DUKE ENERGY.
FLORIDA

May 1, 2013

VIA HAND DELIVERY

Ms. Ann Cole, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

130129-EI

Re: 2013 – 2016 Storm Hardening Plan; Undocketed

Dear Ms. Cole:

Pursuant to Rule 25-6.0342, F.A.C., attached for filing on behalf of Duke Energy Florida, Inc.[1], is its Petition for Commission approval of its Storm Hardening Plan.

Thank you for your assistance in this matter, and please feel free to contact me should you have any questions.

Sincerely,

Dianne M. Triplett

DMT/jlc
Enclosures

[1] Effective April 29, 2013, Florida Power Corporation d/b/a Progress Energy Florida, Inc. changed its name to Duke Energy Florida, Inc. d/b/a Duke Energy. The Company filed notice of this name change with the Commission on April 29, 2013.

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In re: Petition to Approve Duke Energy Florida, Inc.'s Rule 25-6.0342 Storm Hardening Plan.

Docket No. 130129-EI

Filed: May 1, 2013

PETITION

1. Petitioner, Duke Energy Florida, Inc. d/b/a Duke Energy[1] ("DEF"), is an investor-owned utility subject to the jurisdiction of the Commission under Chapter 366, Florida Statutes. DEF's general offices are located at 299 First Avenue North, St. Petersburg, FL 33701.

2. All notices, pleadings and other communications required to be served on petitioner should be directed to:

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For express deliveries by private courier, the address is as stated in paragraph 1.

3. Rule 25-6.0342, Florida Administrative Code, requires investor-owned electric utilities in Florida to file a Storm Hardening Plan with the Florida Public Service Commission ("FPSC") on or before May 7, 2007 and every three years thereafter as a matter of course. Rule 25-6.0342 specifies what must be included in utility storm hardening plans, and DEF has tracked those rule provisions in its Storm Hardening Plan which is attached hereto as Exhibit A.

[1] Effective April 29, 2013, Florida Power Corporation d/b/a Progress Energy Florida, Inc. changed its name to Duke Energy Florida, Inc. d/b/a Duke Energy. The Company filed notice of this name change with the Commission on April 29, 2013.

4. Pursuant to Rule 25-6.0342, DEF hereby submits this petition for approval of its Storm Hardening Plan.

WHEREFORE, DEF respectfully requests that the Commission enter an order granting this petition and approving DEF's Storm Hardening Plan attached hereto as Exhibit A.

Respectfully submitted,

Dianne M. Triplett

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DUKE ENERGY®
FLORIDA

Storm Hardening Plan
2013 – 2015

May 1, 2013

FPSC Rule 25-6.0342, F.A.C.

DUKE ENERGY FLORIDA

Storm Hardening Plan May 1, 2013

I. **Introduction:**

Rule 25-6.0342, Florida Administrative Code, requires investor-owned electric utilities in Florida to file a Storm Hardening Plan with the Florida Public Service Commission ("FPSC") on or before May 7, 2007 and every three years thereafter as a matter of course. Rule 25-6.0342 specifies what must be included in utility storm hardening plans, and Duke Energy Florida, Inc. ("DEF") has tracked those rule provisions in its Storm Hardening Plan below:

25-6.0342(3): *Each utility storm hardening plan shall contain a detailed description of the construction standards, policies, and procedures employed to enhance the reliability of overhead and underground electrical transmission and distribution facilities.*

DEF's construction standards, policies, practices, and procedures related to storm hardening issues are listed below and are attached hereto as **Attachment A**:

Distribution OH Construction Manual

i. Cover page
   1. *Addresses NESC adherence standards.*
ii. General Overhead section
   1. *Discusses company policy on extreme wind.*
   2. *Details Florida's extreme wind contour lines.*
   3. *Discusses the use of the Pole Foreman program.*
iii. Poles, Guys and Anchors Section
   1. *Discusses DEF's standard pole strengths, sizes, and limitations.*
iv. Primary Construction section
   1. *Discusses corporate practices for primary line construction.*
v. Coastal and Contaminated area section
   1. *Discusses corporate practices for primary line construction in coastal areas.*

Distribution UG Construction Manual

vi. Cover page
   1. *Addresses NESC adherence standards.*

vii. Underground General Section
   1. *Discusses location of UG facilities in accessible locations.*

viii. OH-UG Transition section
   1. *Discusses corporate practices for primary framing on dip poles.*

ix. Trenching and Conduit section
   1. *Discusses corporate practices for trenching and use of conduit on primary UG circuits.*

x. Flooding and Storm Surge Requirements
   1. *Discusses corporate procedures for the installation of UG equipment in areas targeted for storm surge hardening.*

Distribution Engineering Manual

xi. Overhead Design guide section
   1. *Addresses line location in accessible location.*
   2. *Addresses NESC compliance.*
   3. *Discusses Pole Foreman program.*

xii. Underground Design guide section
   1. *Addresses line location in accessible location.*
   2. *Addresses NESC compliance.*

Transmission - Extreme Wind Loading Design Criteria Guideline for Overhead Transmission Line Structures

xiii. Standards Position Statement
   1. *Addresses NESC compliance.*
   2. *Addresses American Society of Civil Engineer's Manual 74 (ACSE 74).*
   3. *Discusses transmission line importance for reliability.*
   4. *Details Florida's extreme wind contour lines.*

Transmission - Line Engineering Design Philosophy

xiv. Overhead Line Design philosophy

1. *Addresses NESC compliance.*
2. *Addresses insulator loading criteria.*
3. *Addresses guy / anchor capacity ratings.*
4. *Addresses design load cases.*
5. *Addresses extreme wind guidelines.*
6. *Addresses structural guidelines.*

Joint Use – Pole Attachment Guidelines and Clearances

xv. Pole Attachment Guidelines

1. *Addresses Pole Attachment and Overlash Procedures.*
2. *Addresses Joint Use Construction.*
3. *Addresses Guys and Anchors.*

xvi. Joint Use Clearances

1. *Addresses Line Clearances.*
2. *Addresses Joint Use Clearances.*

In addition to the standards, practices, policies, and procedures identified above, DEF's Wood Pole Inspection Plan, Vegetation Management Plan, and legacy Ongoing Storm Preparedness Plan all contain standards, practices, policies, and procedures that address system reliability and issues related to extreme weather events. These plans are included herewith as **Attachment B**.

25-6.0342(3)(a): *Each filing shall, at a minimum, address the extent to which the utility's storm hardening plan complies, at a minimum, with the National Electric Safety Code that is applicable pursuant to subsection 25-6.0345(2), F.A.C.*

All standards, practices, policies, and procedures in the manuals and plans listed above are based on accepted industry practices designed to meet or exceed the requirements of the National Electric Safety Code (NESC). These standards, practices, policies, and procedures are followed on all new construction and all rebuilding and relocations of existing facilities.

25-6.0342(3)(b): *Each filing shall, at a minimum, address the extent to which the utility's storm hardening plan adopts the extreme wind loading standards specified by Figure 250-2(d) of the 2007 edition of the NESC for new construction, major planned work, and critical infrastructure.*

New Construction:

With respect to new construction for transmission poles, DEF's transmission department is building all new construction with either steel or concrete pole material. Virtually all new transmission structures exceed a height of sixty feet above ground and therefore will be constructed using the NESC Extreme Wind Loading criteria.

DEF's design standards can be summarized as: 1) quality construction in adherence with current NESC requirements 2) well defined and consistently executed maintenance plans, and 3) prudent end-of-life equipment replacement programs. When these elements are coupled with a sound and practiced emergency response plan, construction grades as defined by the NESC provide the best balance between cost and performance.

DEF has extensive experience with the performance of Grade C and Grade B construction standards as defined by the NESC. That experience, which includes several hurricane seasons and other severe weather events, indicates that properly constructed and maintained distribution lines meeting all provisions of the NESC perform satisfactorily and provide a prudent and responsible balance between cost and performance.

DEF has not adopted extreme wind standards for all new distribution construction because of the following reasons:

1. Section 250C of the 2012 version of the NESC does not call for the extreme wind design standard for distribution poles which are less than sixty feet in height. Based on the fact that DEF's distribution poles are less than sixty feet, the extreme wind standard outlined in figure 250-2(d) does not apply.

2. All credible research, which includes extensive studies by the NESC rules committee, demonstrates that applying extreme winds standards would not benefit distribution poles. See Exhibit 4 filed in Docket No. 060172-EU, August 31, 2006 Workshop.
3. Utility experience from around the country further indicates that electrical distribution structures less than sixty feet in height are damaged in extreme wind events by trees, tree limbs, and other flying debris. Thus, applying the extreme wind standard to distribution poles would result in large increases in cost and design complexity without a commensurate benefit.
4. DEF's experience was consistent with that of the other utilities around the nation who found that vegetation and flying debris were the main causes of distribution pole damage, a condition that the extreme wind standard will not address. In 2004, approximately 96% of DEF's pole failures were attributable to flying debris and/or super extreme wind events such as tornadoes and micro-bursts.

Major planned work:

Consistent with NESC Rule 250C, DEF will use the extreme wind standard for all major planned transmission work, including expansions, rebuilds, and relocations of existing facilities. For the reasons discussed in the new construction section above, DEF has not adopted the extreme wind standard for major planned distribution work, including expansions, rebuilds, or relocations of existing facilities.

Critical infrastructure:

With respect to transmission, virtually all new transmission structures exceed a height of sixty feet above ground and therefore are constructed using the NESC extreme wind loading criteria. Accordingly, DEF will use the extreme wind standard for all major planned transmission work, including expansions, rebuilds, and relocations of existing facilities, irrespective of whether they can be classified as "critical" or "major."

DEF, for the reasons discussed in the new construction section above, has not adopted the extreme wind standard for any of its distribution level critical infrastructure. Placing distribution poles constructed to extreme wind standards around facilities such as hospitals and police stations in DEF's service territory would unnecessarily increase costs and restoration time if those poles are knocked down by falling trees or flying debris such as roofs or signs. DEF's current level of construction, around critical facilities and around all other facilities, has performed well during weather events and any pole failures due solely to wind impact were caused by "super extreme" wind events such as tornados and "micro bursts," conditions that would have caused and did cause extreme wind construction to fail as well.

While no current data or research supports the application of the extreme wind standard to distribution pole construction, DEF continues to analyze the extreme wind standard by using its prioritization model for implementation purposes in selected locations throughout DEF's service territory. Since the submittal of the 2007 Storm Hardening plan, DEF constructed several pilot projects using the extreme winds standards. To date, there has not been a significant weather event that allowed DEF to assess the performance of these projects. In conjunction with wind measuring devices, DEF will study the performance of the extreme wind standard at these various sites when a weather event allows for such analysis. From this process, DEF expects to continue to learn and adjust its extreme weather strategy based on information that it will collect and gather from other utilities in Florida and throughout the nation as new standards and applications are applied and tested.

25-6.0342(3)(c): *Each filing shall, at a minimum, address the extent to which the utility's storm hardening plan is designed to mitigate damage to underground and supporting overhead transmission and distribution facilities due to flooding and storm surges.*

Based on DEF's experience in the 2004 and 2005 hurricane seasons, along with the experiences of other utilities in Florida reported to the FPSC after those seasons, DEF has concluded that underground applications may not be best suited for all areas. DEF has identified areas in its service territory where current underground equipment should be replaced with overhead due to the fact that those areas are subject to frequent and prolonged flooding resulting in damage from water intrusion on underground equipment. Thus, one of DEF's most effective tools in its hardening arsenal is to identify areas where underground equipment should and should not be used.

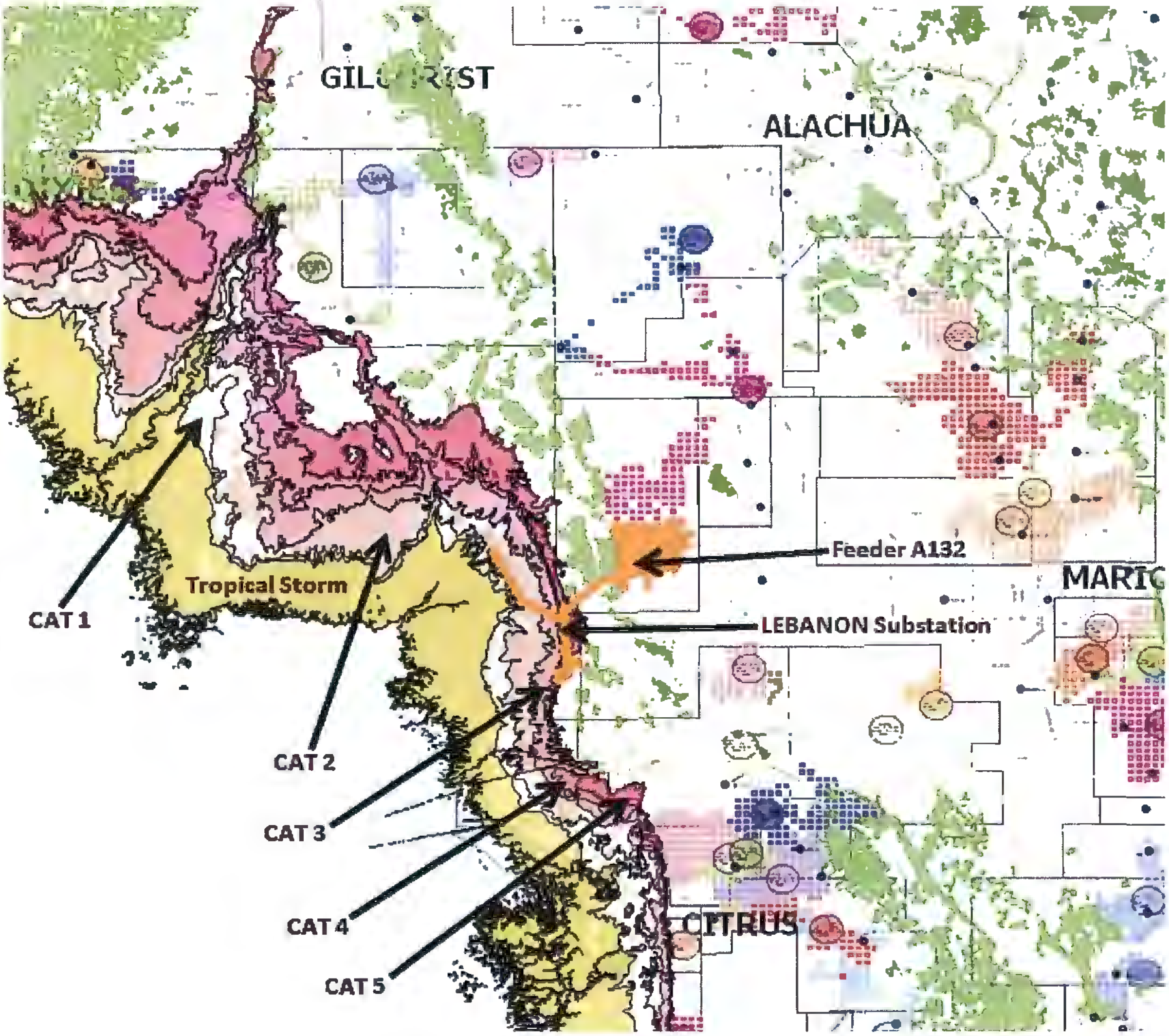
In areas where underground equipment may be exposed to minor storm surge and/or shorter term water intrusion, DEF has used its prioritization model (discussed in detail below) to identify areas where certain mitigation projects will be put into place to test whether flood mitigation techniques and devices can be used to protect equipment such as switchgears, padmounted transformers and pedestals. In these selected project sites, DEF will test:

- Stainless steel equipment;
- Submersible connectors;
- Raised mounting boxes;
- Cold shrink sealing tubes; and
- Submersible secondary blocks.

Throughout the year after a significant weather event, DEF will monitor these installations to collect and analyze data to determine how this equipment performs relative to DEF's current design with respect to outage prevention, reduced maintenance, and reduced restoration times. From this process, DEF will continue to learn and will adapt its flood and storm surge strategies based on information that it will collect and based on the information gathered by other utilities in Florida and throughout the nation as new standards and applications are applied and tested.

St. George Island in Franklin County was one of the areas where DEF used its submersible underground strategy to retrofit its existing facilities using the submersible standards listed above. St George Island is a good example of an area that would be susceptible to surges during a severe storm. The project was completed in 2007 and subsequent construction has conformed to the design standard for areas susceptible to storm surge.

DEF also utilizes Geo Media software to determine the optimum location for submersible underground facilities. The flood zones were provided by the state and overlaid onto DEF's land base computer system along with other facilities. This method allows DEF to visually determine which geographic areas would most benefit from submersible facilities. See example below.



In addition to the actions discussed above, during major storm events, substations that are in the forecast strike zone will have sandbags placed in strategic areas to attempt to eliminate water intrusion into control houses. In the event of water intrusion causing extensive damage requiring prolonged repair, DEF will employ mobile substations to affected areas, where possible, in order to restore power.

<u>25-6.0342(3)(d)</u>: *Each filing shall, at a minimum, address the extent to which the utility's storm hardening plan provides for the placement of new and replacement distribution facilities so as to facilitate safe and efficient access for installation and maintenance pursuant to Rule 25-6.0341, F.A.C.*

DEF will continue to use front lot construction for all new distribution facilities and all replacement distribution facilities unless a specific operational, safety, or other site-specific reason exists for not using such construction at a given location. <u>See</u> Distribution Engineering Manual, Section xv(1).

<u>25-6.0342(4)</u>: *Each utility storm hardening plan shall explain the systematic approach the utility will follow to achieve the desired objectives of enhancing reliability and reducing restoration costs and outage times associated with extreme weather events.*

As part of its systematic approach to storm hardening for the 2007-2009 Storm Hardening plan, DEF engaged industry expert Davies Consulting ("DCI") in developing a comprehensive prioritization model that has helped DEF identify potential hardening projects, procedures, and strategies. DCI has worked with a number of utilities nationally to evaluate their power delivery system major storm preparedness. They have also evaluated options for infrastructure hardening to improve performance and reliability not only day-to-day, but also during major storms. Collaborating with DCI, DEF created an evaluation framework for various hardening options and prioritization of potential alternatives. Since 2007, the model has been improved and enhanced to better reflect the changes in DEF's overall storm hardening strategy. The structure of the model was adjusted to use more consistent scoring criteria to evaluate the pilot projects. New software technology such as Geomedia was incorporated into the model. As more data becomes available, DEF will continue to adjust its prioritization model as appropriate.

Using the same evaluation framework for the 2013-2015 Storm Hardening plan, DEF prioritized its proposed projects based on various components that will be discussed in more details below.

Under the foregoing components of the evaluation framework, the prioritization model is set up to analyze the following hardening alternatives for DEF:

- OH-to-UG Conversions
  - Taking existing overhead (OH) electric lines and facilities and placing them underground (UG) via the use of specialized UG equipment and materials. The primary purpose of this hardening activity is to attempt to eliminate tree and debris related outages in the area of exposure. When applied to crossings on major highways, this hardening activity can also mitigate potential interference with first responders and other emergency response personnel caused by fallen lines.

- Small Wire Upgrade
  - The conversion of an existing overhead line currently with either #4 AL or #6 Cu conductor to a thicker gauge conductor of 1/0 or greater. The primary purpose of this hardening activity is to attempt to utilize stronger conductor that may be better able to resist breakage from falling tree branches and debris.

