supply space.

## Supply and Communications

Amplifiers and equipment other than wireless devices will not be allowed on poles. All communications devices shall have a disconnected switch, which is located at the meter stand. This switch will enable Company authorized workers to disconnect the antennae and the battery backup, thus avoiding RF exposure.

1. A unistrut Meter Stand assembly or an approved pedestal enclosure mounted next to the pole on the ground shall be used.
2. A service application shall be required to provide power to the equipment. An extension may be required if existing facilities are not capable of supplying the required voltage and capacity.
3. Service risers and pole mounted equipment (Appendix C) must be installed by Company or a Company approved contractor that is approved to work in the supply space.
4. Service equipment shall be furnished to the customer.
5. An approved self-contained meter socket shall be furnished by Communication Company.
6. Communication company supply cable shall be in conduit, communications conduit may be in joint trench meeting requirements of Electric Service Standards 10.19.
7. A driven ground is required at each equipment location.
8. Messenger, disconnect, and metal case to power supply shall be connected to the ground with #6SD bare copper bonding wire.
9. Customer's power leads shall extend out of weather head enough for making connection on secondary bus or transformer.

## Pole Top Antenna

Pole top antenna requirements are as follows:

1. The design and mounting requirements of all antennas must be approved by Company Distribution Standards prior to installation.
2. Only one (1) antenna shall be installed per pole.
3. Antenna must be installed by Company or a Company approved contractor that is approved to work in supply space.
4. No work shall be completed in the supply space without prior approval of the Company Operating Authority.
5. All pole locations must be approved by Company prior to installation.

6. All poles must be bucket truck accessible.
7. Antennas should not be installed on equipment poles. Antennas and equipment other than conduit and required supports shall not be installed in the primary zone.
8. The minimum size of all antenna poles will be minimum ANSI class 3. Company Distribution Standards shall be contacted when the height above the ground exceeds 60 feet.
9. The height of all poles used to mount antennas must be increased by a minimum of five (5) feet above the existing pole's height at Attacher's expense.
10. Antenna coax cable must be installed in two (2) inch maximum diameter Sch. 40 PVC conduit. Conduit attachment supports should be installed every five (5) feet. Conduit under one (1) inch may be attached with ground wire molding staples. Riser shall comply with service riser standard found in Appendix C.
11. When required, two (2) RF warning signs must be installed. A sign shall be installed near the pole top at the level where the safe approach distance ends for FCC General Population/uncontrolled power levels. The second sign shall be installed near the base of the pole. These signs should read, "Warning- antenna approach distance is XX feet." The sign should include the antenna owner's name and phone number. When Company work is required within the antenna approach distance, workers will disconnect the RF source.
12. The antenna power source must have a lockable disconnect installed to allow the antenna and battery backup to be de-energized before work is performed within the area designated by the RF Warning signs.
13. Disconnect, meter and antenna boxes must be installed in accordance with drawing for Supply and Communication Equipment in Appendix C.
14. The use of pole top extensions is prohibited.
15. Pole tops must be treated and covered for pole roof preservation.
16. A driven pole ground is required for each antenna pole.
17. If a pole with communications equipment installed is to be replaced, NJUNS will be utilized to notify the attacher to relocate their equipment. If the pole is damaged or must be immediately replaced, the attacher's equipment may be removed to the local Company Service Center and the attacher notified.

## Design Criteria

All pole loading analysis shall be to Grade B construction criteria.

The soil class for anchoring purposes shall be assumed to be Soil Class 6, according to the Chance "Encyclopedia of Anchoring," unless site conditions are known and differ from this assumption.

Any request for attachment to Self-Supporting Structures (Laminated Wood, Steel, Fiberglass, etc.) must be evaluated by the Company.

Midspan poles shall not be used as a make-ready remedy.

## One Touch Make Ready

Company understands the concept of the **One Touch Make-Ready (OTMR)** effort, which will require coordination and pre-approval between the proposed attacher and the existing attachers in order to conduct the rearrangement of existing facilities within the communications space to accommodate the new attachment on Company owned Distribution poles. The OTMR option DOES NOT apply to the supply space.

## Sag/Tension Assumptions

When the observed sag in the field is determined to differ from the values shown in the appropriate sag tables, it is acceptable to use the following assumed design tensions when the new tension value in SAG10 is compared to the sag value observed in the field at the appropriate temperature to ensure the assumption is accurate:

### Primary Wire:

For primary conductors use 100% of the tension value when standard sag is present.

For primary conductors use 50% of the full tension value when the sag is double the standard sag.

For primary conductors use 10% of the full tension value when the sag is significant (reduced tension span).

### Secondary & Service Wire:

For secondary conductors use no more than 30% of the full tension value when standard sag is present.

For secondary conductors use 15% of the full tension value when the sag is double the standard sag normally present.

For secondary conductors use 10% of the tension value when the sag is significant (reduced tension span).

For all service drops use 15% of the full tension value.

Company reserves the right to revise and update this document and supporting reference design and service standards.

## Service Drops

Service Drops (cables extending one span from the final pole to the customer's premises) are for the sole purpose of providing new service to a customer. ATTACHER shall have the right to attach a service drop provided, however, that service drops:

- Are an extension of a previously licensed Attachment and are installed in compliance with NESC and these guidelines.
- Are supported from the attacher's strand measured 24" horizontally from the center of the pole on side closest to the customers attachment point. In no case will the communication drop cross the face of the pole.
- The ATTACHER submits an application for the service drop attachments within 10 days.
- The service drop attachments are subject to a post-installation inspection by Company or its designated inspector to ensure that the attachments comply with NESC and Company Electric Service Standards.

Service drop attachments not reported to Company within 10 days of installation will be treated as unauthorized installations.

## Additional Considerations

### Meters

No electric meters are allowed on Company poles. All meters will need to be in standalone pedestals or in an attachers cabinet on the ground.

### Wi-Fi & Small Cell

Company-owned street light poles were not designed for the additional loading of Wi-Fi & Small Cell antennas, therefore a pole loading analysis would be required prior to mounting antennas to street light poles. A new pole will likely be required to accommodate Wi-Fi or Small Cell antennas. City approval for taller poles will also be required prior to a changeout. Electric service will not be fed from the street light circuit so attacher will be required to cover the cost for dedicated underground service line to a secondary pedestal 10' from the pole.

### Strandmount Equipment

Company must review specs including weight and dimensions for any proposed strandmount equipment.

Company reviews the right to require a sample installation of the proposed equipment at a Company training center before approving new equipment.

Strandmounted equipment must maintain clearances between existing attachers and maintain space for Company employees to climb the pole with fall restraint devices.



## Pole Change-Outs

Company will not be responsible for Pole Change-Outs.

Once a Company pole is removed and facilities transferred, attachments have 10 days to transfer their facilities to the new pole, unless other reasonable mutually acceptable arrangements are made.

## Other

Climbing space and working space shall be maintained in accordance with NESC rules 236 and 237.

All vertical runs installed by tenant shall be placed in conduit and attached to pole using 7" standoff brackets. U-ground and other protective covering are prohibited. Location of tenant risers shall not occupy more than 180° of pole section periphery (See Appendix C).

Horizontal attachments to Company poles must be made by use of a three-bolt suspension clamp with a center trough bolt.

Use of equipment brackets, standoffs, crossarms, extension arms, and davit arms are not permitted by attaching entities.

Communication facilities will not be allowed on temporary Company poles, and poles which are utilized solely for area lights (dusk to dawn).

A 2-inch minimum vertical spacing must be maintained between through bolt holes.

Tenants shall make attachments using existing open bolt holes where available and applicable to meet the clearance requirements stated above. New bolt holes for attachments should only be drilled if necessary. If existing bolt holes cannot be used, the attaching tenant must insert one Osmose brand FLUROD and appropriately sized Osmose treated tapered dowel rod to cap each open end of each bolt hole abandoned from the make-ready work associated with the attachment. Installation of the Osmose FLUROD or treated dowel rods must be made in accordance with Osmose installation instructions. The attaching tenant will pay all costs incurred for Osmose FLUROD and treated dowel rods. Pricing and quantities can be obtained from Osmose Wood Preserving Inc., 980 Ellicott Street, Buffalo, NY 14209, 1-800-877-7653 x254.

Attaching tenants must remove all their out-of-service facilities from Company poles at the time of new attachment or overlash.

All communication messengers shall be bonded to electrical ground a minimum of 4 times per mile.

Pole space and loading capacity may be reserved by Company for future electrical system use as identified in the Company Distribution System Infrastructure Utilization Plan.

# Pole and Facility Data Sheets

Pole ID #	
Pole Height (stamped)	
Pole Class	
Pole Type (S. Pine, Douglas Fir, Cedar, etc.)	
Top of pole height (ft)	
Type of Construction <sup>1</sup>	
Shielded (Y or N)	
Attachment Owner 1	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 2	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

Existing loading (%) <sup>6</sup>	
Loading with attachment (%) <sup>6</sup>	

Attachment Owner 3	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 4	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

Use "Continuation Sheet" for additional attachments

<b>Proposed Attachment Owner</b>	
Wire/Equipment type and size	
Diameter (in.)	
Weight (lbs/ft)	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

**Steel truss reinforced poles** (The unreinforced section is 2 classes lower than the reinforced section, therefore 2 evaluations are required)

Max. % loading above steel (Existing)	
Max. % loading reinforced section (Existing)	
Max. % loading above steel (w/ attachment)	
Max. % loading reinforced section (w/ attach)	

Example: Class 3 pole reinforced with steel to make it a class 1 pole. Evaluate the pole section above the steel at class 3 and evaluate the reinforced section at class 1.

**Remedy for Overloaded Pole or Clearance Violations:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

- Notes:**
1. 8' or 10' xarm, standoffs, crowsfoot, wishbone, double ckt. (vertical or horizontal), 8' or 10' deadend etc.
  2. If equipment is a guy, provide lead length (deadends only)
  3. The bearing is with respect to Magnetic North, therefore the bearing for before and after spans are required on all conductors.
  4. Midspan height required on lowest communications attachment and service drops.
  5. Final tensions under NESC Heavy loading conditions<sup>14</sup> are required on all conductors that have line or pole angles.
  6. Maximum percent pole loading.

# **Pole and Facility Data Sheet (Continuation)**

Date: \_\_\_\_\_

Attachment Owner 5	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 6	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 7	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 8	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 9	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

Attachment Owner 10	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 11	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 12	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 13	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 14	
Wire/Equipment type and size	
Before span length (ft) or Guy lead (ft) <sup>2</sup>	
Before span bearing <sup>3</sup>	
After span length (ft)	
After span bearing <sup>3</sup>	
Attachment height (ft)	
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

## Pole Attachment Cases

### KCP&L Territory

Case 1: Shielded 3-phase w/ 2 attachments (See results at the end of this Section).

- Pole: 45' class3 Southern Pine
- Top of pole @ 38.5'
- Neutral conductor: 3/0 ACSR @ 38.5'
- Primary conductor: 3-phase 477 AA on 8' crossarm @ 32.75'
- 5-bundle cable tv (2-1/2", 2-3/4", & 1-.489") @ 20'
- 2" swb @ 18' (midspan @ 16')
- Before span 250' (all conductors)
- After span 170' (all conductors)
- Proposal: Install 3-bundle cable (2-1/2" & 1-3/4") @ 21'

Case 2: Shielded 3-phase w/ 2 attachments and a steel reinforcing truss

- Pole: 45' class 3 Southern Pine
- Top of pole @ 38.5'
- Neutral conductor: 3/0 ACSR @ 38.5'
- Primary conductor: 3-phase 477 AA on 8' crossarm @ 32.75'
- 20' steel truss install making pole a class 1 pole (below truss)
- 3-bundle fiber optic (2-1/2" & 1-3/4") @ 20'
- 5-bundle cable tv (2-1/2", 2-3/4", & 1-.489") @ 19'
- 2" swb @ 18' (midspan @ 16')
- Before span 230' (all conductors)
- After span 190' (all conductors)
- Proposal: Install 3-bundle fiber optic (2-1/2" & 1-3/4") @ 21'

Case 3: Shielded 3-phase w/ transformer bank, secondary, and 3 attachments

- Pole: 50' class 3 Southern Pine
- Top of pole @ 43'
- Neutral conductor: 3/0 ACSR @ 43'
- Primary conductor: 3-phase 477 AA on 8' crossarm @ 38'
- 3-phase 100 kVA transformer bank @ 30.75'
- 3/0 triplex secondary @ 28'
- 3-bundle fiber optic (2-1/2" & 1-3/4") @ 23'
- 4-bundle cable tv (2-1/2" & 2-3/4") @ 22'
- 2" swb @ 20' (midspan @ 17')
- Before span 265' (all conductors)
- After span 235' (all conductors)
- Proposal: Install 3-bundle fiber optic (2-1/2" & 1-3/4") @ 24'



#### Case 4: Unshielded 3-phase deadend

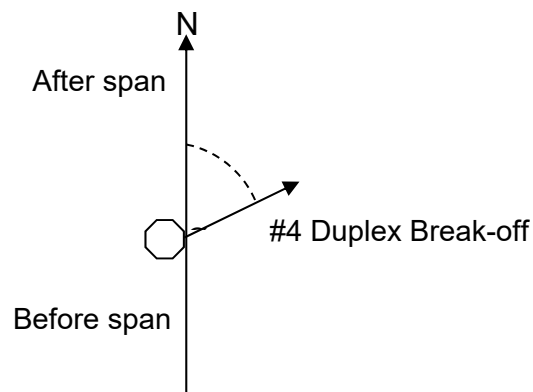
- Pole: 40' class 3 Southern Pine
- Top of pole @ 34'
- Primary conductor: 3-Phase #2 ACSR on 8' deadend arm @ 33.25'
- Neutral conductor: #2 ACSR @ 29.4'
- Down guy @ 32.25', lead @ 32.25' (Initial tension = 3% of rated strength)
- Down guy @ 31.25', lead @ 31.25' (Initial tension = 3% of rated strength)
- Before span 0' (all conductors)
- After span 180' (all conductors)
- Proposal: Install 3-bundle fiber optic (2-1/2" & 1-3/4") @ 18'

#### Case 5: Shielded 3-phase on standoffs. and 5° line angle

- Pole: 50' class 3 Southern Pine
- Top of pole = 43'
- Neutral conductor: #2 ACSR @ 43'
- Primary conductor: #2 ACSR on standoff @ 40'
- Primary conductor: #2 ACSR on standoff @ 36.67' (on opposite side of pole from the other 2 phases)
- Primary conductor: #2 ACSR on standoff @ 33.34'
- Before span 175' (all conductors)
- After span 125' (all conductors)
- After span bearing = 5° and before span bearing = 180° (all conductors)
- Proposal: Install 3-bundle fiber optic (2-1/2" & 1-3/4") @ 20'

#### Case 6: Unshielded 3-phase w/ streetlight and secondaries

- Pole: 40' class 3 Southern Pine
- Top of pole = 34'
- Primary conductor: 3-phase #2 ACSR on 8' crossarm @ 33.25'
- Neutral conductor: #2 ACSR @ 29.4'
- Streetlight @ 27'
- #4 Duplex @ 26.5'
- Above conductors have after span bearing = 360° and before span bearing = 180°
- Before span 200' (conductors above)
- After span 160' (conductors above)
- 75' #4 Duplex break-off @ 26.5' (midspan @ 23'), bearing = 78° (see figure below).
- Proposal: Install 3-bundle cable (2-1/2" & 1-3/4") @ 20'



Shown below are the methods used to determine the vertical and horizontal loads for the conductors of Cases 1 and 5.

### Case #1

3/0 ASCR

- Vertical Load =  $210 \text{ ft} * 1.5 (\text{OCF}) * 0.8538 \text{ lbs/ft} = 268.947 \text{ lbs.}$
- Wind Load =  $210 \text{ ft} * 2.5 (\text{OCF}) * 0.5007 \text{ lbs/ft} = 262.868 \text{ lbs.}$

477 AA (each)

- Vertical Load =  $210 \text{ ft} * 1.5 * 1.2518 \text{ lbs/ft} = 394.317 \text{ lbs.}$
- Transverse Load =  $210 \text{ ft} * 2.5 * 0.5977 \text{ lbs/ft} = 313.793 \text{ lbs.}$

3 bundle cable

- Vertical Load =  $210 \text{ ft} * 1.5 * 1.9744 \text{ lbs/ft} = 621.936 \text{ lbs.}$
- Transverse Load =  $210 \text{ ft} * 2.5 * 1.0000 \text{ lbs/ft} = 525.000 \text{ lbs.}$

5 bundle cable

- Vertical Load =  $210 \text{ ft} * 1.5 * 2.9790 \text{ lbs/ft} = 938.389 \text{ lbs.}$
- Transverse Load =  $210 \text{ ft} * 2.5 * 1.4130 \text{ lbs/ft} = 741.825 \text{ lbs.}$

2" SWB

- Vertical Load =  $210 \text{ ft} * 1.5 * 4.0110 \text{ lbs/ft} = 1263.460 \text{ lbs.}$
- Transverse Load =  $210 \text{ ft} * 2.5 * 1.0833 \text{ lbs/ft} = 568.733 \text{ lbs.}$

### Case #5

The before and after span bearings result in a line angle of  $5^\circ$ , therefore the bi-sector angle is  $2.5^\circ$ .

#2 ASCR (each)

- Vertical Load =  $150 \text{ ft} * 1.5 (\text{OCF}) * 0.5987 \text{ lbs/ft} = 134.715 \text{ lbs.}$
- Transverse Load = Wind + Tension =  $[150 \text{ ft} * 2.5 (\text{OCF}) * 0.4387 \text{ lbs/ft} * \text{Cos } 2.5] + [2 * 1194 \text{ lbs (Tension)} * 1.65 (\text{Tension OCF}) * \text{Sin } 2.5] = 336.216 \text{ lbs.}$

3 bundle cable

- Vertical Load =  $150 \text{ ft} * 1.5 * 1.9744 \text{ ft/lb} = 444.240 \text{ lbs.}$
- Transverse Load = Wind + Tension =  $[150 \text{ ft} * 2.5 * 1.0 \text{ lbs/ft} * \text{Cos } 2.5] + [2 * 2246 \text{ lbs (Tension)} * 1.65 * \text{Sin } 2.5] = 697.941 \text{ lbs.}$

# Pole and Facility Data Sheet

Date: 8/20/2000

Pole ID #	CASE 1
Pole Height (stamped)	45
Pole Class	3
Pole Type (S. Pine, Douglas Fir, Cedar, etc.)	S. PINE
Top of pole height (ft)	38.5
Type of Construction <sup>1</sup>	8' XARM
Shielded (Y or N)	Y
Attachment Owner 1	KCPL
Wire/Equipment type and size	3/0 ACSR
Before span length (ft) or Guy lead (ft) <sup>2</sup>	250
Before span bearing <sup>3</sup>	0
After span length (ft)	170
After span bearing <sup>3</sup>	180
Attachment height (ft)	38.5
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 2	KCPL
Wire/Equipment type and size	3 - 477 AA
Before span length (ft) or Guy lead (ft) <sup>2</sup>	250
Before span bearing <sup>3</sup>	0
After span length (ft)	170
After span bearing <sup>3</sup>	180
Attachment height (ft)	32.75
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

Attachment Owner 3	CATV
Wire/Equipment type and size	2-1/2", 2-3/4" & 1-.489"
Before span length (ft) or Guy lead (ft) <sup>2</sup>	250
Before span bearing <sup>3</sup>	0
After span length (ft)	170
After span bearing <sup>3</sup>	180
Attachment height (ft)	20
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	
Attachment Owner 4	SWB
Wire/Equipment type and size	2"
Before span length (ft) or Guy lead (ft) <sup>2</sup>	250
Before span bearing <sup>3</sup>	0
After span length (ft)	170
After span bearing <sup>3</sup>	180
Attachment height (ft)	18
Midspan height (ft) <sup>4</sup>	16
Final Tension <sup>5</sup>	

se "Continuation Sheet" for additional attachments

<b>Proposed Attachment Owner</b>	NEW
Wire/Equipment type and size	2-1/2" & 1-3/4"
Diameter (in.)	2
Weight (lbs/ft)	0.42
Before span length (ft) or Guy lead (ft) <sup>2</sup>	250
Before span bearing <sup>3</sup>	0
After span length (ft)	170
After span bearing <sup>3</sup>	180
Attachment height (ft)	21
Midspan height (ft) <sup>4</sup>	
Final Tension <sup>5</sup>	

Existing loading (%) <sup>6</sup>	87
Loading with attachment (%) <sup>6</sup>	100

**Steel truss reinforced poles** (The unreinforced section is 2 classes lower then the reinforced section, therefore 2 evaluations are required)

Max. % loading above steel (Existing)	
Max. % loading reinforced section (Existing)	
Max. % loading above steel (w/ attachment)	
Max. % loading reinforced section (w/ attach)	

Example: Class 3 pole reinforced with steel to make it a class 1 pole. Evaluate the pole section above the steel at class 3 and evaluate the reinforced section at class 1.

**Remedy for Overloaded Pole or Clearance Violations:** Replace pole with a 45' cl-1 pole.

- Notes:**
1. 8' or 10' xarm, standoffs, crowsfoot, wishbone, double ckt. (vertical or horizontal), 8' or 10' deadend etc.
  2. If equipment is a guy, provide lead length (deadends only)
  3. The bearing is with respect to Magnetic North, therefore the bearing for before and after spans are required on all conductors.
  4. Midspan height required on lowest communications attachment and service drops.
  5. Final tensions under NESC Heavy loading conditions are required on all conductors that have line or pole angles.
  6. Maximum percent pole loading.

## Setup Parameters for Pole Loading Analysis

Refer to the parameters listed below to perform pole loading analyses. The analyses shall be performed using an approved software program.

1. Load analysis performed per current NESC Grade B construction.
2. Linear analysis is used on un-guyed single structures. Non-Linear analysis is used for guyed single structures. Questions and clarification may be directed to Company as situations arise.
3. Poles (Design stress values pertain to the ANSI O5.1-1992 for Wood Poles – Specifications and Dimensions)
  - Southern Pine; modulus of elasticity = 2278 ksi, design stress = 8 ksi, weight density = 60 lbs/cubic ft.
  - Douglas Fir; modulus of elasticity = 3015 ksi, design stress = 8 ksi, weight density = 40 lbs/cubic ft.
  - Western Red Cedar; modulus of elasticity = 1431 ksi, design stress = 6 ksi, weight density = 60 lbs/cubic ft.
4. Wood Cross Arms
  - 8 ft Douglas Fir crossarm; 3.5" x 4.5", weight = 31 lbs, A-ph = 44", B-ph = 15", & C-ph = 44" from pole center.
  - 10 ft Douglas Fir crossarm; 3.5" x 4.5", weight = 38 lbs, A-ph = 56", B-ph = 15.5", & C-ph = 56" from pole center.
  - 8 ft Douglas Fir deadend; 3.75" x 5.75", weight = 129 lbs, A-ph = 43", B-ph = 0", & C-ph = 43" from pole center.
  - 10 ft Douglas Fir deadend; 3.75" x 5.75", weight = 185 lbs, A-ph = 55", B-ph = 0", & C-ph = 55" from pole center.
  - 26" Douglas Fir crossarm brace; 1" x 1.75", attached to 8' & 10' crossarms 19" from center of pole on each side, attached to pole 15.5" below crossarm.
5. See the list of Additional Cross Arms, Guywire, Standoff Brackets and Anchors (tables attached)
6. Transformer, capacitor bank, & streetlight brackets are modeled as davit arms.
7. Insulators
  - Post insulators (for crossarms attachments); weight = 2 lbs, vertical down capacity = 1500 lbs, vertical up capacity = 1000 lbs, transverse and longitudinal capacities = 1500 lbs. Post 0.5" above crossarm.
  - Clamps (for pole attachments) = 2000 lbs capacity.
8. Dead load factor = 1.65.
9. Wind =  $2.5 * 4 \text{ psf} = 10 \text{ psf}$ , where 2.5 = overload capacity factor (OCF).
10. Wood pole strength factor = 0.65.



## List of Additional Cross Arms, Guywire, Standoff Brackets and Anchors

### 10 ft Fiberglass Crossarms

	KCP&L	Westar
Tangent	Geotek 2000 series, 10' x 4.63"h x 3.63"d, wt = 47 lbs, A = 56", B = 19", & C = 56" from pole center.	Geotek 2000 series, 10' x 4.63"h x 3.63"d, wt = 35 lbs, A = 56", B = 21", & C = 56" from pole center.
Tangent Brace	N/A	
Deadend	Geotek 3000 series, 10' x 3.63"h x 4.63"d, wt = 81 lbs, A = 54", B = 0", & C = 54" from pole center. For 4-wire flat, additional attachments at +/- 19".	Geotek 3000 series, 10' x 3.63"h x 4.63"d, wt = 72 lbs, A = 54", B = 0" on pole 5" above arm, & C = 54" from pole center. For 4-wire flat, additional attachments at +/- 19".

### Guywire (7 strand, class A)

KCP&L	Westar
3/8" HS GSS (before 2005), diam=0.375", wt=0.273 lb/ft, RBS=10,800 lb	3/8" HS GSS (before 2/22/18), diam=0.375", wt=0.273 lb/ft, RBS=10,800 lb
5/16" EHS GSS (after 2005), diam=0.312", wt=0.205 lb/ft, RBS=11,200 lb	3/8" EHS GSS (after 2/22/18), diam=0.375", wt=0.273 lb/ft, RBS=15,400 lb
Legacy 7/16" EHS GSS, diam=0.438", wt=0.399 lb/ft, RBS=20,800 lb	7/16" EHS GSS, diam=0.438", wt=0.399 lb/ft, RBS=20,800 lb
1/2" EHS GSS, diam=0.5", wt=0.517 lb/ft, RBS=26,900 lb	1/2" EHS GSS, diam=0.5", wt=0.517 lb/ft, RBS=26,900 lb

### Standoff Bracket

KCP&L	Westar
16" standoff bracket, wt=3.4 lbs, max. vertical load = 1400 lbs, max. longitudinal load = 1100 lbs, max. transverse load = 2500 lbs.	18" standoff bracket, wt=15.8 lbs, max. vertical load = 2250 lbs, max. longitudinal load = 1400 lbs, max. transverse load = 10,000 lbs.

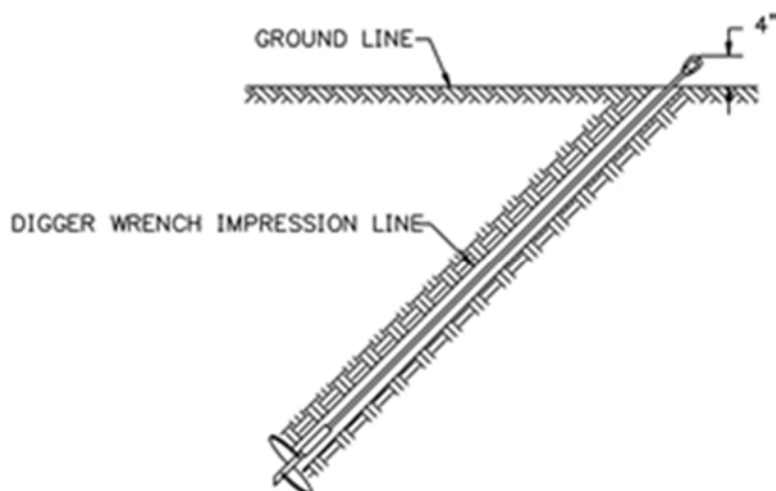
### Anchors

KCP&L	Material Code/Item ID
Square Helical 11-5/16", 1-3/8" shaft, 3/4" rod	407070
Square Helical 8", 1-3/8" shaft, 5/8" rod	407005
Square Helical 10" Double, 1-3/8" shaft, 1" rod	407003
Triple Helix 10"x11-5/16"x13-1/2"	407710
Square Helical 8", 2-1/4" shaft, 3/4" or 1" rod	407713
Square Helical 10" Single, 2-1/4" shaft, 3/4" or 1" rod	407714
Square Helical 10" Double, 1-3/8" shaft, 3/4" or 1" rod	407715

### Anchors

Westar	Material Code/Item ID
6" Screw	7560186
8" Expanding, 3/4" rod	0165400
11 5/16" Helix, 1" rod	0164800
15" Helix, 1" rod	0164900
2-8" Helix, 1" rod	0164700
Expanding Rock, 3/4"x3/4"x53"	0165701
Expanding Rock, 3/4"x3/4"x72"	7560184

See below KCPL & Westar Energy Standards for Anchor/Soil Information



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
4	Gravel; Compact Gravel And Sand Claypan	5/8" ROD *16000	1 - 5/16"
5	Medium Firm Clay; Loose Sand And Gravel; Compact Course Sand	5/8" ROD *16000	1 - 5/16"
6	Soft Plastic Clay; Loose Coarse Sand Clay Silt; Compact Fine Sand	5/8" ROD 15000	1 - 5/16"
7	Fill; Loose Fine Sand; Wet Clays; Silt	5/8" ROD 12000	1 - 5/16"

\* Ultimate strength of rod controls.

**Note:**

1. The holding strength of the anchor given is dependent on either the soil class, anchor diameter, or rod strength.
2. The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum.
3. Expanding anchors shall only be used if soil conditions do not permit the use of screw and high torque anchors, or if installation equipment is unavailable.

**Installation:**

1. Begin anchor in near vertical position.
2. When anchor has a good start, retract boom to correct anchor angle.
3. Avoid excessive uplift. When locking dogs reach ground level, stop installation.
4. Complete installation by installing eye nut.