- Backlot to Frontlot Conversion
  - Taking an existing overhead line located in the rear of a customer's property and relocating it to the front of the customers property. This involves the removal of the existing line in the rear of the property and construction of a new line in the front of the property along with re-routing service drops to individual customer meters. The primary purpose of this hardening activity is to minimize the number of tree exposures to the line to prevent outages and to expedite the restoration process by allowing faster access in the event an outage occurs.

- Submersible UG
  - Taking an existing UG line and equipment and hardening it to withstand a storm surge via the use of the current DEF storm surge

standards. This involves the use of specialized stainless steel equipment and submersible connections. The primary purpose of this hardening activity is to attempt to minimize the damage caused by a storm surge to the equipment and thus expedite the restoration after the storm surge has receded.

- Alternative NESC Construction Standards
  - Building OH line and equipment segments to the extreme wind standard as shown in the NESC extreme wind contour lines of figure 250-2(d). This will be done via the use of the current extreme wind standards which call for the use of the industry accepted Pole Foreman program to calculate the necessary changes. Typical changes include shorter span lengths and higher class (stronger) poles. The primary purpose of this hardening activity is to attempt to reduce the damage caused by elevated winds during a major storm. Locations have been chosen to provide contrasting performance data between open coastal and inland heavily treed environments.

- Feeder ties
  - Tying radial feeders together to provide switching capabilities to reduce outage duration. This hardening alternative will mitigate long outages that would have otherwise occurred as a result of the inability to transfer load/customers to an alternate source.

Although the concept of storm hardening is generally thought of as outage prevention, it is inevitable that outages will still occur during a severe storm as a result of vegetation and flying debris. Feeder ties will help mitigate the duration of such outages. Tying multiple feeders together will give DEF the ability to minimize duration by serving customers from an alternate source while repairs are being made on the affected segment. Based on DEF's experience in the 2004 -2005 hurricane seasons as well as more recent tropical storms, feeder ties are crucial for a distribution system as it provides the opportunity to maximize the number of customers restored in the shortest timeframe possible. Regardless of what caused the outage during a severe storm, a radial feeder will be out for as long as it takes to make the necessary repairs. On the other hand, a feeder tie would allow DEF to restore as many customers as possible, thereby minimizing the number of customers that are without power for the length of the repair.

The development of the prioritization model begins with compiling a list of desired projects submitted by engineers and field personnel most familiar with the specific region. Each project is then evaluated based on the following criteria:

- Major Storm Outage Reduction Impact
  - Determines the potential benefits that the project provides during a major storm based on reduced damages or the ability to restore power more rapidly.
- Community Storm Impact
  - Evaluates the potential benefits that the proposed project will have on a community's ability to cope with damage.
- Third Party Impact
  - Captures complexities of proposed projects in terms of coordination with third parties such as telecommunication, Cable TV, permitting, easements, costs, etc.
- Overall Reliability
  - Captures the overall potential reliability benefits that the project provides on a day to day basis in terms of reduced customer interruptions and outage duration.
- Financial Cost
  - Provides the financial value of the proposed project based on cost per customer and cost per foot of newly installed wire/cable.

The prioritization model is set up to address the following hardening project questions:

- How many customers are served from the upstream protective device?
- What will be the impact of this project on the restoration time during a major storm?
- At what level of hurricane will the area served by this feeder flood due to

storm surges?

- What is the tree density in the area served by this feeder or section?
- What level of tree damage will this project mitigate during a major storm?
- How many critical infrastructure components (lift stations, shelters, hospitals, police, etc...) does this project address?
- How valuable will the project be perceived by the community?
- What are the major obstacles/risks for completing the project? i.e. easements, permits, etc.
- What type of investment is required by joint users (telecoms and cable) to complete this project?
- What is the 3-year average number of CEMI4 customers on this feeder?
- What is the 3-year average number of CMI on this feeder?
- What is the change in the annual CAIDI that this project will result in (on the feeder or section)?
- Will this project reduce the number of momentary customer interruptions on this section?
- What is the 3-year average number of CELID CI on this feeder?
- What is the construction Cost per customer

Each answer to the questions listed above is assigned a numerical value and subsequently weighted to produce an overall rating for each specific hardening project. The prioritization model is based on a structured methodology for evaluating the benefits associated with various hardening options. The model allows for the ranking of the overall list of projects. It enables DEF to strategically determine the order in which these projects are constructed, based on their order of ranking.

DEF is using the prioritization model to ensure a systematic and analytical approach to deploying storm hardening options within its service territory. For proven hardening options that DEF is already using as part of its construction standards and policies, the prioritization model will help DEF best locate and prioritize areas within its system where those options should be used. For unproven or experimental hardening options, such as the extreme wind standard for distribution pole construction, DEF is using its prioritization model to identify areas within its service territory where analytical data collection projects can be used to evaluate the performance and results of such hardening options. Examples of specific projects that took place between 2007 and 2012 are discussed later in this document.

<u>25-6.0342(4)(a)</u>: *A description of the facilities affected, including technical design specifications, construction standards, and construction methodologies employed.*

All of DEF's facilities are affected to some degree by the standards, policies, procedures, practices, and applications discussed throughout this document. Specific facilities are also addressed herein in detail (i.e. upgrading all transmission poles to concrete and steel, using front lot construction for all new distribution lines where possible). Technical design specifications, construction standards, and construction methodologies are specifically discussed at pages 1 through 3 of this plan and are included in **Attachments A** and **B**.

<u>25-6.0342(4)(b)</u>: *The communities and areas within the utility's service area where the electric infrastructure improvements are to be made.*

As discussed above, all of DEF's facilities are affected to some degree by the standards, policies, procedures, practices, and applications discussed throughout this document. As a result, all areas of DEF's service territory are impacted by DEF's storm hardening efforts. Based on DEF's recent storm experience and/or through the prioritization model a number of projects were identified, please see **Attachment D** for the Distribution Projects completed between 2007 and 2012.

Distribution:

The list below is a sampling of the proposed 2013 – 2015 Storm Hardening projects

Op Center	Project Name	Sub Category
Buena Vista	Old Harbor Rd Sky Lake South	Back Lot to Front Lot Conversion
Southeast Orlando	Meadow Woods Village 10	Back Lot to Front Lot Conversion
Winter Garden	Malcom Rd. reconductor/reroute	Back Lot to Front Lot Conversion
Monticello	Alligator Point Extreme Wind Phase 2 of 4	Alternative NESC Construction Standard
Apopka	M451 to M453 feeder tie - Phase 1 of 2	Feeder Tie
Apopka	Apopka Blvd Feeder Tie	Feeder Tie
Buena Vista	Reams Feeder Tie K1110 to K789	Feeder Tie
Buena Vista	Loop ug feeder radial-Celebration	Feeder Tie
Clermont	Minneola Feeder Tie - Phase 1 of 2	Feeder Tie
Deland	Deltona East W0124 feeder tie	Feeder Tie
Deland	Lake Helem W1701 feeder tie	Feeder Tie
Seven Springs	Land O'Lakes-Denham Feeder Tie - Phase 1 of 3	Feeder Tie
Winter Garden	Orlavista	Feeder Tie
Deland	SR 17-92 and Benson Junction	OH to UG Conversion
Apopka	Earlwood AV. reconductor	Small Wire Upgrade
Apopka	Chandler Rd. & Kelly Park reconductor	Small Wire Upgrade
Apopka	Woodward Ave./Eustis	Small Wire Upgrade
Apopka	Reconductor Plymouth M707 feeder exit from 2/0 Cu to 795 AAC	Small Wire Upgrade
Apopka	Reconductor Plymouth M707 feeder from 1/0 Al to 795 AAC(tie to M32)	Small Wire Upgrade

Buena Vista	Cassino Ave Back_lot	Small Wire Upgrade
Clearwater	Highlands C2807 reconductor-Weak Link	Small Wire Upgrade
Clermont	Change conductor size from 336 to 795 between switch K5330622 and K2227	Small Wire Upgrade
Deland	Mercers Fernery Rd.	Small Wire Upgrade
Deland	Pensilvania Ave.	Small Wire Upgrade
Inverness	Lebanon A132 - US 19 South	Small Wire Upgrade
Lake Wales	Hunt Brothers Rd. Reconductor	Small Wire Upgrade
Longwood	N. Ranger Blvd. reconductor	Small Wire Upgrade
Southeast Orlando	Reconductor Hickory Tree Rd, Holopaw - Phase 1 of 4	Small Wire Upgrade
Southeast Orlando	Reconductor US-192 Holopaw (Phase 3)	Small Wire Upgrade
Southeast Orlando	Reconductor 2/0 Cu OH with 795 AAC Daetwyler Dr., Winona Dr.	Small Wire Upgrade
Walsingham	Reconductor 4/0 Cu on Bay Pines Blvd with 795 AAC	Small Wire Upgrade
Winter Garden	Sabrina Drive Back_lot	Small Wire Upgrade
Winter Garden	Pine Street Windermere	Small Wire Upgrade

With regard to system hardening projects in general, DEF's approach is to consider the unique circumstances of each potential location considered for hardening by taking into account variables such as:

- operating history and environment;
- community impact and customer input;
- exposure to storm surge and flooding;
- equipment condition;
- historical and forecast storm experience; and
- potential impacts on third parties;

This surgical approach leads to the best solution for each discrete segment of the delivery system.

For example, Pasadena Feeder X220 was selected as a storm hardening candidate for 2009. X220 is a mainly an overhead feeder along Pasadena Avenue running from the substation south to the Palms of Pasadena Hospital. Engineering was initiated, and pole foreman was used for pole size selection and pole spacing. It was calculated that a 100 foot spacing and pole classes H1, 0, 1, and 2 would be required to meet the extreme wind loading criteria. Class H poles are normally transmission poles, and have a large ground or butt circumference. The general distribution guidelines for pole spacing are between 175 to 220 feet.

The Town of Pasadena was contacted by our Public Affairs Department, given the project scope information, and was made aware of the positive impacts of the project. The city was adamantly opposed to the storm hardening of X220 due to the larger class poles, closer pole spacing, and the perceived overall aesthetic impact. Due to the overwhelming negative reaction of the town, this project was cancelled. On the other hand, the San Blass Extreme wind project in Monticello was well received by the community. The project was discussed with the County Manager and the County Commissioner for the District. This project was also discussed with a local civic club where many of the members were residents in the project area. This project was completed in 2009. This is a real life example of why "one size does not fit all" when it comes to storm hardening.

In areas like Gulf Boulevard and other coastal communities in Pinellas County, local governments have worked with DEF to identify areas where overhead facilities have been or will be placed underground, and this option will help to mitigate storm outages caused by vegetation and flying debris. DEF is also working in these areas to evaluate upgrading portions of those facilities to the surge-resistant design discussed above. Again, these hardening options may work well in these communities, but may not be ideal or desirable in others.

Transmission:

The Transmission Department is employing a system-based approach to changing out wood poles to either concrete or steel poles based upon the inspection cycle and condition of pole. These projects are identified during the transmission pole inspection cycles. Specific new, rebuilt or relocated projects that are planned over the next three years are listed below:

NORTH FLORIDA AREA	Project Type	County	Third Party Impact
Alachua to GE Alachua (GH-2, 4.37mi) 69kV Line Rebuild	Rebuild	Alachua	Likely
Nobleton Tap - Floral City Tap 69 kV line rebuild	Rebuild	Citrus	Possible
Carrabelle Bch Tap to Eastpoint (14.14mi) 69kV Line Rebuild	Rebuild	Franklin	Unlikely
Carrabelle to Carrabelle Bch Tap (1.7mi) 69kV Line Rebuild	Rebuild	Franklin	Unlikely
QX 115kV 10.85 mile rebuild (Atwater - Quincy (QX-1))	Rebuild	Gadsden	Unlikely
Rebuild 115kV JQ-12 Line Havana to Brdfrdvll W 10.53 miles	Rebuild	Gadsden	Likely
Jackson Bluff to Brickyard Tap	Rebuild	Hamilton	Unlikely
Rebuild Existing Jasper-Wrights Chapel 115kV Tie (9.59 mi)	Rebuild	Hamilton	Possible
Liberty-Jackson Bluff 69KV Line Rebld w/design for fut 115KV	Rebuild	Leon	Possible
JQ 1.7 West Lake-Burnham Tap 115 kV rebuild; 1.53 mi	Rebuild	Madison	Unlikely
SI 69kV 4 mile Line Rebuild - Williston to Williston (CFEC)	Rebuild	Marion	Likely
Proctor Tap to Cara Tap 69 kV Line Rebuild	Rebuild	Marion	Unlikely
MS-128 TO MS-135 MARION NW 35TH-49TH ST/ NW 27TH AV TO US441	Rebuild	Marion	Likely

Pinecastle - Sky Lake (WR-7) - 69 kV Rebuild 2.34 miles PCSL	Rebuild	Orange	Possible
Narcoossee to Rio Pinar (WR) - 69 kV Line Rebuild	Rebuild	Orange	Possible
Windermere-Bay Hill (WT) - 69 kV Rebuild 3.66 miles	Rebuild	Orange	Possible
Lake Bryan to Vineland (LV) - 69 kV Line Rebuild	Rebuild	Orange	Possible
Plymouth South Sub - Relocation of PP, WP & EP Lines	Rebuild	Orange	Likely
NR-71 to NR-72 253F ORANGE SR408/SR 417 INTERCHANGE IMPROV	Rebuild	Orange	Possible
CFCX 69kV dedicated line to SECO Continental Sub	rebuild	Sumter	Likely
JF-3 Ft White - Live Oak 69kV rebuild, 25.45 miles	Rebuild	Suwannee	Unlikely
Boyd Tap to Scanlon Tap (DP-3) 69kV rebuild, 8.0 mi	Rebuild	Taylor	Likely
Eridu Tap to Scanlon Tap (DP-2) 69kV rebuild, 5.24 mi	Rebuild	Taylor	Likely
Drifton to Eridu Tap (DP-1) 69kV rebuild, 13.48 mi	Rebuild	Taylor	Likely
PC line; Rebuild Line-Replace 132 Wood Poles w/ Steel[PRG]	Rebuild	Taylor	Possible
Deland West - DeLeon Springs 115kV & DWB Rebuild	Rebuild	Volusia	Likely
GUF Alachua Archer Rd frm SW16th -SW13th City of Gainesville	Governmental	Alachua	Likely
CLT & CC CITRUS 405270-3-52-01 SR589 SUNCOAST PKWY II-SECT 1	Governmental	Citrus	Possible
CSB-93 405270-4-52-01 Citrus Suncoast Pkwy II N.Card-CR486	Governmental	Citrus	Possible

HCR-12 115kV; 405822-2-52-01; SR 55 (US 19) from N of West Green Acres St to N of West Jump Ct; Road Widening, Improvements & Drainage	Governmental	Citrus	Unlikely
069kV CEB Hooks and Grand Sanitary Sewer	Governmental	Lake	Unlikely
OLR-69kV-CR. 470 widening Lake Co. PWDED	Governmental	Lake	Possible
LC ## 238395-5-52-01 Lake SR500 Lake Ella to Avenida Central	Governmental	Lake	Unlikely
LE - Transfer LE to Dbl Ckr on CFS Strs	Governmental	Lake	Likely
DR-90 to DR-98 238720-1-52-01 Marion SR40; SR45/US41 to CR328	Governmental	Marion	Unlikely
DR-36 to DR-94 238648-1 Marion SR45	Governmental	Marion	Unlikely
MS-128 TO MS-135 MARION NW 35TH-49TH ST/ NW 27TH AV TO US441	Governmental	Marion	Unlikely
410674-3-52-01;SR 40 East of CR 314 to east of CR 314A;	Governmental	Marion	Possible
242484-6-52-01 Orange SR-400 Ext-Maitland over Keller Rd	Governmental	Orange	Possible
NR-69_CIP 5029_ORANGE_VALENCIA COLLEGE LANE WIDE & IMPROVE.	Governmental	Orange	Possible
WO 69kV Underground Relocation on Fairbanks Avenue	Governmental	Orange	Yes
NR-71 & -72 230kV 253F; SR 417/SR 408 Interchange Improvements	Governmental	Orange	Possible
SLE 69kV relocation for Kennedy Blvd widening (Orange Cnty)	Governmental	Orange	Likely

SLM 69kV relocations for Kennedy Blvd widening (Orange Cnty)	Governmental	Orange	Likely
SLM 69kV relocations for Kennedy Blvd widening (Orange Cnty)	Governmental	Orange	Possible
WO 69kV relocation for Kennedy Blvd widening (Orange Cnty)	Governmental	Orange	Likely
WO 69kV relocation for Kennedy Blvd widening (Orange Cnty)	Governmental	Orange	Possible
69kV EP 431081 Wekiva Pkwy from US 441 to Ponkan	Governmental	Orange	Unlikely
69kV BK 431081 Wekiva Pkwy at the Y interchange	Governmental	Orange	Unlikely
230kV PS-94 431081 Wekiva Pkwy at the Y interchange	Governmental	Orange	Yes
69kV EP 431081 Wekiva Pkwy at US441 and SR 46	Governmental	Orange	Unlikely
WR and RW 69kV Relocation for Econ Trail	Governmental	Orange	Likely
FPID 242484-5-32-01 WO 69kV Relocation for I-4 Widening	Governmental	Orange	Possible
FTO FTO-141 415030-1-38-01 SEMINOLE CO. SR426/CR419 WIDENING	Governmental	Seminole	Unlikely
ASL-58 FPID#242592-3-32-01 SEMINOLE STATE ROAD 400 (I-4)	Governmental	Seminole	Possible
ASW-17,18,19 242592-2-52-01 Seminole Cnty SR400 / I-4	Governmental	Seminole	Unlikely
WEWC-WF 417545-1-52-01, SEMINOLE, SR417 BRIDGE MOD @ SR426	Governmental	Seminole	Unlikely
WF 69kV & WEWC 69kV CIP 001981-01; Dean Road widening;	Governmental	Seminole	Possible

NLA-23 to NLA-29 69kV 412994-3-52-01 CSXT Comm Rail Longwood	Governmental	Seminole	Yes
ASL-58 FPID#242592-3-32-01 SEMINOLE STATE ROAD 400 (I-4)	Governmental	Seminole	Unlikely
230kV DA, DL & DWS 431081 Wekiva Pkwy at I-4 and SR 46/SR 417	Governmental	Seminole	Unlikely
WA 69 kV Relocation- SR15/600 Interchange @ SR436- #404418-1	Governmental	Seminole	Unlikely
BCF 69kV_CR-468 Four lane curb and Gutter expansion	Governmental	Sumter	Likely
CRCF,CCF,IT,CLT,CC CITRUS 405270-5-52-01 SNCST PKWY II-SCT 3	Governmental	Sumter	Possible
BCF 69kV_CR-468 Four lane curb and Gutter expansion	Governmental	Sumter	Possible
DWB,410251-1-52-01, Volusia Co, SR 15/US 17	Governmental	Volusia	Possible

SOUTH FLORIDA AREA	Project Type	County	Third Party Impact
HCR-12 115kV SR- 55 CITRUS.405822-2-52-01	Rebuild	Citrus	Possible
FV124-128 230kv 5mi Relocation for CF Industries	Rebuild	Hardee	Likely
Brooksville West-Weeki Wachee Switch - 115 kV line rebuild	Rebuild	Hernando	Possible
Avon Park-SunNLakes 69 kv Rebuild, 4.82 miles	Rebuild	Highlands	Likely
Desoto City to Desoto City Tap 69 kV Line Rebuild	Rebuild	Highlands	Possible

Dinner Lake-Phillips Tap (PDL-2) - Rebuild 69 kV, 2.77 miles	Rebuild	Highlands	Possible
Denham to Morgan Rd Line #1	Rebuild	Pasco	Possible
BZ-384 TO BZ-386 C-3216.30 Pasco Clinton Ave road improve	Rebuild	Pasco	Possible
NP-4 thru NP-8 FIN: 256931-2-52-01 Gandy to 4th St	Rebuild	Pinellas	Possible
Land O Lakes - Denham line reroute to Morgan Road substation	Rebuild	Pinellas	Possible
Denham - Tampa Downs line reroute to Morgan Road substation	Rebuild	Pinellas	Possible
Oakhurst - Seminole - Rebuild 69kV Line	Rebuild	Pinellas	Possible
BNUG 115 kV_Norteast Sub FIN:256931-2-52-01 Gandy to 4th St	Rebuild	Pinellas	Unlikely
ICB 69kV 8.25 mi rebuild (I. City to Barnum City)	Rebuild	Polk	No
WLLW 69kV 4.52 mile rebuild (West Lk Wales-LkWales #1)	Rebuild	Polk	Possible
Avon Park-Avon Park North 69 kV Rebuild, 3.69 mi	Rebuild	Polk	Possible
Lake Wales-Crooked Lake Tap 69 kV Line Rebuild 1.03 mi	Rebuild	Polk	Possible
ICB-188 TO ICB-236 197534-2-52-01 POLK SR-25 (US27)	Rebuild	Polk	Possible
ICB & BMF Polk-US27 Barry Rd. to Lake Cnty 197534-4-52-01	Rebuild	Polk	Possible
HT-39, -40 & -42; 405822-3-52-01 SR 55 from Jump Ct to W Fort Island Trail (SR 44)	Governmental	Citrus	Unlikely
CLT-175 TO CLT-178_257298-6-52-01_HERNANDO_CR578	Governmental	Hernando	Unlikely

ALP, 605-610, 431383-1-52-01, HIGHLANDS, STATE ROAD # 25	Governmental	Highlands	Possible
WLB, WLB-2, ORANGE CO, GRANDNATIONAL OVERPASS	Governmental	Orange	Possible
WR and RW 69kV Relocation for Econ Trail	Governmental	Orange	Possible
TMS 69kV Relocation Taft-Vineland Rd from SOBT to Orange Ave	Governmental	Orange	Possible
SCP Relo-Bee Line Exp of John Young Bridge 406090-1-52-01	Governmental	Orange	Possible
69kV TMS-89 & -90 412994; Sunrail Phase II, Meadow Woods Park and Ride Station	Governmental	Orange	Yes
ZNR 44, 57, 58 CIP 6360 Pasco Co Zephyrhills Bypass West Gap	Governmental	Pasco	Likely
416561-2-52-01; SR 54 from eo CR 577 to eo CR 579 (Morris Bridge Rd)	Governmental	Pasco	Likely
BZ-384 TO BZ-386 C-3216.30 Pasco Clinton Ave road improve	Governmental	Pasco	Yes
418325-1,2-52-01; SR 54 from US 19 to Gunn; CR 1 from SR 54 to Embassy Blvd-Ridge Rd; Ridge Rd from US 19 to Broad St	Governmental	Pasco	Highly Unlikely
NP-4 thru NP-8 FIN: 256931-2-52-01 Gandy to 4th St	Governmental	Pinellas	Unlikely
LSP LSP-12 922252 PINELLAS CO. STARKEY ROAD	Governmental	Pinellas	Unlikely
LSP-71-74 PID921321 PINELLAS TRAIL 97TH WAY	Governmental	Pinellas	Unlikely
413622-2-52-01 - CR-296 (118TH AVE.)	Governmental	Pinellas	Unlikely

LSP15-17 PID2182 PINELLAS STARKY RD-BRYAN DAIRY RD IMPROV.	Governmental	Pinellas	Unlikely
BNUG 115 kV_Norteast Sub FIN:256931-2-52-01 Gandy to 4th St	Governmental	Pinellas	Unlikely
CPM-24 TO CPM-25_12043-112_PINELLAS_CITY OF ST.PETE, ADA	Governmental	Pinellas	Unlikely
ICB-188 TO ICB-236 197534-2-52-01 POLK SR-25 (US27)	Governmental	Polk	Likely
ICB & BMF Polk-US27 Barry Rd. to Lake Cnty 197534-4-52-01	Governmental	Polk	Likely
115kV DC-59 to -60 CIP 4904; Rhode Island Ave, From Veterans Memorial Parkway to Normandy Blvd	Governmental	Volusia	Unlikely

<u>25-6.0342(4)(c)</u>: *The extent to which the electric infrastructure improvements involve joint use facilities on which third-party attachments exist.*

In the description of specific hardening projects above, DEF has provided information as to whether the projects involve joint use facilities on which third-party attachments exist. Since 2009, all joint use poles changed out in support of Rule 25-6.0342(6) are scheduled within the company FMDR system. Communication carriers are notified at the time of the pole change out that transfers are needed. This process is in line with the other company pole maintenance programs and the cost to the communication carriers is minimized. By the end of 2013 auditing cycle, DEF will have completed the required inspection of every joint use pole in the DEF system. The 8 year inspection cycle will continue in 2014 starting with poles last inspected in 2007.

<u>25-6.0342(4)(d)</u>: *An estimate of the costs and benefits to the utility of making the electric infrastructure improvements, including the effect on reducing storm restoration costs and customer outages.*

With respect to system-wide storm and extreme weather applications identified in

Attachment B, DEF has provided any available cost/benefit information within the documents in **Attachment B**. Additionally, please see the following chart for money that DEF has spent in 2010, 2011 and 2012 on storm hardening and maintenance:

Duke Energy Florida Storm Hardening and Maintenance Costs

Description	2010 Actual	2011 Actual	2012 Actuals
Vegetation Management (Distribution & Transmission)	$36,059,080	$27,509,602	$31,564,612
Joint Use Pole Inspection Audit	$493,833	$479,684	$537,528
Transmission Pole Inspections	$2,502,186	$3,242,329	$3,927,081
Other Transmission Inspections and Maintenance	$12,771,234	$14,163,748	$15,723,729
Transmission Hardening Projects	$107,070,806	$81,794,465	$90,771,847
Distribution Pole Inspections & Treatments	$2,650,416	$2,328,407	$2,559,172
Distribution Hardening Projects	$23,597,698	$21,833,971	$34,183,578
Total	**$185,145,253**	**$151,352,206**	**$179,267,547**

__25-6.0342(4)(e)__: *An estimate of the costs and benefits, obtained pursuant to Rule 25-6.0342(6), to third-party attachers affected by the electric infrastructure improvements, including the effect on reducing storm restoration costs and customer outages realized by the third-party attachers.*

With respect to system-wide storm and extreme weather applications identified in **Attachments A** and **B**, DEF believes that any entity jointly attached to DEF's equipment would enjoy any benefit that DEF would enjoy from that same application, and DEF has provided any available cost/benefit information within the documents in those attachments.

__25-6.0342(5)__: *Each utility shall maintain written safety, reliability, pole loading capacity, and engineering standards and procedures for attachments by others.*

Please see **Attachment A** and **Attachment C**.

<u>25-6.0342(5)</u>: *The attachment standards and procedures shall meet or exceed the NESC so as to assure that third-party facilities do not impair electric safety, adequacy, or pole reliability; do not exceed pole loading capacity; and are constructed, installed, maintained, and operated in accordance with generally accepted engineering practices for the utility's service territory.*

All third-party joint use attachments on DEF's distribution and transmission poles are engineered and designed to meet or exceed current NESC clearance and wind loading standards. New attachment requests are field inspected before and after attachments to assure company construction standards are being met. All entities proposing to attach joint use attachments to DEF's distribution and transmission poles are given a copy of the company-prepared "Joint Use Attachment Guidelines." Attached hereto as **Attachment C**. These guidelines are a comprehensive collection of information spelling out the company's joint use process, construction standards, timelines, financial responsibilities, and key company contacts responsible for the completing permit requests. All newly proposed joint use attachments are field checked and designed using generally accepted engineering practices to assure the new attachments do not overload the pole or impact safety or reliability of the electric or other attachments. Additionally, annual and full-system audits are performed as detailed in DEF's annual March 1 comprehensive reliability report. For details on this activity, please see **Attachment B**.

<u>25-6.0342(6)</u>: *Each utility shall seek input from and attempt in good faith to accommodate concerns raised by other entities with existing agreements to share the use of its electric facilities.*

Since 2009, DEF has continued to communicate with the telecommunications carriers regarding the pole loading project. DEF has diligently cut cost for carriers by suggesting make ready solutions for over loaded pole conditions that do not include pole change outs. Additional guying and attachment rearrangement solutions have saved the communications carriers thousands of dollars annually. DEF continues to answer any questions and address concerns expressed verbally by joint attachers. DEF has taken all input received into consideration in the development and finalization of this storm hardening plan.

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2013 Storm Hardening Plan Attachment List

Attachment A:

1. Distribution Overhead Construction Manual
2. Distribution Underground Construction Manual
3. Distribution Engineering Manual
4. Transmission Extreme Winds Loading Design Criteria Guideline for Overhead Transmission Line Structures
5. Transmission Line Engineering Design Philosophy
6. Joint Use – Pole Attachment Guidelines and Clearances

Attachment B:

1. Ongoing Storm Preparedness Plan
2. Pole Inspection Plan
3. Vegetation Plan (included in Ongoing Storm Preparedness Plan)
4. 2012 PSC Reliability Report; pages 40-43, 45-47, 48-63

Attachment C:

1. Joint Use Pole Guidelines

Attachment D:

1. Completed Distribution Storm Hardening Projects 2007 through 2012

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ATTACHMENT A

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DISTRIBUTION OVERHEAD CONSTRUCTION MANUAL

Progress Energy

January 1, 2011

Distribution Standards Governance Policy

All standards and procedures in the Construction Specifications manuals are based on accepted industry practices designed to meet or exceed the requirements of the National Electrical Safety Code (NESC) and are approved by the employees of the Standards Unit as governing company policy for construction and work methods on the Florida and Carolina's distribution systems. These Specifications shall be followed and applied on new construction. In addition, all pole replacements shall be brought up to current Specifications. However, equipment may be added to a pole if NESC clearance and strength requirements can be met without replacing the pole to meet the current Specifications. This is a practice Distribution Standards encourages to avoid replacing poles prematurely or unnecessarily as the NESC affords utilities this provision. Also, maintenance replacements of individual items on a pole may be done without bringing the structure up to current specifications. If there are questions regarding application or interpretation, the appropriate Standards engineer should be contacted for consultation. Any planned or engineered deviation from these standards shall be submitted to the appropriate Standards engineer for approval. Field engineering and construction personnel processing or constructing work are ultimately responsible for ensuring that any proposed construction is in compliance with the NESC.

The standards and procedures contained in this manual are not applicable to installations in mines. Mines include open sandpits and rock quarries. Due to specific and unique requirements for electric service inside mines, overhead and underground facilities installed and maintained by Progress Energy must remain outside of the mine area as defined by the Federal Mine Safety and Health Administration (MSHA).

All stock items of material referred to in these manuals and tools in the Tool Catalog (http://webappint/SpecBookWMIS/ToolCatalog/ToolFrontPage.aspx) are selected based on field evaluations and are approved by the Distribution Standards Unit. The appropriate Distribution Standards Unit Engineer shall be consulted before any substitutions or alterations are made to these standards. Any materials found to be defective or unsatisfactory should be reported to Distribution Standards through the Defective/Failed Material Report System (described on spec pages 01.04-10 or 20.04-10) program so appropriate action can be taken.

Revisions to a specification drawing from the previous edition are marked with an arrow. Please review these changes and incorporate them into your new construction. For information regarding specification updates issued prior to the publishing of new editions, visit the Distribution Standards website http://progressnet/edg-deo-specs/index.htm.

We welcome any suggestions or feedback from the users of this book. All suggestions for improvement should be sent to Distribution Standards, TPP 17, Raleigh, N.C.

Jonathan Elkins, P.E.
Manager, Distribution Standards

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2				
1	10/7/11	CECCONI	GUINN	ELKINS
0	11/19/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 1 - OVERHEAD GENERAL

TABLE OF CONTENTS

Progress Energy

FLA DWG. 01.00-00A

01.10 COMPATIBLE UNIT TABLES (CONT.)

3				
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0	12/1/10	CECCONI	GUINN	ELKINS
REVISED	BY	CK'D	APPR.	

GENERAL

1. THE LARGE ASSEMBLIES AS OUTLINED ARE CONSIDERED TO BE PREFERRED CONSTRUCTION. THE LOCATION OF HARDWARE IS POSITIONED TO BE THE BEST FOR OVERALL APPLICATION.
2. ALTERNATE CONSTRUCTION IS FOUND IN THE MATERIAL ASSEMBLY GUIDE. DEVIATION FROM PREFERRED OR ALTERNATE CONSTRUCTION SHOULD BE DONE ONLY WHEN ABSOLUTELY NECESSARY.
3. EQUIPMENT OR HARDWARE THAT IS NOT DIMENSIONED MAY BE ADJUSTED TO ACCOMMODATE FIELD CONDITIONS. CONSIDERATION SHOULD BE GIVEN TO FUTURE MAINTENANCE REQUIREMENTS.
4. FOR CONTAMINATED AREAS, SEE SECTION 12.

PRIMARY CONSTRUCTION: GENERAL

1. THE CONSTRUCTION EXAMPLES ASSUME CLASS "A" WOOD POLE CONSTRUCTION UNLESS OTHERWISE STATED. ALSO MOST EXAMPLES SHOW THREE PHASE CONSTRUCTION. TO OBTAIN THE APPROPRIATE DIMENSIONS FOR SINGLE AND DOUBLE PHASE CONSTRUCTION, START WITH THE NEUTRAL AND USE THE PLATE MEASUREMENTS GOING UP THE POLE.
2. FOR 25 KV CONSTRUCTION, USE 35 KV INSULATORS.
3. FOR THE LINE LOAD CONCEPT, POSITION THE LOAD CONDUCTOR BELOW THE LINE CONDUCTOR FOR TANGENT TO BRANCH LINE TAPS.

INSTALLATION GUIDE FOR CONNECTORS: GENERAL

ALL APPROVED CONNECTORS, COMPRESSION OR BOLTED, SHOULD PERFORM IN A SATISFACTORY MANNER, PROVIDED THE CORRECT SIZE IS SELECTED FOR THE APPLICATION AND IT IS INSTALLED CORRECTLY. THE QUALITY OF THE ELECTRICAL CONNECTION IS GREATLY AFFECTED BY THE SURFACE CONDITION IN THE AREA OF CONTACT OF THE CONDUCTORS TO BE JOINED.

WHEN MAKING AN ALUMINUM TO COPPER OUTSIDE CONNECTION, THE ALUMINUM SHOULD ALWAYS BE ON TOP OF THE COPPER.

A CONNECTOR, COMPRESSION OR BOLTED, IS CLASSIFIED IN TWO WAYS:

1. ELECTRICALLY (HEAT CYCLE - "CURRENT ON" AND "CURRENT OFF" FOR AN EQUAL AMOUNT OF TIME, ONE HOUR OR MORE, AT THE CURRENT RATING OF THE SMALLEST CONDUCTOR)

   CLASS A 500 CYCLES (ALL FLORIDA POWER CONNECTORS)
   CLASS B 250 CYCLES
   CLASS C 125 CYCLES

2. MECHANICALLY (TENSILE STRENGTH)

   CLASS I, FULL TENSION: (STRAIN SLEEVES) PRIMARY AND OPEN WIRE SECONDARY MINIMUM OF 95% OF THE RATED BREAKING STRENGTH OF THE WEAKER OF THE CONDUCTORS JOINED.

   ➤ CLASS II, SEMI-TENSION: THESE SLEEVES ARE RATED AT 40% OF CONDUCTOR STRENGTH. THEY CAN BE USED IN JUMPERS, TPX SERVICE NEUTRALS AND SLACK SPANS.

   CLASS III, MINIMUM TENSION: (SERVICE AND REDUCING SLEEVES) NOT TO BE USED AS STRAIN SLEEVES. MINIMUM OF 5% OF THE WEAKER OF THE CONDUCTORS JOINED, OR 200 POUNDS, WHICHEVER IS LARGER. 100 POUNDS IF NO. 6 OR SMALLER.

MECHANICAL LOADING REQUIREMENTS

THE MECHANICAL LOADINGS ON POLES, INSULATORS, GUY WIRES, BRACKETS, CROSS ARMS, ETC. ARE DYNAMIC AND VARY AS A FUNCTION OF WEATHER AND ELECTRICAL LOAD. THE NATIONAL ELECTRICAL SAFETY CODE SPECIFIES THREE WEATHER LOADINGS THAT MUST BE CONSIDERED WHEN DESIGNING OVERHEAD DISTRIBUTION LINES.

COMBINED ICE AND WIND DISTRICT LOADING

STRUCTURES AND SUPPORTS MUST BE ABLE TO SUPPORT THE LOADS CREATED BY THE COMBINATION OF ICE AND WIND EXPECTED FOR THE DISTRICT WHERE THE LINE WILL BE LOCATED. THE FLORIDA REGIONS LIE IN THE LIGHT LOADING DISTRICT AS DEFINED BY THE NESC. THE DISTRIBUTION SPECIFICATIONS ARE CREATED TO SUPPORT DESIGNS THAT WILL MEET THE LOADING REQUIREMENT OF THE COMBINED ICE AND WIND DISTRICT DISTRICT LOADING RULE.

EXTREME WIND LOADING

IF A STRUCTURE OR ANY SUPPORTED FACILITY IS GREATER THAN 60 FT ABOVE GROUND, THEN THE STRUCTURE AND SUPPORTS MUST BE DESIGNED TO MEET THE REQUIREMENTS OF EXTREME WIND LOADING. THIS IS IN ADDITION TO THE REQUIREMENTS OF COMBINED ICE AND WIND DISTRICT LOADING. THE EXTREME WIND MAPS ON DWG. 01.00-03 AND SHOW THE WIND SPEED TO BE USED FOR THIS DETERMINATION. THE POLEFOREMAN PROGRAM IS THE COMPANY STANDARD FOR STRUCTURE DESIGN TO ENSURE COMPLIANCE WITH THIS RULE. ASSET ENGINEERING AND/OR STANDARDS SHOULD BE CONSULTED TO DETERMINE COMPLIANCE UTILIZING THE POLEFOREMAN PROGRAM.

NOTE: IN FLORIDA, THE PSC HAS DETERMINED THAT THE EXTREME WIND LOADING REQUIREMENTS WILL APPLY TO ALL STRUCTURES ON SOME CIRCUITS, REGARDLESS OF HEIGHT. ASSET MANAGEMENT SHALL IDENTIFY THESE LOCATIONS. POLEFOREMAN SHALL BE USED ON FACILITIES CONSTRUCTED ON THESE CIRCUITS TO ENSURE COMPLIANCE.