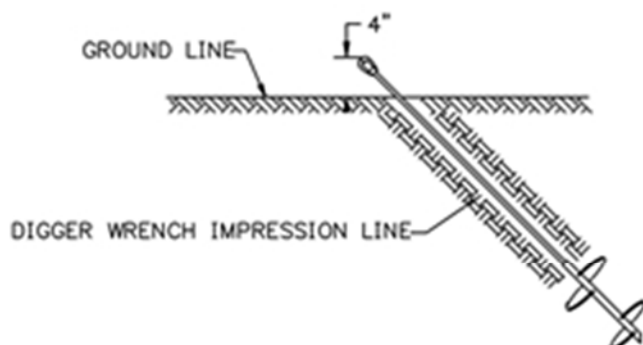
**Additional Equipment:**

1. Anchor rod, nevercreep 1" x 10' - STK# 429-890.
2. Anchor rod, screw type 1" x 10' - STK# 407-706.
3. Anchor rod, screw type 1" x 7' - STK# 407-705.
4. Anchor rod, screw type 3/4" x 7' - STK# 407-703.
5. Anchor rod, screw type extension 1" x 3-1/2' - STK# 407-704.
6. Anchor rod, screw type 5/8" x 3-1/2' - STK# 407-702.

**SCREW ANCHOR  
SINGLE HELIX**

DWG REV: 1/10/08

DWG: 420.1-52



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
2	Dense Clay; Compact Gravel; Dense Fine Sand; Slate; Schist; Sandstone	1" ROD - *36000	3 - 5/16"
		3/4" ROD - *23000	2 - 5/16"
3	Shale; Broken Bed Rock; Hardpan; Compact Clay-Gravel Mixtures	1" ROD - *36000	3 - 5/16"
		3/4" ROD - *23000	2 - 5/16"
4	Gravel; Compact Gravel And Sand Claypan	1" ROD - 33000	3 - 5/16"
		3/4" ROD - *23000	2 - 5/16"
5	Medium Firm Clay; Loose Sand And Gravel; Compact Course Sand	1" ROD - 28000	3 - 5/16"
		3/4" ROD - *23000	2 - 5/16"
6	Soft Plastic Clay; Loose Coarse Sand Clay Silt; Compact Fine Sand	3/4" ROD - 23000	2 - 5/16"
7	Fill; Loose Fine Sand; Wet Clays; Silt	3/4" ROD - 20000	2 - 5/16"

\* Ultimate strength of rod controls.

**Note:**

1. The holding strength of the anchor given is dependent on either the soil class, anchor diameter, or rod strength.
2. The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum.
3. Expanding anchors shall only be used if soil conditions do not permit the use of screw and high torque anchors, or if installation equipment is unavailable.

**Installation:**

1. Begin anchor in near vertical position.
2. When first helix is buried, make angular adjustment for the correct anchor angle.
3. Avoid excessive uplift. When locking dogs reach ground level, stop installation.
4. Complete installation by installing eye nut.

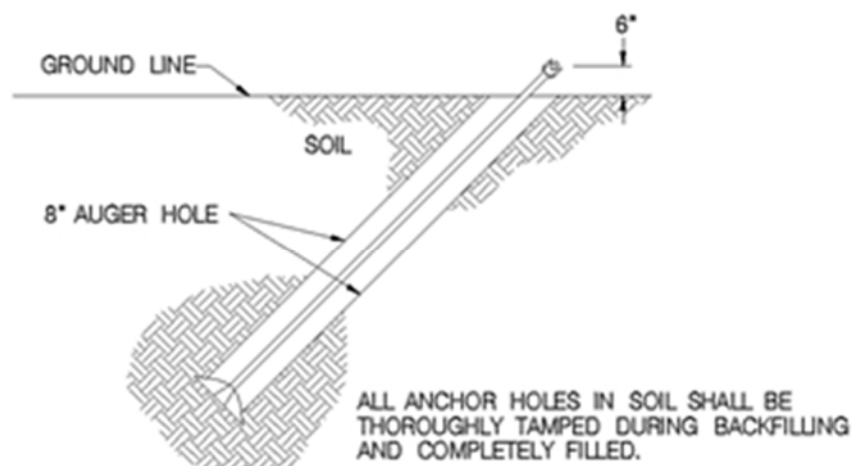
**Additional Equipment:**

1. Anchor, multi-helix screw type guy adapter, double eye - STK# 407-709.
2. Anchor, multi-helix screw type extension, 5' - STK# 407-707.
3. Anchor, multi-helix screw type guy adapter - STK# 407-708.
4. Anchor, multi-helix screw type 3 helix, 10" x 11-5/16" - STK# 407-710.

**SCREW ANCHOR  
DOUBLE HELIX**

DWG REV: 1/9/08

DWG: 420.1-53



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
3	Shale; Broken Bed Rock; Hardpan; Compact Clay-Gravel Mixtures	5/8" ROD *16000	1 - 5/16"
4	Gravel; Compact Gravel And Sand Claypan	5/8" ROD *16000	1 - 5/16"
5	Medium Firm Clay; Loose Sand And Gravel; Compact Course Sand	5/8" ROD *16000	1 - 5/16"
6	Soft Plastic Clay; Loose Coarse Sand Clay Silt; Compact Fine Sand	5/8" ROD 15000	1 - 5/16"
7	Fill; Loose Fine Sand; Wet Clays; Silt	5/8" ROD 10000	1 - 5/16"

\* Ultimate strength of rod controls.

**Note:**

1. The holding strength of the anchor given is dependent on either the soil class, anchor diameter, or rod strength.
2. The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum
3. Expanding anchors shall only be used if soil conditions do not permit the use of screw and high torque anchors, or if installation equipment is unavailable.

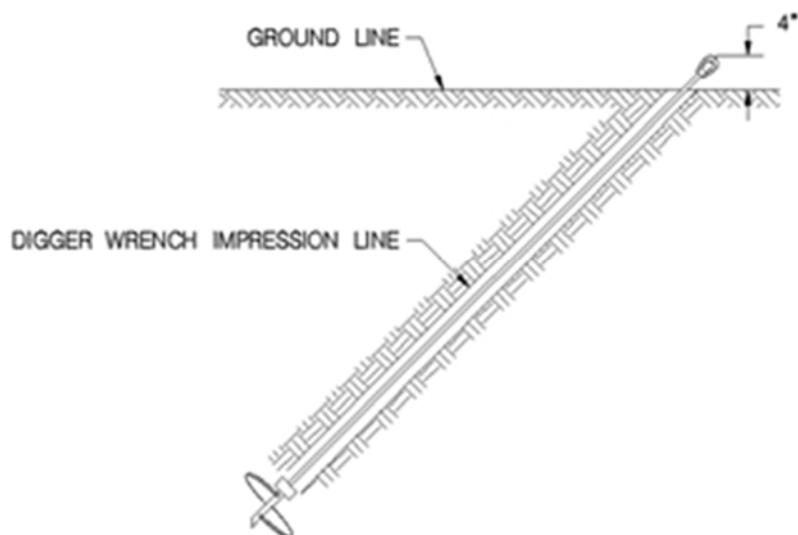
**Installation:**

1. The hole shall be drilled at an angle nearest to the angle the guy will be oriented.
2. Insert the anchor in its closed position to the bottom of the hole to where the eye hole will extend 6" above the ground line when it is expanded.
3. Strike the top of the anchor until the leaves are fully expanded.
4. The effectiveness of this anchor is dependent upon the thoroughness of backfill tamping.

**EXPANDING ANCHOR**

DWG REV: 12/01/03

DWG: 420.1-54



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
2	Dense Clay; Compact Gravel; Dense Fine Sand; Slate; Schist; Sandstone	5/8" ROD *16000	1 - 5/16"
3	Shale; Broken Bed Rock; Hardpan; Compact Clay-Gravel Mixtures	5/8" ROD *16000	1 - 5/16"
4	Gravel; Compact Gravel And Sand Claypan	5/8" ROD *16000	1 - 5/16"

\* Ultimate strength of rod controls.

**Note:**

1. The holding strength of the anchor given is dependent on either the soil class, anchor diameter, or rod strength.
2. The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum.
3. High torque anchors shall only be used in dense soil due to high cost of the anchor.
4. Expanding anchors shall only be used if soil conditions do not permit the use of screw and high torque anchors, or if installation equipment is unavailable.

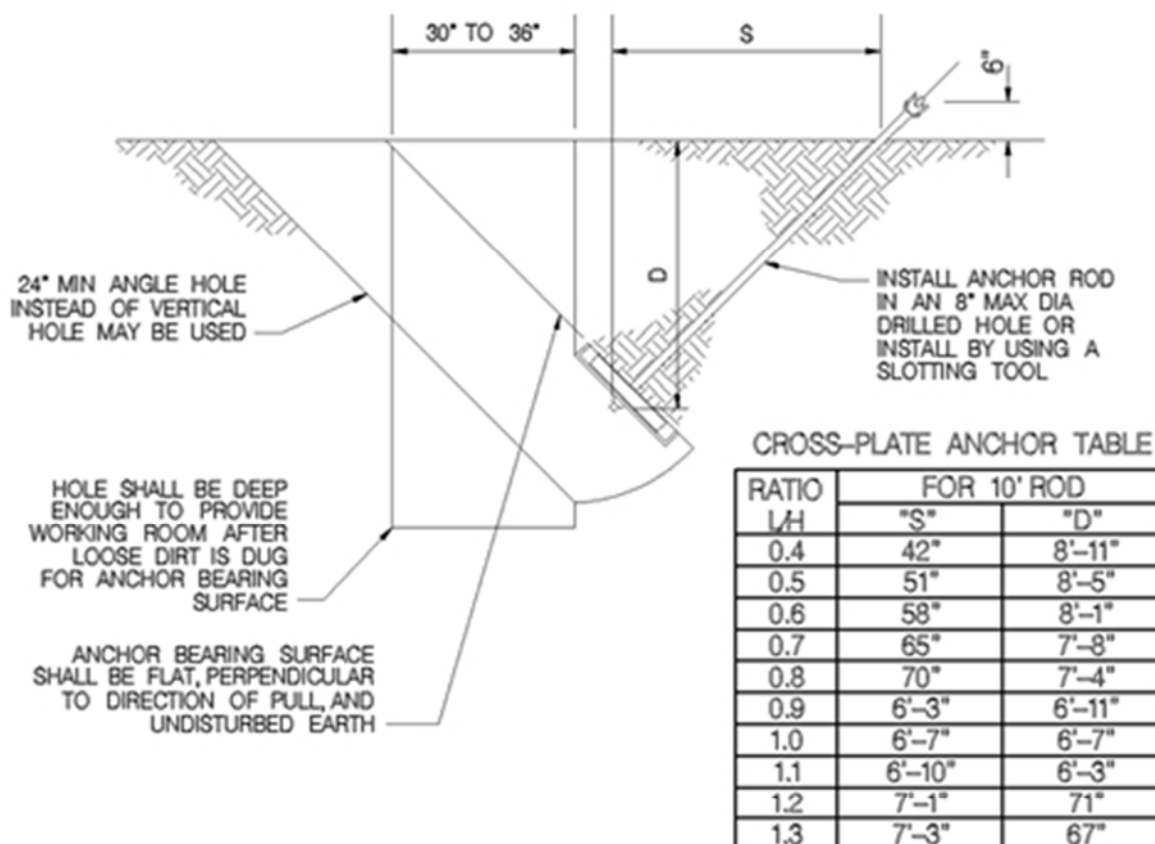
**Installation:**

1. Begin anchor in near vertical position.
2. When anchor has a good start, retract boom to correct anchor angle.
3. Avoid excessive uplift. When locking dogs reach ground level, stop installation.
4. Complete installation by installing eye nut.

**SCREW ANCHOR  
HIGH TORQUE**

DWG REV: 12/01/03

DWG: 420.1-55



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
2	Dense Clay; Compact Gravel; Dense Fine Sand; Slate; Schist; Sandstone	1" ROD	3 - 516"
		34000	1 - 12"
3	Shale; Broken Bed Rock; Hardpan; Compact Clay-Gravel Mixtures	1" ROD	3 - 516"
		34000	1 - 12"
4	Gravel; Compact Gravel And Sand Claypan	1" ROD	3 - 516"
		29000	1 - 12"

Note:

- The holding strength of the anchor given is dependent on either the soil class, anchor dimension, or rod strength.
- The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum.
- Cross plate anchors shall only be used for multiple guy attachments, where soil conditions do not permit the use of a double helix anchor.

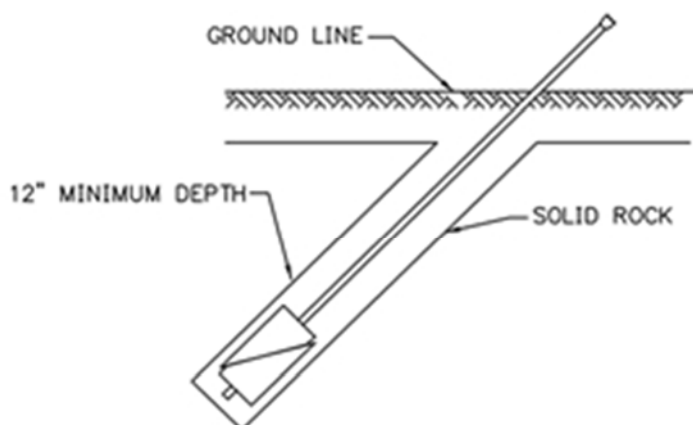
Installation:

- Drill a vertical or angled hole.
- Undercut the hole so that the anchor plate can be installed at a right angle to the guy.
- Cut a narrow rod trench with a trenching tool or a small auger.
- Assemble rod to anchor and install the anchor so that the rod is aligned within 10 degrees of the guy.
- Thoroughly backfill and tamp the anchor hole and rod trench. If soil conditions do not allow for tight compaction, concrete backfill may be used.

CROSS PLATE

DWG REV: 1201/03

DWG: 420.1-56



CLASS	DESCRIPTION OF SOIL	HOLDING STRENGTH (LBS)	MAXIMUM GUYS PER ANCHOR
1	SOLID BED ROCK	1" ROD	3 - 5/16"
		36000	1 - 1/2"
		3/4" ROD	2 - 5/16"
		23000	0 - 1/2"

**Note:**

1. The holding strength of the anchor given is dependent on either the soil class, anchor diameter, or rod strength.
2. The maximum number of guys per anchor is given to ensure that the anchor will not be overloaded when the guy lead lengths are at their minimum.
3. Rock anchors shall only be installed into solid rock.
4. When the rock anchor is installed properly, the strength of the rod controls.
5. For triple eye rod, w/ 1" diameter & 96" length use STK# 407-701.

**Installation:**

1. A hole shall be drilled at least 12" into solid rock, this does not include soil above the rock. Make sure the diameter of the hole is 1/8" larger than the diameter of the anchor. The hole shall be drilled at an angle nearest to the angle the guy will be oriented.
2. Drop the anchor in the hole. Put a bar through the eye of the anchor rod. Turn the rod until the anchor is firmly expanded against the side of the hole.

**ROCK ANCHOR**

DWG REV: 1/10/08

DWG: 420.1-57

**SOIL-ANCHOR HOLDING STRENGTH -POUNDS (STRENGTH FACTOR INCLUDED)**

CLASS	DESCRIPTION OF SOIL	ROCK 3/4" ROD	ROCK 1" ROD	EXPANDING 5/8" ROD	SCREW 5/8" ROD	CROSS PLATE 1" ROD	DOUBLE HELIX 1" ROD
1	SOLID BED ROCK	23000	36000				
2	DENSE CLAY; COMPACT GRAVEL; DENSE FINE SAND; LAMINATED ROCK; SLATE; SCHIST; SANDSTONE				26000	34000	36000
3	SHALE; BROKEN BED ROCK; HARDPAN; COMPACT CLAY-GRAVEL MIXTURES			26500	22000*	34000	36000
4	GRAVEL, COMPACT GRAVEL AND SAND CLAYPAN			22000	18000	29000	33000
5	MEDIUM-FIRM CLAY; LOOSE SAND AND GRAVEL; COMPACT COARSE SAND			18500	14000	24000	28000
6	SOFT-PLASTIC CLAY; LOOSE COARSE SAND; CLAY SILT; COMPACT FINE SAND			15000	10000	19000	23000
7	FILL; LOOSE FINE SAND; WET CLAYS; SILT			10000	6000	14000	20000

\* AUGER HUB

**RECOMMENDED GUY TO ANCHOR SELECTION**

- 1 - 5/16" GUY STRAND PER EXPANDING OR SCREW ANCHOR
- 1 - 5/16" GUY STRAND PER HIGH TORQUE SCREW ANCHOR
- 2 to 3 - 5/16" GUY STRANDS PER PLATE OR ROCK ANCHOR
- 2 to 3 - 5/16" GUY STRANDS PER DOUBLE HELIX ANCHOR
- 1 - 1/2" GUY STRAND PER PLATE OR ROCK ANCHOR
- 1 - 1/2" GUY STRAND PER DOUBLE HELIX ANCHOR

(Additional guy strands may be connected only if actual guy tensions are determined, and soil class and anchor rod strength permits).

**RATED BREAKING STRENGTH IN TENSION (LB)  
(STRENGTH FACTORS INCLUDED)**

**POLE LINE BOLTS**

1/2"	7800
5/8"	12400
3/4"	18350
7/8"	25400

**ANCHOR RODS**

5/8"	16000
3/4"	23000
1"	36000
1-1/2"	70000

**GUY STRAND**

5/16" EHS	10080
1/2" EHS	24210

**POLE EYE PLATE OR HOOK  
USING 5/8" BOLT**


12000
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ANCHORS SHALL HAVE A 5' MINIMUM SPACING.


NESC STRENGTH FACTORS FOR GRADE B CONSTRUCTION	
SUPPORT HARDWARE	1.0
GUY ANCHOR AND FOUNDATION	1.0
GUY WIRE	0.9



GUY WIRE/GRIP

SIZE	GUY WIRE CU NAME	GUY WIRE ITEM ID	GUY WIRE GRADE	MAX WORKING LOAD	PREFORM GRIP CU NAME	PREFORM GRIP ITEM ID
3/8" 	WRGYGS3/8IN	0208700	HIGH STRENGTH	5,890 LBS	GRGYGS3/8IN	0194200
	WRGYGS3/8IN-EHS	8005103	EHS	8,310 LBS		
7/16"	WRGYGS7/16IN	7899629	EHS	11,345 LBS	GRGYGS7/16IN	0194300
1/2"	WRGYGS1/2IN	7563804	EHS	14,600 LBS	GRGYGS1/2IN	7563681

NOTES:

-  3/8" HIGH STRENGTH GUY WIRE (WRGYGS3/8IN) REPLACED BY 3/8" EHS GUY WIRE (WRGYGS3/8IN-EHS), DO NOT BUILD WITH HIGH STRENGTH GUY WIRE, FOR REFERENCE ONLY.

ANCHOR WORKING STRENGTH  
(LBS)

ANCHOR	ANCHOR CU NAME	ANCHOR ITEM ID	SOIL CLASS					ANCHOR RODS		
			3	4	5	6	7	CU NAME	ITEM ID	ROD SIZE
6" SCREW ANCHOR	ANCSGR6IN	7560186			3,930	3,030	1,510	N/A	N/A	
8" EXPAND	ANCTWHX8-WAYASP/ST8IN	0165400	13,900	13,300	10,900	9,000	6,000	RDANC3/4IN8FT	0224100	3/4" X 8'
11 5/16" HELIX	ANCSGHX11IN	0164800	15,100	12,700	10,300	7,900	5,400	RDANCNT1IN7FT	0224400	1" X 7'
15" HELIX	ANCSGHX15IN	0164900	18,100	15,700	13,900	10,900	8,400	RDANCNT1IN7FT	0224400	1" X 7'
2-8" HELIX	ANCTWHX8IN	0164700	20,000	16,300	13,000	9,600	6,000	RDANCNT1IN7FT	0224400	1" X 7'
ROCK EXPANDING	ANCRCK1-3/4IN3/4IN53IN	0165701	WHEN SET 12" DEEP IN SOLID					N/A	N/A	3/4" X 53"
ROCK EXPANDING	ANCRCK1-3/4IN3/4IN72IN	7560184	ROCK, ANCHORS HOLD 13,900 POUNDS					N/A	N/A	3/4" X 53"

CLASS 3 - SHALE; BROKEN BEDROCK; HARDPAN; COMPACT CLAY-GRAVEL MIXTURES, PROBE VALUE - 500 TO 600 IN-LBS.

CLASS 4 - GRAVEL; COMPACT GRAVEL AND SAND; CLAYPAN, PROBE VALUE - 400 TO 500 IN-LBS.

CLASS 5 - MEDIUM-FIRM CLAY; LOOSE SAND AND GRAVEL; COMPACT COARSE SAND, PROBE VALUE - 300 TO 400 IN-LBS.

CLASS 6 - SOFT-PLASTIC CLAY; LOOSE COARSE SAND; CLAYEY SILT; COMPACT FINE SAND, PROBE VALUE - 200 TO 300 IN-LBS.

CLASS 7 - FILL; LOOSE FINE SAND; WET CLAYS; SILT, PROBE VALUE - 100 TO 200 IN-LBS.

NOTES:

- SWAMP, MARSH, SATURATED SILT OR HUMUS REQUIRE SPECIAL ANCHORS.
- ALL CONSTRUCTION IS DESIGNED TO MEET GRADE C.

 DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.



8	12/12/16	MCG	HM	RO	WESTAR ENERGY, INC. ALL RIGHTS RESERVED
9	9/22/17	CM	SO	RO	
NO.	DATE	BY	CK	APP	SHEET 1 OF 1

GUYS AND ANCHORS  
WORKING STRENGTH

LCS 5-020 REV 9

# Conductor Data

## KCPL Conductor Data

Legacy KCP&L Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)

Span (ft)	266 ACSR 18/1	477 AA	3/0 ACSR	2 ACSR	3/0 AA	397 ACSR	T-2 4/0	4ACSR	1/0 ACSR	2/0 ACSR	4/0 ACSR	336.4 ACSR	477 ACSR
10	1725	2098	1659	738	803	4197	4179	493	1108	1332	2091	3658	5015
15	1734	2109	1665	744	821	4201	4184	499	1113	1338	2096	3661	5019
20	1743	2123	1672	751	841	4206	4191	508	1119	1346	2103	3666	5024
25	1755	2140	1681	761	863	4212	4200	518	1127	1356	2111	3672	5031
30	1771	2160	1704	771	887	4202	4211	529	1136	1367	2121	3679	5039
35	1787	2184	1704	783	911	4230	4223	542	1150	1381	2133	3687	5049
40	1806	2209	1718	796	936	4240	4238	555	1164	1395	2146	3697	5060
45	1826	2237	1734	810	961	4252	4254	572	1180	1411	2160	3708	5073
50	1848	2266	1750	828	986	4265	4271	589	1197	1428	2176	3719	5086
55	1871	2297	1768	846	1011	4279	4290	607	1215	1447	2193	3732	5101
60	1894	2329	1786	864	1036	4294	4311	624	1234	1465	2211	3746	5117
65	1919	2362	1806	883	1061	4310	4330	642	1253	1485	2230	3760	5135
70	1944	2396	1826	902	1086	4328	4357	659	1272	1505	2249	3776	5153
75	1971	2431	1847	921	1110	4346	4381	677	1292	1526	2270	3792	5172
80	1997	2465	1868	940	1134	4364	4406	694	1313	1547	2291	3809	5192
85	2024	2501	1890	959	1158	4384	4432	711	1333	1568	2313	3827	5213
90	2051	2536	1912	978	1181	4405	4459	728	1354	1590	2335	3846	5235
95	2079	2572	1934	998	1205	4426	4487	745	1374	1612	2357	3865	5257
100	2107	2608	1957	1016	1227	4447	4515	760	1395	1634	2380	3885	5280
105	2134	2644	1980	1035	1250	4470	4545	772	1416	1656	2404	3905	5304
110	2162	2699	2003	1054	1270	4492	4575	785	1437	1678	2428	3926	5328
115	2190	2752	2026	1073	1289	4516	4606	797	1458	1700	2451	3947	5353
120	2218	2803	2050	1091	1308	4540	4637	810	1479	1723	2476	3969	5379
125	2246	2853	2073	1110	1328	4564	4669	822	1499	1745	2500	3991	5405
130	2274	2902	2097	1128	1346	4588	4701	834	1520	1767	2524	4013	5431
135	2302	2949	2120	1146	1365	4613	4734	846	1541	1789	2549	4036	5457
140	2330	2995	2144	1165	1384	4638	4767	858	1561	1812	2574	4059	5484
145	2358	3041	2167	1180	1402	4664	4800	870	1582	1834	2599	4082	5512
150	2386	3085	2191	1194	1420	4689	4834	881	1603	1856	2623	4105	5539
155	2413	3118	2214	1208	1438	4715	4867	893	1623	1878	2648	4129	5567
160	2441	3145	2238	1221	1456	4742	4901	904	1643	1900	2673	4153	5595
165	2468	3172	2261	1235	1474	4768	4935	916	1664	1922	2698	4177	5623
170	2495	3199	2285	1248	1491	4794	4970	927	1684	1944	2723	4201	5652
175	2522	3225	2308	1262	1509	4821	5004	920	1704	1966	2748	4225	5680
180	2549	3252	2331	1275	1520	4847	5039	930	1724	1987	2772	4250	5709
185	2576	3278	2355	1288	1520	4874	5073	930	1743	2009	2797	4274	5738
190	2603	3304	2378	1302	1520	4901	5108	930	1759	2030	2822	4299	5767
195	2629	3331	2401	1315	1520	4928	5143	930	1774	2051	2847	4324	5796
200	2655	3357	2424	1328	1520	4955	5177	930	1789	2073	2871	4348	5825
205	2682	3383	2446	1340	1520	4982	5212	930	1803	2094	2896	4373	5854
210	2708	3409	2469	1353	1520	5009	5247	930	1818	2115	2920	4398	5883
215	2734	3435	2492	1366	1520	5036	5282	930	1837	2136	2945	4422	5913
220	2759	3460	2514	1379	1520	5063	5317	930	1847	2154	2969	4447	5942
225	2785	3486	2537	1391	1520	5090	5351	930	1862	2170	2993	4472	5971
230	2810	3511	2559	1404	1520	5117	5386	930	1877	2186	3017	4497	6000
235	2835	3536	2581	1416	1520	5144	5421	930	1891	2202	3041	4522	6030
240	2861	3562	2604	1425	1520	5171	5455	930	1905	2217	3065	4546	6059
245	2882	3586	2626	1425	1520	5198	5490	930	1920	2233	3089	4571	6088
250	2902	3611	2648	1425	1520	5225	5524	930	1934	2249	3133	4596	6117
255	2921	3636	2669	1425	1520	5252	5559	930	1948	2265	3137	4620	6146
260	2941	3661	2691	1425	1520	5279	5593	930	1962	2280	3160	4645	6175
265	2960	3685	2709	1425	1520	5306	5627	930	1976	2296	3184	4669	6204
270	2980	3709	2726	1425	1520	5332	5661	930	1991	2311	3207	4694	6233
275	2999	3733	2743	1425	1520	5359	5695	930	2004	2327	3231	4718	6262
280	3018	3757	2759	1425	1520	5386	5729	930	2018	2342	3254	4743	6291
285	3037	3781	2776	1425	1520	5412	5763	930	2032	2357	3277	4767	6320
290	3056	3805	2793	1425	1520	5439	5797	930	2046	2373	3300	4791	6349
295	3075	3828	2809	1425	1520	5465	5830	930	2060	2388	3323	4815	6377
300	3093	3851	2826	1425	1520	5491	5864	930	2073	2403	3345	4839	6406
305	3112	3875	2842	1425	1520	5517	5897	930	2087	2418	3368	4863	6434
310	3130	3898	2859	1425	1520	5543	5930	930	2100	2433	3391	4887	6463
315	3149	3920	2875	1425	1520	5569	5964	930	2114	2448	3413	4911	6491
320	3167	3943	2891	1425	1520	5595	5997	930	2127	2463	3435	4935	6519
325	3185	3966	2908	1425	1520	5621	6030	930	2141	2478	3452	4958	6547
330	3205	3988	2924	1425	1520	5647	6062	930	2154	2492	3470	4982	6575
335	3222	4011	2940	1425	1520	5672	6095	930	2167	2507	3488	5006	6603
340	3240	4033	2956	1425	1520	5698	6127	930	2180	2522	3505	5029	6631
345	3257	4055	2972	1425	1520	5723	6160	930	2190	2536	3523	5052	6658
350	3275	4077	2988	1425	1520	5748	6192	930	2190	2551	3540	5075	6686
355	3293	4098	3004	1425	1520	5774	6224	930	2190	2565	3557	5099	6713
360	3310	4120	3020	1425	1520	5799	6256	930	2190	2579	3575	5122	6741
365	3328	4141	3035	1425	1520	5824	6288	930	2190	2594	3592	5145	6768
370	3345	4163	3051	1425	1520	5849	6320	930	2190	2608	3609	5167	6795
375	3363	4180	3067	1425	1520	5873	6351	930	2190	2622	3626	5190	6822
380	3380	4180	3082	1425	1520	5898	6383	930	2190	2636	3643	5213	6849
385	3397	4180	3098	1425	1520	5923	6414	930	2190	2650	3660	5235	6875
390	3414	4180	3113	1425	1520	5947	6445	930	2190	2655	3677	5258	6902
395	3431	4180	3129	1425	1520	5971	6477	930	2190	2655	3694	5280	6929
400	3440	4180	3144	1425	1520	5971	6477	930	2190	2655	3711	5302	6955

Legacy KCP&amp;L Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)

Span (ft)	556 ACSR	#2 ACSR cov	#4 ACSR cov	1/0 AAC	4/0 AAC	336.4 AAC	3/0 AAC cov	1/0 AAC cov	477 AAC cov
10	5795	916	598	525	1009	1546	750	493	1966
15	5801	921	604	542	1028	1557	773	514	1979
20	5806	928	612	561	1050	1571	798	538	1966
25	5814	937	622	582	1073	1588	826	563	2018
30	5823	948	633	603	1097	1608	854	589	2044
35	5834	959	646	625	1123	1631	883	615	2072
40	5846	972	659	647	1149	1656	912	640	2103
45	5859	986	673	669	1176	1683	941	665	2136
50	5874	1001	687	692	1203	1711	970	690	2171
55	5890	1016	702	717	1230	1740	999	714	2206
60	5908	1032	718	741	1257	1770	1027	738	2243
65	5926	1048	736	765	1284	1800	1053	760	2283
70	5946	1065	755	789	1311	1831	1077	781	2326
75	5967	1081	773	809	1337	1863	1100	801	2372
80	5988	1098	791	827	1364	1894	1124	820	2418
85	6011	1117	809	844	1390	1926	1147	840	2464
90	6034	1138	827	861	1416	1958	1169	859	2509
95	6059	1158	845	878	1441	1990	1192	877	2553
100	6084	1178	863	895	1467	2022	1214	895	2596
105	6109	1198	881	911	1491	2054	1236	895	2639
110	6135	1219	898	927	1512	2085	1258	895	2682
115	6162	1239	916	943	1533	2117	1280	895	2723
120	6190	1259	933	959	1554	2157	1301	895	2764
125	6217	1279	947	975	1575	2196	1322	895	2805
130	6246	1299	960	990	1595	2235	1342	895	2845
135	6274	1318	973	995	1616	2272	1363	895	2884
140	6303	1338	986	995	1636	2308	1370	895	2923
145	6333	1357	999	995	1657	2344	1370	895	2961
150	6362	1377	1012	995	1677	2379	1370	895	2998
155	6392	1396	1025	995	1696	2408	1370	895	3035
160	6423	1415	1037	995	1716	2432	1370	895	3072
165	6453	1434	1050	995	1736	2455	1370	895	3101
170	6484	1453	1062	995	1755	2478	1370	895	3129
175	6514	1472	1074	995	1774	2501	1370	895	3157
180	6545	1487	1086	995	1793	2524	1370	895	3185
185	6577	1501	1098	995	1812	2547	1370	895	3213
190	6608	1516	1110	995	1831	2570	1370	895	3240
195	6639	1530	1120	995	1850	2592	1370	895	3268
200	6670	1544	1120	995	1868	2615	1370	895	3295
205	6702	1559	1120	995	1886	2637	1370	895	3322
210	6733	1573	1120	995	1904	2659	1370	895	3349
215	6765	1587	1120	995	1915	2681	1370	895	3375
220	6796	1601	1120	995	1915	2703	1370	895	3402
225	6828	1615	1120	995	1915	2725	1370	895	3428
230	6859	1629	1120	995	1915	2747	1370	895	3454
235	6891	1642	1120	995	1915	2768	1370	895	3480
240	6922	1656	1120	995	1915	2789	1370	895	3506
245	6954	1669	1120	995	1915	2811	1370	895	3531
250	6985	1683	1120	995	1915	2832	1370	895	3557
255	7017	1696	1120	995	1915	2853	1370	895	3582
260	7048	1710	1120	995	1915	2873	1370	895	3607
265	7079	1723	1120	995	1915	2894	1370	895	3631
270	7111	1730	1120	995	1915	2915	1370	895	3656
275	7142	1730	1120	995	1915	2935	1370	895	3680
280	7173	1730	1120	995	1915	2955	1370	895	3705
285	7204	1730	1120	995	1915	2975	1370	895	3729
290	7325	1730	1120	995	1915	2995	1370	895	3752
295	7266	1730	1120	995	1915	2995	1370	895	3776
300	7296	1730	1120	995	1915	2995	1370	895	3799
305	7327	1730	1120	995	1915	2995	1370	895	3823
310	7358	1730	1120	995	1915	2995	1370	895	3846
315	7388	1730	1120	995	1915	2995	1370	895	3869
320	7419	1730	1120	995	1915	2995	1370	895	3891
325	7449	1730	1120	995	1915	2995	1370	895	3910
330	7479	1730	1120	995	1915	2995	1370	895	3910
335	7509	1730	1120	995	1915	2995	1370	895	3910
340	7539	1730	1120	995	1915	2995	1370	895	3910
345	7569	1730	1120	995	1915	2995	1370	895	3910
350	7598	1730	1120	995	1915	2995	1370	895	3910
355	7628	1730	1120	995	1915	2995	1370	895	3910
360	7658	1730	1120	995	1915	2995	1370	895	3910
365	7687	1730	1120	995	1915	2995	1370	895	3910
370	7716	1730	1120	995	1915	2995	1370	895	3910
375	7745	1730	1120	995	1915	2995	1370	895	3910
380	7774	1730	1120	995	1915	2995	1370	895	3910
385	7803	1730	1120	995	1915	2995	1370	895	3910
390	7832	1730	1120	995	1915	2995	1370	895	3910
395	7860	1730	1120	995	1915	2995	1370	895	3910
400	7889	1730	1120	995	1915	2995	1370	895	3910

Legacy KCP&amp;L Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)

Span (ft)	4 Duplex	6 Duplex	1/0 Triplex	2/0 Triplex	3/0 Triplex	#2 Triplex	4 Triplex	336.4 Triplex	1/0 Quad	3/0 Quad	336.4 Quad	8 Awld
10	496	325	1115	1340	1666	744	498	1566	1118	1818	1699	3474
15	507	337	1127	1354	1679	756	510	1598	1134	1834	1748	3475
20	520	351	1143	1372	1698	773	526	1639	1154	1855	1807	3477
25	535	367	1162	1393	1721	792	543	1686	1178	1880	1873	3479
30	552	389	1184	1418	1747	813	562	1796	1204	1908	1940	3482
35	570	408	1210	1446	1775	835	582	1903	1232	1939	2009	3486
40	592	428	1238	1475	1805	859	605	1999	1262	1971	2077	3490
45	614	448	1267	1506	1837	883	629	2068	1294	2005	2143	3494
50	636	468	1297	1538	1869	907	652	2107	1328	2040	2208	3499
55	658	486	1328	1571	1903	932	676	2147	1361	2075	2270	3505
60	680	500	1358	1604	1937	959	699	2187	1395	2110	2331	3511
65	702	514	1389	1638	1972	985	722	2227	1428	2146	2393	3517
70	724	529	1420	1671	2008	1012	744	2267	1462	2181	2456	3524
75	745	543	1451	1705	2044	1038	765	2307	1495	2217	2515	3532
80	764	556	1482	1738	2080	1064	782	2346	1527	2252	2572	3540
85	780	570	1512	1772	2166	1089	799	2385	1559	2287	2625	3548
90	795	583	1543	1805	2152	1115	816	2423	1591	2322	2676	3557
95	811	595	1573	1838	2187	1140	832	2461	1623	2356	2724	3566
100	826	595	1602	1870	2223	1164	848	2498	1654	2390	2770	3575
105	842	595	1632	1903	2258	1189	864	2534	1684	2424	2814	3585
110	857	595	1661	1975	2293	1208	880	2570	1714	2457	2855	3595
115	872	595	1690	1966	2327	1227	895	2605	1744	2489	2895	3606
120	886	595	1718	1998	2362	1246	910	2640	1773	2522	2933	3617
125	901	595	1746	2028	2396	1265	925	2674	1802	2553	2968	3628
130	915	595	1774	2059	2429	1283	930	2707	1730	2585	3002	3639
135	929	595	1799	2089	2462	1301	930	2739	1853	2616	3035	3651
140	930	595	1821	2119	2495	1319	930	2771	1876	2646	3066	3663
145	930	595	1842	2149	2527	1337	930	2803	1898	2676	3095	3676
150	930	595	1864	2178	2559	1354	930	2833	1920	2705	3124	3688
155	930	595	1885	2206	2591	1372	930	2863	1942	2734	3151	3701
160	930	595	1906	2234	2622	1389	930	2893	1964	2762	3176	3714
165	930	595	1927	2257	2653	1406	930	2921	1986	2789	3201	3728
170	930	595	1947	2280	2683	1423	930	2950	2007	2816	3224	3741
175	930	595	1968	2303	2713	1425	930	2977	2028	2843	3247	3755
180	930	595	1988	2326	2743	1425	930	3004	2049	2869	3268	3769
185	930	595	2008	2348	2772	1425	930	3031	2070	2895	3289	3783
190	930	595	2028	2370	2801	1425	930	3057	2090	2921	3308	3798
195	930	595	2048	2392	2830	1425	930	3075	2110	2947	3310	3812
200	930	595	2067	2414	2858	1425	930	3075	2130	2972	3310	3827
205	930	595	2086	2436	2884	1425	930	3075	2150	2998	3310	3842
210	930	595	2106	2457	2908	1425	930	3075	2169	3023	3310	3857
215	930	595	2125	2479	2932	1425	930	3075	2188	3048	3310	3872
220	930	595	2143	2500	2955	1425	930	3075	2190	3072	3310	3887
225	930	595	2162	2521	2978	1425	930	3075	2190	3096	3310	3903
230	930	595	2181	2541	3001	1425	930	3075	2190	3119	3310	3918
235	930	595	2190	2562	3024	1425	930	3075	2190	3142	3310	3934
240	930	595	2190	2582	3047	1425	930	3075	2190	3164	3310	3949
245	930	595	2190	2602	3069	1425	930	3075	2190	3186	3310	3965
250	930	595	2190	2622	3092	1425	930	3075	2190	3208	3310	3981
255	930	595	2190	2642	3114	1425	930	3075	2190	3229	3310	3997
260	930	595	2190	2655	3136	1425	930	3075	2190	3250	3310	4013
265	930	595	2190	2655	3157	1425	930	3075	2190	3271	3310	4029
270	930	595	2190	2655	3179	1425	930	3075	2190	3291	3310	4045
275	930	595	2190	2655	3200	1425	930	3075	2190	3311	3310	4062
280	930	595	2190	2655	3221	1425	930	3075	2190	3331	3310	4078
285	930	595	2190	2655	3242	1425	930	3075	2190	3351	3310	4094
290	930	595	2190	2655	3263	1425	930	3075	2190	3370	3310	4111
295	930	595	2190	2655	3283	1425	930	3075	2190	3389	3310	4127
300	930	595	2190	2655	3304	1425	930	3075	2190	3395	3310	4144
305	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4160
310	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4177
315	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4193
320	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4210
325	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4227
330	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4243
335	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4260
340	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4277
345	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4293
350	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4310
355	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4327
360	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4344
365	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4360
370	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4377
375	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4394
380	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4411
385	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4427
390	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4444
395	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4461
400	930	595	2190	2655	3310	1425	930	3075	2190	3395	3310	4478

Legacy KCP&amp;L Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)

Span (ft)	3/8 EHS	6A Cwld	1/0 Cu	2/0 Cu	3/0 Cu	4/0 Cu	#4 Cu	6Cu	10 Cwld	250 Cu	500 Cu	795 AAC
10	3851	651	1194	1488	1845	2295	494	331	1042	2885	5480	3481
15	3852	657	1201	1495	1852	2302	505	344	1044	2860	5485	3487
20	3853	665	1212	1505	1862	2311	519	359	1048	2868	5494	3496
25	3855	675	1224	1517	1873	2322	535	375	1052	2878	5504	3509
30	3857	686	1239	1531	1887	2336	553	392	1057	2891	5516	3521
35	3860	698	1256	1548	1903	2352	572	410	1063	2905	5531	3537
40	3867	712	1274	1565	1921	2369	591	428	1070	2920	5547	3555
45	3866	726	1294	1585	1940	2388	610	446	1077	2938	5565	3576
50	3870	740	1314	1605	1960	2409	630	463	1085	2957	5585	3597
55	3874	756	1335	1626	1982	2431	650	481	1094	2977	5607	3621
60	3878	771	1357	1649	2004	2454	669	498	1103	2998	5630	3645
65	3883	787	1380	1672	2028	2478	689	515	1113	3021	5634	3672
70	3888	803	1403	1695	2052	2502	708	531	1123	3044	5680	3966
75	3894	819	1426	1719	2077	2528	727	544	1134	3069	5707	3728
80	3900	835	1449	1743	2102	2554	746	557	1144	3094	5735	3757
85	3906	851	1472	1768	2127	2581	765	570	1156	3120	5763	3787
90	3912	867	1496	1792	2153	2607	784	583	1167	3146	5794	3818
95	3919	884	1519	1817	2179	2635	802	595	1179	3173	5825	3849
100	3926	900	1543	1842	2205	2662	820	608	1191	3200	5856	3881
105	3934	916	1566	1866	2231	2690	838	620	1203	3227	5888	3913
110	3942	932	1589	1891	2257	2718	856	632	1215	3255	5920	3946
115	3950	948	1613	1916	2284	2745	874	640	1227	3283	5953	3979
120	3958	964	1636	1940	2310	2773	891	640	1240	3311	5987	4013
125	3967	979	1659	1965	2336	2801	908	640	1252	3339	6020	4046
130	3976	995	1681	1989	2362	2829	925	640	1265	3367	6054	4080
135	3985	1011	1704	2013	2388	2857	942	640	1278	3396	6088	4114
140	3994	1026	1727	2038	2414	2884	957	640	1291	3424	6122	4148
145	4004	1041	1749	2061	2439	2912	970	640	1304	3452	6157	4182
150	4014	1057	1771	2085	2465	2939	970	640	1317	3480	6191	4215
155	4024	1072	1793	2109	2490	2966	970	640	1330	3509	6225	4249
160	4035	1087	1814	2132	2515	2993	970	640	1343	3537	6260	4283
165	4045	1102	1836	2155	2540	3020	970	640	1356	3565	6294	4317
170	4056	1117	1857	2178	2565	3047	970	640	1369	3592	6328	4351
175	4067	1132	1879	2201	2590	3073	970	640	1382	3620	6362	4385
180	4078	1146	1899	2224	2614	3100	970	640	1395	3648	6396	4418
185	4090	1160	1920	2246	2638	3126	970	640	1408	3675	6430	4451
190	4101	1171	1941	2268	2662	3151	970	640	1421	3702	6464	4485
195	4113	1182	1961	2291	2686	3177	970	640	1434	3729	6497	4518
200	4125	1193	1981	2312	2709	3202	970	640	1447	3756	6531	4551
205	4137	1204	2001	2334	2733	3228	970	640	1460	3782	6564	4583
210	4150	1215	2021	2355	2756	3253	970	640	1473	3809	6597	4616
215	4162	1225	2041	2377	2779	3277	970	640	1485	3835	6629	4648
220	4175	1236	2060	2398	2801	3302	970	640	1498	3861	6662	4681
225	4187	1246	2080	2419	2824	3326	970	640	1511	3887	6694	4713
230	4200	1256	2099	2439	2846	3350	970	640	1524	3913	6726	4744
235	4213	1266	2118	2460	2868	3374	970	640	1537	3938	6757	4776
240	4226	1276	2136	2480	2890	3397	970	640	1550	3963	6789	4807
245	4240	1286	2155	2500	2912	3421	970	640	1562	3988	6820	4839
250	4253	1292	2173	2520	2933	3444	970	640	1575	4013	6850	4870
255	4266	1292	2191	2539	2954	3466	970	640	1588	4037	6881	4900
260	4280	1292	2209	2559	2975	3489	970	640	1600	4061	6911	4931
265	4294	1292	2227	2578	2996	3511	970	640	1613	4085	6941	4961
270	4308	1292	2245	2597	3017	3534	970	640	1625	4109	6970	4992
275	4321	1292	2263	2616	3037	3555	970	640	1638	4133	7000	5022
280	4335	1292	2280	2635	3057	3577	970	640	1650	4156	7029	5051
285	4349	1292	2297	2654	3077	3599	970	640	1663	4179	7057	5081
290	4364	1292	2314	2672	3097	3620	970	640	1675	4202	7086	5110
295	4378	1292	2331	2690	3116	3641	970	640	1687	4225	7114	5139
300	4392	1292	2348	2708	3136	3662	970	640	1700	4248	7141	5168
305	4406	1292	2365	2726	3155	3682	970	640	1712	4270	7169	5197
310	4421	1292	2375	2744	3174	3702	970	640	1724	4292	7196	5225
315	4435	1292	2375	2761	3193	3723	970	640	1736	4314	7223	5253
320	4450	1292	2375	2779	3211	3743	970	640	1749	4335	7249	5281
325	4464	1292	2375	2796	3230	3762	970	640	1761	4357	7276	5309
330	4479	1292	2375	2813	3248	3782	970	640	1773	4378	7320	5337
335	4494	1292	2375	2830	3266	3801	970	640	1783	4399	7327	5364
340	4508	1292	2375	2847	3284	3820	970	640	1792	4420	7352	5391
345	4523	1292	2375	2863	3302	3839	970	640	1801	4440	7378	5418
350	4538	1292	2375	2880	3319	3858	970	640	1810	4461	7402	5445
355	4553	1292	2375	2896	3336	3876	970	640	1819	4481	7427	5472
360	4568	1292	2375	2912	3354	3894	970	640	1828	4501	7451	5498
365	4583	1292	2375	2928	3371	3913	970	640	1837	4520	7475	5524
370	4598	1292	2375	2944	3387	3930	970	640	1846	4540	7498	5550
375	4613	1292	2375	2960	3404	3948	970	640	1855	4559	7522	5576
380	4628	1292	2375	2965	3421	3966	970	640	1864	4579	7545	5602
385	4643	1292	2375	2965	3437	3983	970	640	1872	4598	7567	5627
390	4658	1292	2375	2965	3452	4000	970	640	1881	4616	7590	5652
395	4673	1292	2375	2965	3469	4017	970	640	1890	4635	7612	5677
400	4688	1292	2375	2965	3485	4034	970	640	1899	4653	7634	5702

## Westar Conductor Data

**Legacy Westar Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)**

Year	Span (ft)	266 ACSR 26/7	477 ACSR 26/7	1/0 ACSR 6/1	2 ACSR 6/1
Prior to 1/22/16	275	3910	5500	1720	1550
After 1/22/16	175	2400	3750	1365	1075
	200	2600	4000	1480	1160
	250	3025	4700	1700	1335
	300	3400	5000	1920	1485

Year	Span (ft)	2/0 ACSR 6/1	4/0 ACSR 6/1	336 ACSR 26/7	556 ACSR 18/1	T2-4/0 ACSR 6/1	T2-266 ACSR 26/7	T2-1/0 ACSR 26/7
Prior to 10/10/16	275	2138	3300	4700	5000	5547	5500	2500
After 10/10/16	175	1575	2125	2850	4570	3650	4100	2180
	200	1715	2330	3100	4750	3980	4500	2370
	250	1950	2680	3600	5090	4560	5250	2730
	300	2210	3025	4000	5400	5140	5925	3070

Year	Span (ft)	3/8" HS GSS ACSR
Prior to 10/10/16	275	3250
10/10/16 to 2/23/18	175	3084
	200	3172
	250	3355
	300	3539

Year	Span (ft)	3/8" EHS GSS ACSR	24-Strand OPGW (AC- 64/528)
After 2/23/18	175	1860	2560
	200	2030	2780
	250	2375	3250
	300	2685	3660

Year	Span (ft)	Slack 266 ACSR 26/7	Slack 477 ACSR 26/7	Slack 1/0 ACSR 6/1	Slack 2 ACSR 6/1
Prior to 10/10/16	50	1000	-	500	500
	80	-	500	-	-
After 10/10/16	20	40	50	30	30
	30	90	125	65	60
	40	160	225	125	110
	50	250	325	185	165
	60	350	450	275	250
	70	475	625	360	325
	80	600	800	425	400
	90	650	-	525	500
	100	800	-	600	575

**Legacy Westar Tensions at 1/2" ice, 4 psf wind, 0 deg, initial (all tensions in lb)**

Copper & CW	275 ft Span Tensions, Final
#6 solid HD bare copper	760
#4 solid HD bare copper	1180
#2 solid HD bare copper	1750
#1-3 strand HD bare copper	1950
1/0-7 strand HD bare copper	2325
4/0-7 strand HD bare copper	3650
3-#10 EHS CW	1700

Secondaries	125 ft Span Tensions, Final
#6 Duplex (Shepherd)	575
#4 Duplex (Terrier)	998
#4 Triplex (Periwinkle)	877
#2 Triplex (Conch)	1200
#2 Triplex (Cockle)	950
1/0 Triplex (Janthina)	1300
2/0 Triplex (Triton)	2034
4/0 Triplex (Cerafus)	2108
#2 Quadruplex (Palomino)	1200
1/0 Quadruplex (Costena)	1200
2/0 Quadruplex (Grullo)	2109
4/0 Quadruplex (Appaloosa)	2600



# Steel Reinforcing Data

## Steel Reinforcing Bracing

The following is a brief explanation of the installation and analysis of steel reinforcing bracing on wood poles to increase an existing pole's strength.

### Construction:

Osmose's bracing design is a vertically stacked two section C shaped truss banded to the pole. The lower section is either 10' or 11' in length driven into the ground leaving 4' of truss about the installation tables provided by Osmose. The total range of upper section length is from 17' to 30'. These lengths were designed to cover 35' to 65' poles. Bracing is designed for installation on the Line-Of-Lead (LOL) side of the pole (transverse face or face of the pole perpendicular to the conductor run) and 45 degrees off from the LOL, meaning there are up to six different locations the bracing may be installed. If the brace must be installed at 45 degrees from LOL, additional brace strength and stiffness is required as identified in the tables provided by Osmose.

It is acceptable to use steel reinforcing braces on poles that are readily accessible by bucket truck. The steel reinforcing braces shall be installed on the approaching side of the pole along a street, the opposite side of the pole of risers or communications cabinets. It is unacceptable to use steel reinforcing braces on poles that are not readily accessible by bucket truck. Poles that are not readily accessible by bucket truck have an extremely good chance of being climbed and the bracing would likely prohibit acceptable climbing space on these poles.

### Strength and Pole Loading Analysis:

Osmose designs their steel braces to improve the reinforced section of the existing pole by 2 pole class levels below the "H" class series, e.g. change a Class 5 pole into a Class 3 pole, and likewise change a Class 3 pole into a Class 1 pole. Osmose has also stated that their steel brace design can reinforce Class 1 poles to Class H1 poles. To clarify, the steel reinforcing that is used to reinforce a Class 3 pole to a Class 1 pole can also be used to reinforce a Class 1 pole to a Class H1 pole.

It is apparent that the entire pole does not increase in strength. The pole's strength can be increased up to the point where the steel reinforcing bracing ends, leaving a considerable portion of the pole at the original pole class.

It follows that any pole loading analyses performed on a steel reinforced pole must include two analysis runs per loading scenario, one where the pole is modeled at its pre-reinforced class, and the other where the pole is modeled at its reinforced class. The pole will be considered failed if the loading within the section of the pole above the steel bracing exceeds the pre-reinforced strength of the pole **or** the loading within the reinforced section of the pole exceeds the reinforced strength of the pole. The pole will be considered acceptable if the loading within the section of the pole above the steel bracing is below the pre-reinforced strength of the pole **and** the loading within the reinforced section of the pole is below the reinforced strength of the pole. Note: It is imperative that all conductor and equipment loads are accurately modeled in all pole-loading analyses.

Attaching companies are responsible for collecting the necessary information for performing pole loading analyses on steel reinforced poles. The information necessary to collect includes:

- Pre-reinforce pole class
- Reinforced section pole class
- Height of reinforcing steel above ground



## Extended Tapered C-Truss Matching KCPL

	Shielded	Unshielded
Original Length/Class	40/3	40/3
Final Length/Class	40/1	40/1
Standard Installation:		
Top C-Truss size	T 8x17	T 8x17
Base C-Truss size	T 8x10	T 8x10
Install 45° outside L-O-L:		
Top C-Truss size	T 980x17	T 980x17
Base C-Truss size	T 980x10	T 980x10

Shielded	Unshielded
40/5	40/5
40/1	40/1
T 880x20	T 880x30
T 880x10	T 880x10
T 1080.375x20	T 1080.375x30
T 1080.375x10	T 1080.375x10

	Shielded	Unshielded
Original Length/Class	45/3	45/3
Final Length/Class	45/1	45/1
Standard Installation:		
Top C-Truss size	T 8x17	T 8x20
Base C-Truss size	T 8x10	T 8x10
Install 45° outside L-O-L:		
Top C-Truss size	T 980x17	T 980x20
Base C-Truss size	T 980x10	T 980x10

Shielded	Unshielded
45/5	
45/1	
T 980x25	
T 980x10	
T 1080.375x25	
T 1080.375x10	

	Shielded	Unshielded
Original Length/Class	50/3	50/3
	Double Circuit	Double Circuit
Final Length/Class	50/1	50/1
Standard Installation:		
Top C-Truss size	T 9x17	T 9x25
Base C-Truss size	T 9x10	T 9x10
Install 45° outside L-O-L:		
Top C-Truss size	T 1080x17	T 1080x25
Base C-Truss size	T 1080x10	T 1080x10

Shielded	Unshielded
55/3	55/3
Double Circuit	Double Circuit
55/1	55/1
T 9x20	T 9x30
T 9x10	T 9x10
T 1080x20	T 1080x30
T 1080x10	T 1080x10

	Shielded	Unshielded
Original Length/Class	60/3	
	Double Circuit	
Final Length/Class	60/1	
Standard Installation:		
Top C-Truss size	T 9x25	
Base C-Truss size	T 9x11	
Install 45° outside L-O-L:		
Top C-Truss size	T 1080x25	
Base C-Truss size	T 1080x11	

Shielded	Unshielded
65/3	
Double Circuit	
65/1	
T 9x30	
T 9x11	
T 1080x30	
T 1080x11	

# Remedy Estimates

Units for make ready and construction	Transfer or Replace Accessible Price	Transfer or Replace Inaccessible Price	Adjust Accessible Price	Adjust Inaccessible Price	Install Accessible Price	Install Inaccessible Price	Remove Accessible Price	Remove Inaccessible Price
<b><u>Pole Only</u></b>								
55' & Below								
60' & Above								
<b><u>Stub Poles</u></b>								
Pulling Stub Poles on Job Site								
Return Trip to Pull Stub Poles								
<b><u>Straighten Pole in Dirt</u></b>								
55' & Below								
60' & Above								
<b><u>Straighten Pole in Rock</u></b>								
55' & Below								
60' & Above								
<b><u>Equipment &amp; Conductors</u></b>								
Single Phase Transformers								
Two Phase (Delta) Transformer Bank								
Three Phase Transformer Bank								
Capacitor Bank								
Regulators								
Crossarms (Single Phase)								
Crossarms (Three Phase)								
Vertical Insulators								
Switches (C-Mounted, Single Phase)								
Switches (C-Mounted, Three Phase)								
Switches (600 Amp, Three Phase)								
Lightning Arrestors								
Bolted Attachments w/in Communication Space								
Drop Attachments w/in Communication Space								
<b><u>Conductors</u></b>								
<b>34.5 kV (energized)</b>								
Three Phase								
<b>Primary &lt;34.5 kV</b>								
Single Phase								
Two Phase (Delta)								
Three Phase								
<b>Secondary/Service</b>								
Single Phase								
Three Phase								
<b><u>Relocation of URD Cable Riser</u></b>								
<b>Primary</b>								
Single Phase								
Three Phase								
<b>Secondary/Service</b>								
Single Phase								
Three Phase								
<b><u>Replace Cable Back to Transformer</u></b>								
<b><u>(Only Cable in Conduit)</u></b>								
<b>Primary</b>								
Single Phase								
Three Phase								
<b>Secondary/Service</b>								
Single Phase								
Three Phase								
<b><u>Miscellaneous</u></b>								
Streetlight								
Ground Wires								
Guy Wires								
Anchors								
Rock Excavation - Per Vertical Ft								
Cell Net								
Riser (Secondary Riser Pole)								
Hand Digging (Per Location)								

## Appendix A-1: KCPL Conductor Properties, Sag and Tension Tables

## ALUMINUM CONDUCTORS

STK. NO.	DESCRIPTION	CODE NAME	DESIGN LOADING AMPACITY*	O.D. INCHES	BREAKING STRENGTH POUNDS	BARE WEIGHT LBS./FT.	VERTICAL LOADING 1/2" ICE LBS./FT.**	HORIZONTAL LOADING 4 PSF WIND 1/2" ICE LBS./FT.**
420-005	#2 ACSR 6/1	Sparrow	184	0.316	2,850	0.0912	0.599	0.439
420-008	#2/0 ACSR 6/1	Quail	276	0.447	5,310	0.1828	0.772	0.482
420-176	#3/0 AA 7 (REF. ONLY)	Phlox	331	0.464	3,040	0.1572	0.757	0.488
420-009	#3/0 ACSR 6/1	Pigeon	315	0.502	6,620	0.2304	0.853	0.501
420-133	336.4 kCM ACSR 26/7	Linnet	529	0.720	14,100	0.4620	1.221	0.573
	2-4/0 ACSR 6/1 (T-2)	Penguin	690	1.127	16,700	0.582	1.594	0.709
420-132	266 kCM ACSR 18/1	Waxwing	435	.609	6,880	.290	.9792	
420-159	397.5 kCM ACSR 26/7	Ibis	587	0.783	16,300	0.5460	1.344	0.594
420-712	477 kCM AA 19 STRAND	Cosmos	639	0.793	8,360	0.4468	1.251	0.598
420-180	477 kCM ACSR 18/1	Pelican	630	.614	11,800	.814	1.500	
	477 kCM ACSR 26/7	Hawk	659	0.858	19,500	0.6553	1.500	0.619
420-155	556.5 kCM ACSR 26/7	Dove	726	0.927	22,600	0.7652	1.652	0.642
420-703	795 kCM AA 37 STRAND	Arbutus	878	1.026	13,900	.746	1.695	

\*Ampacities are from the Aluminum Association Tables for the condition as shown<sup>6</sup> and 75 C conductor temperature.

\*\*No safety factors.