EXTREME ICE AND CONCURRENT WIND LOADING

IF A STRUCTURE OR ANY SUPPORTED FACILITY IS GREATER THAN 60 FT ABOVE GROUND, THEN THE STRUCTURE AND SUPPORTS MUST BE DESIGNED TO MEET THE REQUIREMENTS OF EXTREME ICE AND CONCURRENT WIND LOADING. THIS IS IN ADDITION TO THE REQUIREMENTS OF COMBINED ICE AND WIND DISTRICT LOADING. THE EXTREME ICE AND CONCURRENT WIND MAPS ON DWG. 01.00-03 SHOW THE WIND SPEED AND ICE TO BE USED FOR THIS DETERMINATION. THE POLEFOREMAN PROGRAM IS THE COMPANY STANDARD FOR STRUCTURE DESIGN TO ENSURE COMPLIANCE WITH THIS RULE. WHEN CONDITIONS REQUIRE CONSIDERATION OF EXTREME ICE AND CONCURRENT WIND LOADING, COMPLIANCE OF ALL STRUCTURES SHALL BE DETERMINED UTILIZING THE POLEFOREMAN PROGRAM.

3				
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0	11/16/10	BURLISON	GUINN	ELKINS
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MECHANICAL LOADING REQUIREMENTS

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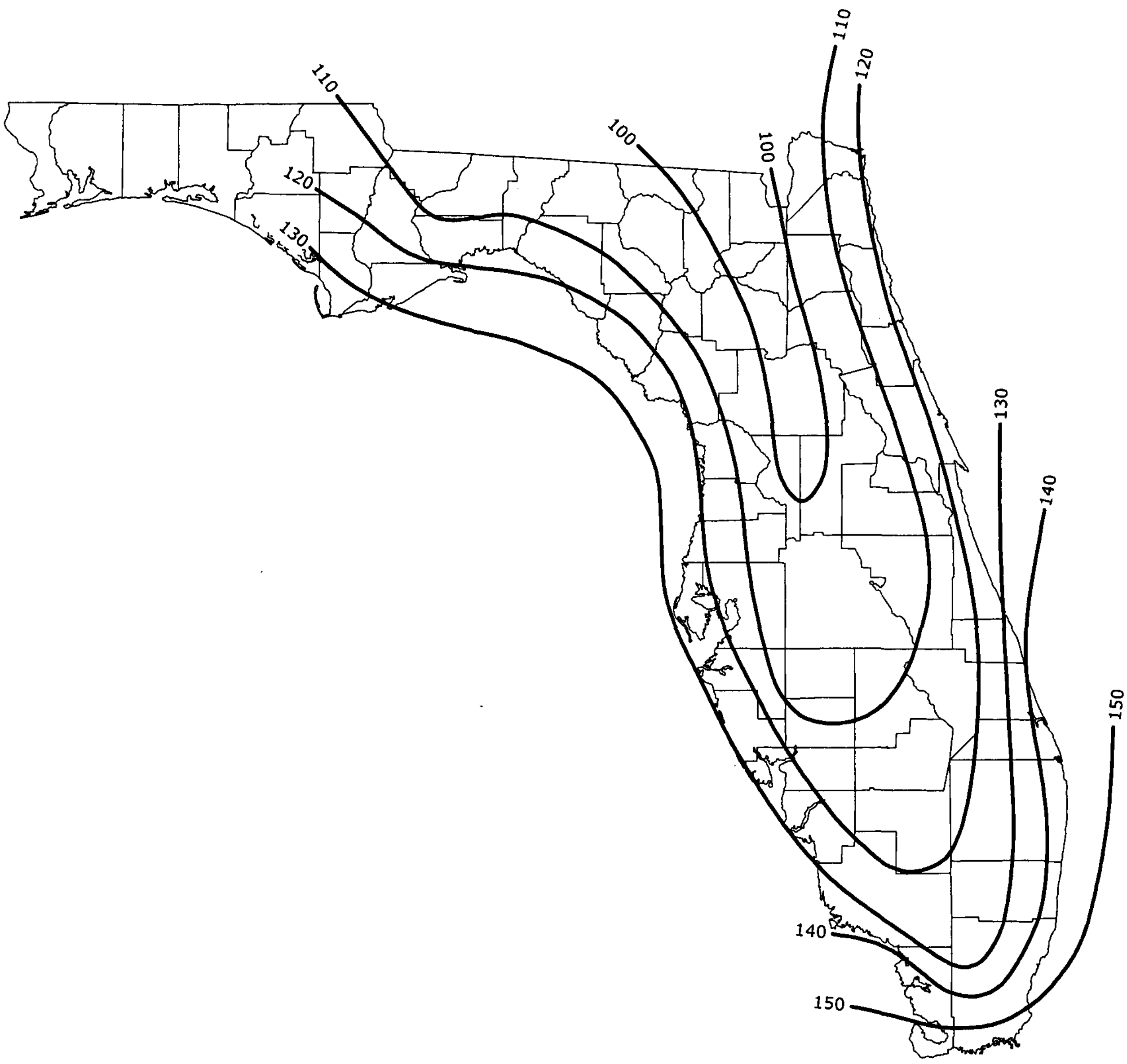


NOTES:

1. THIS MAP SHOWS THE VALUES OF NOMINAL DESIGN 3-SECOND GUST WIND SPEEDS IN MILES PER HOUR AT 33 FT ABOVE GROUND. THESE ARE THE VALUES TO BE USED TO DETERMINE COMPLIANCE WITH THE EXTREME WIND LOADING REQUIREMENTS OF THE NESC RULE 250C. SEE DWG. 01.00-02 TO DETERMINE IF A PARTICULAR LINE MUST BE DESIGNED TO MEET EXTREME WIND LOADING. THESE VALUES ARE TO BE USED IN THE POLEFOREMAN PROGRAM AS DEFINED BY DWG. 01.00-06. WHEN BETWEEN CONTOUR LINES, UTILIZE THE HIGHER VALUE. (EXAMPLE: IF THE LOCATION LIES BETWEEN THE 110 AND 120 CONTOUR LINES, UTILIZE 120 MPH IN THE POLEFOREMAN PROGRAM)

3					FLORIDA EXTREME WIND REGIONS	Duke Energy®
2						
1						
0	11/16/10	BURLISON	GUINN	ELKINS		FLA DWG. 01.00-03
REVISED		BY	CK'D	APPR.		

POLEFOREMAN

POLEFOREMAN IS A COMPUTER PROGRAM WRITTEN BY POWER LINE TECHNOLOGY INC. ITS FUNCTION IS CLASSING POLES, CALCULATING GUY WIRE TENSIONS AND PERFORMING JOINT USE ANALYSIS TO HELP ASSURE COMPLIANCE WITH A COMPANY'S STANDARDS AND THE NATIONAL ELECTRICAL SAFETY CODE (NESC). PROGRESS ENERGY HAS ADOPTED THIS PROGRAM AS ITS STANDARD TOOL FOR THIS PURPOSE. THE STANDARDS DEPARTMENT HAS CREATED AND MAINTAINS TEMPLATES FOR USE IN THE PROGRAM. A TEMPLATE REPRESENTS A BASIC SPECIFICATION WITH THE RELATIVE CONDUCTOR AND GUY LOCATIONS PRESET. THE USER MUST PROVIDE SPAN LENGTHS, GUY LEADS, EQUIPMENT CHARACTERISTICS, AND ANY ADDITIONAL CONDUCTORS OR ATTACHMENTS. THE PROGRAM UTILIZES THIS INFORMATION AND ACCURATELY CALCULATES THE MECHANICAL LOADING ON THE POLE AND GUYS BASED ON THE LOADING REQUIREMENTS OF SECTION 25 OF THE NESC. IT THEN COMPARES THE LOADS TO THE ANSI STANDARD CAPABILITIES OF THE POLES AND GUYS TO ASSURE COMPLIANCE WITH THE STRENGTH REQUIREMENTS OF SECTION 26 OF THE NESC.

DWG. O1.00-07 IS AN EXAMPLE OF THE OUTPUT FROM POLEFOREMAN. THE INFORMATION CAN BE USED TO VALIDATE COMPLIANCE WITH THE NESC AND ALSO THE FLORIDA PUBLIC SERVICE COMMISSION.

PoleForeman
Monday, October 09, 2006

SPANS

Span: 1 Span Length (ft): 200 Direction: 90°

Circuit: 1

Primary	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension (lbs)	Sag (in)
795 AAC (37)	250	9	6	6	6443	20
795 AAC (37)	250	9	42	42	6443	20
795 AAC (37)	250	9	78	78	6443	20

Neutral	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension (lbs)	Sag (in)
1/0 AAAC (7) RT	250	1	138	138	1682	25

Span: 2 Span Length (ft): 200 Direction: 270°

Circuit: 1

Primary	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension (lbs)	Sag (in)
795 AAC (37)	250	9	6	6	6443	20
795 AAC (37)	250	9	42	42	6443	20
795 AAC (37)	250	9	78	78	6443	20

Neutral	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension (lbs)	Sag (in)
1/0 AAAC (7) RT	250	1	138	138	1682	25

INSULATORS

Insulator	Attach	Loading	Angle
15KV Horz Post	6"	40% (250C)	0°
15KV Horz Post	42"	40% (250C)	0°
15KV Horz Post	78"	40% (250C)	0°
Spool	138"	19% (250C)	0°

PoleForeman
Monday, October 09, 2006

ANALYSIS DATA

Pole: 45/1	Loading District: Light	Construction Grade: Grade C (Elsewhere)
Horizontal Loading:	83% (250C)	Rule 250B Loading: Wind (psf): 9 Ice (in): 0
Vertical Loading:	18% (250C)	Rule 250C Loading: Wind (mph): 130 MPH

POLES

Pole	Length (ft)	Depth (ft)	Elevation (ft)
0	45	6.5	0
1	45	6.5	-5
2	45	6.5	-5

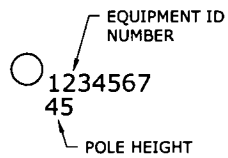
3					
2					
1					
0	7/5/10	SIMPSON	SIMPSON	ELKINS	
REVISED		BY	CK'D	APPR.	

POLEFOREMAN - OUTPUT EXAMPLE

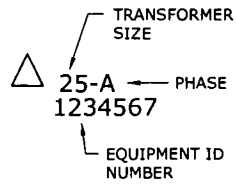
Progress Energy

PGN DWG. 01.00-07

TAG POLE WITH EQUIPMENT ID NUMBER



POLE

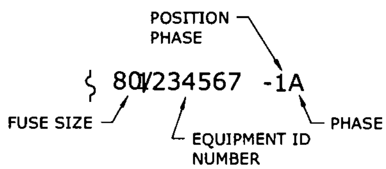


TRANSFORMER

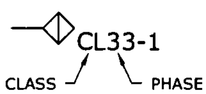
NOTES:

FOR POLES, TRANSFORMERS, PRIMARY METERS AND CAPACITORS THE EQUIPMENT ID NUMBER HAS SEVEB (7) NUMERICAL DIGITS. ADDITIONAL TEXT DESCRIBES THE POLE HEIGHT, TRANSFORMER SIZE AND PHASE, ETC.

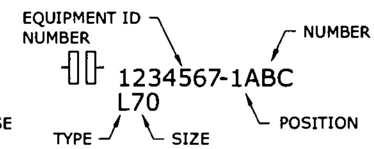
TAG POLE WITH EQUIPMENT ID NUMBER
TAG POSITION NUMBER AS DIRECTED BY ENGINEERING



OH FUSE



STREET LIGHT

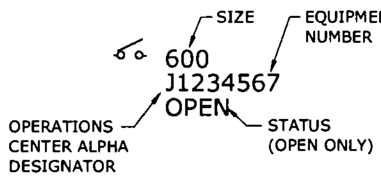


RECLOSER

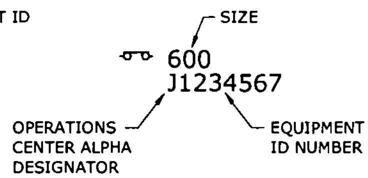
NOTES:

FOR OH FUSES, RECLOSERS, SECTIONALIZERS AND STREET LIGHTS THE EQUIPMENT ID NUMBER HAS SEVEN (7) NUMERICAL DIGITS. ADDITIONAL TEXT DESCRIBES THE FUSE SIZE, RECLOSER TYPE/SIZE, SL CLASS AND "POSITION" NUMBER.

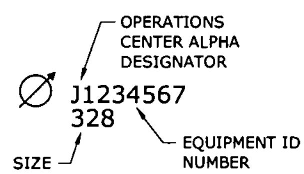
TAG POLE WITH EQUIPMENT ID NUMBER INCLUDING ALPHA DESIGNATOR



SWITCH (OPEN)



SWITCH (CLOSED)



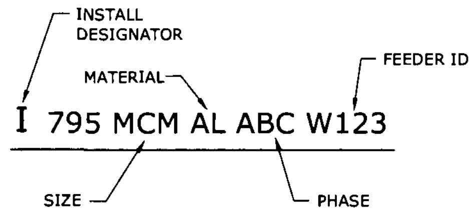
REGULATOR

NOTES:

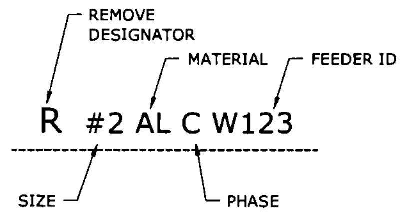
FOR 300/600 AMP SWITCHES, AND REGULATORS THE EQUIPMENT ID NUMBER HAS SEVEN (7) NUMERICAL DIGITS WITH THE OPERATIONS CENTER IDENTIFIER ALPHA ON THE FRONT.

3					GIS DEVICE DESCRIPTIONS	Duke Energy
2						
1						
0	4/12/10	SIMPSON	SIMPSON	ELKINS		FLA DWG. 01.00-08A
REVISED		BY	CK'D	APPR.		

PRIMARY



PRIMARY

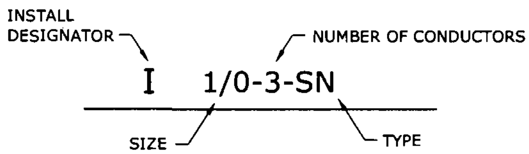


NOTES:

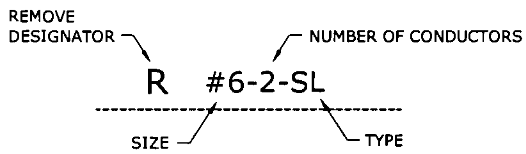
FOR OH & UG PRIMARY WIRE AND CABLE, THERE IS TEXT DESCRIBING THE WIRE/CABLE SIZE, MATERIAL TYPE, PHASE, FEEDER ID AND INSTALL (I) OR REMOVE (R) STATUS. SOME OF THIS TEXT IS OPTIONAL AND WILL NOT BE SHOWN IN ALL CASES.

EQUIPMENT ID NUMBER FORMAT FOR SWITCHGEAR

SECONDARY



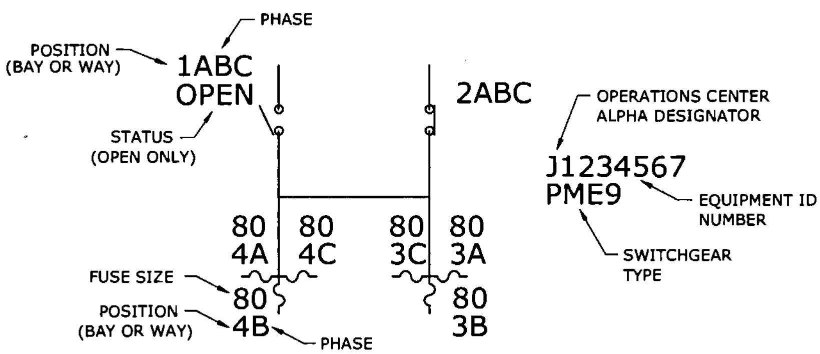
SECONDARY



NOTES:

FOR OH AND UG SECONDARY CABLE, THERE IS TEXT DESCRIBING THE CABLE SIZE, NUMBER OF CONDUCTORS, WHETHER IT IS SECONDARY NEUTRAL (SN), SERVICE (S) OR STREET LIGHT (SL) CABLE AND INSTALL (I) OR REMOVE (R) STATUS.

TAG CABINET WITH EQUIPMENT ID NUMBER
INCLUDING ALPHA DESIGNATOR AND POSITION NUMBERS



SWITCHGEAR

3					
2					
1				GIS DEVICE DESCRIPTIONS	Duke Energy®
0	4/12/10	SIMPSON	SIMPSON	ELKINS	FLA DWG. 01.00-08B
REVISED		BY	CK'D	APPR.	

ARRESTER		
BREAKER		B
CAPACITOR		
DOWN GUY		
ELBOWS	OPEN	
	CLOSED	
FAULT INDICATOR		FI
GENERATOR		G
	UPS	U
INTERRUPTER (VFI'S)		
POLES	NON-PROGRESS ENERGY	
	WOOD	
	JOINT USE (WOOD)	
	CONCRETE	
	JOINT USE (CONCRETE)	
	TRANSM WITH ATTACHMENT	
	TRANSM WITHOUT ATTACHMENT	
	PUSH BRACE	PB
	STUB	
PRIMARY CONDUCTOR NODES	PHASE CONNECTOR	
	MIDSPAN TAP	
	OPEN POINT	
	CABLE MARKER	
PRIMARY FUSE	OPEN	
	CLOSED	
PRIMARY METER		

PRIMARY SWITCH	OPEN	
	CLOSED	
RECLOSER	OPEN	R
	CLOSED	R
REGULATOR		R
SECONDARY CONDUCTOR NODES	SPLICE	
	CABLE MARKER	
	OPEN POINT	
SECONDARY SWITCH	OPEN	
	CLOSED	
SECTIONALIZER	OPEN	S
	CLOSED	
SIREN (AT NUCLEAR PLANTS)		
STEP TRANSFORMER		
STREETS, AREA LIGHTS		
	DECORATIVE	
STRUCTURES	MANHOLE	
	PAD	
	PEDESTAL	P
	VAULT	
	BOX	
	ENCLOSURE	
	HANDHOLE	F
	PLATFORM	
STREETS, AREA LIGHTS	BANK	
SWITCHGEAR		

REVISED		BY	CK'D	APPR.
3				
2				
1	8/3/12	KATIGBAK	BURLISON	ELKINS
0	7/5/10	SIMPSON	SIMPSON	ELKINS

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

Progress Energy

PGN

DWG. 01.00-10A

TRANSFORMERS, OVERHEAD *	'A' PHASE	
	'B' PHASE	
	'C' PHASE	
	OPEN BANK	
	CLOSED BANK	
TRANSFORMERS, UNDERGROUND W/ PAD *	'A' PHASE	
	'B' PHASE	
	'C' PHASE	
	OPEN BANK	
	CLOSED BANK	
TRANSFORMERS, UNDERGROUND W/ PAD		
VACCUUM SWITCH	2 WAY	
	3 WAY	
	4 WAY	
SENSING DEVICES	MEDIUM VOLTAGE	
	LOW VOLTAGE	

* WILL HAVE VOLTAGE AND PHASE TEXT INFO

3				
2				
1	8/3/12	KATIGBAK	BURLISON	ELKINS
0	7/5/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

Progress Energy

PGN	DWG. 01.00-10B

GROUNDING ELECTRODES FOR DISTRIBUTION LINES

THE OVERHEAD DISTRIBUTION LINE DESIGN STANDARD IN THE CAROLINAS AND FLORIDA IS CONSIDERED TO BE A MULTI-GROUNDED SYSTEM PER THE NESC. THE NESC REQUIRES THE NEUTRAL OF A MULTI-GROUNDED SYSTEM TO BE CONNECTED TO A MAN MADE ELECTRODE (GROUND ROD) AT EACH TRANSFORMER AND AT A SUFFICIENT NUMBER OF ADDITIONAL ELECTRODES TO TOTAL NOT LESS THAN 4 GROUNDS IN EACH MILE OF THE ENTIRE LINE, NOT INCLUDING GROUNDS AT INDIVIDUAL SERVICES (CUSTOMER'S GROUND ROD).

THE INTENT OF THIS NESC RULE IS TO ENSURE THE GROUNDING ELECTRODES ARE DISTRIBUTED AT APPROXIMATELY 1/4 MILE INTERVALS OR SMALLER, ALTHOUGH SOME INTERVALS MAY EXCEED 1/4 MILE. IN ANY MILE INTERVAL OF A GIVEN LINE, A MINIMUM OF 4 GROUNDS SHOULD BE FOUND EVENLY DISTRIBUTED THROUGHOUT THE MILE INTERVAL.

IN URBAN AND OTHER CONGESTED AREAS WHERE THERE ARE MANY TRANSFORMERS INSTALLED, THE 4 GROUNDS PER MILE REQUIREMENT IS MORE THAN SUFFICIENTLY MET. HOWEVER, IN RURAL AREAS, ESPECIALLY SINGLE-PHASE LINES WHERE VERY FEW IF ANY TRANSFORMERS, ARRESTER STATIONS OR CAPACITOR BANKS ARE INSTALLED, ADDITIONAL ELECTRODES AT 1/4 MILE INTERVALS MAY NEED TO BE INSTALLED TO MEET THE MINIMUM OF 4 PER MILE.

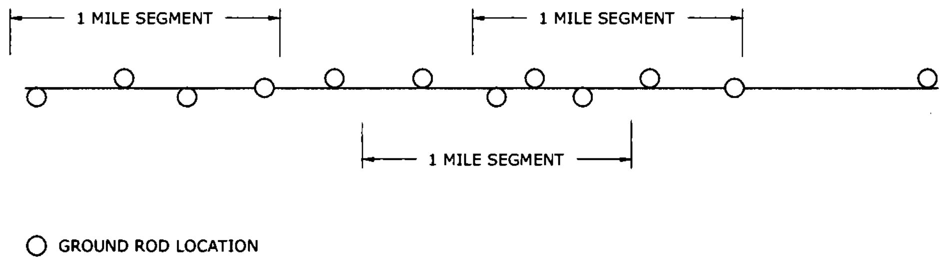


ILLUSTRATION OF 4 GROUND RODS IN EACH RANDOMLY SELECTED MILE OF LINE

3				
2				
1				
0	7/5/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

GROUNDING ELECTRODES FOR OVERHEAD DISTRIBUTION LINES

Progress Energy

PGN DWG. 01.01-01A

EQUIPMENT GROUNDING/BONDING

WHERE EQUIPMENT GROUNDING IS REQUIRED, ALL EQUIPMENT TANKS, HANGERS, AND OTHER HARDWARE MUST BE SOLIDLY BONDED TOGETHER AND THEN CONNECTED TO THE SYSTEM NEUTRAL.

- EQUIPMENT PROTECTED BY A FUSE (i.e. OH TRANSFORMERS, OH CAPACITOR BANKS) WILL REQUIRE A #6 SD BC GROUND WIRE, CONNECTED TO THE SYSTEM NEUTRAL. THE GROUND WIRE DOWN THE POLE IS ALL #6 SD BC, CONNECTED TO THE SYSTEM NEUTRAL AND THE GROUND RODS.
- ALL PAD-MOUNTED TRANSFORMERS AND UNDERGROUND PRIMARY ENCLOSURES, SINGLE AND THREE-PHASE, REQUIRE A #4 SD BC LOOPED GROUND TO MATCH THE NEUTRAL OF #1/0 UG PRIMARY CABLE.
- EQUIPMENT THAT WILL BE SUBJECT TO OPERATING ON THE SUBSTATION BREAKER (i.e. REGULATORS, PAD-MOUNTED SWITCHGEAR, PAD-MOUNTED CAPACITORS, PRIMARY METERING ENCLOSURES, RECLOSERS, ETC.) WILL REQUIRE #2 SD BC GROUND. (THE GROUND WIRE DOWN THE POLE TO THE GROUND RODS IS #6 SD BC.)
- BULK FEEDER (TERMINAL) POLES REQUIRE THE GROUND BRAID STRAPS (PROVIDED IN THE TERMINATOR KIT) BE RUN TO THE SYSTEM NEUTRAL AND CONNECTED. (THE GROUND WIRE DOWN THE POLE TO THE GROUND GROUND RODS IS #6 SD BC.)

WHERE EQUIPMENT OR MATERIAL IS NOT GROUNDED, IT MUST BE SEPARATED FROM OTHER GROUNDED EQUIPMENT BY A MINIMUM OF 4". SPECIAL INSTRUCTIONS MAY BE GIVEN THAT REQUIRE ADDITIONAL SEPARATION. THIS WILL MINIMIZE RADIO AND TV INTERFERENCE.

CONCRETE POLES OR POLES SET IN CONCRETE

A DRIVEN GROUND CONNECTED TO THE SYSTEM NEUTRAL IS REQUIRED ON ALL CONCRETE POLES CARRYING PRIMARY CONDUCTORS. ALSO, ALL PRIMARY HARDWARE ON CONCRETE POLES SHALL BE BONDED TO THE SYSTEM NEUTRAL WITH #6 SD BC. SEE DWG. 02.02-07.

OTHER DISTRIBUTION POLES

- METAL POLES WITHOUT PRIMARY AND EMBEDDED DIRECTLY IN EARTH DO NOT NEED A GROUND BUT MUST BE BONDED TO THE NEUTRAL AT THE POLE.
- WOOD POLES SUPPORTING ONLY SECONDARY DO NOT REQUIRE A GROUND.
- UNDERGROUND-FED STREET AND AREA LIGHT POLES THAT HAVE A METAL U-GUARD OR CONDUIT MUST HAVE THE METAL U-GUARD BONDED TO THE NEUTRAL AT THE POLE.

GUYS - SEE SECTION 02

USE OF TRANSMISSION STATIC LINE GROUNDS

WHEN A DISTRIBUTION GROUND IS REQUIRED ON AN EXISTING WOOD, STEEL OR CONCRETE TRANSMISSION UNDERBUILD POLE, THE EXISTING TRANSMISSION STATIC LINE GROUNDING CONDUCTOR AND GROUND ROD SHOULD BE USED WHERE ONE EXISTS, EXCEPT AS NOTED BELOW. IN GENERAL, A SEPARATE DISTRIBUTION GROUNDING CONDUCTOR TO THE GROUND IS NEITHER REQUIRED NOR DESIRABLE ON A TRANSMISSION LINE STRUCTURE DUE TO EXPENSE AND CREATING POTENTIAL RADIO INTERFERENCE.

FOR LIGHT DUTY, DIRECT-EMBEDDED STEEL POLES, A DISTRIBUTION GROUND CAN BE ATTACHED DIRECTLY TO A GROUND CLAMP INSTALLED BY FIELD DRILLING THE POLE.

FIELD DRILLING OF SPECIAL DESIGN STEEL POLES ON CONCRETE FOUNDATION IS NOT PERMITTED. THEREFORE, IF DISTRIBUTION IS UNDERBUILT AND NEEDS A GROUND, AN INTERMEDIATE DISTRIBUTION POLE MUST BE SET FOR THE EQUIPMENT AND GROUND. NEW SPECIAL DESIGNED STEEL TRANSMISSION STRUCTURES CAN BE FACTORY-EQUIPPED WITH A GROUNDING NUT OR PAD FOR DISTRIBUTION GROUNDING ATTACHMENTS IF DISTRIBUTION UNDERBUILD IS PLANNED AND SPECIFIED PRIOR TO THE POLE FABRICATION.

PEF CONDITIONS

DISTRIBUTION NEUTRALS ARE NOT TO BE BONDED TO STATIC LINE GROUNDS ON STEEL TRANSMISSION POLES EMBEDDED IN EARTH. NEUTRALS MAY BE BONDED IF THE STEEL POLES ARE EMBEDDED IN CONCRETE.

IN ST. PETERSBURG AND CLEARWATER, THERE ARE THREE EXCEPTIONS THAT REQUIRE ALL DISTRIBUTION GROUNDS TO BE ON SEPARATE INTERMEDIATE DISTRIBUTION POLES BECAUSE OF CATHODIC PROBLEMS.

1. NORTHEAST - 40TH STREET 230 KV LINE
2. ANCLOTE - LARGO 230 KV LINE - SECTION ANL129 TO ANL147 AND POLES ANL99, 105 AND 111.
3. DISSTON TO KENNETH CITY SUBSTATION - KD-35 TO KD-57.

3				
2				
1				
0	11/16/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

EQUIPMENT GROUNDING/BONDING

Duke Energy®

FLA DWG. 01.01-01B

GROUNDS

STANDARDS PROCEDURES BULLETIN

THIS BULLETIN DESCRIBES THE PROCEDURE FOR USING GROUND ROD ELECTRODES ON OVERHEAD AND UNDERGROUND DISTRIBUTION LINES ON THE SYSTEM. THE GROUND RESISTANCE AT A POLE IS TO BE LOW ENOUGH TO MINIMIZE HAZARDS TO PERSONNEL AND TO PERMIT PROMPT OPERATION OF CIRCUIT PROTECTIVE DEVICES. ON A MULTI-GROUNDED SYSTEM, THE RESISTANCE OF THE SYSTEM NEUTRAL IS AFFECTED BY THE RESISTANCE OF THE POLE GROUNDS AND ALSO BY THE NUMBER OF GROUNDS INSTALLED ALONG THE LINE. ON A GROUNDED-WYE SYSTEM, MULTIPLE GROUNDS AT DIFFERENT LOCATIONS ALONG THE DISTRIBUTION SYSTEM ARE MORE IMPORTANT THAN THE RESISTANCE OF ONE PARTICULAR GROUND ROD INSTALLATION. THUS IT IS IMPORTANT TO CONSIDER THE OVERALL GROUNDING SYSTEM WHEN EVALUATING THE RESISTANCE LEVEL OF A SINGLE GROUND ELECTRODE.

GROUND RESISTANCE CAN VARY CONSIDERABLY WITH SOIL AND WEATHER CONDITIONS. THE AMOUNT OF MOISTURE IN THE SOIL WILL AFFECT A RESISTANCE LEVEL AS WILL THE TEMPERATURE OR THE CHEMICAL CONTENT OF THE SOIL. THE USE OF DEEP DRIVEN ROD ELECTRODES WILL MINIMIZE THE VARIATIONS IN RESISTANCE DUE TO WEATHER CONDITIONS AND IN SOME AREAS WILL INCREASE THE PROBABILITY OF PENETRATING A LOW RESISTANCE SOIL LAYER.

WHERE DISTRIBUTION EQUIPMENT WITH ARRESTERS IS INSTALLED (i.e. TRANSFORMERS, CAPACITOR BANKS, RECLOSERS, ETC.) A DRIVEN ROD SHALL BE INSTALLED AS FOLLOWS:

ONE DEEP-DRIVEN GROUND CONSISTING OF 4-5' RODS (INSTALLED ONE ON TOP OF THE OTHER TO PROVIDE 1 VERTICAL ELECTRODE 20' IN LENGTH). IF IT BECOMES IMPRACTICAL TO INSTALL 4 DEEP-DRIVEN RODS DUE TO ADVERSE SOIL CONDITIONS (I.E., ROCK), THEN INSTALLATION WILL BE CONSIDERED COMPLETE WITH THE MAXIMUM NUMBER OF RODS THAT THE SOIL WILL PERMIT.

EQUIPMENT WITH **NO** ARRESTERS REQUIRES ONLY 2 - 5' RODS.

WHEN STREET LIGHT INSTALLATIONS REQUIRE A DRIVEN GROUND, 2 - 5' RODS WILL BE INSTALLED AND INTERCONNECTED WITH THE NEUTRAL CONDUCTOR.

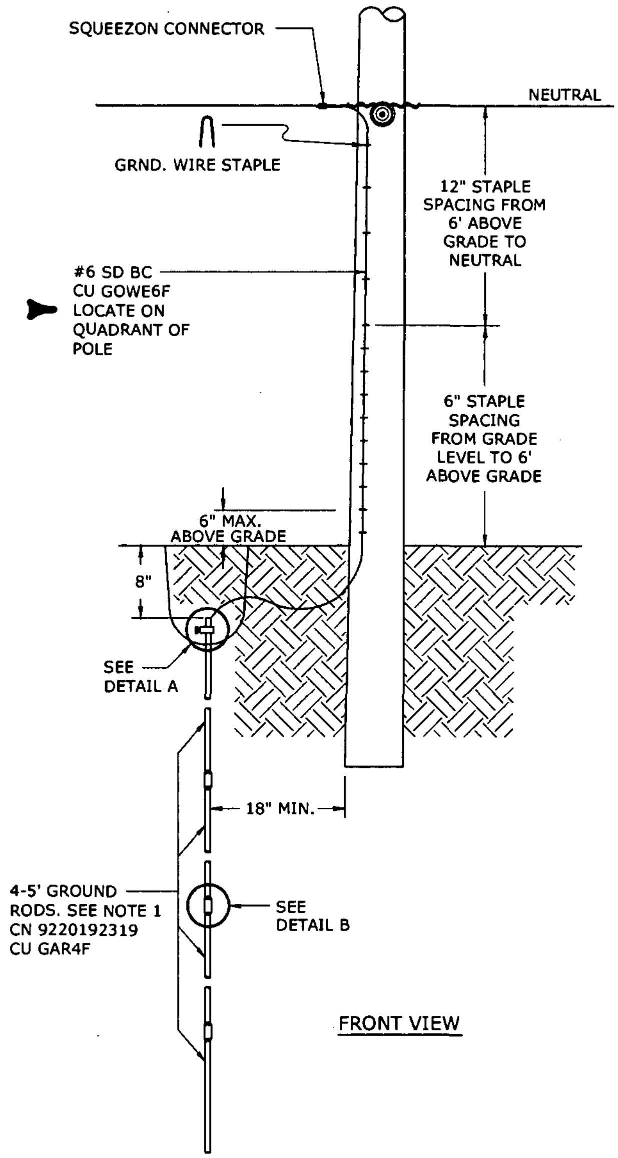
GROUNDING COMPATIBLE UNITS	DESCRIPTION/APPLICATION
GAR2F	GROUND EQUIPMENT WITHOUT ARRESTERS - 2 - 5' RODS ONLY
GAR4F	GROUND EQUIPMENT WITH ARRESTERS - 4 - 5' RODS ONLY
GOWE6F	WOOD POLE GROUND WITH EQUIPMENT - WIRE ONLY
GOCE6F	CONCRETE POLE GROUND - WIRE ONLY
GOME6F	METAL POLE GROUND WITH EQUIPMENT - WIRE ONLY
GUPED6F	BONDING GROUND FOR JOINT USE/ PEDESTAL
GUB6F	BONDING GROUND FOR JOINT USE PMT
GUP1E4F	GROUND SINGLE-PHASE PMT - WIRE ONLY
GUP3E4F	GROUND THREE-PHASE PMT - WIRE ONLY
GUPGE2F	GROUND PAD-MOUNTED SWITCHGEAR - WIRE ONLY
GUFPCE2F	GROUND PAD-MOUNTED CAPACITOR - WIRE ONLY
GUFTPE2F	GROUND FOR TERMINAL POLE - WIRE ONLY
GUEMB2F	GROUND PRIMARY METER UNDERGROUND CABINET - WIRE ONLY

3				
2				
1				
0	8/4/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

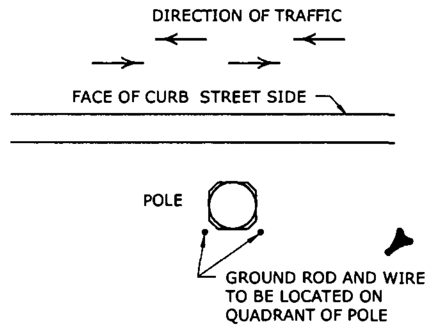
GROUND ROD ELECTRODE
FOR DISTRIBUTION LINES

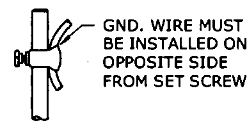
Duke Energy®

FLA DWG. 01.01-01C

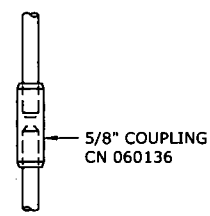


FRONT VIEW





DETAIL 'A'



DETAIL B

NOTES:

1. WHERE DENSE SOIL DOES NOT PERMIT DRIVING FOUR RODS, TWO OR THREE IS ACCEPTABLE. NESC REQUIRES A MINIMUM OF EIGHT FEET SO WE SHALL ALWAYS DRIVE TWO RODS MINIMUM.
2. THE GROUNDING CONDUCTOR SHALL BE ATTACHED TO THE POLE. USE #6 SOLID BARE COPPER FOR THE DRIVEN GROUND CONDUCTOR.
3. FOR ALL DISTRIBUTION GROUNDS, USE COPPER WIRE AND BRONZE CLAMPS. THE AREA OF THE ROD AT THE CLAMP SHALL BE WIRE BRUSHED. SECTIONAL COPPER-CLAD RODS SHALL NOT BE DRIVEN CLOSE TO KNOWN STEEL PIPES OR CONDUITS.
4. RUN GROUND FROM ROD TO NEUTRAL POSITION AND CONNECT TO SYSTEM NEUTRAL.

3				
2				
1	2/14/11	BURLISON	BURLISON	ELKINS
0	4/12/10	SIMPSON	SIMPSON	GUINN
REVISED		BY	CK'D	APPR.

EQUIPMENT POLE GROUNDING DETAIL

Duke Energy®

FLA

DWG. 01.01-05

02.02 POLES

02.04 GUYING

02.06 ANCHORS

02.08 OPERATIONS AND MAINTENANCE

3				
2				
1	10/22/12	KATIGBAK	BURLISON	ADCOCK
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 2 - POLES, GUYS AND ANCHORS

TABLE OF CONTENTS

Duke Energy®

FLA DWG. 02.00-00A

POLE LOCATION

POLES SHALL BE LOCATED AS SPECIFIED ON THE WORK ORDER. POLES FOR NEW LINES ALONG CITY STREETS SHOULD BE BACK OF THE SIDEWALK OR ACCORDING TO CITY/TOWN SPECIFICATIONS. IF CURBS ARE NOT ALREADY ESTABLISHED, APPROPRIATE AUTHORITIES SHOULD BE CONTACTED IN ORDER TO CONDUCT A SURVEY AND ESTABLISH FUTURE CURB LINES. SEE DWG. 09.02-03 FOR CLEARANCES TO HYDRANTS.