**CONDUCTOR  
INFORMATION CODE,  
NAME, AMPACITY, AND  
STRENGTH CHARACTERISTICS**

DWG REV: 03/22/04      DWG: **440.1-3**



**DISTRIBUTION  
CONSTRUCTION  
STANDARDS**

**PRIMARY CONDUCTORS & ACCESSORIES**

Issued: 1/1/2008

AAC AND ACSR CONDUCTORS				COMPACT AND COMPRESSED CONDUCTORS			
SIZE	STRANDING	DIA.	WEIGHT	WEIGHT			
				SIZE	STRANDS	COMPACT	COMPRESSED
#2	6/1	0.316	91.3	8	7	0.133	
#2/0	6/1	0.447	183.1	6	7	0.167	
#3/0	6/1	0.502	230.9	4	7	0.211	
#3/0	7	0.464	157.5	2	7	0.266	
2-4/0 (T-2)	6/1	0.922	582.2	1	19	0.299	0.321
266,000 cm	18/1	.609	290.0	1/0	19	0.366	0.361
397,500 cm	26/7	0.783	546.9				
477,000 cm	19	0.793	447.8	2/0	19	0.376	0.405
477,000 cm	26/7	0.858	656.8	3/0	19	0.423	0.456
795,000 cm	37	1.026	746.0	4/0	19	0.475	0.511
				250	37	0.520	0.557
				300	37	0.570	0.610
				350	37	0.616	0.659
SIZE			CODE	400	37	0.659	0.706
#2			sparrow	500	37	0.736	0.788
#2/0			quail	600	61	0.813	0.866
#3/0			pigeon				
#3/0			phlox	750	61	0.908	0.970
2-4/0 (T-2)			T-2 penguin	800	61	0.938	1.000
266,000 cm			waxwing	900	61	0.999	1.060
397,500 cm			ibis				
477,000 cm			cosmos	1000	61	1.060	1.116
795,000 cm			arbutus				
477,000 cm			hawk				
AAC: ALL ALUMINUM CONDUCTOR							
ACSR: ALUMINUM CABLE STEEL REINFORCED							

SOLID AND CONCENTRIC STRANDED CONDUCTORS									
SIZE	SOLID			STRANDED					
	DIAMETER	WEIGHT		B STRANDING		C STRANDING		WEIGHT	
		ALUM.	COPPER	WIRES	DIA.	WIRES	DIA.	ALUM.	COPPER
6	0.162	24.15	79.4	7	0.184	19	0.186	24.60	81.0
4	0.204	38.44	126.4	7	0.232	19	0.235	39.20	129.0
2	0.257	61.07	200.9	7	0.292	19	0.296	62.30	205.0
1/0	0.325	97.15	319.6	19	0.373	37	0.374	99.10	326.0
2/0	0.365	122.15	402.9	19	0.419	37	0.420	125.0	411.0
3/0	0.409	154.4	507.9	19	0.470	37	0.471	157.0	518.0
4/0	0.460	194.7	640.5	19	0.528	37	0.529	199.0	653.0
300				37	0.630	61	0.631	282.0	926.0
350				37	0.681	61	0.681	329.0	1081.0
500				37	0.813	61	0.815	469.0	1544.0
600				61	0.893	91	0.893	563.0	1853.0
750				61	0.998	91	0.999	704.0	2316.0
1000				61	1.152	91	1.153	939.0	3088.0
1500				91	1.412	127	1.413	1408.0	4631.0
1750				127	1.526	169	1.527	1643.0	5403.0

Diameters are in inches (outside)  
Weights are in pounds per 1000 feet

**CONDUCTOR  
INFORMATION DIAMETERS,  
STRANDING, AND WEIGHT**

DWG REV: 01/22/08 DWG: **440.1-4**



**DISTRIBUTION  
CONSTRUCTION  
STANDARDS**

**PRIMARY CONDUCTORS & ACCESSORIES**

Issued: 1/1/2008

TEMP.		SPAN, in feet																													
		80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350		
		#3/O AAC CODE: PHLOX																													
10°	2	2	3	4	4	5	6	7	8	9	10	12	15	18	22	32	38														
20°	3	3	3	4	5	6	7	8	9	10	11	14	17	21	26	31	36	42													
30°	3	3	4	5	6	7	8	9	10	11	13	16	20	24	29	35	40	46													
40°	4	4	5	6	7	8	10	11	12	14	15	19	23	28	33	38	44	50													
50°	5	6	7	8	9	10	12	13	15	16	18	22	27	31	36	42	48	53													
60°	7	8	9	10	11	13	14	16	17	19	21	26	30	35	40	45	51	57													
70°	8	10	11	12	14	15	17	19	20	22	25	29	33	38	43	49	54	60													
80°	10	12	13	15	16	18	20	22	23	25	28	32	37	41	47	52	58	63													
90°	12	14	15	17	19	20	22	24	26	28	31	35	40	45	50	55	61	67													
100°	14	15	17	19	21	23	25	27	29	31	34	38	43	48	53	58	64	69													
		477KCM AAC CODE: COSMOS																													
10°	2	3	3	4	5	5	6	7	8	9	10	11	12	13	14	16	17	19	20	22	23	25	27								
20°	3	3	4	5	5	6	7	8	9	10	11	12	14	15	16	18	19	21	23	24	26	28	30								
30°	3	4	5	6	7	7	8	9	10	12	13	14	16	17	19	20	22	24	25	27	29	31	33								
40°	4	5	6	7	8	9	10	11	12	14	15	17	18	20	22	23	25	27	29	31	33	35	37								
50°	6	7	8	9	10	11	12	13	14	16	18	19	21	23	25	26	28	30	32	34	36	38	41	43	45	47	49	51	54		
60°	7	9	10	11	12	13	14	16	17	19	20	22	24	26	28	30	32	34	36	38	40	42	45	47	49	51	54	57	60		
70°	9	11	12	13	14	16	17	18	20	22	24	25	27	29	31	34	36	38	40	42	45	47	49	51	54	57	60	62			
80°	11	12	14	16	17	18	19	21	23	25	27	29	31	33	35	37	39	42	44	46	49	51	54	57	60	62					
90°	13	14	16	18	19	20	22	24	25	28	30	32	34	37	38	41	43	45	48	50	53	55	58	60	62						
100°	14	16	18	19	21	23	24	26	28	30	33	35	37	39	42	44	47	49	52	54	57	60	62								
		#2 ACSR CODE: SPARROW																													
10°	1	2	2	2	3	3	3	3	4	4	5	6	6	7	7	8	9	10	12	13	16	19	22	27	32	38	45	53	61		
20°	1	2	2	2	3	3	4	4	5	5	6	6	7	8	9	9	10	11	12	15	17	21	25	30	35	42	49	57	65		
30°	1	2	2	2	3	4	4	4	5	6	6	7	8	9	9	10	10	11	13	16	19	23	27	33	39	46	53	61	69		
40°	2	2	2	3	3	4	4	5	5	6	7	8	8	9	10	11	12	15	17	21	25	30	36	42	50	57	65	73	81		
50°	2	2	3	3	4	5	5	6	6	7	8	9	10	11	12	13	16	19	23	28	33	39	46	54	61	69	77	85	93		
60°	2	2	3	4	5	5	6	6	7	8	9	10	11	12	13	15	18	21	26	31	37	43	50	57	65	73	81	89	97		
70°	2	3	3	4	5	6	6	7	8	9	10	11	12	14	15	16	20	24	28	34	40	47	54	61	69	77	85	93	101		
80°	3	3	4	5	6	7	8	9	10	12	13	14	15	16	18	18	22	26	32	37	44	51	58	65	73	80	88	96	104		
90°	3	4	5	6	8	8	9	10	11	12	13	14	16	17	18	20	24	29	35	41	47	54	61	69	76	84	92	100	108		
100°	4	5	6	7	9	10	11	12	14	15	16	18	19	21	23	27	31	37	43	50	57	65	72	80	87	95	103	111	119		
		#2/O ACSR CODE: QUAIL																													
10°	1	2	2	3	3	3	4	4	5	6	6	7	7	8	9	10	11	12	13	14	15	16	18	19	20	21	22	24	25		
20°	1	2	2	3	3	4	4	5	6	7	8	8	9	9	10	10	11	12	13	14	15	16	18	19	20	21	22	24	25		
30°	2	2	3	3	4	4	5	6	7	8	9	9	10	11	11	12	13	14	15	16	18	19	20	21	23	24	26	27	29		
40°	2	3	3	4	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	20	22	23	25	27	28	30	32	34	36		
50°	2	3	4	4	5	6	7	8	9	10	11	12	13	14	15	17	18	19	21	22	24	26	27	29	30	32	34	36	38		
60°	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	19	20	21	22	24	26	28	30	31	33	35	37	39		
70°	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	18	21	22	24	25	27	29	30	32	33	35	37	39	41		
80°	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	23	24	26	28	30	32	33	35	37	39	41	43		
90°	4	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	23	25	26	28	30	32	33	35	37	39	41	43	45		
100°	5	7	8	9	10	11	12	13	14	15	16	17	18	20	21	23	25	27	29	30	32	33	35	37	39	41	43	45	47		

INITIAL SAG, in inches, FOR BARE OVERHEAD CONDUCTORS



		SPAN, in feet																											
		80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
		#3/O ACSR CODE: PIGEON																											
TEMP.		10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°
10°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
50°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
60°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
80°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
90°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
100°	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10°	5	6	7	8	9	10	12	13	14	15	16	18	19	20	21	23	24	25	27	28	30	32	34	36	38	40	42	44	44

		397.5kCM ACSR CODE: 1B1S																											
TEMP.		10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°
10°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
50°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
60°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
80°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
90°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
100°	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10°	5	6	7	8	9	10	12	13	14	15	16	18	19	20	21	23	24	26	27	29	31	33	34	36	38	40	42	44	44

		2-4/0 ACSR CODE: T-2 PENGUIN																											
TEMP.		10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°
10°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
50°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
60°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
80°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
90°	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
100°	6	7	8	9	10	11	13	14	16	17	18	20	22	23	25	26	28	30	31	33	35	37	38	40	42	44	46	48	48

		477kCM ACSR CODE: HAWK																											
TEMP.		10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	10°	20°	30°	40°	50°	60°	70°	80°
10°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20°	1	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
50°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
60°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
70°	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
80°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
90°	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
100°	4	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10°	5	6	7	8	9	10	12	13	14	15	16	18	19	20	21	23	24	26	27	28	30	32	34	36	38	40	42	44	44

INITIAL SAG, IN INCHES, FOR BARE OVERHEAD CONDUCTOR

## INITIAL SAG TABLES 2 OF 3

DWG REV: 05/10/10

DWG: 440.1-6

DISTRIBUTION  
CONSTRUCTION  
STANDARDS

PRIMARY CONDUCTORS &amp; ACCESSORIES

Issued: 1/1/2008

TEMP.	SPAN, in feet																				290	300	310	320	330	340	350
	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270							
10°	1.68	0.18	0.22	0.26	0.31	0.36	0.41	0.46	0.52	0.59	0.65	0.72	0.79	0.87	0.95	1.03	1.11	1.2	1.29	1.39	1.5	1.61	1.72				
20°	1.92	0.2	0.25	0.29	0.34	0.4	0.46	0.52	0.59	0.65	0.73	0.8	0.88	0.96	1.05	1.13	1.22	1.32	1.42	1.53	1.65	1.76	1.88				
30°	2.28	0.24	0.29	0.34	0.4	0.46	0.52	0.59	0.66	0.74	0.82	0.9	0.99	1.08	1.17	1.26	1.36	1.46	1.58	1.7	1.82	1.95	2.08				
40°	2.76	0.28	0.34	0.4	0.47	0.54	0.61	0.69	0.77	0.85	0.94	1.03	1.12	1.22	1.32	1.42	1.52	1.64	1.77	1.89	2.03	2.16	2.3				
50°	3.48	0.35	0.42	0.49	0.56	0.64	0.72	0.81	0.9	0.99	1.09	1.19	1.29	1.4	1.51	1.62	1.72	1.85	1.99	2.13	2.27	2.41	2.56				
60°	4.44	0.45	0.52	0.61	0.69	0.78	0.87	0.97	1.07	1.17	1.27	1.38	1.5	1.61	1.73	1.85	1.96	2.1	2.24	2.39	2.54	2.7	2.86				
70°	6	0.58	0.67	0.76	0.85	0.95	1.05	1.16	1.27	1.38	1.49	1.61	1.73	1.86	1.98	2.11	2.23	2.37	2.53	2.69	2.85	3.01	3.18				
80°	7.68	0.74	0.83	0.94	1.04	1.15	1.26	1.37	1.49	1.61	1.73	1.86	1.99	2.12	2.26	2.39	2.52	2.67	2.83	3	3.17	3.34	3.52				
90°	9.48	0.9	1.01	1.12	1.23	1.35	1.47	1.6	1.72	1.85	1.98	2.12	2.26	2.4	2.54	2.68	2.82	2.98	3.15	3.32	3.5	3.68	3.87				
100°	11.16	1.05	1.17	1.3	1.42	1.55	1.68	1.82	1.95	2.09	2.23	2.38	2.53	2.68	2.83	2.98	3.12	3.29	3.47	3.65	3.84	4.02	4.22				

TEMP.	SPAN, in feet																				290	300	310	320	330	340	350
	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270							
10°	2	3	3	4	5	6	6	7	8	9	10	11	12	13	15	16	17	19	20	22	23	25	27				
20°	3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	19	21	22	24	26	28	30				
30°	3	4	5	6	7	8	9	10	11	12	13	14	15	17	18	20	22	23	25	27	29	31	33				
40°	4	5	6	7	8	9	10	11	13	14	15	16	18	19	21	23	25	26	28	30	32	34	36				
50°	6	7	8	9	10	11	12	14	15	16	18	19	21	22	24	26	28	30	32	34	36	38	40				
60°	7	8	10	11	12	13	15	16	18	19	20	22	24	25	27	29	31	33	36	38	40	42	45				
70°	9	10	12	13	14	16	17	19	20	22	23	25	27	29	31	33	35	37	39	42	44	46	49				
80°	11	12	14	15	17	18	20	21	23	25	27	28	30	32	34	36	39	41	43	46	48	51	53				
90°	12	14	16	17	19	21	22	24	26	28	30	31	33	36	38	40	42	45	47	50	52	55	57				
100°	14	16	18	19	21	23	25	27	29	30	33	34	36	39	41	43	46	48	51	54	56	59	61				

INITIAL SAG, in inches, FOR BARE OVERHEAD CONDUCTORS

## INITIAL SAG TABLES 3 OF 3

DWG REV: 2/14/08

DWG: 440.1-7



**DISTRIBUTION  
CONSTRUCTION  
STANDARDS**

**PRIMARY CONDUCTORS & ACCESSORIES**

Issued: 1/1/2008



## DISTRIBUTION CONSTRUCTION STANDARDS

## PRIMARY CONDUCTORS & ACCESSORIES

## General

Issued: 1/1/2008

440.1-8



T.		SPAN, in feet																											
		80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
		#3/0 ACSR STRANDING 6/1 CODE: PIGEON																											
10'	1591	1604	1619	1633	1648	1663	1679	1694	1710	1726	1742	1758	1774	1790	1806	1822	1838	1854	1870	1873	1873	1873	1874	1874	1875	1876	1876	1876	1876
20'	1464	1478	1493	1508	1524	1539	1555	1572	1588	1605	1621	1638	1655	1671	1688	1705	1722	1738	1755	1758	1759	1760	1761	1762	1763	1764	1765	1765	1766
30'	1335	1350	1365	1381	1397	1413	1430	1447	1464	1482	1499	1517	1534	1551	1569	1586	1604	1621	1639	1642	1644	1645	1647	1649	1651	1653	1655	1656	1656
40'	1203	1218	1235	1251	1268	1286	1303	1321	1339	1358	1376	1394	1412	1431	1449	1467	1485	1503	1522	1526	1528	1531	1534	1536	1539	1542	1544	1547	1547
50'	1069	1085	1103	1120	1138	1157	1176	1195	1214	1233	1252	1271	1291	1310	1329	1348	1367	1386	1405	1410	1411	1412	1415	1421	1425	1428	1432	1436	1439
60'	935	951	970	989	1008	1028	1048	1068	1089	1109	1129	1150	1170	1190	1210	1230	1250	1270	1290	1296	1301	1307	1310	1315	1320	1325	1330	1335	1335
70'	798	818	838	859	880	901	922	944	966	987	1009	1030	1052	1073	1094	1115	1136	1157	1177	1185	1191	1197	1203	1209	1215	1222	1228	1234	1234
80'	665	687	709	732	755	778	801	824	848	870	893	916	938	961	983	1005	1026	1048	1069	1078	1086	1093	1101	1108	1116	1123	1131	1134	1134
90'	539	564	589	614	639	664	689	713	737	762	785	809	832	856	878	901	923	946	968	978	987	996	1005	1014	1023	1032	1040	1049	1049
100'	429	456	483	510	536	562	588	614	639	664	688	712	736	760	783	806	829	852	874	886	897	907	917	928	938	948	956	967	967
		397.5kVCM ACSR STRANDING 26/7 CODE: 1B1S																											
10'	3975	3989	4003	4019	4034	4051	4067	4083	4100	4117	4133	4150	4166	4182	4199	4214	4230	4245	4260	4275	4289	4304	4318	4331	4344	4357	4370	4382	4382
20'	3691	3706	3722	3738	3755	3772	3789	3807	3825	3843	3861	3879	3896	3914	3931	3948	3965	3982	3998	4015	4030	4046	4061	4076	4091	4105	4119	4133	4133
30'	3402	3418	3434	3452	3470	3489	3507	3526	3545	3565	3584	3604	3623	3642	3661	3679	3698	3717	3735	3752	3770	3787	3804	3820	3837	3852	3868	3883	3883
40'	3107	3124	3142	3161	3180	3200	3221	3242	3263	3284	3305	3326	3347	3368	3389	3410	3430	3450	3470	3490	3509	3528	3547	3565	3583	3601	3619	3636	3636
50'	2806	2825	2844	2868	2892	2909	2932	2955	2978	3001	3025	3048	3071	3094	3117	3140	3163	3185	3207	3229	3250	3272	3293	3313	3333	3353	3372	3392	3392
60'	2501	2522	2544	2568	2597	2616	2642	2667	2693	2719	2745	2771	2797	2823	2848	2874	2899	2924	2948	2972	2996	3020	3043	3066	3088	3111	3132	3154	3154
70'	2193	2217	2242	2269	2297	2325	2353	2382	2411	2441	2470	2499	2528	2556	2585	2613	2641	2669	2696	2723	2750	2776	2801	2827	2852	2876	2900	2924	2924
80'	1885	1914	1943	1974	2006	2038	2071	2104	2137	2170	2203	2235	2268	2300	2332	2363	2394	2425	2455	2485	2514	2543	2571	2599	2626	2653	2679	2705	2705
90'	1583	1617	1653	1689	1726	1764	1801	1839	1876	1913	1950	1987	2023	2058	2094	2128	2162	2195	2229	2261	2293	2324	2355	2385	2415	2444	2473	2501	2501
100'	1295	1338	1380	1423	1466	1509	1552	1594	1636	1678	1718	1758	1798	1837	1875	1912	1949	1985	2021	2056	2090	2123	2156	2189	2220	2252	2282	2312	2312
		2-4/0 ACSR STRANDING 6/1 CODE: T-2 PENGUN																											
10'	3925	3941	3957	3973	3990	4007	4023	4040	4057	4073	4090	4110	4129	4149	4169	4189	4209	4228	4248	4268	4287	4307	4326	4345	4364	4382	4401	4419	4419
20'	3604	3620	3638	3655	3672	3690	3707	3728	3747	3765	3783	3805	3826	3848	3869	3891	3913	3934	3956	3977	3998	4020	4041	4061	4082	4102	4123	4143	4143
30'	3276	3294	3313	3332	3352	3372	3392	3413	3433	3453	3474	3497	3521	3544	3568	3592	3616	3640	3663	3687	3710	3733	3756	3779	3802	3824	3847	3869	3869
40'	2942	2962	2983	3004	3027	3049	3072	3094	3117	3140	3163	3189	3215	3241	3268	3294	3320	3347	3373	3399	3425	3450	3476	3501	3526	3550	3575	3599	3599
50'	2603	2625	2649	2674	2699	2725	2750	2776	2802	2828	2854	2883	2913	2942	2971	3000	3030	3059	3088	3116	3145	3173	3201	3229	3256	3283	3310	3337	3337
60'	2261	2287	2315	2344	2373	2402	2432	2462	2492	2522	2552	2584	2617	2650	2683	2715	2747	2780	2811	2843	2874	2906	2936	2967	2997	3026	3055	3085	3085
70'	1920	1952	1985	2019	2053	2088	2123	2157	2192	2226	2261	2297	2334	2371	2407	2443	2479	2514	2549	2584	2618	2652	2685	2718	2751	2783	2815	2846	2846
80'	1589	1628	1668	1708	1749	1790	1830	1870	1910	1950	1990	2030	2070	2111	2150	2190	2229	2267	2305	2342	2379	2416	2452	2487	2522	2556	2590	2624	2624
90'	1279	1328	1376	1425	1472	1519	1566	1611	1656	1700	1743	1788	1832	1876	1918	1961	2002	2043	2084	2123	2162	2201	2239	2276	2313	2349	2385	2420	2420
100'	1015	1072	1128	1182	1236	1288	1339	1388	1437	1484	1530	1578	1624	1670	1713	1759	1802	1845	1887	1928	1969	2009	2048	2087	2125	2163	2200	2236	2236
		477kVCM ACSR STRANDING 26/7 CODE: HAWK																											
10'	4749	4766	4783	4802	4821	4841	4860	4881	4901	4921	4941	4961	4981	5001	5019	5039	5057	5075	5094	5112	5129	5146	5163	5179	5195	5210	5225	5240	5240
20'	4408	4426	4445	4465	4485	4506	4527	4549	4570	4592	4613	4635	4658	4677	4698	4719	4739	4759	4779	4799	4818	4836	4855	4873	4890	4907	4924	4941	4941
30'	4060	4079	4108	4121	4143	4165	4188	4211	4235	4258	4281	4305	4328	4351	4374	4396	4419	4441	4462	4484	4505	4525	4546	4566	4585	4604	4623	4641	4641
40'	3706	3726	3748	3771	3795	3819	3844	3870	3895	3921	3946	3969	3993	4017	4042	4067	4092	4117	4145	4169	4192	4215	4238	4260	4281	4303	4324	4344	4344
50'	3344	3367	3391	3417	3443	3470	3494	3525	3553	3581	3609	3638	3666	3694	3722	3749	3776	3803	3830	3856	3882	3907	3933	3957	3981	4005	4029	4052	4052
60'	2978	3004	3031	3059	3088	3114	3140	3180	3211	3243	3274	3306	3338	3369	3400	3430	3460	3490	3519	3548	3577	3606	3634	3661	3688	3715	3741	3767	3767
70'	2608	2638	2669	2701	2734	2768	2803	2838	2873	2909	2944	2979	3014	3049	3083	3118	3151	3185	3217	3250	3282	3313	3344	3375	3405	3434	3463	3492	3492
80'	2239	2274	2310	2347	2386	2425	2465	2505	2545	2585	2624	2664	2703	2742	2780	2818	2856	2893	2929	2965	3000	3035	3069	3102	3135	3167	3199	3230	3230
90'	1877	1918	1962	2008	2051	2097	2142	2188	2233	2278	2323	2367	2410	2453	2495	2537	2578	2619	2658	2697	2736	2773	2812	2847	2883	2918	2952	2986	2986
100'	1533	1585	1637	1689	1741	1794	1845	1896	1947	1997	2046	2094	2142	2189	2235	2280	2324	2368	2410	2452	2493	2534	2575	2616	2657	2698	2742	2760	2760

FOR THE EQUIVALENT TABLE WITH INITIAL SAG IN INCHES,  
PLEASE REFER TO STANDARD DRAWING 44Q.1-5.

INITIAL TENSION TABLE 2 OF 3

DWG REV: 12/4/12

DWG: 440.1-9

T.	SPAN, in feet										CODE:	WAXWING
	80	90	100	110	120	130	140	150	160	170		
10'	1627	1648	1669	1688	1707	1724	1741	1757	1773	1788	1802	1816
20'	1427	1450	1472	1493	1513	1533	1551	1569	1586	1603	1618	1634
30'	1222	1247	1271	1294	1317	1338	1369	1379	1395	1416	1434	1451
40'	1014	1042	1069	1095	1120	1144	1168	1190	1212	1232	1253	1272
50'	809	841	872	901	930	957	983	1009	1033	1057	1080	1101
60'	620	656	691	724	756	787	816	844	871	897	922	946
70'	467	506	543	578	611	644	675	704	733	761	787	813
80'	362	399	434	469	502	534	565	594	623	651	678	704
90'	294	328	361	392	423	453	483	511	539	566	592	618
100'	251	281	310	339	367	395	423	449	475	501	526	551

T.	SPAN, in feet										CODE:	ARBUTUS
	80	90	100	110	120	130	140	150	160	170		
10'	3119	3183	3245	3304	3360	3414	3466	3515	3562	3607	3650	3691
20'	2625	2696	2764	2829	2891	2951	3008	3063	3115	3166	3214	3260
30'	2135	2214	2290	2363	2432	2499	2563	2624	2683	2740	2794	2845
40'	1671	1760	1845	1926	2004	2078	2149	2217	2282	2344	2404	2462
50'	1273	1370	1461	1548	1631	1711	1787	1860	1930	1997	2061	2123
60'	980	1075	1166	1253	1337	1417	1494	1569	1640	1709	1775	1839
70'	786	873	958	1040	1119	1196	1271	1343	1413	1481	1546	1610
80'	660	738	815	890	963	1035	1105	1173	1240	1305	1368	1429
90'	574	644	714	782	849	916	981	1044	1107	1168	1228	1287
100'	513	576	640	702	764	825	886	945	1004	1061	1118	1173

FOR THE EQUIVALENT TABLE WITH INITIAL SAG IN INCHES,  
PLEASE REFER TO STANDARD DRAWING 440.1-7.

NEW BARE OVERHEAD CONDUCTOR  
INITIAL TENSION, in pounds

### INITIAL TENSION TABLE 3 OF 3

DWG REV: 2/4/08

DWG: **440.1-10**



**DISTRIBUTION  
CONSTRUCTION  
STANDARDS**

**PRIMARY CONDUCTORS & ACCESSORIES**

Issued: 1/1/2008



Conductor loadings are recommended by ALCOA but with initial loadings @ 0 reduced to 30% of UTS.

FINAL SAG TABLE, in feet

TEMP.		SPAN, in feet																												350
		80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340		
#3/0 ALL ALUMINUM CONDUCTOR (AAC) CODE: PHLOX	0°	.86	1.04	1.22	1.43	1.65	1.89	2.13	2.38	2.64	2.91	3.20	3.57	3.96	4.35	4.79	5.24	5.70	6.19											
	32°	.91	1.08	1.26	1.46	1.67	1.89	2.12	2.36	2.61	2.86	3.14	3.51	3.89	4.30	4.72	5.17	5.63	6.12											
	167°	1.95	2.20	2.45	2.72	2.99	3.27	3.55	3.84	4.13	4.43	4.75	5.14	5.56	5.99	6.44	6.91	7.40	7.90											
	477kcm ALL ALUMINUM CONDUCTOR (AAC) CODE: COSMOS	0°	.55	.67	.81	.95	1.10	1.26	1.43	1.60	1.80	2.00	2.21	2.42	2.65	2.87	3.11	3.35	3.60	3.85	4.10	4.37	4.67	4.90	5.18					
	32°	.72	.86	1.00	1.16	1.32	1.49	1.66	1.84	2.04	2.25	2.46	2.68	2.91	3.14	3.38	3.62	3.87	4.12	4.38	4.64	4.91	5.18	5.45						
	167°	1.95	2.20	2.45	2.70	2.96	3.22	3.48	3.74	4.02	4.30	4.58	4.87	5.17	5.46	5.76	6.06	6.37	6.67	6.98	7.30	7.61	7.93	8.25						
#2 ACSR CONDUCTOR CODE: SPARROW	0°	.89	1.08	1.28	1.50	1.72	1.95	2.20	2.46	2.74	3.02	3.32	3.62	3.93	4.25	4.58	4.92	5.28	5.73	6.20	6.69	7.19	7.72	8.26	8.82	9.41				
	32°	.75	.91	1.08	1.26	1.45	1.65	1.85	2.08	2.32	2.56	2.82	3.08	3.36	3.64	3.93	4.22	4.54	4.97	5.42	5.89	6.38	6.89	7.42	7.96	8.53				
	167°	.95	1.09	1.23	1.37	1.51	1.65	1.79	1.96	2.14	2.33	2.52	2.72	2.92	3.13	3.34	3.55	3.80	4.22	4.67	5.14	5.63	6.15	6.68	7.23	7.81				
#2/0 ACSR CONDUCTOR CODE: QUAIL	0°	.63	.77	.93	1.09	1.27	1.45	1.64	1.84	2.04	2.25	2.47	2.69	2.92	3.16	3.40	3.67	3.94	4.21	4.49	4.78	5.07	5.37	5.68	5.99	6.30	6.63	6.95	7.28	
	32°	.59	.72	.86	1.01	1.17	1.33	1.50	1.68	1.86	2.05	2.24	2.44	2.64	2.85	3.07	3.31	3.55	3.80	4.06	4.32	4.59	4.86	5.13	5.42	5.70	6.00	6.29	6.60	
	167°	.98	1.13	1.28	1.44	1.60	1.76	1.93	2.10	2.27	2.44	2.62	2.80	2.98	3.17	3.35	3.58	3.80	4.03	4.26	4.49	4.73	4.97	5.21	5.46	5.71	5.97	6.23	6.49	
	#3/0 ACSR CONDUCTOR CODE: PIGEON	0°	.55	.68	.82	.97	1.13	1.30	1.48	1.66	1.85	2.04	2.24	2.45	2.66	2.88	3.11	3.34	3.57	3.81	4.06	4.32	4.59	4.86	5.14	5.43	5.72	6.02	6.32	6.62
	32°	.54	.66	.79	.93	1.08	1.23	1.39	1.56	1.73	1.91	2.10	2.28	2.48	2.68	2.88	3.09	3.30	3.52	3.74	3.98	4.23	4.48	4.74	5.00	5.27	5.54	5.82	6.10	
	167°	1.00	1.15	1.31	1.47	1.64	1.81	1.98	2.15	2.33	2.51	2.70	2.89	3.08	3.27	3.46	3.66	3.86	4.06	4.27	4.50	4.73	4.97	5.22	5.46	5.71	5.97	6.22	6.48	
397.5kcm ACSR CONDUCTOR CODE: IBIS	0°	.33	.42	.51	.61	.72	.84	.96	1.09	1.23	1.37	1.52	1.67	1.83	2.00	2.17	2.34	2.52	2.71	2.89	3.09	3.29	3.49	3.69	3.90	4.12	4.34	4.56	4.79	
	32°	.36	.45	.55	.66	.77	.89	1.01	1.14	1.28	1.42	1.57	1.73	1.88	2.05	2.21	2.38	2.56	2.74	2.92	3.11	3.31	3.50	3.70	3.91	4.11	4.32	4.54	4.76	
	167°	.84	.99	1.14	1.29	1.46	1.62	1.79	1.97	2.14	2.33	2.51	2.70	2.90	3.09	3.29	3.50	3.71	3.92	4.13	4.35	4.57	4.79	5.02	5.25	5.48	5.72	5.95	6.20	

NOTE: For 266 ACSR & 795 AAC, consult standards engineers.

FINAL SAG TABLE  
FOR

BARE OVERHEAD CONDUCTORS

The sag for  $D_u$  includes  $1/2''$  ice and 4 p.s.f. wind.

The sag for  $32_u$  includes  $1/2''$  ice.

$167_u$  F = 75, C

FINAL SAG TABLE 1 OF 2

DWG REV: 1/30/08

DWG: 440.1-11



DISTRIBUTION  
CONSTRUCTION  
STANDARDS

PRIMARY CONDUCTORS & ACCESSORIES

Issued: 1/1/2008

Conductor loadings are recommended by ALCOA but with initial loadings @ 0° reduced to 30% of UTS.

FINAL SAG TABLE, in feet

SPAN, in feet

TEMP.	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
2-40 ACSR CONDUCTOR CODE: T-2 PENGUIN																												
0°	.35	.44	.54	.64	.75	.87	1.00	1.13	1.27	1.42	1.57	1.73	1.89	2.06	2.23	2.41	2.59	2.78	2.97	3.16	3.36	3.57	3.78	3.99	4.21	4.43	4.65	4.88
32°	.40	.50	.60	.71	.83	.96	1.09	1.23	1.37	1.52	1.67	1.83	2.00	2.17	2.34	2.52	2.70	2.88	3.07	3.26	3.46	3.66	3.87	4.08	4.29	4.51	4.73	4.95
167°	1.04	1.20	1.36	1.54	1.71	1.89	2.08	2.27	2.46	2.65	2.82	3.02	3.23	3.43	3.64	3.86	4.07	4.29	4.51	4.74	4.97	5.20	5.43	5.67	5.91	6.15	6.40	6.64

TEMP.	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350	
477kCM ACSR CONDUCTOR CODE: HAWK																													
0°	.31	.38	.47	.56	.66	.77	.89	1.01	1.14	1.27	1.41	1.55	1.70	1.86	2.02	2.19	2.36	2.53	2.71	2.89	3.08	3.28	3.47	3.67	3.88	4.09	4.30	4.52	
32°	.34	.43	.52	.62	.73	.84	.96	1.09	1.22	1.36	1.50	1.65	1.80	1.96	2.12	2.28	2.45	2.63	2.81	2.99	3.18	3.37	3.56	3.76	3.96	4.16	4.37	4.58	
167°	.85	1.20	1.14	1.30	1.46	1.63	1.80	1.97	2.15	2.34	2.52	2.71	2.91	3.10	3.30	3.51	3.72	3.93	4.14	4.36	4.58	4.80	5.03	5.26	5.49	5.73	5.97	6.21	

FINAL SAG TABLE 2 OF 2

DWG REV: 03/22/04

DWG: 440.1-12

NOTE: Changes to the NESC for 1990 include the requirement that vertical clearances to objects from energized conductors apply under conditions that produce the largest final sag. Use whichever is the greater sag in the above table and the separation from objects from Division 11. The greater sags are underlined.

The sag for 0° includes 1/2" ice and 4 p.s.f. wind.

167° F = 75° C

The sag for 32° includes 1/2" ice.

FINAL SAG TABLE  
FOR  
BARE OVERHEAD CONDUCTORS



DISTRIBUTION  
CONSTRUCTION  
STANDARDS

PRIMARY CONDUCTORS & ACCESSORIES

Issued: 1/1/2008

The following table lists the horizontal displacement from the "at rest" condition of conductors at mid-span. The NESC minimum conductor wind loading of 6 p.s.f. at a temperature of 60 F was used.

CONDUCTOR HORIZONTAL DISPLACEMENT, in feet

SPAN feet	Conductor						
	#3/0 AAC	477 AAC	#2 ACSR	#2/0 ACSR	#3/0 ACSR	2-4/0 T-2	397.5 ACSR
80	.69	.54	.23	.23	.22	.19	.15
90	.79	.63	.28	.28	.28	.24	.19
100	.90	.72	.34	.34	.33	.28	.23
110	1.01	.81	.41	.41	.40	.34	.27
120	1.13	.90	.49	.48	.47	.39	.32
130	1.25	1.00	.55	.55	.53	.45	.37
140	1.38	1.09	.64	.62	.61	.51	.42
150	1.51	1.20	.71	.70	.69	.58	.48
160	1.67	1.31	.80	.78	.77	.65	.54
170	1.90	1.41	.89	.87	.85	.71	.60
180	2.18	1.52	.98	.96	.94	.79	.66
190	2.49	1.63	1.09	1.05	1.03	.86	.73
200	2.81	1.76	1.18	1.15	1.12	.94	.79
210	3.14	1.87	1.30	1.25	1.21	1.02	.87
220	3.49	1.99	1.47	1.35	1.31	1.10	.94
230	3.87	2.12	1.78	1.46	1.41	1.19	1.02
240	4.25	2.26	2.13	1.56	1.52	1.27	1.09
250	4.66	2.40	2.52	1.67	1.62	1.36	1.17
260		2.55	2.90	1.78	1.73	1.45	1.25
270		2.69	3.28	1.89	1.84	1.55	1.33
280		2.84	3.67	2.01	1.95	1.64	1.42
290		3.00	4.10	2.13	2.07	1.74	1.51
300		3.15	4.54	2.26	2.19	1.84	1.60
310			5.01	2.38	2.31	1.94	1.69
320			5.50	2.50	2.43	2.04	1.78
330				2.63	2.56	2.15	1.88
340				2.80	2.69	2.25	1.97
350				2.96	2.81	2.36	2.07

#### IMPORTANT NOTE

The NESC requires horizontal clearances between objects and energized conductors to be the greater of two distances:

- (1) the separation to a conductor at rest, or
- (2) the separation to a conductor at 60 F. blown by a 6 p.s.f. wind towards the object.

This table provides the displacement of the conductor by the wind. The values for the separations to specific objects to conductors at rest and displaced by wind are listed in Division 11. As an example, the NESC requires a minimum "at rest" clearance between buildings and lines of 34kV, or less, of 7.5 feet. It also requires a minimum wind displaced conductor clearance of 4.5 feet. From the above table, a 270' span of #2 ACSR has a 3.28' blow out. When added to the 4.5', a minimum clearance of 7.8' is required from a straight line between the attachment points.

#### NOTE

Consult standards engineering for 266ACSR & 795AAC information.

#### CONDUCTOR BLOW OUT BY WIND TABLE OF HORIZONTAL DISPLACEMENTS

DWG REV: 2/5/08

DWG: 440.1-13



DISTRIBUTION  
CONSTRUCTION  
STANDARDS

PRIMARY CONDUCTORS & ACCESSORIES

Issued: 1/1/2008

## Overhead 600V Secondary and Service Cable

Stock Number	Description	Ampacity	Nominal Insulation Thickness	Overall* Diameter (inches)	Breaking Strength (pounds)	Weight (lb/ft)	Iced 1/2" Vertical Loading (lb/ft)	INDUSTRY IDENT. CODE
420-224	477 AA	610	5/64"	.95	8360	.574	1.476	HUCKLEBERRY
420-228	4 duplex (4 ACSR messenger)	103	.045"	.57	1860	.117	.82	TERRIER
420-212	4 triplex (2-4 AA w/ 4 ACSR messenger)	103	.045"	.66	1860	.182	.90	PERIWINKLE
420-221	1/0 triplex (2-1/0 AA w/ 1/0 ACSR messenger)	200	.060"	1.02	4380	.42	1.37	NERITINA
420-226	1/0 quadruplex (3-1/0 AA w/ 1/0 ACSR messenger)	180	.060"	1.20	4380	.57	1.71	STANDARDRED
420-222	3/0 triplex (2-3/0 AA w/ 3/0 ACSR messenger)	265	.060"	1.23	6620	.62	1.70	CHERRYSTONE
420-001	3/0 quadruplex (3-3/0 AA w/ 3/0 AA messenger)	240	.060"	1.46	3040	.68	2.81	TROTTER
420-207	336.4 triplex (2-336.4 AA w/ 336.4 AA messenger)	438	.080"	1.63	6150	1.12	2.44	NANNYNOSE
420-208	336.4 quadruplex (3-336.4 AA w/ 3/0 ACSR messenger)	390	.080"	1.90	6620	1.44	3.03	

Ampacities are Aluminum Association values for wind and sun condition, XLP, 90 deg C.

\*circumscribed circle in case of cables

TRIPLEX CABLE DATA  
ACSR REDUCED SIZE BARE NEUTRAL-MESSENGER

SIZE AWG		PHASE CONDUCTORS							NEUTRAL CONDUCTORS					TOTAL WEIGHT PER 1000 FT.
		STRANDS AND STRAND DIAMETER (INCHES)	BARE DIAM. (INCHES)	INSULATION THICKNESS (MILS)	TOTAL DIAM. (INCHES)	AC RESIST OHMS/ 1000 FT. (75°C)	INDUCTIVE REACTANCE	AMPACITY (AMPS)	STRANDS & STRAND DIAM. (INCHES)	BARE DIAM. (INCHES)	AC RESIST OHMS/ 1000 FT. (75°C)	INDUCTIVE REACTANCE	BREAKER STRENGTH POUNDS	
PHASE COND.	NEUT. COND.	DIAMETER (INCHES)												
2	4	7-.0974	.292	45	.386	.3182	.029	120	6/1-.0834	.250	.5064	.030	1830	224.2
1/0	2	19-.0745	.373	60	.498	.2002	.029	160	6/1-.1052	.316	.3182	.029	2790	361.6
4/0	2/0	19-.1055	.528	60	.653	.1001	.027	245	6/1-.1490	.447	.1589	.028	5345	681.8

QUADRUPLEX CABLE DATA  
ACSR BARE NEUTRAL-MESSENGER

1/0	1/0	19-.0745	.373	.60	.498	.2002	.029	140	6/1-.1327	.398	.216	.029	4280	224.2
4/0	4/0	19-.1055	.528	.60	.653	.1001	.027	210	6/1-.1878	.563	.116	.027	8420	361.6
500	266.8	37-.1162	.831	.80	.985	.0425	.026	460	26/7-.0788	.642	.078	.026	11250	681.8
750	477	61-.1109	.998	.80	1.200	.0286	.026	604	26/7-.1054	.858	.0437	.026	19450	681.8

DWG REV: 12/13/07  
 ALUMINUM AND ACSR  
 CABLES & CONDUCTORS  
 OVERHEAD 600V CLASS USE  
 DWG: 500.1-3



**DISTRIBUTION  
CONSTRUCTION  
STANDARDS**

**OH SECONDARIES & SERVICES-GENERAL**

Issued: 1/1/2008

Appendix A-2: Westar Energy Conductor Properties, Sag and Tension Tables



COPPER -- BARE									
SIZE	NO OF STRANDS	OVERALL DIA (IN)	BARE WT (LB/FT)	BREAKING STRENGTH (LBS)	MAX CURRENT (AMPS)	► CU NAME	SDB ITEM ID	► CU NAME	HDB ITEM ID
6	1	0.162	0.08	1280	144	WRCU6SD	0161200	CNDCU6HDB	0148800
4	1	0.204	0.129	1970	187	WRCU4SD	0161300	CNDCU4HDB	0148900
2	1	0.258	0.205	3000	243	WRCU2SD	0161400	CNDCU2HDB	0149000
1	3	0.360	0.256	3620	270	----	----	----	0150000
1/0	7	0.368	0.326	4750	318	CNDCU1/0SDB	7621007	CNDCU1/0	0150200
2/0	7	0.414	0.411	5927	362	CNDCU2/0SDB	0151102	CNDCU2/0HDB	0150300
4/0	7	0.522	0.654	9154	470	CNDCU4/0SD	0151130	CNDCU4/0HDB	0150500
300	19	0.629	0.927	13510	573	----	7626590	----	----
500	19	0.811	1.544	21950	758	CNDCU500SDB	7626635	----	----
750	61	0.998	2.316	34090	942	CNDCU750SDB	7626680	----	----

COPPERWELD -- EHS BARE							
SIZE	NO OF STRANDS	OVERALL DIA (IN)	BARE WT (LB/FT)	BREAKING STRENGTH (LBS)	MAX CURRENT (AMPS)	► CU NAME	ITEM ID
3--NO 10	3	0.220	0.087	3720	110	CNDCW3-10	0151700


ACSR -- BARE *								
CODE NAME	SIZE	NO OF STRANDS	OVERALL DIA (IN)	BARE WT (LB/FT)	BREAKING STRENGTH (LBS)	MAX CURRENT (AMPS)	► CU NAME	ITEM ID
SPARROW	2	6/1	0.316	0.091	2790	*	CNDAL2	0162702
RAVEN	1/0	6/1	0.398	0.145	4380	*	CNDAL1/0	0162802
QUAIL	2/0	6/1	0.447	0.183	5310	*	CNDAL2/0	0162900
PENGUIN	4/0	6/1	0.563	0.291	8350	*	CNDAL4/0	0163100
OWL	266	6/1	0.633	0.342	9680	----	----	7650574
PARTRIDGE	266	26/7	0.642	0.367	11300	*	CNDAL266	0163200
LINNET	336	26/7	0.721	0.463	14100	*	CNDAL336	0163300
HAWK	477	26/7	0.858	0.657	19500	*	CNDAL477	7650640
OSPREY	556	18/1	0.879	0.604	13700	*	CNDAL556	0163600
FLAMINGO	666	24/7	1.000	0.858	23700	*	CNDAL666	7650642
DRAKE	795	26/7	1.108	1.094	31500	*	CNDAL795	0163800
RAIL	954	45/7	1.165	1.075	25900	*	CNDAL954	7650645
T-2 RAVEN	2 --1/0	--	0.652	0.290	8760	*	CNDAL1/0T2	0162801
T-2 PENGUIN	2 --4/0	--	0.922	0.582	16700	*	CNDAL4/0T2	7650190
T-2 PARTRIDGE	2-266	--	1.051	0.735	22600	*	CNDAL266T2	0163201
T-2 HAWK	2-477	--	1.405	1.314	39000	*	CNDAL477T2	7650192

**NOTES:**

\* FOR MAX CURRENT (AMPS) SEE LCS 7-020

□ AMPACITIES FROM EBASCO TABLE M 551 A 40°C AMBIENT, 40°C RISE WIND 2 FPS.

► DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.							PHYSICAL CHARACTERISTICS OF CONDUCTORS		
	9	12/12/16	MCG	HM	RO	WESTAR ENERGY, INC.			
	8	12/31/13	KD	JJR	BB	ALL RIGHTS RESERVED			
	NO.	DATE	BY	CK	APP	SHEET 1 OF 1	LCS	7 -040	REV 9

ALUMINUM UNDERGROUND CABLE  
SINGLE CONDUCTOR  
600 VOLT XLP INSULATION

1

ITEM ID	▶ CU CODE	CONDUCTOR SIZE	NO. OF STRANDS	SINGLE CABLE LBS/FT	DIAMETER (INCHES)	AMPACITY TRIPLEXED	AMPACITY SINGLE CONDUCTOR IN AIR
						BURIED IN CONDUIT	
0144500	CBLUAL1/0	1/0	19	0.154	0.54	154	200
0144800	CBLUAL4/0	4/0	19	0.281	0.69	232	312
0144900	CBLUAL350	350 MCM	37	0.441	0.88	313	431
0145000	CBLUAL500	500 MCM	37	0.612	1.01	383	544
0145100	CBLUAL750	750 MCM	61	0.905	1.2	482	707
0145200	CBLUAL1000	1000 MCM	61	1.162	1.33	562	853

ALUMINUM UNDERGROUND CABLE  
FACTORY MULTIPLEXED  
600 VOLT XLP INSULATION

2

ITEM ID	▶ CU CODE	CONDUCTOR SIZE	NEUTRAL SIZE	NO. OF STRANDS	MULTI- PLEXED (LBS/FT)	DIAMETER (INCHES)	AMPACITY	
							BURIED IN CONDUIT	(40° C AMB) IN AIR
0144000	CBLUALTPX1/0	1/0 TRI	2	19	0.416	1.13	160	215
0144300	CBLUALTPX4/0	4/0 TRI	2/0	19	0.729	1.47	241	285
7655751	CBLUALTPX350	350 TRI	4/0	37	1.158	1.85	326	364
8005006	CBLUALQPX1/0	1/0 QUAD	2	9	0.534	1.24	160	215
0144350	CBLUALQPX4/0	4/0 QUAD	2/0	18	0.971	1.59	241	285
7655752	CBLUALQPX350	350 QUAD	4/0	30	1.527	2.01	326	364

ALUMINUM OVERHEAD SERVICE CABLE

3

ITEM ID	▶ CU CODE	TYPE	COND SIZE	NEUTRAL	DIAMETER (INCHES)	MULTI-PLEXED (LBS/FT)	AMPACITY
0146502	CBLALDPX6	DUPLEX	6	6	0.452	0.075	70A
0146901	CBLALTPX2	TRIPLEX	2	4	0.75	0.228	130A
0147002	CBLALTPX1/0	TRIPLEX	1/0	2	0.95	0.366	185A
7655411	CBLALTPX4/0	TRIPLEX	4/0	2/0	1.26	0.681	295A
0147401	CBLALQPX1/0	QUADRUPLX	1/0	1/0	1.12	0.549	175A
7655419	CBLALQPX4/0	QUADRUPLX	4/0	4/0	1.49	1.038	275A

NOTES:

1 ONDU TOR T RATUR 0° ARTH A BI NT 75% LOAD FA TOR IN TH TRIPLEX C NFIGURATI N.

2 A A ITI SAR FRO I A -46-4 6 TABL S FOR 90° ONDU TOR T RATUR AND 40° AIR A BI NT.

3 AMPACITIES ARE FR M ALUMINUM ASS CIATI N TABLE 10-1.

4 WESTAR ENERGY USES XLP INSULATI N F R ITS ST CKED 600-V LT CABLES.

▶ DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.



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NO.	DATE	BY	CK	APP	SHEET 1 OF 1

PHYSICAL  
CHARACTERISTICS  
OF CONDUCTORS

LCS 7 -050 REV 8

ALL ALUMINUM-BARE  
EC-H19 ASTMB231

CODE WORD	SIZE	STRANDING	DIAMETER	WEIGHT LBS/FT	BREAKING STRENGTH LBS	MAXIMUM CURRENT	ITEM ID.
IRIS	2	7	.292	.0623	1350	180	7650630
ASTER	2 / 0	7	.414	.1249	2510	280	7650620
OXLIP	4 / 0	7	.522	.1986	3830	380	7650622
SYRINGA	477	37	.795	.4478	8690	645	7650639
ARBUTUS	795	37	1.026	.7463	13900	900	7650644
MAGNOLIA	954	37	1.124	.896	16400	1010	0164050

□ 40° AMBIENT  
50°C RISE IN AIR  
WIND 2 FPS  
FROM ALUMINUM ASSOCIATION TABLES


COPPER CABLE  
SINGLE CONDUCTOR  
600 VOLT XLP INSULATOR

ITEM ID.	▶ CU CODE	CONDUCTOR SIZE	NO. OF STRANDS	SINGLE CABLE LBS/FT	AMPACITY TRIPLEXED*	AMPACITY Δ SINGLE CONDUCTOR IN AIR
					BURIED IN CONDUIT	
7651330	--	2	7	0.243	153	192
7651342	CBLUCU1/0600V	1/0	19	0.384	204	258
7651345	CBLUCU3/0	3/0	19	0.591	268	345
7651360	CBLUCU350	350	37	1.190	416	552
0156500	CNDCUWP500	500	37	1.681	509	695
7651370	CBLUCU750	750	61	2.511	636	898
0158000	CBLUCU1000	1000	61	3.316	731	1076

\* AMPACITIES ARE FROM IPCEA P-46-426 TABLES FOR RHO 90, 90°C CONDUCTOR TEMPERATURE, 20°C EARTH AMBIENT, 75% LOAD FACTOR IN THE TRIPLEX CONFIGURATION.

Δ AMPACITIES ARE FROM IPCEA P-46-426 TABLES FOR 90, 90°C CONDUCTOR AIR AMBIENT.

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NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.							PHYSICAL CHARACTERISTICS OF CONDUCTORS		
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	3	12/31/13	KD	JJR	BB	ALL RIGHTS RESERVED			
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# SAG TABLE DESIGN PARAMETERS - COMMON CONDUCTORS

CONDUCTOR		RULING SPAN	MAXIMUM DESIGN TENSION AT 0° F, 0.5" ICE, 4 LBS. WIND, INITIAL	
		FEET	% of RATED TENSILE STRENGTH (RTS)	POUNDS
477.0 ACSR	"HAWK"	175	19.2%	3750
26/7	RTS = 19500	200	20.5%	4000
		250	24.1%	4700
		300	△1	5000
266.8 ACSR	"PARTRIDGE"	175	21.2%	2400
26/7	RTS = 11300	200	23.0%	2600
		250	26.8%	3025
		300	36.5%	3400
1/0 AWG ACSR	"RAVEN"	175	31.1%	1365
6/1	RTS = 4380	200	33.8%	1480
		250	38.8%	1700
		300	43.8%	1920
#2 AWG ACSR	"SPARROW"	175	40.0%	1075
6/1	RTS = 2850	200	40.7%	1160
		250	46.8%	1335
		300	52.1%	1485

## NOTES:

- △1 MAXIMUM ALLOWABLE STANDARD TENSION ON HARDWARE PER WESTAR POLICY IS 5000 LBS. THIS IS APPROXIMATELY HALF OF A TYPICAL MANUFACTURER'S RATING FOR HARDWARE (10000 LBS). FOR DESIGNS OUTSIDE THESE PARAMETERS, CONSULT ENGINEERING.
- LOWER RULING SPANS ARE PREFERRED BECAUSE OF LOWER CONDUCTOR TENSION. THE DESIGNER CAN LOWER THE RULING SPAN BY SHORTENING SPAN LENGTHS WHEN SPANS LENGTHS ARE NOT CONTROLLED BY DESIGN REQUIREMENTS. SEE LCS 7-067 FOR INFORMATION ON CALCULATING THE RULING SPAN. CALCULATING RULING SPAN INCORRECTLY OR SELECTING THE WRONG SAG TABLE WILL RESULT IN INCORRECT CONDUCTOR TENSION AND SAG VALUES.
- FOR NEW CONSTRUCTION, RULING SPANS OF 175 AND 200 FEET ARE CONSIDERED STANDARD. RULING SPANS OF 250 AND 300 FEET ARE CONSIDERED NON-STANDARD.
- DOWNGUYS MAY BE NECESSARY FOR DIFFERENTIAL TENSIONS AT DOUBLE-DEADENDS USING THE SAME CONDUCTOR BUT DIFFERENT RULING SPANS, AND THEREFORE DIFFERENT TENSIONS. CONSULT STANDARDS IF ASSISTANCE IS NECESSARY TO DETERMINE THE NECESSITY OF AN ADDITIONAL DOWNGUY OR ALTERNATIVE METHOD OF HANDLING THE DIFFERENTIAL TENSIONS.
- SAG VALUES COMPLETED ON 10/25/2015 WITH SOUTHWIRE SAG 10 SOFTWARE, VERSION 3.10.7.

► DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.



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SAG TABLE  
DESIGN PARAMETERS

LCS 7 -065 REV 0

## RULING SPAN CALCULATIONS

### RULING SPANS:

**DESIGNERS SHALL CALCULATE RULING SPAN VALUES AND NOTE THEM ON THE PLANS FOR THE JOB.**

SAG VALUES ARE DEPENDENT ON THE CALCULATION OF A RULING SPAN. THIS INVOLVES CONSIDERING ALL SPANS IN A JOB FROM DEADEND-TO-DEADEND.

A CALCULATED RULING SPAN WILL ALWAYS BE EQUAL OR GREATER TO THE AVERAGE SPAN, ALTHOUGH A RULING SPAN CAN SOMETIMES BE APPROXIMATED BY AN AVERAGE SPAN. IF ALL SPANS IN A JOB ARE THE SAME THE RULING SPAN AND AVERAGE SPAN ARE EQUAL. (SIMILARLY, IF ONLY ONE SPAN EXISTS BETWEEN TWO DEADENDS THE RULING SPAN IS THE SPAN LENGTH.) AS THE VARIANCE BETWEEN THE SPANS INCREASE, THE GREATER THE RULING SPAN WILL BE VERSUS THE AVERAGE SPAN. THIS IS THE REASON FOR USING AN ACTUAL RULING SPAN CALCULATION INSTEAD OF A SIMPLE AVERAGE.

A RULING SPAN IS THE SQUARE ROOT OF THE SUM OF THE CUBE OF EACH SPAN DIVIDED BY THE SUM OF THE SPANS. A VISUAL REPRESENTATION OF THIS FOLLOWS:

$$\sqrt{\frac{S1^3 + S2^3 + S3^3 \dots}{S1 + S2 + S3 \dots}}$$

FORTUNATELY, THERE ARE MANY FREE WEBPAGES AND EVEN PHONE APPS FOR THE PURPOSE OF CALCULATING A RULING SPAN, SO MANUAL CALCULATIONS MAY NOT ALWAYS BE NECESSARY.

SEE SECTION 3 OF RURAL UTILITIES SERVICE (RUS) BULLETIN 1724E-152 FOR ADDITIONAL INFORMATION ON RULING SPAN.

### IMPORTANT - CONSIDER LONG SPANS AGAINST RULING SPAN:

AFTER A NUMBER IS CALCULATED FOR A RULING SPAN AND A RULING SPAN IS CHOSEN FROM THE FOUR AVAILABLE TABLES, IT IS HIGHLY RECOMMENDED TO LOOK AT ALL SPANS IN A JOB TO SEE IF ANY SPAN EXCEEDS 1.25 TIMES THE CHOSEN RULING SPAN VALUE. THIS ENSURES THE SAG WILL NOT BE MORE THAN PREDICTED FOR THE LONGEST SPANS IN THE JOB. USING THE EXAMPLE ABOVE, THE HIGHEST SPAN LENGTH (230) DOES NOT EXCEED (1.25 x 200 = ) 250 FEET. IF IT DID, CORRECTIVE ACTION SHOULD BE TAKEN. THIS COULD BE DONE BY EITHER:

1. BUMPING UP TO THE NEXT RULING SPAN, -OR-
2. DEADENDING TO ISOLATE THE LONG SPANS SO AS TO REMOVE THEM FROM THE RULING SPAN CALCULATION. SINCE THE LONG SPANS THEMSELVES WOULD LIKELY BE TENSIONED HIGHER, AS THEY WOULD BE PART OF THEIR OWN RULING SPAN CALCULATION, THIS MAY REQUIRE GUYS TO HANDLE THE DIFFERENTIAL TENSION AT THE POLE(S) AT THE NEW DEADENDS CREATED.

MOST OF THE TIME SIMPLY USING THE NEXT HIGHER RULING SPAN WILL TAKE CARE OF THE PROBLEM BUT THE DEADEND OPTION MAY BE WORTH CONSIDERATION IN SOME CASES.

► DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.



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SHEET 1 OF 1

### RULING SPAN CALCULATIONS

LCS 7 -067

REV 0

## RULING SPAN CALCULATIONS

### ROUNDING

CALCULATED RULING SPAN SHOULD BE ROUNDED UP OR DOWN TO ONE OF THE STANDARD RULING SPANS. THIS IS DONE SIMPLY BY CONSIDERING WHICH NUMBER THE RULING SPAN IS CLOSER TO. FOR EXAMPLE, A CALCULATED RULING SPAN OF 220 FEET IS ROUNDED DOWN TO THE 200-FOOT STANDARD SPAN, A CALCULATED RULING SPAN OF 228 FEET IS ROUNDED UP TO THE 250-FOOT STANDARD SPAN.

IT IS IMPORTANT TO CONSIDER WHETHER THE LONGEST SPANS IN A RUN VIOLATE THE 125% RULE. IF A RULING SPAN IS CALCULATED TO BE 220 FEET AND A STANDARD SPAN OF 200 FEET IS CHOSEN, AND UPON LOOKING AT THE SPAN LENGTHS WE FIND TWO SPANS OF 260 FEET, IT MIGHT BE PRUDENT TO INSTEAD USE THE STANDARD 250-FOOT SPAN.

CONSULT STANDARDS FOR MORE INFORMATION.

### M

AN EXAMPLE CALCULATION FOLLOWS. CONSIDER FOUR SPANS

SPAN 1 = 200  
SPAN 2 = 230  
SPAN 3 = 190  
SPAN 4 = 195

THE CUBES CAN BE FOUND:

SPAN 1: 8000000  
SPAN 2: 12167000  
SPAN 3: 6859000  
SPAN 4: 7414875 --> SUM OF THESE CUBES IS 34440875

THE SUM OF CUBES (34440875) DIVIDED BY THE SUM OF SPANS (815) IS 42258.7. WE THEN TAKE THE SQUARE ROOT OF THAT NUMBER TO GET A RULING SPAN OF 205.6. NOTE THIS IS SLIGHTLY HIGHER THAN THE AVERAGE SPAN OF 203.8. THE SAG TABLES GIVE US FOUR OPTIONS TO CHOOSE FROM FOR A RULING SPAN FOR THE JOB (175, 200, 250, AND 300). FOR THIS CASE, WE WOULD USE A 200-FOOT RULING SPAN FROM THE SAG TABLES.