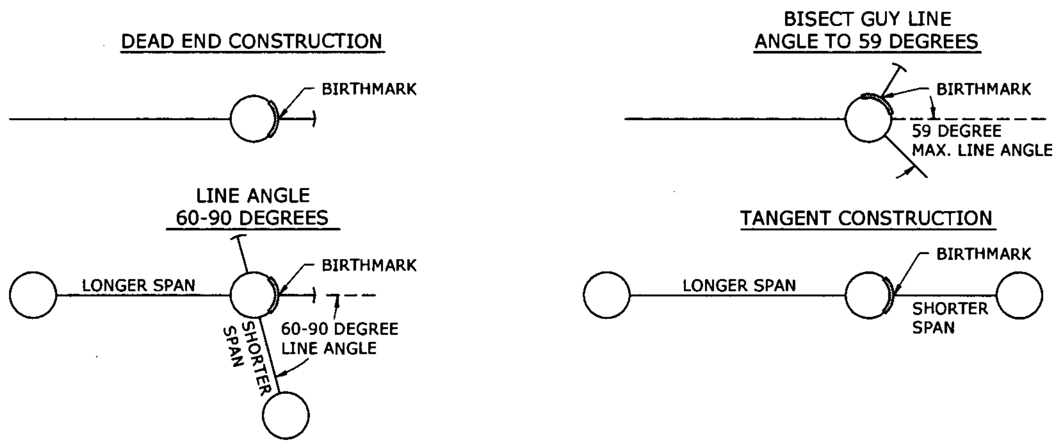
POLES OUTSIDE OF A TOWN'S CORPORATE LIMITS MAY NOT BE SET ON THE RIGHT-OF-WAY OF ANY PUBLIC ROAD OR HIGHWAY WITHOUT THE APPROVAL OF COMPANY ENGINEERING AND THE APPROPRIATE HIGHWAY OFFICIALS.

CARE AND CONSIDERATION OF PROPERTY OWNER'S INCONVENIENCE SHOULD BE TAKEN INTO ACCOUNT IN DETERMINING BOTH POLE AND GUY LOCATIONS.

ORIENTATION

WHEN SETTING NEW POLES ON DEADENDS OR ANGLES OF UP TO 59 DEGREES, THE POLE'S BIRTHMARK SHOULD BE FACING THE ANCHOR. ON ANGLED POLES EXCEEDING 59 DEGREES, THE BIRTHMARK SHOULD FACE THE ANCHORS THAT SUPPORT THE LARGEST STRAIN AND CONDUCTOR TENSION. WHEN TENSIONS ARE EQUAL, TURN THE BIRTHMARK TOWARD EITHER ANCHOR, PREFERABLY PARALLEL TO A ROAD IF ONE EXISTS.

FOR TANGENT CONSTRUCTION, FACE THE BIRTHMARK IN LINE WITH THE PRIMARY CONDUCTORS AND IN THE DIRECTION OF THE SHORTER SPAN. THE POLE MANUFACTURER PLACES THE BIRTHMARK ON THE INSIDE FACE OF A WOOD POLE'S NATURAL CONCAVE SURFACE. FOLLOWING THE ORIENTATION RULES ABOVE TAKES ADVANTAGE OF THE NATURAL STRENGTH CHARACTERISTICS OF THE POLE AND IMPROVES AESTHETICS.



POLE SIZING

POLES ARE A LARGE ITEM OF EXPENSE ON DISTRIBUTION SYSTEMS. CARE SHOULD BE TAKEN WHEN SELECTING THE PROPER CLASS FOR A GIVEN LOAD AND THE PROPER HEIGHT FOR A GIVEN CONDITION.

USE OF DIFFERENT SIZES AND CLASSES SHOULD BE ON A CASE BY CASE BASIS. THE GUY LEAD LENGTH IS THE MAIN DETERMINING FACTOR OF POLE CLASS. TALLER POLES SHOULD BE SPECIFIED WHERE TERRAIN, JOINT-USE, ANTICIPATED EQUIPMENT AND CONDUCTORS, AND CONDUCTOR GROUND CLEARANCES SO DICTATE. HEAVIER CLASS POLES SHOULD BE SPECIFIED WHERE REASONABLY ANTICIPATED FUTURE MECHANICAL LOADS SO DICTATE.

THE WOOD POLES SHOWN ON DWG. 02.02-03 ARE STOCKED. UNUSUAL QUANTITIES, NON-STOCK, OR NON-STANDARD POLES WILL NEED TO BE SPECIAL ORDERED.

HOLES IN POLES

HOLES IN POLES ARE NOT TO BE LOCATED LESS THAN 4 INCHES APART IN ANY SECTION UNLESS DESIGNATED ON A SPECIFICATION DRAWING OR APPROVED BY DISTRIBUTION STANDARDS.

3				
2				
1				
0	10/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

POLES - GENERAL

Duke Energy

FLA DWG. 02.02-01

COMPATIBLE UNITS FOR DISTRIBUTION WOOD POLES						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	P306F	1	030306	1	POLE, WOOD, 30', CLASS-6
	2	P353F	1	030353	1	POLE, WOOD, 35', CLASS-3
	3	P355F	1	030355	1	POLE, WOOD, 35', CLASS-5
	4	P401F	1	9220165759	1	POLE, WOOD, CLASS-1, 40', CCA
	5	P402F	1	9220165760	1	POLE, WOOD, CLASS-2, 40', CCA
	6	P403F	1	030403	1	POLE, WOOD, 40', CLASS-3
	7	P404F	1	030404	1	POLE, WOOD, 40', CLASS-4
	8	P405F	1	030405	1	POLE, WOOD, 40', CLASS-5
	9	P451F	1	9220162033	1	POLE, WOOD, CLASS-1, 45', CCA
	10	P452F	1	030452	1	POLE, WOOD, 45', CLASS-2
	11	P453F	1	9220165757	1	POLE, WOOD, CLASS-3, 45', CCA
	12	P454F	1	030454	1	POLE, WOOD, 45', CLASS-4
	13	P501F	1	030501	1	POLE, WOOD, 50', CLASS-1
	14	P503F	1	030503	1	POLE, WOOD, 50', CLASS-3
	15	P50H1F	1	9220161789	1	POLE, WOOD, CLASS-H1, 50', CCA
	16	P50H2F	1	9220169868	1	POLE, WOOD, CLASS-H2, 50', CCA
	17	P551F	1	030551	1	POLE, WOOD, 55', CLASS-1
	18	P552F	1	030552	1	POLE, WOOD, 55', CLASS-2
	19	P553F	1	030553	1	POLE, WOOD, 55', CLASS-3
	20	P55H1F	1	9220161790	1	POLE, WOOD, CLASS-H1, 55', CCA
	21	P55H2F	1	9220161792	1	POLE, WOOD, CLASS-H2, 55', CCA
	22	P601F	1	030601	1	POLE, WOOD, 60', CLASS-1
	23	P602F	1	030602	1	POLE, WOOD, 60', CLASS-2
	24	P603F	1	030603	1	POLE, WOOD, 60', CLASS-3
	25	P652F	1	030652	1	POLE, WOOD, 65', CLASS-2
	26	P653F	1	030653	1	POLE, WOOD, 65', CLASS-3
	27	P701F	1	030701	1	POLE, WOOD, 70', CLASS-1
	28	P751F	1	030751	1	POLE, WOOD, 75', CLASS-1

COMPATIBLE UNITS FOR DISTRIBUTION CONCRETE POLES						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	PCC18PILASTERF	1	328732	1	PILASTER 18'
	2	PCC30T1F	1	034301	1	POLE, CONCRETE, PLAIN 30'TYPE 1
	3	PCC30T3F	1	034303	1	POLE, CONCRETE, 30' TY 3
	4	PCC35T1F	1	034351	1	POLE, CONCRETE, 35 FT. TYPE 1, SAME DRILLING AS 30' TYPE 1
				152105	2	BOLT, MACH, SQ, NUT, 5/8"X6"
	5	PCC35T3F	1	034353	1	POLE, CONCRETE, 35' TY 3
	6	PCC40T3F	1	034403	1	POLE, CONCRETE, 40', TYPE-3
	7	PCC45T3F	1	034453	1	POLE, CONCRETE, 45', TYPE-3
	8	PCC50T2F	1	034502	1	POLE, CONCRETE, 50' TY CLASS II
	9	PCC55T2F	1	034552	1	POLE, CONCRETE, 55' TYPE CLASS - II, DISTRIBUTION
	10	PCC6514KF	1	034148	1	POLE, CONCRETE, 65', SPUN, ROUND, 14, KIP, 15.39", TIP

COMPATIBLE UNITS FOR CONCRETE LIGHTING POLES						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	PCC15T0TNF	1	34150	1	POLE CNCR 15' TY 0 TENNON
	2	PCC15T0TNWF	1	34150	1	POLE, CNCR 15' TY 0 TENNON
				192107	18	WIRE, COPPER, #10, STREETLIGHT, ST LIGHT # 10 CU
	3	PCC16OCTF	1	34155	1	POLE, CNCR, 16FT, EMBEDDED
				192107	16	WIRE, COPPER, #10, STREETLIGHT, ST LIGHT # 10 CU

3				
2				
1				
0	9/24/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

POLES - GENERAL

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LABOR ONLY COMPATIBLE UNITS FOR POLES						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	BKTPTE54FBGF	1	-	1	POLE TOP EXTENSION - 54 INCH FIBERGLASS
	2	OHBKTBANDINGF	1	-	1	BAND OVERHEAD BRACKET TO CONCRETE OR STEEL POLE
	3	OHLABFLAGMANF	1	-	1	OH LABOR FOR FLAGMAN (PER HOUR)
	4	OHLABREINFORCEF	1	-	1	OH LABOR TO REINFORCE EXIST POLE, INCLUDES SETUP (PER POLE)
	5	OHLABSETUPF	1	-	1	CONTRACT POLE INSPECTION SETUP AND JOB BRIEF (PER POINT)
	6	OHLTLABSETUPF	1	-	1	OH LINE TRUCK, PPE,TOOL SETUP AND JOB BRIEF (PER POINT)
	7	PFILLBIRDHOLEF	1	-	1	POLE - FILL BIRD HOLE
	8	PLABHANDDIGLF	1	-	1	POLE LABOR TO HAND DIG, INACESSIBLE (30FT AND LARGER)
	9	PLABHANDDIGSF	1	-	1	POLE LABOR TO HAND DIG, INACESSIBLE (LESS THAN 30FT)
	10	PLABHANDSETLF	1	-	1	POLE LABOR TO HAND SET, INACESSIBLE (30FT AND LARGER)
	11	PLABHANDSETSF	1	-	1	POLE LABOR TO HAND SET, INACESSIBLE (LESS THAN 30FT)
	12	PLABHOLDPOLEF	1	-	1	POLE LABOR SETUP TRUCK TO HOLD EXISTING POLE (PER MAN HOUR)
	13	PLABINSPF	1	-	1	POLE LABOR TO VISUALLY INSP HARDWARE, CONNECTIONS, DECAY
	14	PLABJETF	1	-	1	POLE LABOR WHEN JETTING IS REQUIRED FOR HOLE
	15	PLABOHGUARDF	1	-	1	POLE LABOR TO INSTALL AND REMOVE POLE GUARD (PER SECTION)
-	16	PLABREALIGNF	1	-	1	POLE LABOR TO REALIGN, STRAIGHTEN OR LEAN
	17	PLABREMREINFF	1	-	1	POLE LABOR TO REMOVE STEEL REINFORCEMENT
	18	PLABREMSTUBF	1	-	1	POLE LABOR TO REMOVE POLE STUB
	19	PLABROCKCHIPF	1	-	1	POLE LABOR FOR HAND CHIPPING ROCK FOR HOLE
	20	PLABROCKCOLARF	1	-	1	POLE LABOR TO INSTALL ROCK COLAR (ROCK NOT INCLUDED)
	21	PLABSAWOFFF	1	-	1	POLE LABOR TO SAW POLE OFF PER CUT
	22	PLABTEMPPOLEF	1	-	1	POLE LABOR TO INSTALL AND REMOVE TEMP WOOD POLE - ANY SIZE
	23	PLLABHANDDIGLF	1	-	1	LIGHT POLE LABOR TO HAND DIG, INACESSIBLE (30FT AND LARGER)
	24	PLLABHANDDIGSF	1	-	1	LIGHT POLE LABOR TO HAND DIG, INACESSIBLE (LESS THAN 30FT)
	25	PLLABHANDSETLF	1	-	1	LIGHT POLE LABOR TO HAND SET, INACESSIBLE (30FT AND LARGER)
	26	PLLABHANDSETSF	1	-	1	LIGHT POLE LABOR TO HAND SET, INACESSIBLE (LESS THAN 30FT)
	27	PLLABINSPF	1	-	1	LIGHT POLE LABOR TO VISUALLY INSP HARDWARE, CONNECTS, DECAY
	28	PLLABREALIGNF	1	-	1	LIGHT POLE LABOR TO REALIGN, STRAIGHTEN OR LEAN
	29	PLLABROCKCHIPF	1	-	1	LIGHT POLE LABOR FOR HAND CHIPPING ROCK FOR HOLE
	30	PLLABSAWOFFF	1	-	1	LIGHT POLE LABOR TO SAW POLE OFF PER CUT
	31	POLETREATF	1	-	1	TREAT POLE
	32	UGLABFLAGMANF	1	-	1	UG LABOR FOR FLAGMAN (PER HOUR)

3				
2				
1				
0	9/24/12	WOJNAROWSKI	BURLISON	ADCOCK
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POLES - GENERAL

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COMMON STOCKED WOOD POLES			
HEIGHT	CLASS	COMPATIBLE UNIT	CATALOG NUMBER
30	6	P306F	030306
35	5	P355F	030355
40	5	P405F	030405
45	4	P454F	030454
45	2	P452F	030452
50	3	P503F	030503
55	3	P553F	030553
55	2	P552F	030552
55	1	P551F	030551

SELF SUPPORTING POLES:

THE USE OF SELF SUPPORTING POLES, FOR ANGLES GREATER THAN 15 DEGREES, IS STRONGLY DISCOURAGED DUE TO THE ASSOCIATED HIGH COSTS AND AN EXTENSIVE DESIGN PROCESS TAKING UPWARDS OF SIX MONTHS.

IF ALL OTHER OPTIONS ARE EXHAUSTED AND A SELF SUPPORTING POLE IS REQUIRED, CONTACT DISTRIBUTION STANDARDS TO START THE DESIGN PROCESS.

DISTRIBUTION STANDARDS HAS CREATED SEVERAL QUICK REFERENCE TABLES FOR SELF SUPPORTING POLES HAVING ANGLES LESS THAN 15 DEGREES IN EFFORTS TO MINIMIZE THE DESIGN PROCESS. NOT EVERY SCENARIO WITH AN ANGLE LESS THAN 15 DEGREES FITS WITHIN THE GUIDELINES OF THESE TABLES. CONTACT DISTRIBUTION STANDARDS IN REFERENCE TO THE SELF SUPPORTING POLE TABLES.

NOTES:

1. POLE SIZING TABLES ARE INCLUDED ON APPLICABLE TANGENT DRAWINGS IN SECTION 03.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	12/1/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STANDARD POLE SIZING - WOOD

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RECOMMENDED ALLOWABLE WEIGHT OF ALL EQUIPMENT AT VARIOUS DISTANCES FROM TOP OF POLE
(MEASURED TO TOP EQUIPMENT MOUNTING BOLT)

POLE LENGTH	POLE CLASS	4 FT.	6 FT.	8 FT.	10 FT.	12 FT.	14 FT.	16 FT.	18 FT.	20 FT.
35	5	1461	1569	1698	1855	2048	2292	2609	3037	3646
	4*	1809	2187	2363	2577	2841	3174	3608	4194	5029
	3	2467	2967	3201	3486	3837	4282	4862	5645	6762
	2*	3284	3934	4238	4609	5068	5650	6407	7433	8894
	1	4285	5112	5502	5977	6566	7312	8284	9601	11478
40	5	1308	1579	1697	1834	1995	2189	2425	2720	3099
	4	1807	2168	2324	2507	2723	2983	3299	3695	4204
	3	2434	2902	3107	3346	3629	3969	4384	4904	5572
	2	3206	3804	4067	4374	4737	5174	5709	6378	7239
	1	4144	4896	5227	5614	6074	6626	7303	8151	9243
45	4	1955	2078	2215	2371	2551	2758	3002	3292	3645
	3	2601	2759	2936	3138	3369	3638	3954	4330	4788
	2*	3524	3734	3971	4241	4550	4909	5331	5835	6447
	1	4502	4763	5059	5395	5781	6230	6758	7388	8155
	H1*	5664	5985	6349	6762	7238	7792	8444	9222	10169
	H2*	7261	7669	8129	8655	9259	9962	10790	11779	12982
50	3	2513	2657	2817	2995	3194	3420	3678	3977	4326
	2	3376	3567	3777	4012	4276	4574	4915	5310	5771
	1	4439	4685	4958	5262	5603	5990	6432	6943	7541
	H1	5547	5847	6178	6549	6965	7437	7978	8603	9335
	H2	7056	7432	7849	8314	8837	9430	10109	10895	11815
55	3	2451	2586	2733	2894	3072	3270	3492	3742	4028
	2	3267	3443	3636	3846	4079	4338	4628	4956	5329
	1	4268	4493	4739	5010	5309	5641	6013	6434	6914
	H1	5476	5760	6071	6412	6789	7208	7678	8210	8816
	H2	6717	7057	7428	7836	8288	8791	9354	9992	10720
60	3	2407	2535	2673	2823	2986	3165	3362	3581	3825
	2	3186	3352	3530	3724	3935	4167	4422	4706	5023
	1	4136	4346	4573	4820	5088	5383	5708	6069	6473
	H1*	5278	5541	5825	6134	6470	6840	7247	7700	8207
	H2*	6635	6960	7311	7692	8108	8565	9069	9629	10255
65	3	2377	2500	2631	2772	2925	3090	3270	3467	3684
	2	3126	3283	3452	3633	3828	4040	4271	4524	4802
	1*	4034	4233	4445	4673	4920	5188	5479	5799	6151
	H1*	5122	5369	5633	5917	6224	6557	6920	7318	7756
	H2*	6410	6713	7037	7386	7763	8172	8619	9108	9647

* POLE CLASS IS AVAILABLE, BUT MUST BE SPECIAL ORDERED. CONTACT STORES AS SOON AS YOU KNOW THIS CLASS IS REQUIRED TO ENSURE POLE IS AVAILABLE AT CONSTRUCTION TIME.

THE TABLE ABOVE SHOULD BE USED FOR GRADE C CONSTRUCTION. GRADE B CONSTRUCTION REQUIRES ANALYSIS USING POLEFOREMAN.

DO NOT EXCEED VALUES IN TABLE WITHOUT AN ANALYSIS USING POLEFOREMAN.

ALLOWABLE WEIGHTS ARE BASED ON CENTER OF LOAD BEING LOCATED A MAXIMUM OF 24" FROM FACE OF POLE. LOADS LOCATED GREATER THAN 24" FROM FACE OF POLE REQUIRE ANALYSIS USING POLEFOREMAN.

IMPORTANT:

LOADS GREATER THAN 5010 LBS (THREE 167 KVA TRANSFORMERS) REQUIRE ANALYSIS USING POLEFOREMAN.
LOADS GREATER THAN 3000 LBS (OR THREE 75 KVA AND LARGER TRANSFORMERS) REQUIRE 10% PLUS 4 FT POLE EMBEDMENT, OTHERWISE USE EMBEDMENTS SHOWN ON DWG. 02.02-08.