► DENOTES LATEST REVISION

NOTE: UNLESS SPECIFIED OTHERWISE, ALL DIMENSIONS ARE IN INCHES.



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SHEET 2 OF 2

### RULING SPAN CALCULATIONS

LCS 7 -067

REV 0

## Appendix B-1: MIL-STD-105D Variable Definitions for Field Measurements

### Definition of Defects

#### Major Defect

- Incorrect pole measured
- Incorrect pole type (species) recorded
- Incorrect pole class recorded
- Incorrect type of construction recorded
- Existing conductor or equipment not accounted for
- Lack of minimum ground clearance measurement for the lowest cable or conductor along each span in each unique direction to the pole
- Existing steel reinforcing truss not accounted for

#### Minor Defect

- Pole Facility height measurements off by more than 6"
- Conductor or cable span measurements off by more than 2'
- Line angle measurement for primary voltage conductors or 1" or larger communications conductors off by more than 2 degrees
- Line angle measurement for secondary, service drop, or communications conductors smaller than 1" off by more than 5 degrees
- Conductor, cable, or equipment type and size off by the next common size

#### Variable Definitions

- General Inspection Level II (Table I of MIL-STD-105D) shall be used
- Single Sampling Plan shall be used
- 'Normal' inspection level shall be used as the initial inspection level for each attaching entity or its agents
- The Acceptable Quality Level (AQL) for Major Defects, as described above, shall be 4.0
- The AQL for Minor Defects, as described above, shall be 6.5

## Appendix B-2: MIL-STD-105D Variable Definitions for Pole Loading Analysis

### Definition of Defects

#### Critical Defect

- Incorrect pole analyzed
- Pole not analyzed that meets criteria requiring modeling
- Pole loading analysis results indicate an overloaded pole as not being overloaded
- Remedy for overloaded pole or clearance violations do not resolve pole overload or clearance violation
- Remedy for overloaded pole or clearance violations violate NESC or Company Construction Standards
- Pole loading analysis results off by more than 20%

#### Minor Defect

- Incorrect Final Tension values calculated and recorded on the Pole & Facility Data Sheet
- Incomplete or incorrect data based on data recorded in the Pole & Facility Data Sheet (Checker's field data corrections shall not be considered a defect for this area)
- Not accounting for all loads in the pole loading analysis
- Improper modeling of loads in the pole loading analysis
- Not modeling loads based on the most recent NESC Tables 251-1 and 261-1A
- Not providing data (all necessary and accurately defined) on proposed attachment(s)
- Improper modeling and analysis of steel reinforcing truss (analysis above and below truss required), if applicable
- Improper modeling and analysis of wickers, if applicable
- Improper pole loading analysis program settings
- Pole loading analysis results off by more than 5%

#### Variable Definitions

- General Inspection Level II (Table I of MIL-STD-105D) shall be used
- Single Sampling Plan shall be used
- 'Normal' inspection level shall be used as the initial inspection level for each attaching entity or its agents
- The Acceptable Quality Level (AQL) for Major Defects, as described above, shall be 1.0
- The AQL for Minor Defects, as described above, shall be 4.0



## Appendix B-3: MIL-STD-105D Variable Definitions for As-Built Construction

### Definition of Defects

#### Critical Defect

- NESC clearance violations exist
- Violations to Company clearance requirements exist
- Through bolt holes drilled within 3" (vertically measured) or another through bolt hole

#### Major Defect

- Construction does not reflect pole or clearance remedy design
- Attachment installed is larger or heavier than proposed in the attachment application
- Assigned facility positioning order is not adhered to in the make-ready or construction
- New conductor or cable facilities are not attached to each pole in the cable's route
- New facilities installed on a cross arm or on the opposite side of the pole as the other existing attacher's facilities
- Tenant's facilities are not properly guyed
- Tenant's guys are attached to Company anchors
- Tenant's guys are missing insulators
- Vertical and horizontal runs of tenant's facilities are improperly constructed and installed per NESC and Company Construction Standards.

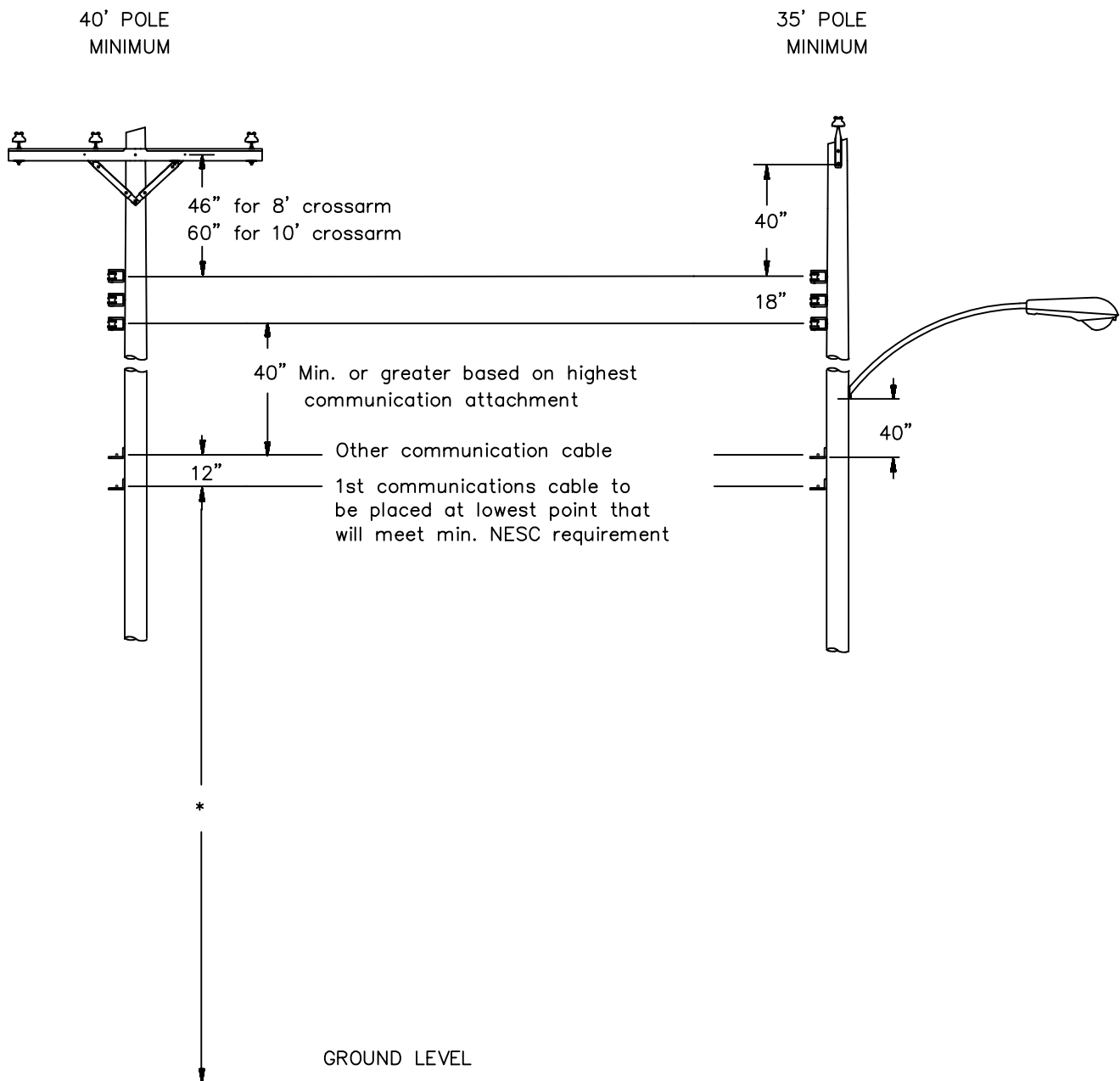
#### Minor Defect

- Missing, improperly installed, or improperly located tenant tag.
- Tenant Tag installed does not meet Tenant Tag Material Specifications (see Appendix D).
- Installation of tenant's facilities infringe upon climbing and working space on the pole
- Abandoned bolt holes resulting from make-ready or construction are not plugged

#### Variable Definitions

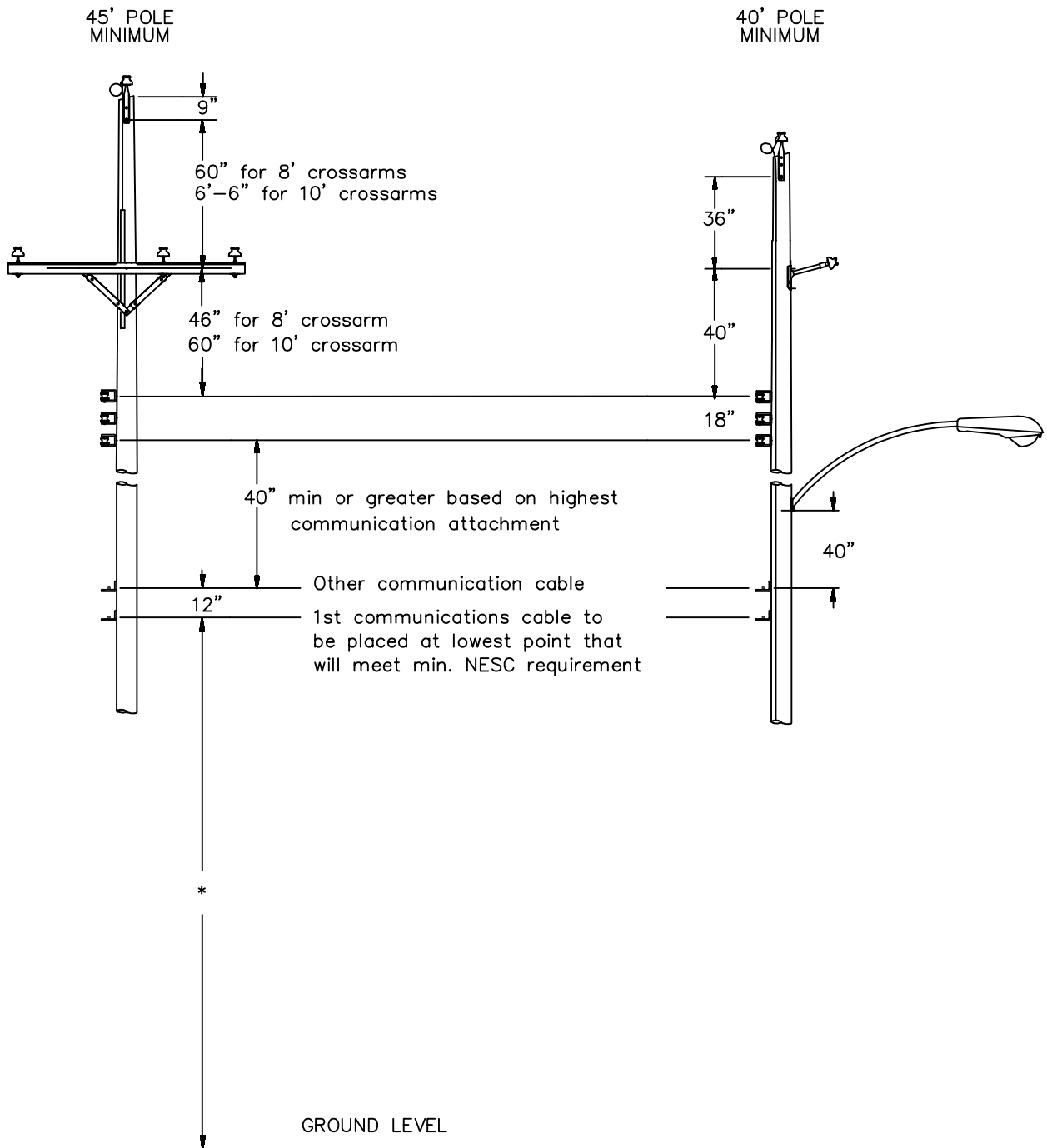
- General Inspection Level II (Table I of MIL-STD-105D) shall be used
- Single Sampling Plan shall be used
- 'Normal' inspection level shall be used as the initial inspection level for each attaching entity or its agents
- The Acceptable Quality Level (AQL) for Critical Defects, as described above, shall be 1.0
- The AQL for Major Defects, as described above, shall be 4.0
- The AQL for Minor Defects, as described above, shall be 6.5

## Appendix C: Drawings



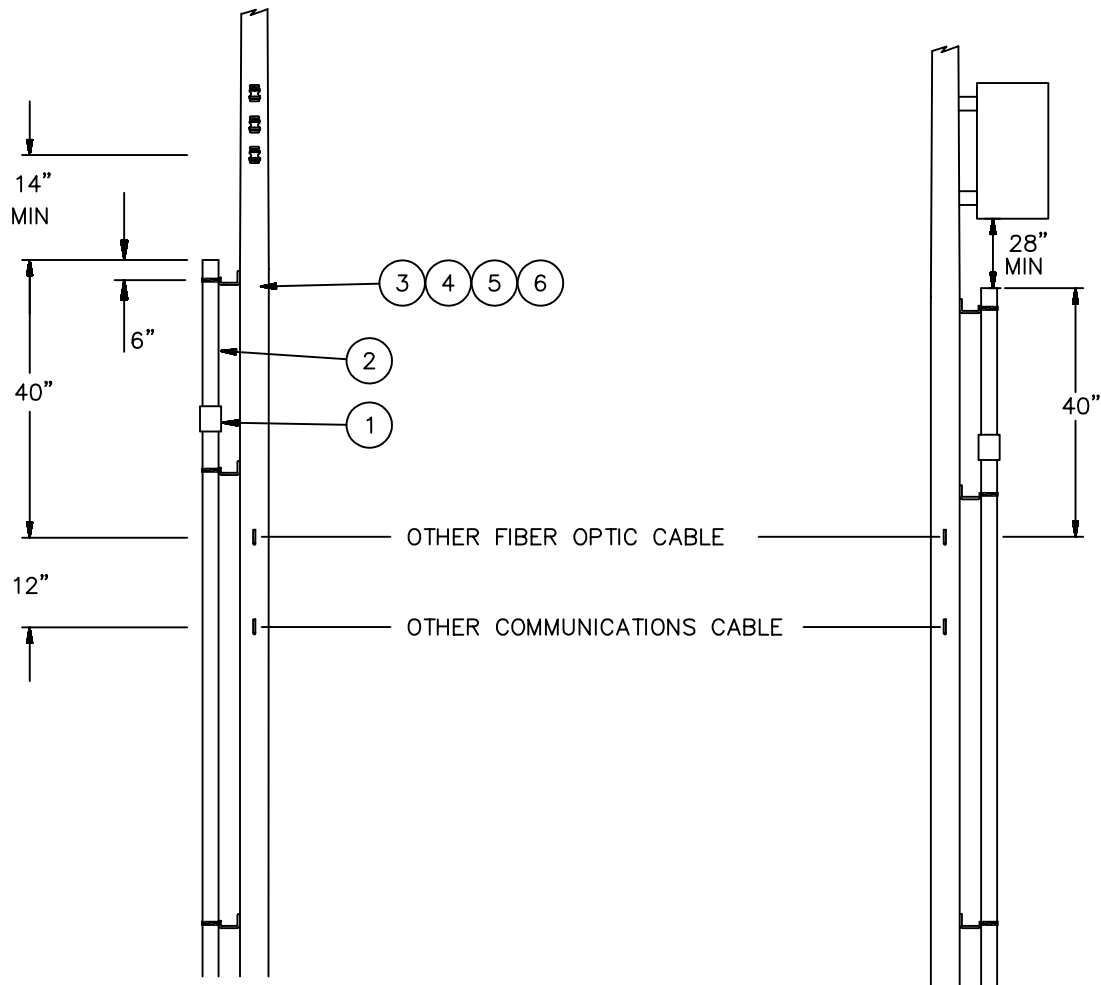
\*Lowest communications attachment height is dictated by achieving minimum ground clearance allowed by NESC at any point in a span.

**SPACING FOR  
POLE ATTACHMENTS  
(UNSHIELDED CONSTRUCTION)**



\*Lowest communications attachment height is dictated by achieving minimum ground clearance allowed by NESC at any point in a span.

**SPACING FOR  
POLE ATTACHMENTS  
(SHIELDED CONSTRUCTION)**



DUCT SIZE	QUANTITY	STOCK NUMBER	
	1/2" STEEL BANDING	SPLIT DUCT	SPLIT COUPLING
2"	1.5'	450-010	450-013
3"	2'	450-011	450-016
4"	2.5'	450-012	450-014
5"	3'	D.O.	D.O.
6"	3.5'	D.O.	D.O.

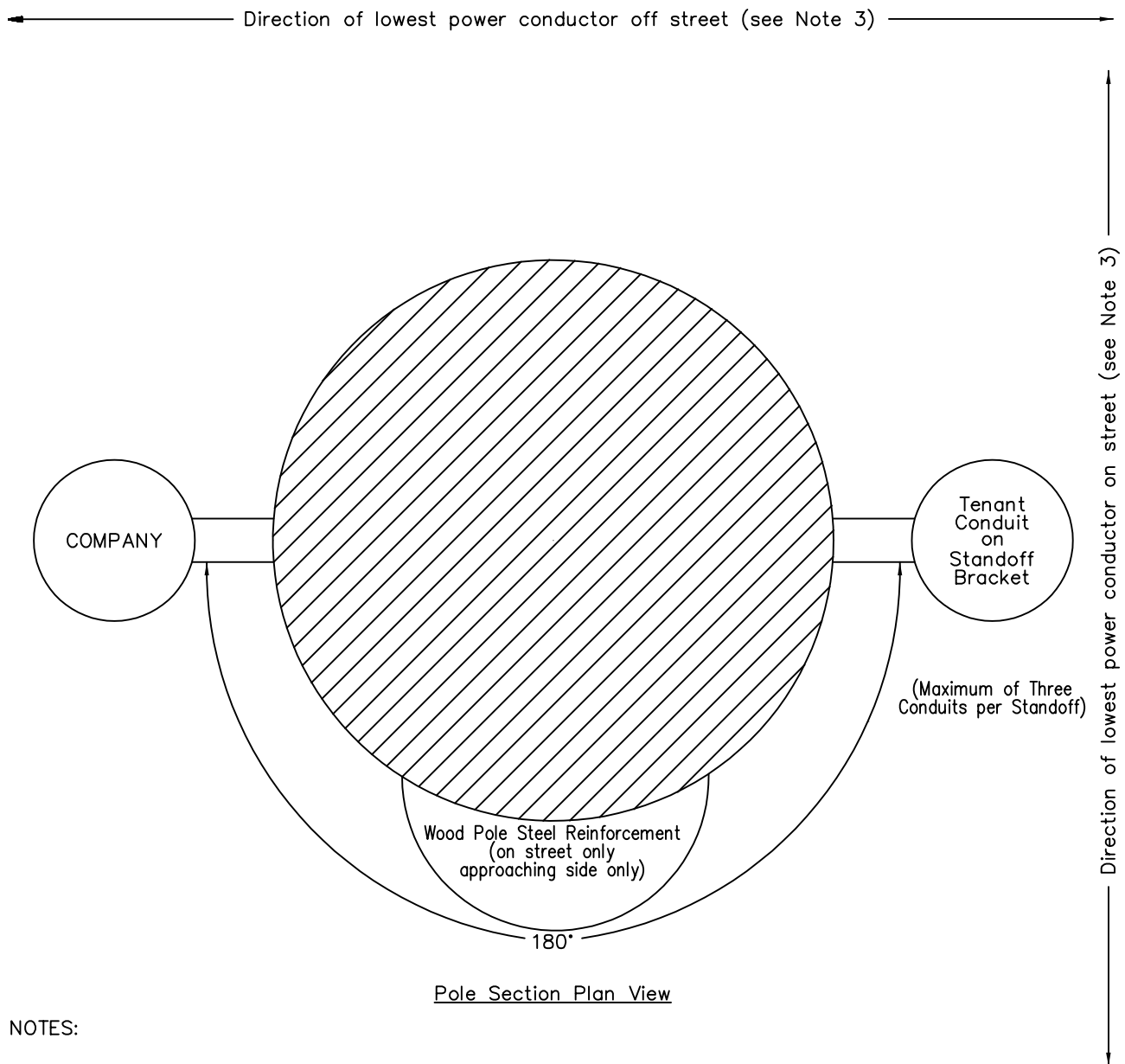
D.O. - DIRECT ORDER

6	SEE TABLE	1/2" STEEL BANDING	453-070
5	1	1/2" X 4" LAG SCREW	409-064
4	1	1/2" BANDING BUCKLE	453-072
3	1	STANDOFF BRACKET	406-084
2	SEE TABLE	SPLIT DUCT PIPE	SEE TABLE
1	SEE TABLE	SPLIT DUCT COUPLING	SEE TABLE
ITEM	QUAN	DESCRIPTION	STK NO

**DUST RISER EXTENSION  
SECONDARY SERVICES**

DWG REV: 09/21/04

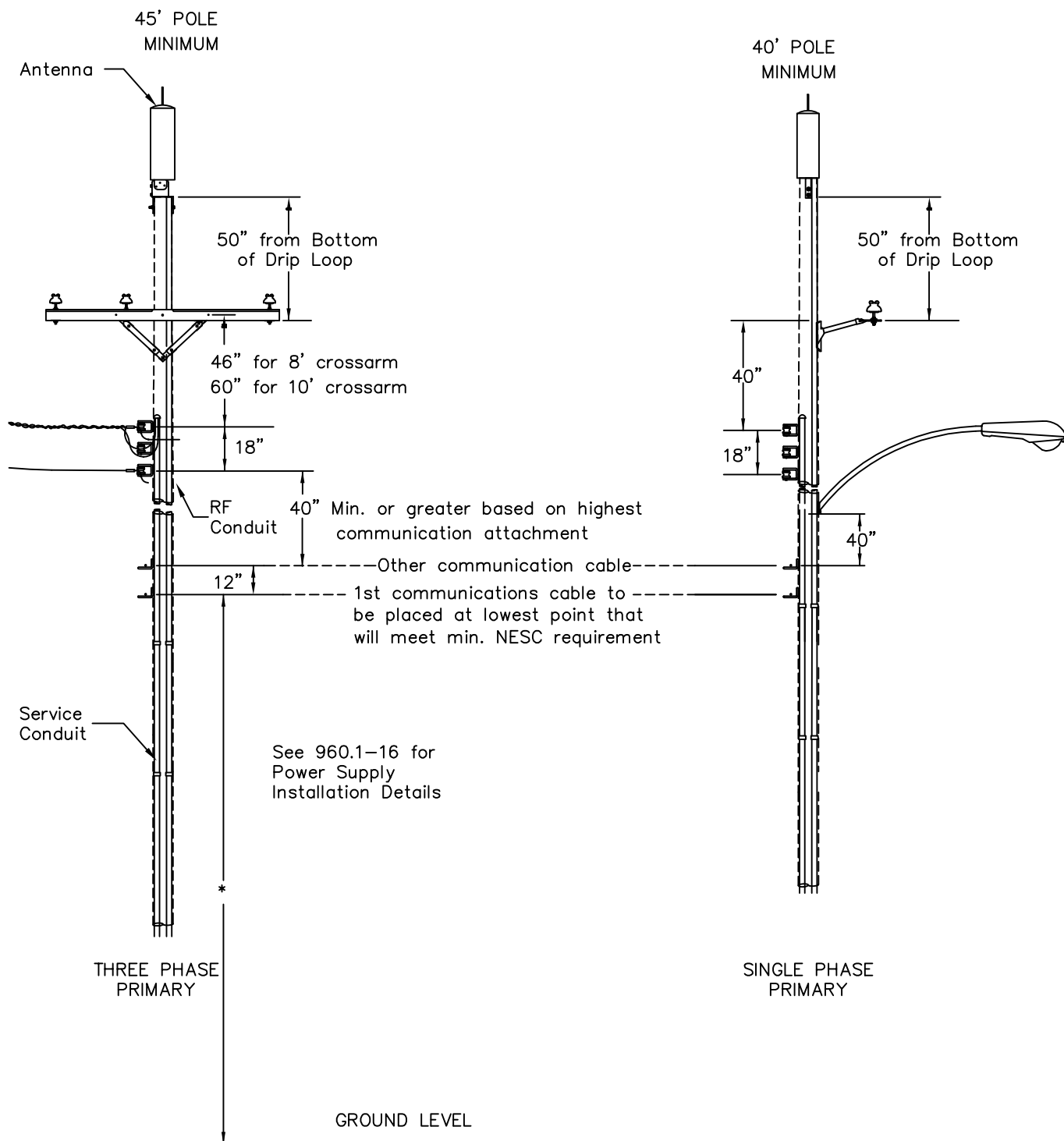
DWG: **960.1-10**



NOTES:

1. TENANT'S CONDUIT ON STANDOFF BRACKETS MUST NOT OCCUPY MORE THAN 180° OF POLE SECTION PERIPHERY.
2. ILLUSTRATION IS AN EXAMPLE ONLY AND IS NOT INTENDED TO INDICATE A PARTICULAR ORDER OR QUANTITY OF DEVICES OR RISERS ON A POLE.
3. LOWEST POWER CONDUCTOR MAY BE SECONDARY, NEUTRAL, OR PRIMARY DEPENDING ON STYLE OF CONSTRUCTION.
4. THERE SHALL BE NO MORE THAN TWO STANDOFF BRACKETS PER POLE AS SHOWN ABOVE. ONE STANDOFF BRACKET WILL BE RESERVED FOR FUTURE KCPL FACILITIES.

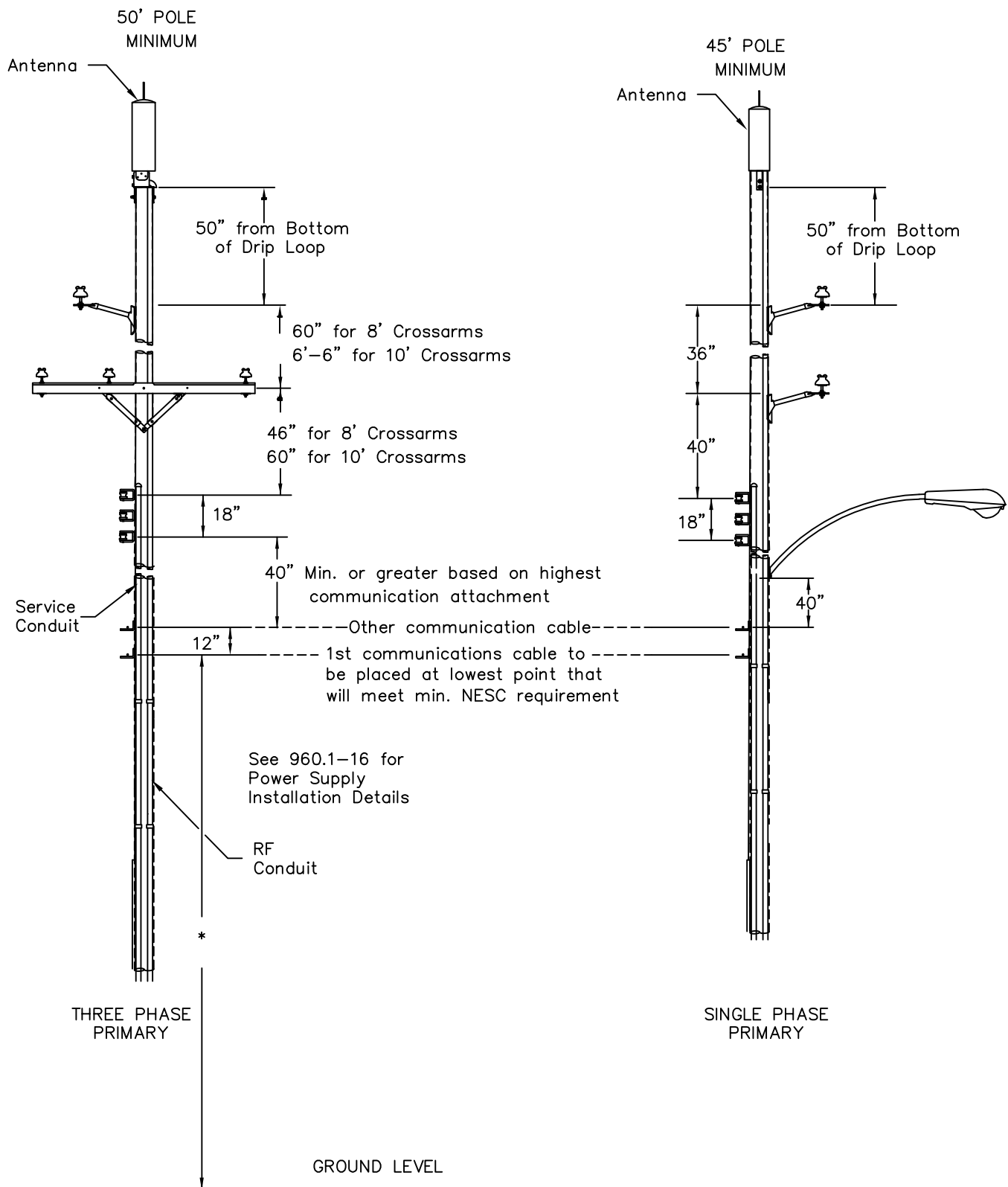
**MAXIMUM POLE RISER  
OCCUPANCY**



\*LOWEST COMMUNICATIONS ATTACHMENT HEIGHT IS DICTATED BY ACHIEVING MINIMUM GROUND CLEARANCE ALLOWED BY NESC AT ANY POINT IN A SPAN.

SEE 960.1-17 FOR EQUIPMENT STAND AND RISER LOCATIONS.

**SPACING FOR  
POLE ATTACHMENTS  
(UNSHIELDED CONSTRUCTION)**



\*Lowest communications attachment height is dictated by achieving minimum ground clearance allowed by NESC at any point in a span.

See 960.1-17 for Equipment Stand and Riser Locations.

**SPACING FOR  
POLE ATTACHMENTS  
(SHIELDED CONSTRUCTION)**



Company Secondary  
Pole by Company.

40"  
Min.

Communication  
Cables

RF Conduit  
to Antenna  
See 960.1-14 or  
960.1-15 for  
Antenna details

Customer shall install ground wire and rod as shown. All metal enclosures shall be bonded to pole ground. Service mast may be Schedule 40 PVC electrical plastic conduit. RF conduit shall be Schedule 40 PVC, 2" maximum.

See 960.1-17 for  
Equipment Stand  
and Riser location

Ground Wire  
Molding

See 960.1-17 for  
Cable Riser details

12"

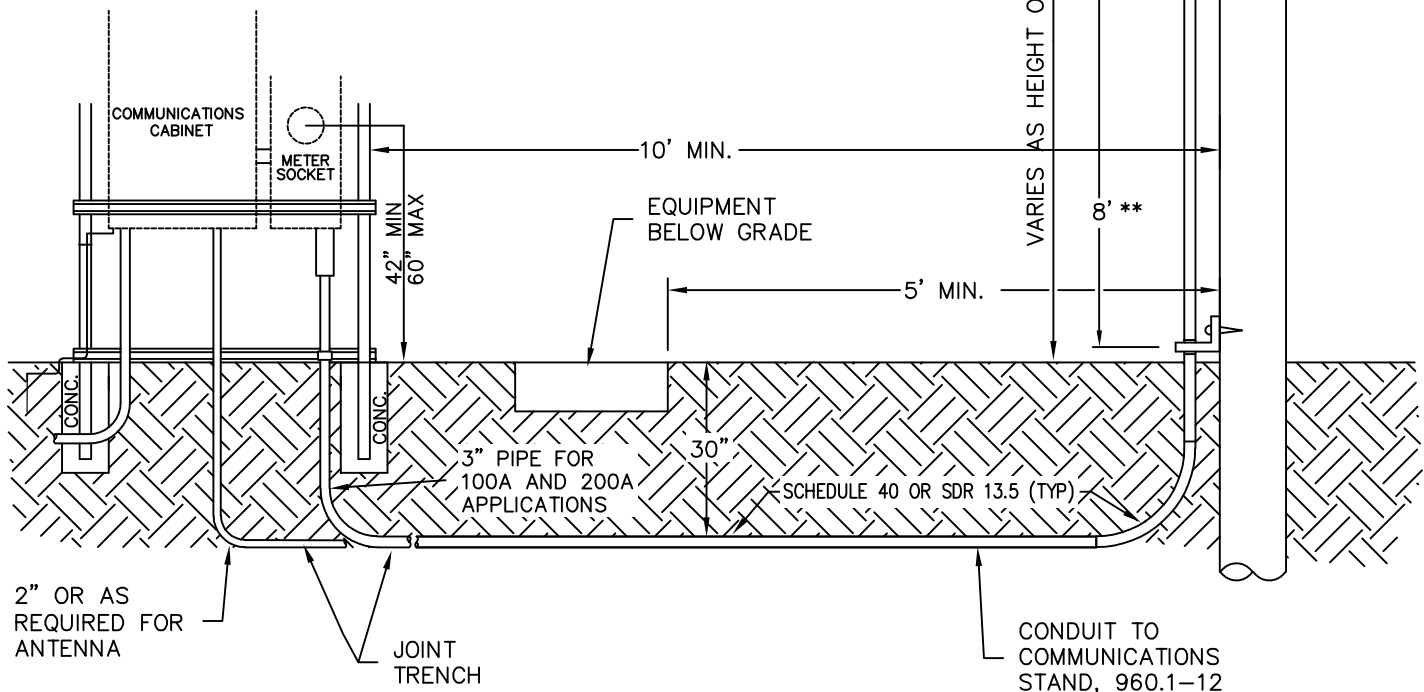
**POLE MOUNTED  
COMMUNICATIONS  
EQUIPMENT AND  
POWER SUPPLY FEED**

**NOTES:**

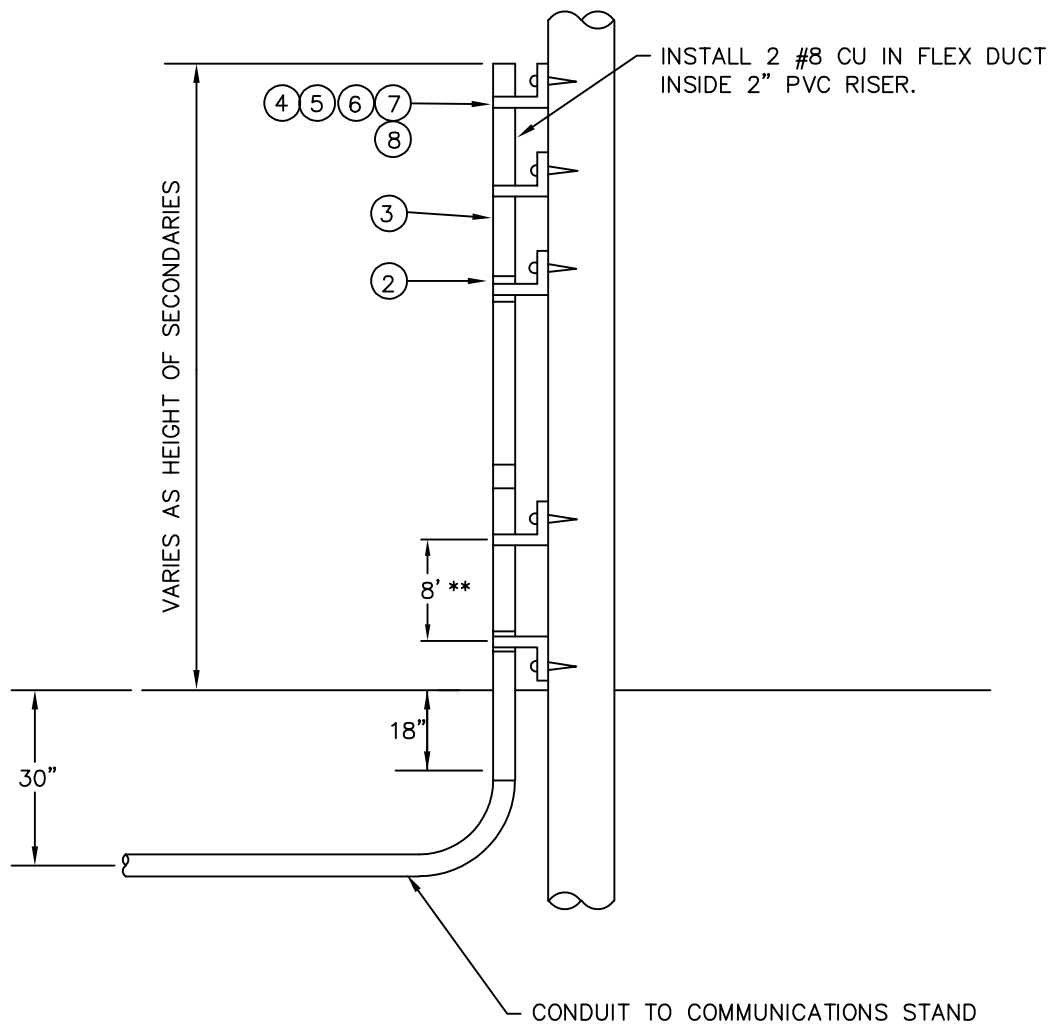
- A. APPROVED METER SOCKET FURNISHED AND INSTALLED BY CUSTOMER. DO NOT USE METER SOCKET TO ENCLOSE OR TERMINATE HIS SYSTEM GROUND.
  - B. INSULATED BUSHING FURNISHED AND INSTALLED BY CUSTOMER.
  - C. INSTALL CONDUIT SLIP JOINT TO COMPENSATE FOR SOIL SETTLING. LEAVE SUFFICIENT SLACK IN SERVICE CONDUCTORS TO ALLOW JOINT TO WORK.
  - D. DO NOT USE CENTER KNOCKOUT FOR INCOMING CONDUIT.
  - E. ALL CONDUIT-ELECTRICAL PLASTIC WHOLE INCH SIZE CONDUIT FURNISHED, PROPERLY INSTALLED, OWNED AND MAINTAINED BY CUSTOMER. COMPANY TO INSPECT BEFORE BACKFILLING.
  - F. COMMERCIAL CUSTOMERS MUST PROVIDE AND INSTALL CABLE, LEAVE ENOUGH CABLE TO GO UP THE POLE.
  - G. CONDUITS MAY BE INSTALLED IN JOINT TRENCH MEETING REQUIREMENTS OF 960.1-13. FOREIGN SERVICE CONDUITS TO BE A MINIMUM OF 18" FROM COMPANY.
  - H. INSTALL 2-HOLE CLAMP ABOVE ELBOW TO STAND. LEAVE CLAMP LOOSE TO ALLOW SLIP JOINT TO WORK.
  - J. COMMUNICATIONS, RF AND SERVICE COUDUITS SHALL BE BANDED TO ONE SET OF STAND-OFF BRACKETS.
  - K. BELOW GRADE EQUIPMENT MUST BE 5' MINIMUM FROM POLE.
- \*\* THE DISTANCE BETWEEN THE BOTTOM STANDOFF BRACKET AND THE SECOND STANDOFF BRACKET SHALL BE 8'.

SEE 960.1-14 FOR ANTENNA DETAILS  
SEE 960.1-16 FOR SERVICE DETAILS

**COMMUNICATIONS CUSTOMER EQUIPMENT**  
SEE DWG 820.1-13 FOR DETAILS



**CABLE RISER FOR  
COMMUNICATION  
TERMINAL POLES**



NOTE:

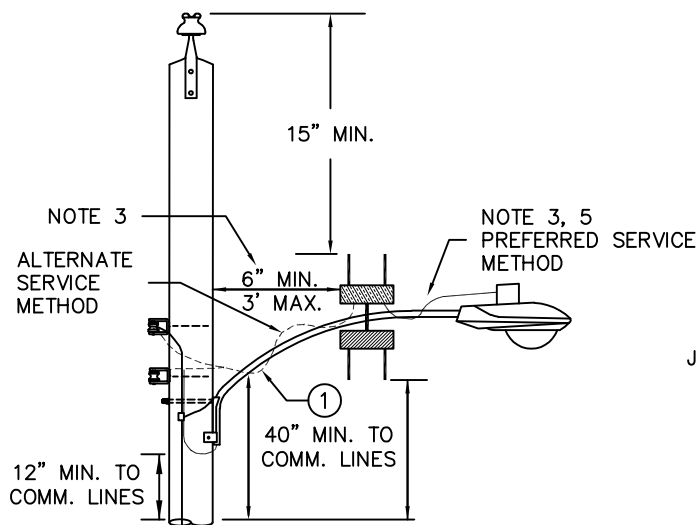
1. INSTALL PIPE AS HIGH AS CONNECTIONS WILL ALLOW. INSTALL TWO STANDOFF BRACKETS PER 10' SECTION OF PIPE ABOVE BOTTOM SECTION.

\* AS REQUIRED

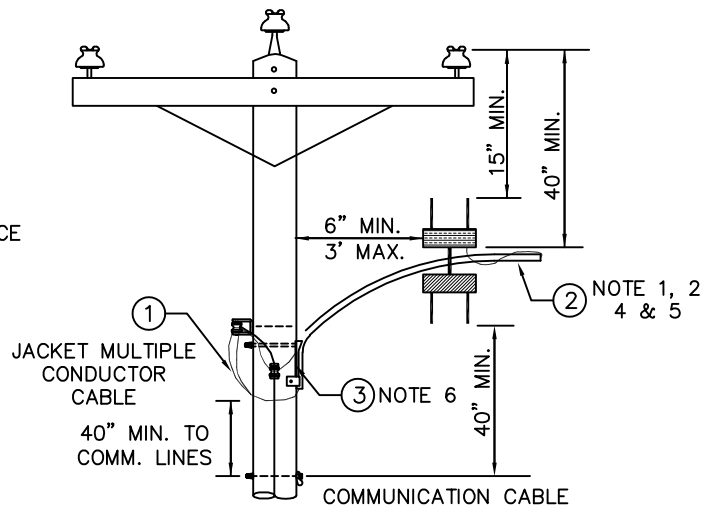
\*\* THE DISTANCE BETWEEN THE BOTTOM STANDOFF BRACKET AND THE SECOND STANDOFF BRACKET SHALL BE 8'.

MU-6SRP-2

ITEM	QUAN	DESCRIPTION	STK NO
2	*	2" COUPLING	450-063
3	*	2" PLASTIC PIPE	450-057
4	*	STANDOFF BRACKET	406-084
5	*	1/2" X 4" LAG SCREW	409-064
6	*	1/2" STEEL BANDING	453-070
7	*	1/2" BANDING BUCKLE	453-072
8	*	RISER BRACKET MULTIPLE PIPE ADT	406-001



EXISTING OPEN WIRE SECONDARY  
AND STREET LIGHT



CABLE SECONDARY, NO STREET LIGHT

NOTE:

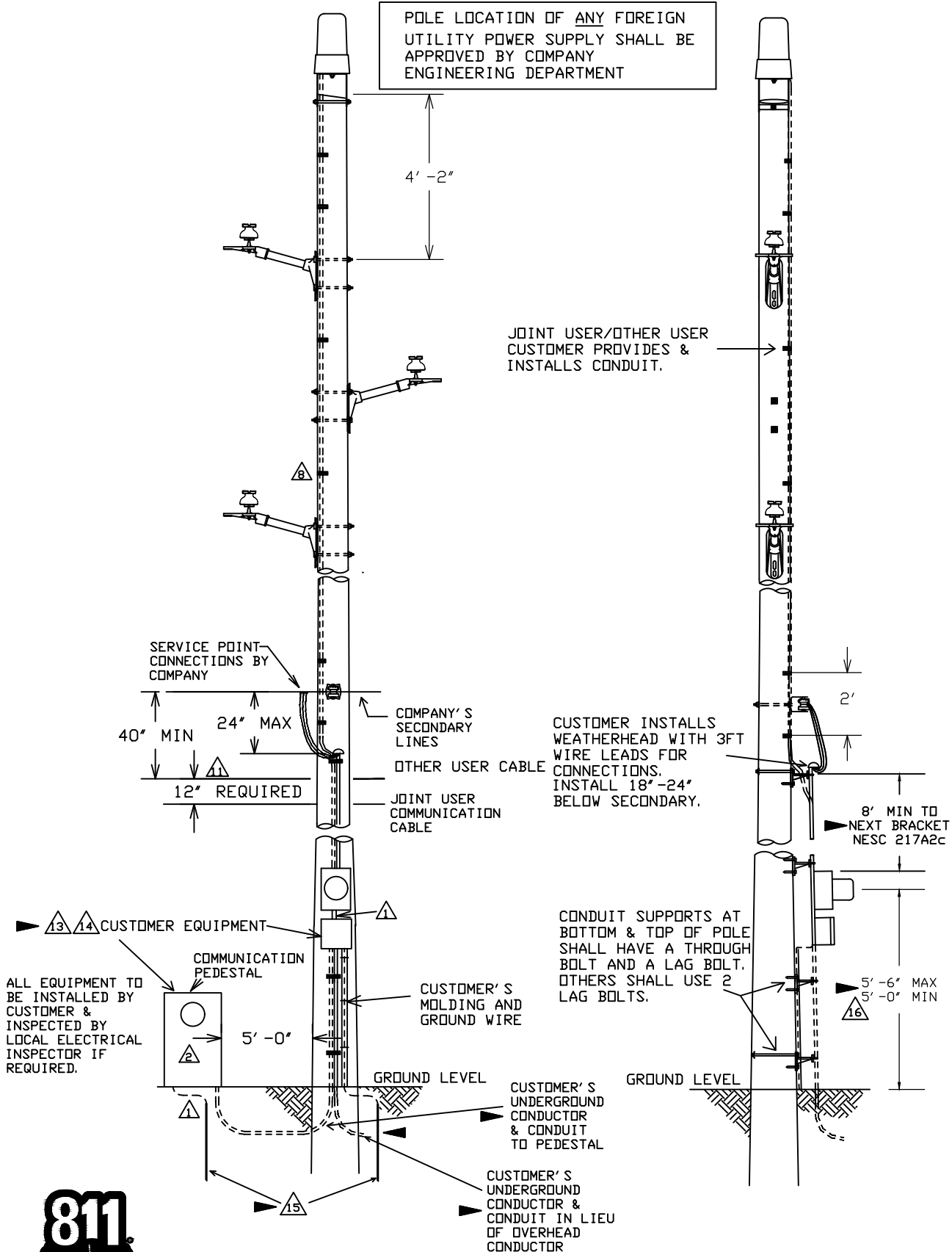
1. SUPPLY CABLE FOR PACKET ANTENNA & COMMUNICATION EQUIPMENT TO BE JACKETED MULTIPLE CONDUCTOR CABLE.
2. IF THERE IS NO EXISTING STREET LIGHT BRACKET ARM USE BRACKET ARM LISTED IN ITEM 2. WHEN A BRACKET ARM IS INSTALLED SOLELY TO MOUNT COMMUNICATION EQUIPMENT THE JACKETED MULTIPLE CONDUCTOR CABLE SHOULD BE INSTALLED INSIDE THE BRACKET ARM. SEE 910.1-4.
3. MAXIMUM WEIGHT OF COMMUNICATION EQUIPMENT NOT TO EXCEED 15 lbs WHEN INSTALLED ON EXISTING STREET LIGHT BRACKET ARM. COMMUNICATION EQUIPMENT TO BE INSTALLED A MAXIMUM OF 3' FROM POLE ON EXISTING BRACKET ARM.
4. CUSTOMER TO PROVIDE AND INSTALL BRACKET ARM, CONNECTORS AND JACKETED MULTIPLE CONDUCTOR CABLE AS REQUIRED.
5. TO INSTALL AND MAINTAIN EQUIPMENT WORKERS MUST BE QUALIFIED TO WORK IN SUPPLY SPACE AND USE SUPPLY WORK RULES AND METHODS.
6. BRACKET ARM SHALL BE BONDED TO POLE GROUND WITH #6 S.D. BARE COPPER CONDUCTOR.

**ANTENNA MOUNTED  
IN SUPPLY SPACE  
WIRELESS ATTACHMENT  
DEVICE**

RD	NF	KD	1/17/14	0	6/30/14	JJR	BY
BB	RD	JJR	6/30/14	1	6/30/14	RD	CHECK
				2	6/30/14	BB	APPROVED
NEW DRAWING FUNCTIONALLY REPLACING OLD DWG 69.0 MULTIPLE CHANGES AFFECTING CUSTOMER EQUIPMENT							

# ELECTRIC SERVICE STANDARDS

SS-69. 0A



Know what's below.  
Call before you dig.

► DENOTES LATEST REVISION

COMMERCIAL-OVERHEAD  
SERVICE TO JOINT USER/OTHER USER  
REQUIREMENTS FOR POLE TOP  
ANTENNAS OR CABLE ATTACHEMENTS

ELECTRIC SERVICE STANDARDS					SS-69.0B	
REV	DATE	DESCRIPTION	BY	CHECK	APPROVED	
2	10/10/16	ADD NOTE REF SERVICE TYPE AND METERS	JJR	JJR	RO	
1	6/30/14	MULTIPLE CHANGES AFFECTING CUSTOMER EQUIPMENT	JJR	RO	BB	
0	1/17/14	NEW DRAWING FUNCTIONALLY REPLACING OLD DWG 69.0	KD	NF	RO	

NOTES:

1

CUSTOMER SHALL INSTALL FUSE DISCONNECT AND GROUND ROD PER NEC AND LOCAL CODE. IF A PEDESTAL IS USED, CUSTOMER'S 1/2" X 8 FT GROUND ROD SHALL BE AT THE PEDESTAL AT A MINIMUM 5' FROM POLE. SEE NOTE #16.

2

METER ENCLOSURE FURNISHED OR APPROVED BY COMPANY, INSTALLED BY CUSTOMER. METER TO BE WIRED 120/240, 3 WIRE AT THE PEDESTAL. REFER TO SS-50.1 THROUGH SS-50.5 FOR MORE INFORMATION.

3

CUSTOMER SHALL BOND POWER SUPPLY BOX TO CUSTOMER INSTALLED GROUND ROD AS PER NEC REQUIREMENTS. (SEE SS-57.0 FOR ADDITIONAL GROUNDING DETAILS)

4

IN THE EVENT COMPANY'S GROUND ROD IS PRESENT, CUSTOMER'S GROUND ROD SHALL BE LOCATED A MINIMUM OF 6FT FROM WESTAR ENERGY'S GROUND ROD.

5

ANTENNA CABLE(S) SHALL BE INSTALLED IN MAX 2" NON METALLIC CONDUIT.

6

ANTENNA CABLE(S) CONDUIT SHALL BE INSTALLED ON STANDOFF ADJACENT TO SERVICE RISER TO WITHIN 24" BELOW WESTAR ENERGY'S NEUTRAL.

7

ANTENNA CABLE(S) CONDUIT SHALL TRANSITION TO TANGENT FACE OF POLE BELOW NEUTRAL FROM STANDOFF.

8

ANTENNA CABLE(S) CONDUIT SHALL BE ATTACHED TO POLE USING 2-HOLE CONDUIT STRAPS AT INTERVALS OF MAXIMUM 2 FEET USING A MINIMUM OF 4" LENGTH LAG SCREWS .

9

THE ANTENNA POWER SOURCE MUST HAVE LOCKABLE DISCONNECT INSTALLED TO ALLOW THE ANTENNA AND BATTERY BACKUP TO BE DE-ENERGIZED BEFORE WORK IS PERFORMED WITHIN THE AREA DESIGNATED BY THE RF WARNING SIGNS.

10

THE USE OF POLE TOP EXTENSIONS IS PROHIBITED.

11

NEW "OTHER USER" CABLE SHALL BE INSTALLED AT THE TOP COMMUNICATION LOCATION AND ALL EXISTING CABLES SHALL BE LOWERED AND SEPARATED AS REQUIRED BY THE NESC (LATEST EDITION) ARTICLE 235 AND 238.

12

ALL JOINT USE AND OTHER USER CABLES SHALL BE TAGGED WITH COMPANIES ASSIGNED TAG NUMBER ON EQUIPMENT AND EVERY THIRD POLE.

13

ATTACHEE MAY HAVE THEIR EQUIPMENT MOUNTED TO THE POLE CONTAINED WITHIN NO MORE THAN TWO SEPARATE BOXES, ONE OF WHICH COULD BE COMPANY'S METER ENCLOSURE. ATTACHEE MAY ALSO HAVE A SEPARATE PEDESTAL WITH ADDITIONAL EQUIPMENT 5 FEET FROM THE POLE.

14

SIZE LIMIT FOR INDIVIDUAL EQUIPMENT BOXES ON POLE LIMITED TO 12"H X 10"W X 4"D. WEIGHT LIMIT FOR THE TWO BOXES COMBINED IS 40 POUNDS.

15

GROUND RODS SHALL MEET REQUIREMENTS OF NEC ARTICLE 250. BOTH RODS SHOWN IN DRAWING MAY NOT BE NECESSARY. CUSTOMER'S GROUND ROD SHALL BE LOCATED A MINIMUM OF 6FT FROM COMPANY'S GROUND ROD.

16


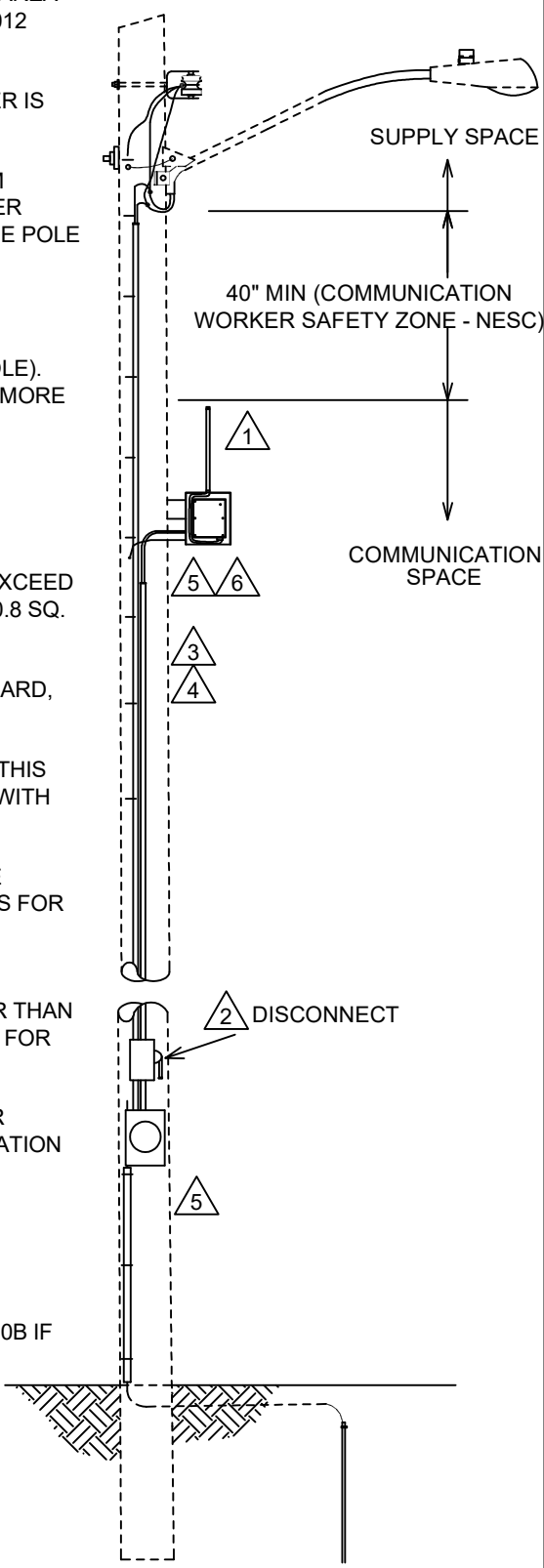
IF NEITHER OF THE TWO COMMUNICATIONS BOXES MOUNTED ON THE POLE CONTAIN COMPANY'S METERING EQUIPMENT, THE 5'-0" TO 5'-6" RANGE FOR THE METER FACE DOES NOT APPLY. IN THIS CASE, BOTH BOXES SHALL BE MOUNTED ON THE POLE WITH THEIR HIGHEST POINT NO MORE THAN 16 FEET FROM GROUND LEVEL.