EXAMPLE: 3-100 KVA TRANSFORMERS WEIGH (SEE DWG. 06.00-12) 1369 LBS. X 3= 4107 LBS. MOUNTED 12 FT. FROM THE TOP OF POLE, USE A 45C2 POLE. EMBED POLE 10% PLUS 4 FT.= 8.5 FT.

IF REQUIRED POLE IS NOT AVAILABLE, SEE DWG. 02.02-03C TO DETERMINE EQUIVALENT POLE.

IN THIS EXAMPLE, A 55C3 WITH 10 FT. CUT OFF THE TOP WOULD BE EQUIVALENT TO A 45C2, BASED ON THE RULE OF THUMB STATED ON DWG. 02.02-03C.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	12/1/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STANDARD POLE SIZING - WOOD

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TABLE A - ANSI DIMENSIONS FOR SOUTHERN PINE POLES								
CLASS	H2	H1	1	2	3	4	5	6
MINIMUM CIRCUMFERENCE AT TOP (INCHES)	31	29	27	25	23	21	19	17
LENGTH OF POLE (FEET)	MINIMUM CIRCUMFERENCE AT 6 FEET FROM BUTT (INCHES)							
30	-	-	36.5	34.0	32.0	29.5	27.5	25.0
35	43.5	41.5	39.0	36.5	34.0	31.5	29.0	27.0
40	46.0	43.5	41.0	38.5	36.0	33.5	31.0	28.5
45	48.5	45.5	43.0	40.5	37.5	35.0	32.5	30.0
50	50.5	47.5	45.0	42.0	39.0	36.5	34.0	-
55	52.0	49.5	46.5	43.5	40.5	38.0	-	-
60	54.0	51.0	48.0	45.0	42.0	39.0	-	-
65	55.5	52.5	49.5	46.5	43.5	40.5	-	-
70	57.0	54.0	51.0	48.0	45.0	41.5	-	-
75	59.0	55.5	52.5	49.0	46.0	-	-	-
80	60.0	57.0	54.0	50.5	47.0	-	-	-

TABLE B - TAPER FACTOR CHART FOR SOUTHERN PINE POLES								
CLASS	H2	H1	1	2	3	4	5	6
LENGTH OF POLE (FEET)	CIRCUMFERENCE TAPER FACTOR (INCHES PER FOOT)							
30	-	-	0.3958	0.3750	0.3750	0.3542	0.3542	0.3333
35	0.4310	0.4310	0.4138	0.3966	0.3793	0.3621	0.3448	0.3448
40	0.4412	0.4265	0.4118	0.3971	0.3824	0.3676	0.3529	0.3382
45	0.4487	0.4231	0.4103	0.3974	0.3718	0.3590	0.3462	0.3333
50	0.4432	0.4205	0.4091	0.3864	0.3636	0.3523	0.3409	-
55	0.4286	0.4184	0.3980	0.3776	0.3571	0.3469	-	-
60	0.4259	0.4074	0.3889	0.3704	0.3519	0.3333	-	-
65	0.4153	0.3983	0.3814	0.3644	0.3475	0.3305	-	-
70	0.4063	0.3906	0.3750	0.3594	0.3438	0.3203	-	-
75	0.4058	0.3841	0.3696	0.3478	0.3333	-	-	-
80	0.3919	0.3784	0.3649	0.3446	0.3243	-	-	-

THE TABLES ABOVE PROVIDE INFORMATION NEEDED TO DETERMINE POLE EQUIVALENCY. TO BE EQUIVALENT POLES MUST HAVE AT LEAST THE SAME CIRCUMFERENCE AT THE GROUND LINE AND AT THE TOP.

RULE OF THUMB FOR DETERMINING EQUIVALENCY : TEN FEET CAN BE CUT OFF THE TOP OF A POLE TO INCREASE THE CLASS BY 1. THIS RULE CAN ONLY BE USED ON POLES LOCATED ABOVE THE BOLD LINE SHOWN IN THE TABLES ABOVE.

FOR POLES THAT DO NOT FOLLOW THE RULE OF THUMB, A QUICK CHECK CAN BE PERFORMED. SEE EXAMPLE BELOW.

EXAMPLE: WE NEED A 65C1 POLE BUT ONLY HAVE A 80C2 AND AN 75C2, WHICH IS ACCEPTABLE?

FIRST CHECK THE CIRCUMFERENCE AT 6 FT. FROM THE BUTT SHOWN IN TABLE A. THE 65C1 IS 49.5", 80C2 IS 50.5" AND THE 75C2 IS 49". THE 85C3 WILL BE TOO SMALL EVEN AT 6 FT. FROM THE BUTT. TO BE ABSOLUTELY ACCURATE, YOU WOULD NEED TO CHECK THE CIRCUMFERENCE AT THE GROUND LINE RATHER THAN AT 6 FT. FROM THE BUTT. HOWEVER, IN THIS CASE, IT IS OBVIOUS THAT THE GROUNDLINE CIRCUMFERENCE OF THE 80C2 IS GREATER THAN THE 65C1.

NEXT COMPARE THE TOP CIRCUMFERENCES OF THE 2 POLES. THE 65C1 REQUIRES A 27" TOP CIRCUMFERENCE (SEE TABLE A) NOW CHECK THE CIRCUMFERENCE OF THE 80C2 AT 15 FT. FROM THE TOP (15 FT. CUT OFF TO MAKE IT A 65 FT. POLE).

THE TOP CIRCUMFERENCE OF A 80C2 IS 25" (SEE TABLE A) AND THE TAPER FACTOR (SEE TABLE B) IS .3446" PER FT.
25 INCHES + (.3446 INCHES PER FT. X 15 FT.)=25"+5.17"= 30.16". THIS EXCEEDS THE REQUIREMENTS OF A 65C1.

ALL POLES WHICH HAVE THEIR TOPS CUT OFF SHOULD BE CAPPED USING POLE CAP (CN 9220132559) IF THEY ARE TO REMAIN IN SERVICE.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STANDARD POLE SIZING - WOOD

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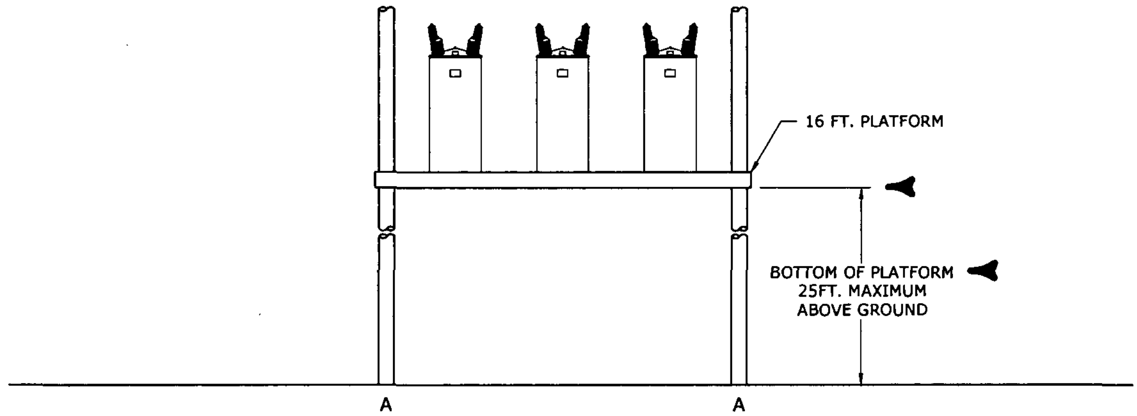
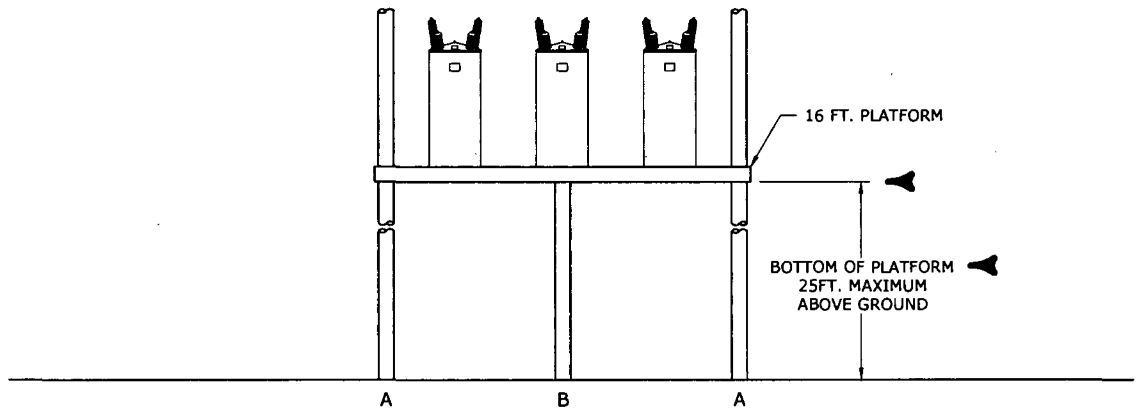
2 POLE PLATFORM WITH 795 DOUBLE CIRCUIT, 200 FT MAX SPAN AND MAXIMUM EQUIPMENT LOAD OF 9900 LBS.



2 POLE PLATFORM DESIGN	
PLATFORM HEIGHT ABOVE GROUND	A (OUTSIDE POLES)
21' - 25'	55C1 OR 50C1
16' - 20'	50C2 OR 45C2
<15'	45C3

3 POLE PLATFORM WITH 795 DOUBLE CIRCUIT, 200 FT MAX SPAN AND MAXIMUM EQUIPMENT LOAD OF 15,000 LBS.



2 POLE PLATFORM DESIGN		
PLATFORM HEIGHT ABOVE GROUND	A (OUTSIDE POLES)	B (CENTER STUB)
21' - 25'	55C1 OR 50C1	55C2 OR 50C2
16' - 20'	50C2 OR 45C2	50C3 OR 45C3
<15'	45C3	45C3

NOTES:

1. FOR INSTALLATIONS THAT EXCEED THE DESIGN CONDITIONS ABOVE, CONTACT DISTRIBUTION STANDARDS.
2. ALL PLATFORM POLES ARE TO BE EMBEDDED AT A DEPTH OF 10% THE POLE LENGTH PLUS 4 FT.
3. THIS DRAWING IS TO BE USED FOR POLE SIZING ONLY. SEE SPECIFIC EQUIPMENT (REGULATORS, TRANSFORMERS) INSTALLATION DRAWINGS FOR ADDITIONAL DETAILS.
4. FOR REGULATOR INSTALLATIONS, SEE DWG. 07.10-05 FOR SPECIFIC REGULATOR WEIGHTS.
5. FOR TRANSFORMER INSTALLATIONS, SEE DWG. 06.00-12 FOR SPECIFIC TRANSFORMER WEIGHTS.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOADING CRITERIA FOR EQUIPMENT PLATFORMS

Duke Energy

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APPLICATION GUIDE FOR REUSE OF WOOD DISTRIBUTION POLES

ALL CCA DISTRIBUTION POLES REMOVED FROM SERVICE WILL USUALLY BE CANDIDATES FOR REUSE. AGE IS NOT A MAJOR FACTOR IN DETERMINING THE REUSE OF CCA POLES. A CAREFUL INSPECTION AS TO THE SOUNDNESS AND CLASSIFICATION FOR REUSE OF ALL POLES WILL BE THE RESPONSIBILITY OF FIELD CONSTRUCTION PERSONNEL.

CLASSIFICATION

POLE SHALL BE FREE OF EXCESSIVE AMOUNTS OF THE FOLLOWING DEFECTS:

A. ROT
B. WEATHER CRACKS
C. BREAKS
D. SPLINTER WOOD
E. HOLES

FINAL DETERMINATION SHOULD BE MADE BY THE CONSTRUCTION PERSONNEL AT THE TIME THE POLE IS TO BE REUSED, BASED ON THE OVERALL CONDITION OF THE POLE AND THE TYPE OF APPLICATION FOR USE AT THE TIME THE POLE IS TO BE INSTALLED.

TYPES OF USE

RECLAIMED CCA POLES CAN BE REUSED FOR MOST ALL APPLICATIONS DEPENDING ON POLE CONDITION. THE LIFE OF A CCA POLE IS EXPECTED TO EXTEND BEYOND THAT OF PENTA OR CREOSOTE IN TERMS OF PRESERVATIVE RETENTION.

1. IN GENERAL, RECLAIMED POLES CAN BE USED ON FUSED TAP/BRANCH LINES, STREET LIGHT INSTALLATIONS, GUY STUBS, TANGENT POLES, AND OTHER SIMILAR INSTALLATIONS.

2. RECLAIMED POLES SHOULD NOT BE USED FOR FEEDERS.

3. RECLAIMED POLES WITH BAD TOPS SHOULD BE CUT BACK TO A SIZE THAT CAN BE RECLASSIFIED AND REUSED.

POLE TOPPING, CAPPING, AND SAWING

CCA POLES SHOULD NOT BE SAWED OFF FOR CONDUCTOR TRANSFERS, FOREIGN ATTACHMENTS, ETC., UNLESS NECESSARY.

CCA OR CREOSOTE POLES WHICH REQUIRE SAWING SHALL BE SAWED OFF NO LESS THAN 25' ABOVE THE GROUND LINE. POLES WHICH HAVE BEEN SAWED OFF 25' ABOVE THE GROUND LINE, MAY BE LATER USED AS 30' AREA LIGHT AND SECONDARY LIFT POLES.

ALL POLES WHICH HAVE THEIR TOPS CUT OFF SHOULD BE CAPPED USING POLE CAP (CN 9220132559) IF THEY ARE TO REMAIN IN SERVICE.

POLE PAINTING

PAINTING OF DISTRIBUTION LINE POLES IS NOT PERMITTED.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/17/10	CECCONI	GUINN	ELKINS
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DISTRIBUTION LINE POLE MAINTENANCE

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FLA DWG. 02.02-04

PILASTER POLE INSTALLATION

THE MAIN PURPOSE OF THE SLAG IS TO PROVIDE AN INSULATING LAYER TO PROTECT PERSONNEL FROM HARMFUL STEP AND TOUCH POTENTIALS DURING SYSTEM FAULTS. OTHER REASONS ARE WEED CONTROL, WATER DRAINAGE, AND FIRE CONTROL (OR CONTAINMENT). IN ORDER TO MAINTAIN ITS INSULATING CHARACTERISTICS THE SLAG SHOULD REMAIN AS DIRT FREE AS POSSIBLE.

*AT PILASTER POLE LOCATIONS, PROCEED AS FOLLOWS:

1. REMOVE TOP LAYER OF CLEAN SLAG FROM AN AREA WIDER THAN THE EXPECTED DIRT SPRAY RADIUS OF THE AUGER BIT. THE SLAG IS TO BE REMOVED TO WITHIN ONE INCH OF THE DIRT GRADE BY SHOVELING AND/OR RAKING BACK THE REQUIRED DISTANCE. DO NOT ALLOW DIRTY SLAG TO MIX WITH CLEAN SLAG.
2. PLACE A TARP OR HEAVY DUTY (4-6 MILS) POLYETHYLENE FILM (VISQUEEN) MATERIAL AT A SUITABLE LOCATION AND PLACE THE REMAINING ONE INCH OF DIRTY SLAG ON IT.
3. SET PALISTER/POLE, BACKFILL, AND COMPACT.
4. EXCESS SOIL SHOULD BE SPREAD AT SUBSTATION SITE.
5. SPREAD DIRTY SLAG EVENLY OVER AREA.
6. SPREAD CLEAN SLAG OVER AREA AND RAKE TO MATCH EXISTING SLAG GRADE.
7. SEE DWG. 02.02-07 FOR BONDING/GROUNDING CONNECTION TO CONCRETE AND STEEL POLES.

*ALL SOIL EXCAVATED MUST REMAIN ON SUBSTATION SITE.

*SEE UNDERGROUND SECTION FOR ADDITIONAL INFORMATION ON PILASTER POLE INSTALLATIONS

CONCRETE POLE CONSTRUCTION

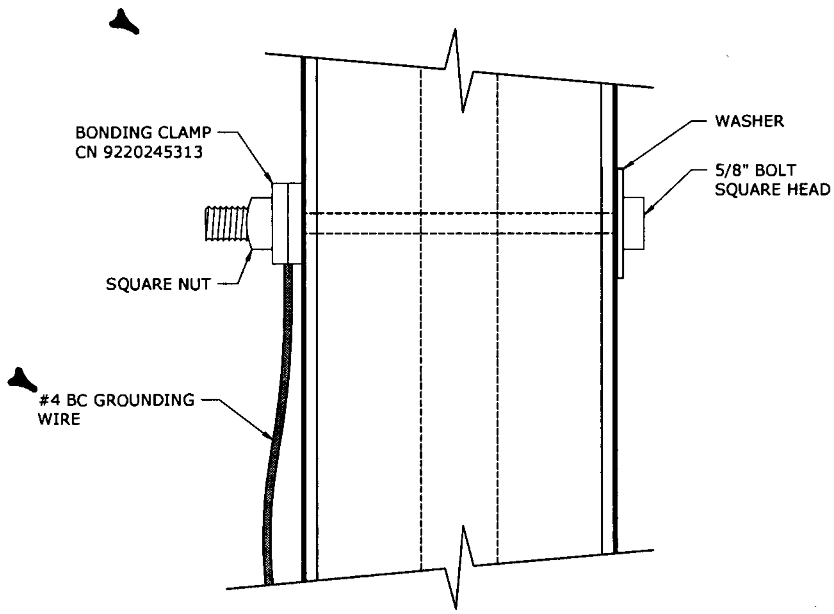
1. ALL HARDWARE AND EQUIPMENT SHOULD BE GROUNDED ON CONRETE POLES.
2. SPRING WASHERS ARE NOT REQUIRED HARDWARE ON CONCRETE POLES.
3. FLAT WASHERS ARE USED IN PLACE OF CURVED WASHERS ON CONCRETE POLES.
4. USE 35KV POST INSULATORS ON CONCRETE POLES.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

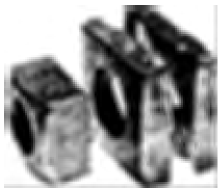
PILASTER AND CONCRETE POLE CONSTRUCTION

Duke Energy®

FLA DWG. 02.02-06



EQUIPMENT HARDWARE GROUND
(ALL HARDWARE)



BONDING CLAMP
CN 9220245313

NOTES:

1. MINIMUM SIZE FOR BONDING CONDUCTOR IS #4.

REVISED		BY	CK'D	APPR.
3				
2	10/3/12	WOJNAROWSKI	BURLISON	ADCOCK
1	2/14/11	BURLISON	BURLISON	ELKINS
0	11/11/10	CECCONI	GUINN	ELKINS

EQUIPMENT HARDWARE GROUNDS

Duke Energy®

PGN DWG. 02.02-07

** WEIGHTS CCA DISTRIBUTION POLES 0.6 LB. BY ASSAY									
CLASS	H-2	H-1	1	2	3	4	5	6	7
BREAKING*** STR. (LBS.)	XXXX	XXXX	4500	3700	3000	2400	1900	1500	1200
LENGTH (FT.)	CCA	CCA	CCA	CCA	CCA	CCA	CCA	CCA	CCA
30			1395	1180	1005	855	720	600	495
35			1710	1465	1260	1095	940	810	705
40			2055	1770	1530	1330	1155	1005	880
45			2425	2085	1815	1575	1390	1215	1065
50	3848	3426	2820	2415	2100	1840	1630	1450	1275
55	4472	3933	3265	2800	2400	2110	1875	1705	
60		4692	3765	3210	2740	2385	2130	1965	
65			4380	3645	3070	2680	2440		
70			5040	4125	3430	2980	2715		