► DENOTES LATEST REVISION

COMMERCIAL - OVERHEAD  
SERVICE TO JOINT USER/OTHER USER  
REQUIREMENTS FOR POLE TOP  
ANTENNAS OR CABLE ATTACHMENTS

WESTAR ENERGY, INC. ALL RIGHTS RESERVED

SS-69.0B

ELECTRIC SERVICE STANDARDS					SS-69.20A	
REV	DATE	DESCRIPTION	BY	CHECK	APPROVED	
0	10/10/16	NEW DRAWING BASED ON OLD SS 69.20	JJR	JJR	RO	
<p><u>ATTACHEE OBLIGATIONS:</u></p> <p>1 NO PORTION OF THE ANTENNA SHALL ENCROACH INTO THE AREA 40 INCHES BELOW THE SUPPLY SPACE. (AS REQUIRED BY 2012 NESC 238A)</p> <p>3 DISCONNECT SHALL ALWAYS BE REQUIRED, EVEN IF A METER IS ABSENT FROM THE INSTALLATION.</p> <p>4 CUSTOMER POWER WIRES SHALL BE ENCLOSED IN MINIMUM SCHEDULE 40 PVC CONDUIT. ANY CONDUIT WITH A DIAMETER LARGER THAN 1" WILL BE REQUIRED TO BE MOUNTED TO THE POLE VIA STANDOFF BRACKETS.</p> <p>5 CUSTOMER OWNED COMMUNICATIONS EQUIPMENT (BOXES, ANTENNAE) SHALL BE MOUNTED TO THE POLE VIA MIN. 6" STANDOFF BRACKETS (NOT MOUNTED DIRECTLY TO THE POLE). CUSTOMER EQUIPMENT AND CONDUITS SHALL TAKE UP NO MORE THAN TWO QUADRANTS OF THE POLE (SO AS TO MITIGATE CLIMBING SPACE ISSUES).</p> <p>6 BOND ALL CUSTOMER EQUIPMENT AND BRACKETS TO POLE GROUND.</p> <p>7 WEIGHT OF UNIT, ANTENNAS, AND EQUIPMENT SHALL NOT EXCEED 35 LBS, WITH A MAXIMUM EFFECTIVE PROJECTED AREA OF 0.8 SQ. FT, OR OTHERWISE APPROVED BY COMPANY ENGINEERING.</p> <p>8 ALL INSTALLATIONS SHALL BE IN ACCORDANCE WITH STANDARD, NESC, NEC, AND LOCAL CODES.</p> <p>9 MAKE READY WORK TO MEET REQUIREMENTS OUTLINED IN THIS STANDARD WILL BE BILLED TO ATTACHEE IN ACCORDANCE WITH THE AGREEMENT.</p> <p>10 COMPANY: 1) WILL APPROVE ALL POLE LOCATIONS BEFORE EQUIPMENT IS INSTALLED. 2) WILL APPROVE ANY REQUESTS FOR DEVIATIONS FROM THIS STANDARD.</p> <p>11 POLE LOADING ANALYSIS REQUIRED WITH PROPOSED COMMUNICATIONS AND EQUIPMENT. FOR ANY POLE TALLER THAN 60 FEET FROM GROUND LEVEL, CUSTOMER SHALL ANALYZE FOR EXTREME ICE/WIND USING NESC 250C AND 250D.</p> <p>12 ONLY ONE WIRELESS DEVICE (RECEIVER, TRANSMITTER, OR COMBINATION UNIT) SHALL BE ALLOWED IN THE COMMUNICATION SPACE ON THE POLE. BY EXTENSION, MULTIPLE WIRELESS ATTACHERS IN THE COMMUNICATION SPACE ARE NOT PERMITTED ON A SINGLE POLE.</p> <p>13 ADDITIONAL REQUIREMENTS STATED ON SS 69.21</p> <p>14 LOW-POWER AMI INSTALLATIONS ONLY MAY UTILIZE SS-69.20B IF SO DESIRED.</p>						
						
<p>► DENOTES LATEST REVISION</p>		<p><b>WIRELESS COMMUNICATION INSTALLATION IN COMMUNICATION SPACE (SMALL CELL)</b></p>				
WESTAR ENERGY, INC. ALL RIGHTS RESERVED					SS-69.20A	

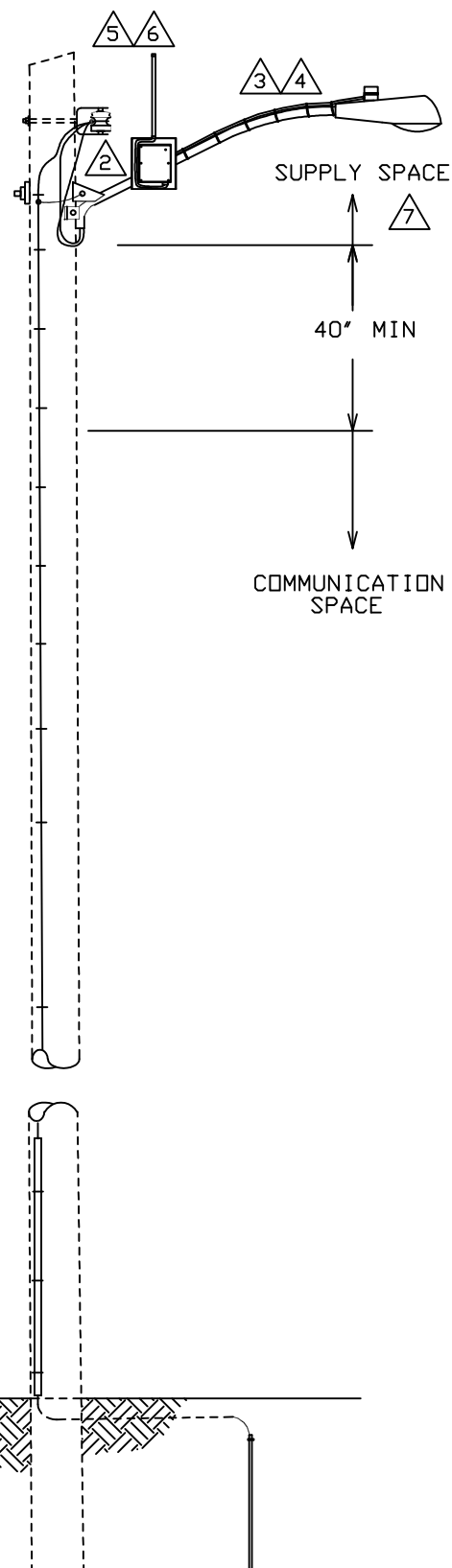
## NOTES:

## ATTACHEE OBLIGATIONS:

1. UNIT SHALL BE INSTALLED ON 120V STREETLIGHT INSTALLATIONS ONLY.
2. UNIT SHALL BE INSTALLED ON THE STREETLIGHT BRACKET AT A MAXIMUM DISTANCE OF 2 FEET FROM THE POLE SURFACE.
3. UNIT TO BE INSTALLED ON 2" DIA. STEEL STREETLIGHT BRACKET.
4. UNIT SUPPLY CABLE SHALL BE SECURED TO THE STREETLIGHT BRACKET.
5. UNIT SHALL BE MOUNTED WITH THE ANTENNA(S) RISING ABOVE THE UNIT.
6. WEIGHT OF UNIT, ANTENNAS AND EQUIPMENT SHALL NOT EXCEED 30 LBS. WITH A MAXIMUM EPA OF 0.8 SQ. FT. FOR 250W AND SMALLER LUMINAIRES. A MAXIMUM EPA OF 0.4 SQ. FT. FOR 400W LUMINAIRES. NO WIRELESS UNITS WILL BE INSTALLED ON BRACKETS WITH 1000W LUMINAIRES.
7. UNIT SHALL BE INSTALLED BY A QUALIFIED ELECTRICAL WORKER, SINCE THE UNIT WILL BE INSTALLED IN THE SUPPLY SPACE AS DEFINED IN THE NESC.
8. INSTALLATION SHALL BE IN ACCORDANCE TO THIS STANDARD, NESC, NEC AND LOCAL CODE.
9. MAKE READY WORK TO MEET REQUIREMENTS OUTLINED IN THIS STANDARD WILL BE BILLED TO ATTACHEE.
10. COMPANY: 1) WILL APPROVE ALL POLE LOCATIONS BEFORE EQUIPMENT IS INSTALLED.  
2) WILL APPROVE ANY ALTERATIONS FROM THIS STANDARD.
11. ADDITIONAL REQUIREMENTS STATED ON SS 69.21
12. ONLY ONE WIRELESS DEVICE (RECEIVER, TRANSMITTER, OR COMBINATION UNIT) LESS THAN 6x12x4 INCHES WILL BE ALLOWED PER POLE. MULTIPLE WIRELESS ATTACHERS ARE NOT PERMITTED ON A SINGLE POLE. A WIRELESS UNIT MAY BE ATTACHED TO A STREETLIGHT BRACKET ARM (DWG: 960.1-19). IF ATTACHED TO THE STREET LIGHT BRACKET ARM, THE WIRELESS UNIT MUST BE NO MORE THAN 3 FEET AND NO LESS THAN 6 INCHES FROM THE POLE THE BRACKET ARM IS MOUNTED TO. MAXIMUM WEIGHT OF COMMUNICATION EQUIPMENT SHALL NOT EXCEED 15 LBS WHEN INSTALLED ON EXISTING STREET LIGHT BRACKET ARM. WIRELESS DEVICE MUST BE INSTALLED BY COMPANY APPROVED CONTRACTOR THAT IS APPROVED TO WORK IN THE SUPPLY SPACE.
13. THIS DRAWING, FORMERLY 69.20, NOW TO BE USED FOR LOW-POWER AMI INSTALLATIONS ONLY. NON-AMI APPLICATIONS SHOULD REFER TO SS 69.0A AND/OR 69.20A AS APPROPRIATE.

\* EPA: EFFECTIVE PROJECTED AREA

▶ DENOTES LATEST REVISION

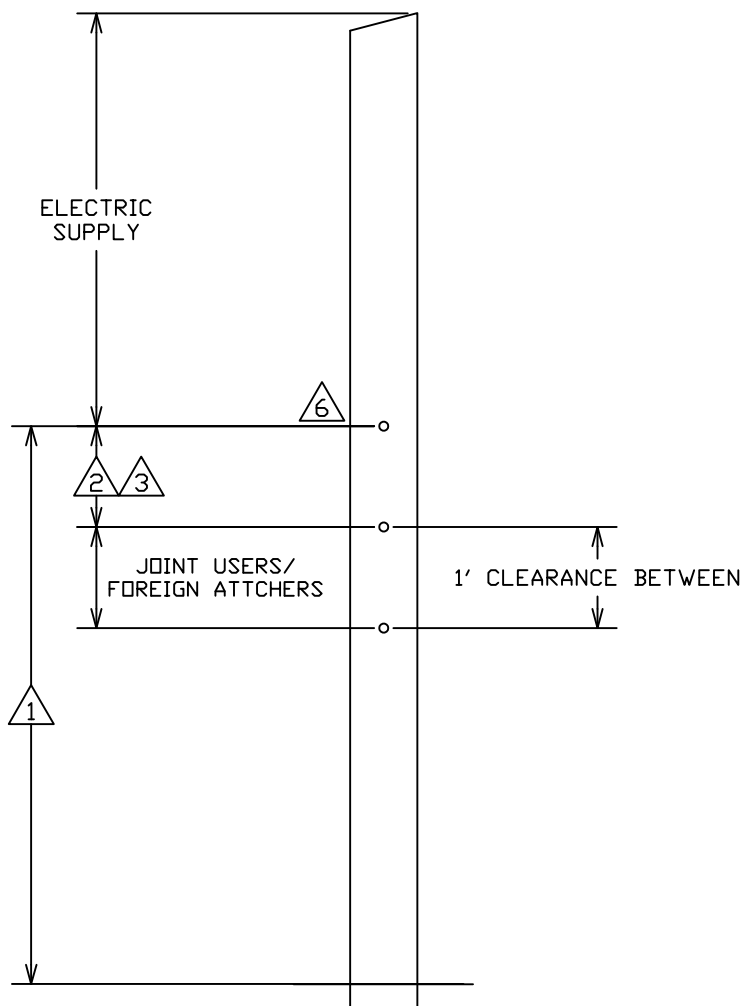


WIRELESS COMMUNICATION - AMI ONLY  
INSTALLATION ON STREETLIGHT  
BRACKETS



## EXHIBIT B-2

NEUTRAL HIGH OR NEUTRAL LOW, THE SPACING IS FROM THE LOWEST POINT OF ELECTRIC CONSTRUCTION TO THE HIGHEST POINT OF OTHER USERS/JOINT USERS CONSTRUCTION.



## NOTES:

1. REFERENCE NESC TABLES 232-1 LATEST REV. SEE SHEETS 8 AND 9.

2. POWER PRIMARY

VOLTAGE PHASE TO GROUND	SPACING TO OTHERS
0 - 8,700	40'
8,700 - 22,000	46'
22,000 - 35,000	53'
35,000 & GREATER	5'

3. MINIMUM CLEARANCE REQUIRED AT MID-SPAN IS 2/3 OF CLEARANCE AT POLE PER NESC 238.

4. COMMUNICATIONS CROSSING BENEATH AND PERPENDICULAR TO BUT NOT ATTACHED TO MUST MAINTAIN A 5' CLEARANCE, UNLESS HORIZONTAL DISTANCE IS CLOSER THAN 5', THEN THE COMMUNICATION LINE SHALL ATTACH, REF. NESC 223.

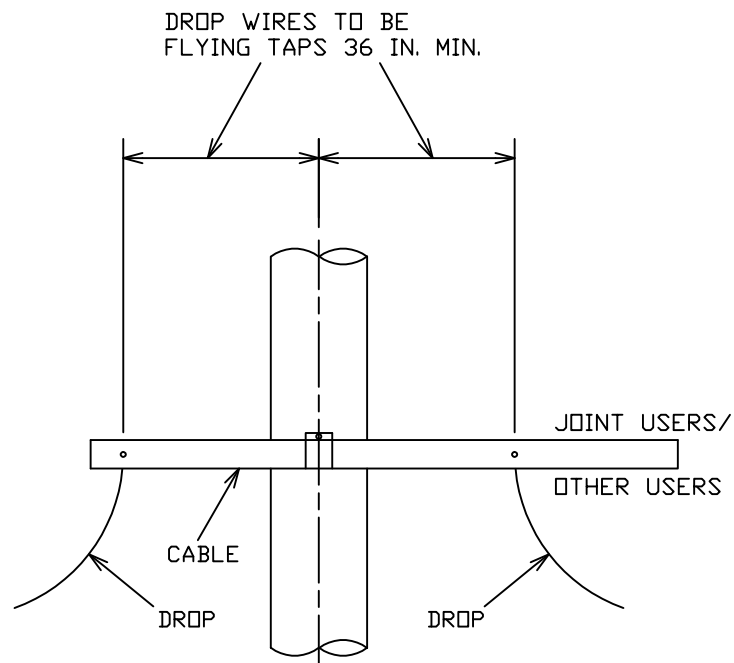
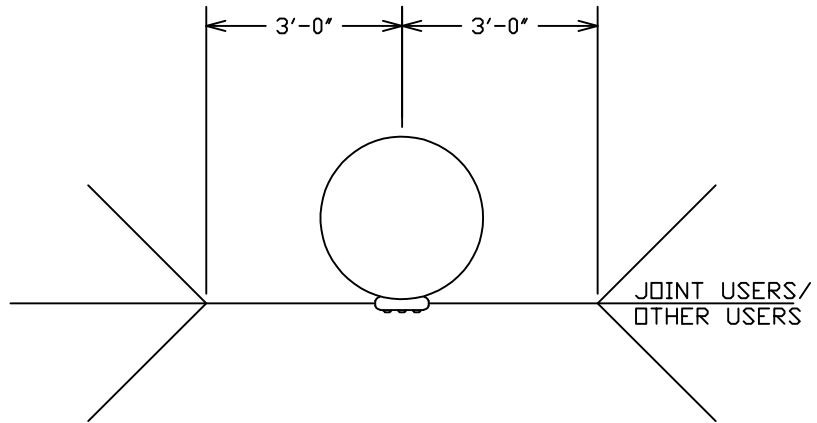
5. COMMUNICATION CONDUCTORS OR CABLES SHALL NOT ATTACH TO THE VOLTAGES (TRANSMISSION).

6. NEW 'OTHER USER' CABLE SHALL BE INSTALLED AT THE TOP COMMUNICATION LOCATION AND ALL EXISTING CABLES SHALL BE LOWERED AND SEPARATED AS REQUIRED BY THE NESC (LATEST EDITION) ARTICLE 235 AND 238.

7. ALL JOINT USE AND OTHER USER CABLES SHALL BE TAGGED WITH COMPANIES ASSIGNED TAG NUMBER ON EQUIPMENT AND EVERY POLE.

► DENOTES LATEST REVISION

JOINT USERS/OTHER USERS  
CLEARANCE ABOVE GROUND



## NOTES:

1. ALL ATTACHMENTS TO BE ON STREET SIDE OR FACE OF POLE.
2. DO NOT CRISSCROSS CABLES OR DROPS AT POLE.

► DENOTES LATEST REVISION

CLIMBING SPACE  
CLEARANCE

BY	KD	1/17/14	1
CHECK	NF	1/17/14	2
APPROVED	RD	1/17/14	3

REV		DATE	DESCRIPTION	BY	CHECK	APPROVED
1		9/22/17	ADDED NOTE 2:	CM	JJR	RO
0		1/17/14	NEW DRAWING	KD	NF	RO

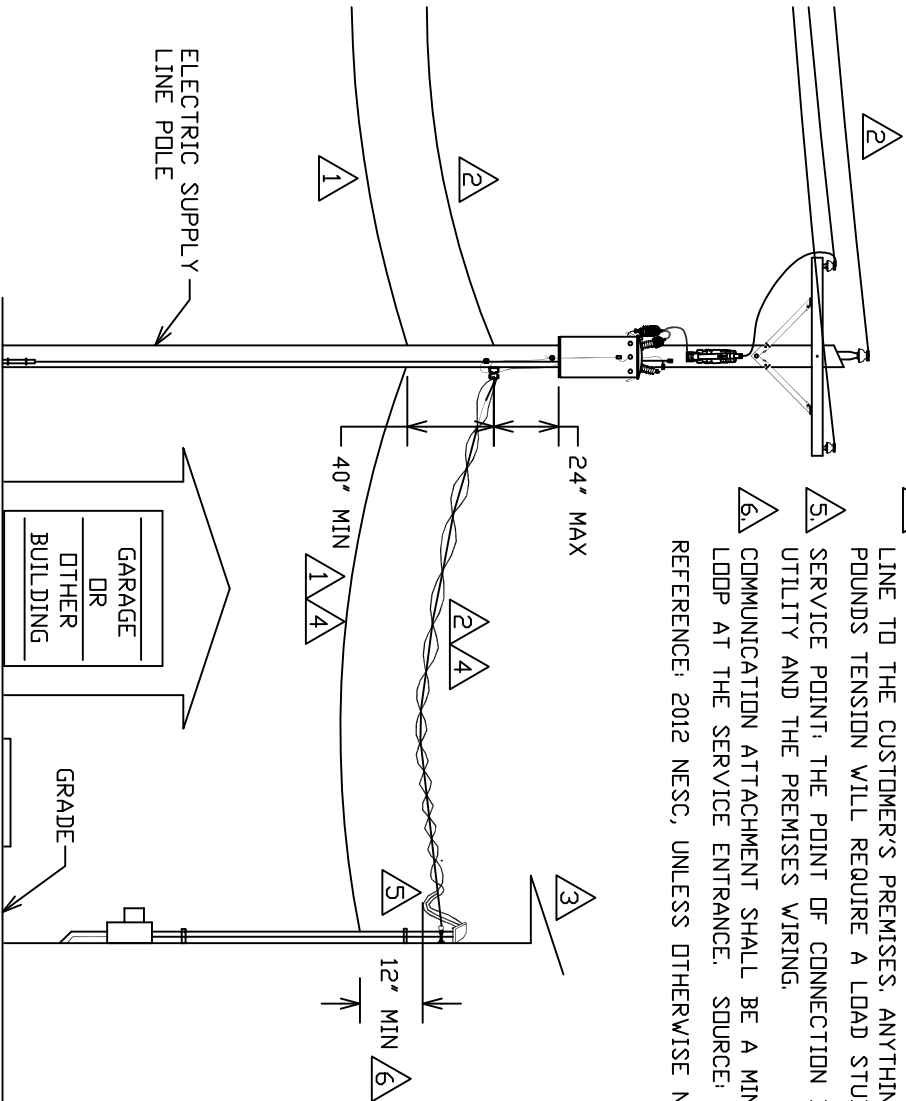


## ELECTRIC LIGHT BRACKET CLEARANCE

BY	JJR	8/20/14	1	4/17/14	REMOVED INTERMEDIATE POLE	NF	SKT	RD
CHECK	JRT	8/20/14	2	6/30/14	CLARIFIED COMM DISTANCE FROM SERVICE DRIP LOOP	JJR	RD	BB
APPROVED	BB	8/20/14	3	8/20/14	REQ FOR 30' MIDSPAN CLEARANCE B/T OH SVC AND COMM R/M	JJR	JRT	BB

SS 69.34 DEFINITIONS

1. COMMUNICATION LINES: THE CONDUCTORS AND THEIR SUPPORTING OR CONTAINING STRUCTURES, EQUIPMENT, AND APPARATUS THAT ARE USED FOR PUBLIC OR PRIVATE SIGNAL OR COMMUNICATIONS SERVICE LOCATED IN THE COMMUNICATION SPACE.
  2. ELECTRIC SUPPLY LINES: THOSE WIRES, CONDUCTORS, AND CABLES USED TO TRANSMIT ELECTRIC OR LIGHT ENERGY AND THEIR NECESSARY SUPPORTING OR CONTAINING STRUCTURES, EQUIPMENT, AND APPARATUS THAT ARE USED TO PROVIDE PUBLIC OR PRIVATE ELECTRIC SUPPLY OR LIGHTING SERVICE.
  3. PREMISES: THE LAND AND BUILDINGS OF A USER LOCATED ON THE USER SIDE OF THE SERVICE POINT (SOMETIMES CALLED THE UTILITY-USER NETWORK POINT OF DEMARCATION FOR COMMUNICATION WIRING) TO ELECTRIC SUPPLY, COMMUNICATION, OR SIGNAL PREMISES WIRING.
  4. SERVICE DROP: CABLE EXTENDING ONE SPAN FROM THE FINAL POLE OF AN EXISTING SUPPLY LINE TO THE CUSTOMER'S PREMISES. ANYTHING IN EXCESS OF ONE SERVICE DROP OR 45 POUNDS TENSION WILL REQUIRE A LOAD STUDY.
  5. SERVICE POINT: THE POINT OF CONNECTION BETWEEN THE FACILITIES OF THE SERVING UTILITY AND THE PREMISES WIRING.
  6. COMMUNICATION ATTACHMENT SHALL BE A MINIMUM OF 12 INCHES BELOW COMPANY'S DRIP LOOP AT THE SERVICE ENTRANCE. SOURCE: NEC 800.44(A)(4)
- REFERENCE: 2012 NESC, UNLESS OTHERWISE NOTED

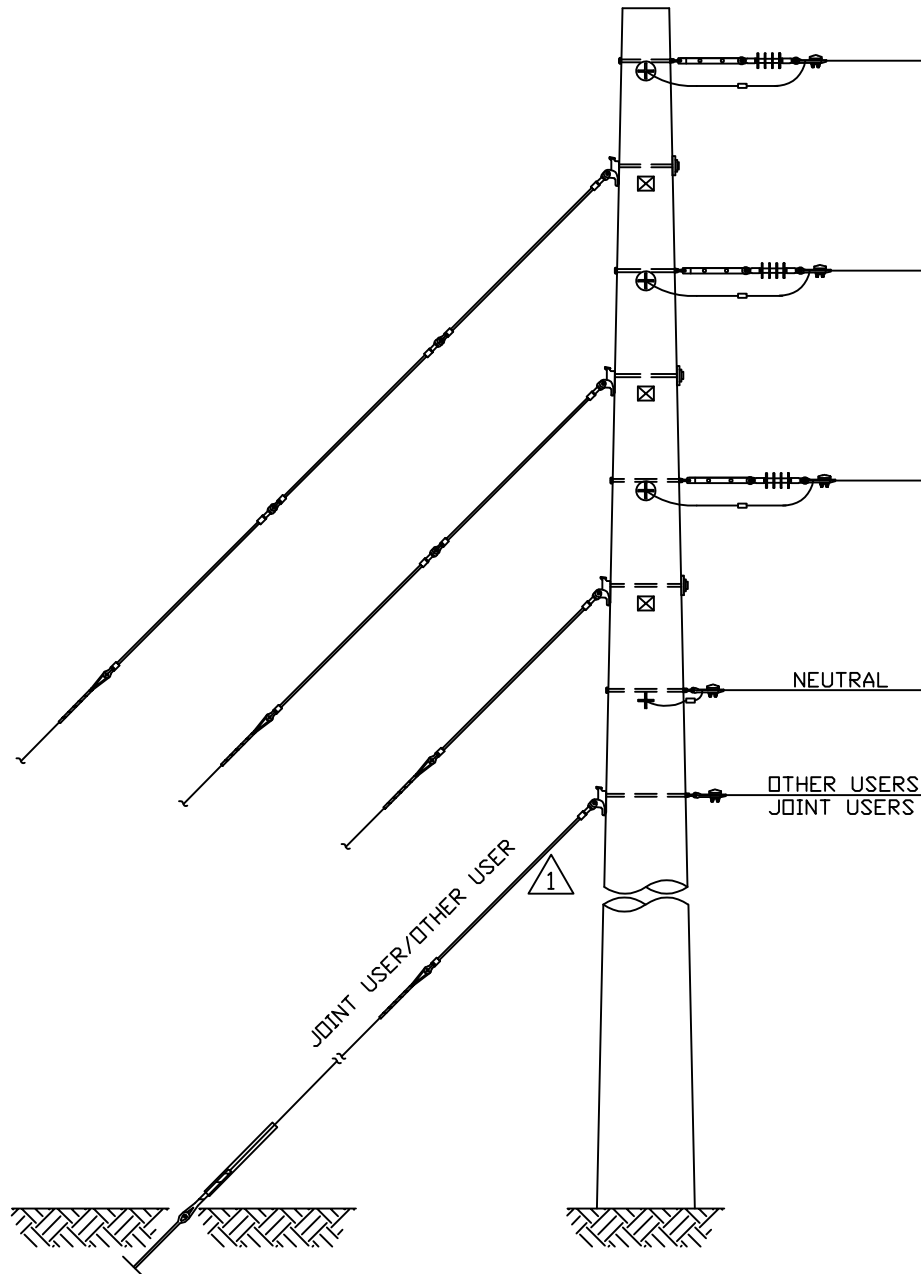


JOINT USERS / OTHER USERS  
COMMUNICATION SERVICE DROP

▼ DENOTES LATEST REVISION

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SS-69.34



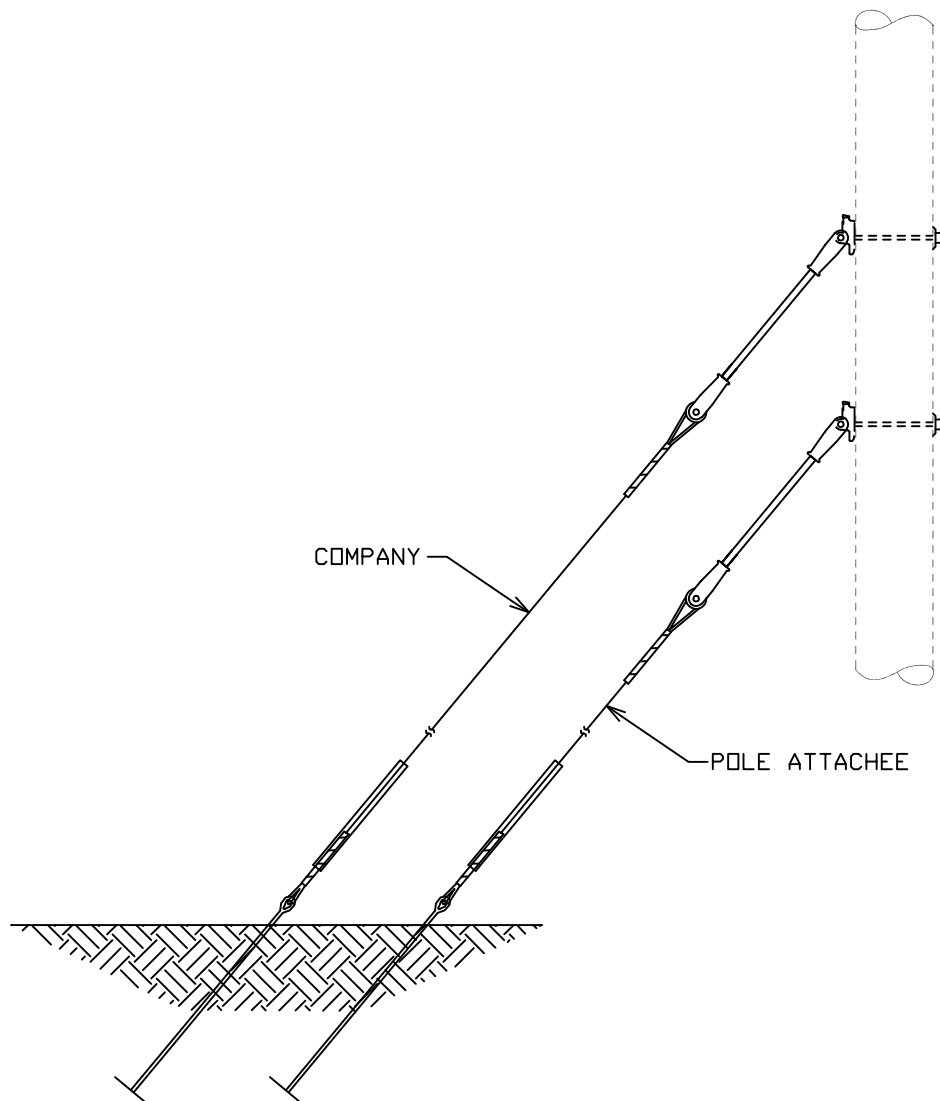
## NOTES:

1. JOINT/OTHER USERS SHALL INSTALL THEIR OWN GUY INSULATORS, ANCHORS, AND GUY WIRE.
2. WHEN JOINT/USERS/OTHER USERS INSTALL A GUY AND ANCHOR, THEY ARE TO BE PARALLEL TO COMPANY GUYS AND ANCHORS.
3. JOINT USERS/OTHER USERS SHALL ATTACH THEIR GUYS TO THEIR ANCHORS ONLY, AND SHALL NOT ATTACH ANY ACCESSORIES TO COMPANY EQUIPMENT.

► DENOTES LATEST REVISION

JOINT USERS/OTHER USERS  
GUY ANCHORS AND REQUIREMENTS

BY	KD	1/17/14	1
CHECK	NF	1/17/14	2
APPROVED	RD	1/17/14	3



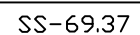
## NOTES:

1. JOINT/OTHER USERS SHALL INSTALL THEIR OWN GUY INSULATORS, ANCHORS, AND GUY WIRE.
2. WHEN JOINT/USERS/OTHER USERS INSTALL A GUY AND ANCHOR, THEY ARE TO BE PARALLEL TO COMPANY GUYS AND ANCHORS.
3. JOINT USERS/OTHER USERS SHALL ATTACH THEIR GUYS TO THEIR ANCHORS ONLY, AND SHALL NOT ATTACH ANY ACCESSORIES TO COMPANY EQUIPMENT.

► DENOTES LATEST REVISION

GUYS AND ANCHORS HELIX

BY	JJR	11/7/14	0	1/17/14	ORIGINAL DRAWING		KD	NF	RD
CHECK	JRT	11/7/14	1	11/7/14	5/8" GROUND ROD WHEN WESTAR GROUND IS PRESENT AT POLE		JJR	JRT	BB
APPROVED	BB	11/7/14	2						



## Appendix D: Tenant Tag Material Specifications

### 1. Scope

This specification covers tags to be attached to the facilities of parties other than Company attaching their cables to Company poles.

### 2. Pole Tag Requirements

2.1 Material shall be 0.010" thick yellow tear-resistant polyester film laminated on both sides with 0.001" thick ultraviolet-inhibiting clear Tedlar film.

2.1.1 Exception: If manufacturer determines there will be a low volume of tags, yellow ultraviolet-inhibiting polyethylene laminate tags may be used.

2.2 The overall dimensions of the tag shall be 2" high by 4" wide.

2.3 The tag shall be imprinted or engraved on both faces with the number that Company assigns to pole tenant. Such number shall be black in color and 1 ½" high and shall read horizontally.

2.4 A 5/16" hole shall be included in each of the two upper corners of each tag.

2.4.1 5/16" brass grommets are preferred on polyester tags.

2.5 Each tag shall be furnished with two non-reusable 7" black UV-resistant nylon cable ties.

### 3. Company Approval

Any material furnished under this specification is subject to approval by Company Distribution Standards.