WEIGHTS (LBS) OF CONCRETE DISTRIBUTION POLES					
CLASS/TYPE IN LENGTH (FT)	TYPE 0	TYPE I	TYPE II	TYPE III	TYPE IV
15	457				
18			1100		
30		1350			
35		1860			
35				3173	
40				3961	
45			4400	5270	
50					6913
55					8383

**AVERAGE FIGURES AND VARIATIONS MUST BE ACCEPTED
***AVERAGE LOAD AT 2' FROM TOP THAT WILL BREAK POLE

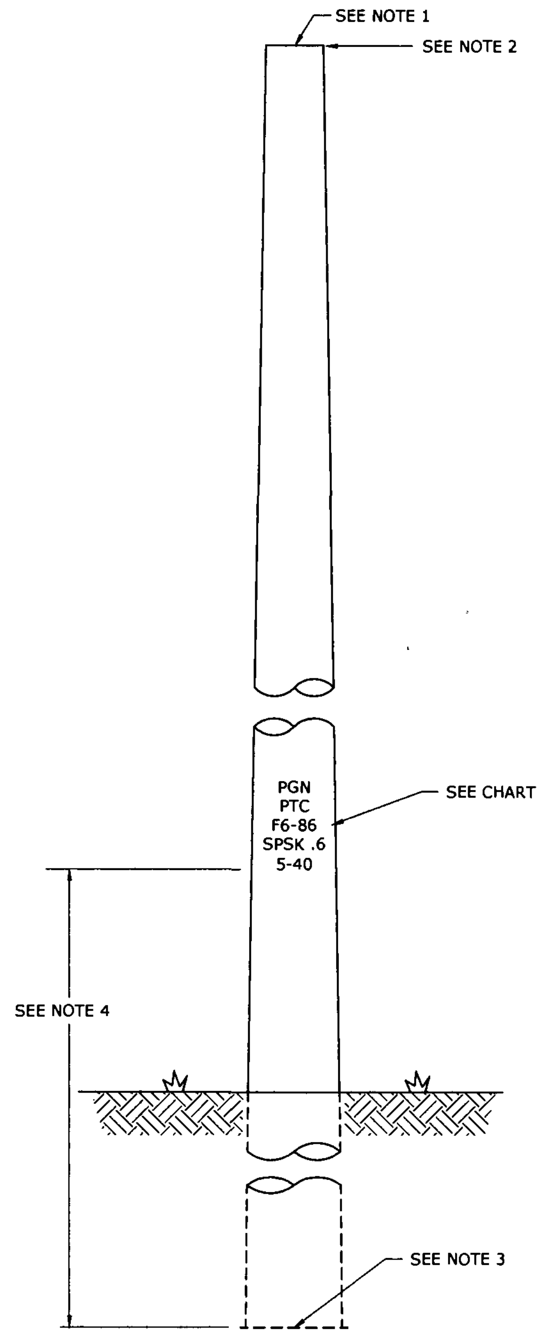
POLE LENGTH	CLAY	SAND OR MARSH	SOLID ROCK
30'	5'-6"	5'-6"	3'-6"
35'	6'-0"	6'-0"	3'-6"
40'	6'-0"	6'-0"	3'-6"
45'	6'-6"	6'-6"	4'-0"
50'	7'-0"	8'-0"	4'-0"
55'	7'-6"	8'-6"	4'-0"
60'	8'-0"	9'-0"	4'-0"
65'	8'-6"	9'-6"	4'-6"
70'	9'-0"	10'-0"	4'-6"
75'	9'-6"	10'-6"	4'-6"
OTHER	SEE TRANSMISSIONS SPEC.		
BACKFILL SOLID ROCK HOLES WITH POLE SETTING FOAM (CU PFSETKITF)			

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

POLE PROPERTIES AND STANDARD BURIAL DEPTH

Duke Energy®

FLA DWG. 02.02-08



CODE	DESCRIPTION
PGN	PROGRESS ENERGY
PTC	POLE TREATING COMPANY I.D.
F6-86	PLANT LOCATION (F), MONTH (6) AND YEAR (86) OF TREATMENT
SPSK .6	SOUTHERN PINE CCA, .6 LBS RETENTION
5-40	POLE CLASS AND LENGTH
MARKING AND CODE LETTERS: PER ANSI 05.1 LATEST REVISION (PARAGRAPH 7.5)	

NOTES:

1. PRETREATMENT INSPECTION STAMP, LENGTH, AND CLASS STAMPED IN TOP.
2. ROOF OF POLE SHALL BE FLAT CUT WITH NO SLANT. THERE SHALL BE NO PRE-DRILLED HOLES OR SLAB GAIN.
3. POST TREATMENT INSPECTION STAMP AND METAL TAG SHOWING LENGTH AND CLASS.
4. PROGRESS ENERGY COMPLIES WITH ANSI O5.1 WHICH REQUIRES THE BIRTHMARK TO BE LOCATED (±2") 10 FEET FROM THE BUTT FOR POLES 50 FOOT AND BELOW AND 14 FEET FOR POLES 55 FOOT AND ABOVE.

3				
2				
1				
0	10/3/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

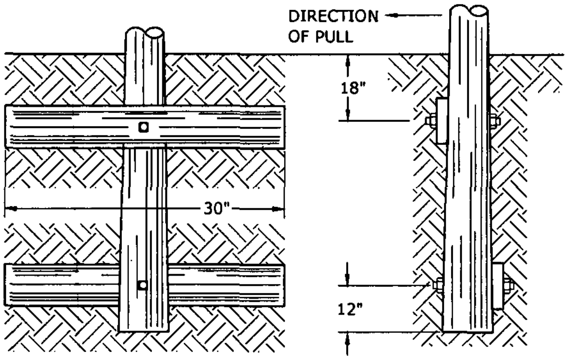
STANDARD FRAMING AND BRANDING

FOR DISTRIBUTION CCA POLES

Duke Energy®

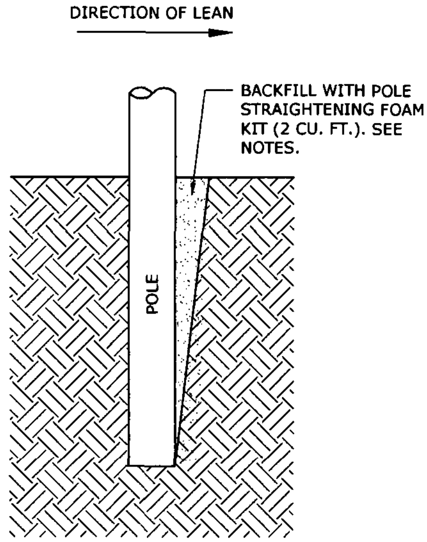
PGN DWG. 02.02-10

METHOD OF BRACING IN LOOSE SOIL CONDITIONS



PLANKS (CU ANCPPLANKF)
SEE NOTE 1

POLE STRAIGHTENING FOAM KIT
CU PFSTRAIGHTKITF



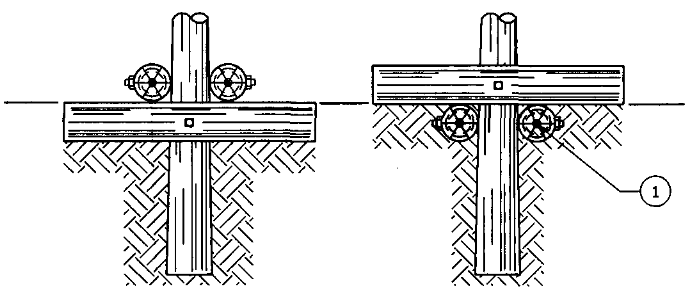
NOTES:

1. USE PLANKS (CU ANCPPLANKF) AS SHOWN FOR ADDED STABILITY IN UNDESIRABLE SOIL CONDITIONS TO PREVENT THE POLE FROM LEANING. POLE SETTING FOAM KITS (CU PFSETKITF) (6 CUBIC FT) MAY BE USED IN PLACE OF THE PLANKS.

2. POLE STRAIGHTENING KITS (CU PFSTRAIGHTKITF) (2 CUBIC FT) MAY BE USED IN PLACE OF CONCRETE FOR ADDED STABILITY IN UNDESIRABLE SOIL CONDITIONS TO PREVENT THE POLE FROM LEANING. THESE KITS ARE USED PRIMARILY TO STRAIGHTEN EXISTING LEANING POLES.

3. TO INSTALL, MIX COMPOUNDS TOGETHER IN BUCKET USING THE PROVIDED MIXER FOR THE AMOUNT OF TIME SPECIFIED IN THE INSTRUCTIONS. WITH THE POLE IN THE DESIRED POSITION, POUR THE POLY-SET ON THE POLE APPROX. 6 TO 10 INCHES ABOVE THE GROUNDLINE AND LET RUN DOWN THE POLE. THE POLY-SET WILL HARDEN AND THE POLE MAY BE RELEASED IN AS LITTLE AS 15 MINUTES UNDER NORMAL CONDITIONS. MORE DETAILED INSTRUCTIONS ARE PROVIDED WITH EACH KIT.

INSTALLATION OF BOG SHOES



BOG SHOES SHOULD BE USED IN SOFT OR SWAMPY GROUND WHERE POLES MIGHT SETTLE EXCESSIVELY. SHOES ARE MADE OF 6' SECTIONS OF OLD CREOSOTED OR SIMILARLY TREATED WOOD POLES SECURELY FASTENED TO THE POLE AS SHOWN. POLE MUST BE GUYED AS SPECIFIED BY ENGINEER.

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ANCPBOGF	2	011376	2	BOLT, DOUBLE ARMING, 7/8" X 26", ST, GALV.
				013208	4	WASHER, LOCK, 7/8", STEEL, GALV., SPRING
				013236	4	WASHER, ROUND, 7/8", GALV.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/22/12	WOJNAROWSKI	BURLISON	ADCOCK

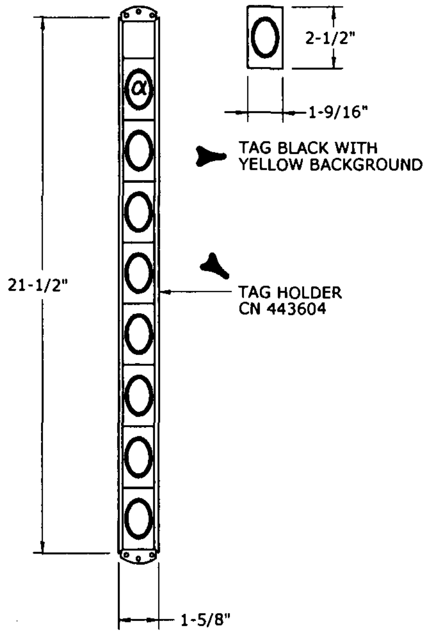
POLE BRACING

Duke Energy

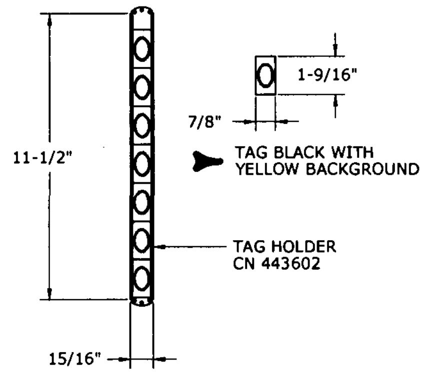
FLA DWG. 02.02-16

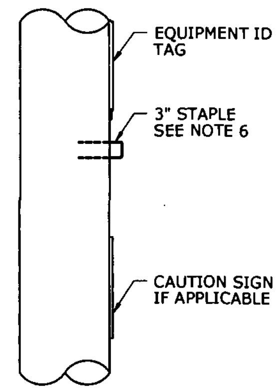
POLES WITH SWITCHES

(DISCONNECTS, SOLID BLADE CUTOUTS)

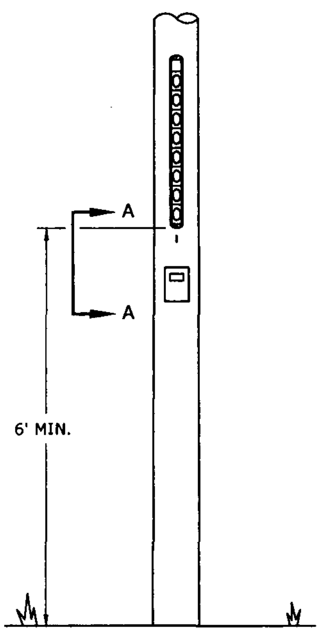


POLES WITHOUT SWITCHES





SECTION A-A



FRONT VIEW

NOTES:

1. IDENTIFY POLE WITH ONE 7 DIGIT EQUIPMENT ID NUMBER ASSIGNED BY GIS.
2. SOLID BLADE SWITCH POLES - ADD THE ALPHA CHARACTER REPRESENTING THE AREA TO THE BEGINNING OF THE 7 DIGIT EQUIPMENT ID NUMBER.
3. TRANSFORMER BANKS - ASSIGNED THE SAME 7 DIGIT NUMBER EQUIPMENT ID AS THE POLE IN THE GIS. NO ADDITIONAL TAGGING IS REQUIRED.
4. UNDERGROUND FUSED FEEDS ON POLE - ASSIGN THE SAME 7 DIGIT EQUIPMENT ID NUMBER AS THE POLE
   - 3-PHASE AND 1-PHASE TERMINAL POLE FUSES WILL BE IDENTIFIED BY THE POLE EQUIPMENT ID AND PHASES.
   - IF TWO UG FEEDS OF SAME PHASE ARE ON POLE THEN ONE WILL BE DESIGNATED AS POSITION 1 AND THE OTHER AS POSITION 2.
5. SWITCHABLE DEVICES - ASSIGN THE SAME EQUIPMENT ID NUMBER AS THE POLE TO FUSES, RECLOSERS AND SECTIONALIZERS.
6. ON POLES WITH SWITCHES, DRIVE A 3 INCH STAPLE INTO THE POLE JUST BELOW THE EQUIPMENT ID NUMBER. LEAVE ONLY A SMALL GAP BETWEEN STAPLE AND POLE, LARGE ENOUGH TO PUT A ZIP TIE THROUGH. ON A CONCRETE POLE INSTALL A BAND AROUND THE POLE JUST BELOW THE SWITCH TAG. THIS WILL BE THE DESIGNATED LOCATION FOR HANGING TAGS REQUIRED BY SWITCHING AND TAGGING.

TYPE	DESCRIPTION
WOOD	USE TWO ROOFING TYPE NAILS CN 015171
CONCRETE	APPLY ADHESIVE CN 152240
FIBERGLASS	ATTACH WITH ADHESIVE CN 152240
*TAG MAY BE PAINTED TO MATCH POLE	

7. INSTALL TAGS ON ROAD SIDE OF POLE
8. TRANSFERING OF EXISTING POLE NUMBERS AND 14 DIGIT GRID NUMBERS RELATED TO POLE EQUIPMENT CHANGEOUTS - DO NOT TRANSFER EXISTING POLE NUMBERS AND/OR 14 DIGIT GRID NUMBERS UNLESS THE ADJACENT EQUIPMENT CONTAINS CABLE TAGS/LABELS THAT CANNOT BE UPDATED.

3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

POLE NUMBERS AND LABELS

Duke Energy®

FLA

DWG. 02.02-22

PROCEDURES:

1. GUYING SHOULD BE DONE IN ACCORDANCE WITH THE WORK ORDER INSTRUCTIONS TO ASSURE COMPLIANCE WITH STRENGTH REQUIREMENTS AND CONSTRUCTION STANDARDS. CHOOSE GUY STRAIN INSULATORS BASED ON GUY WIRE SIZE AND REQUIRED CLEARANCE.

2. REFER TO SECTION 3, OVERHEAD PRIMARY CONSTRUCTION, TO SEE THE EXACT NUMBER AND POSITION GUY WIRES. USE SPAN TABLES (DWGS. 02.04-32, 02.04-34, 02.04-36, 02.04-44, 02.04-46 AND 02.04-48 TO DETERMINE TENSION IN GUY WIRE BASED ON DIFFERENT LEAD TO HEIGHT RATIOS FOR EACH CONDUCTOR.

NOTES:

1. GUYS AND ANCHORS SHOULD BE INSTALLED PRIOR TO THE INSTALLATION OF CONDUCTORS.

2. GUYS SHOULD BE BONDED TO THE SYSTEM NEUTRAL EXCEPT IN HIGHLY CORROSIVE AREAS. SEE COASTAL SECTION 12.

3. CONCRETE POLE GUYING - SEE GUYING ATTACHMENT DWG. 02.04-06.

4. CUT END OFF GUY STRAND AS CLOSE AS BOLT CUTTERS WILL PERMIT. END OF GUYSTRAND MUST NOT PROTRUDE OUTSIDE OF TRAFFIC GUARD. ALL DOWN GUYS SHALL HAVE TRAFFIC GUARDS INSTALLED.

5. AVOID USING PLIERS TO WRAP THE LAST FEW STRANDS OF A GUY GRIP. SPLIT THE STRANDS AND WRAP BY HAND OR USE A SCREWDRIVER FOR LEVERAGE.

GUY INSULATOR INSTALLATIONS:

1. ALL GUYS ABOVE THE NEUTRAL POSITION MUST HAVE A GUY INSULATOR OF SUFFICIENT LENGTH TO PREVENT THE TRANSFER OF VOLTAGE TO THE BOTTOM OF THE DOWN GUY IN CASE THE DOWN GUY SAGS DOWN INTO A BARE ENERGIZED CONDUCTOR OR AN ENERGIZED BARE CONDUCTOR SAGS DOWN INTO THE DOWN GUY. BARE ENERGIZED CONDUCTOR INCLUDES OPEN WIRE SECONDARY. TRIPLEX CABLE AND BARE NEUTRALS ARE NOT CONSIDERED BARE ENERGIZED CONDUCTOR AND DO NOT REQUIRE THE DOWN GUY TO EXTEND 2 FEET BELOW THEIR ATTACHMENT POINT.

2. THE INSULATOR SHALL EXTEND 24 INCHES BELOW ANY SUCH BARE ENERGIZED CONDUCTOR OR PART.

3. ALL GUYS SHALL BE BONDED TO THE SYSTEM NEUTRAL (EXCEPTION IS MADE IN COASTAL AREAS TO PREVENT CORROSION, SEE COASTAL SECTION FOR MORE INFORMATION).

4. BONDING CONDUCTOR SHALL BE #4 SD AL (#6 SD BC ACCEPTABLE ON EXISTING GUYS).

5. TPX/QPX CONDUCTORS ARE NOT CONSIDERED BARE ENERGIZED CONDUCTORS.

6. OPEN WIRE SECONDARIES ARE CONSIDERED BARE ENERGIZED CONDUCTORS. GUYED OPEN WIRE SECONDARY REQUIRES A GUY INSULATOR.

7. THE NEUTRAL IS NOT CONSIDERED A BARE ENERGIZED CONDUCTOR FOR THE APPLICATION OF GUY INSULATORS.

8. THE PRIMARY AND SECONDARY BUSHINGS OF A TRANSFORMER ARE BARE ENERGIZED PARTS.

9. AN UNDERGROUND PRIMARY CABLE TERMINATOR IS CONSIDERED A BARE ENERGIZED CONDUCTOR TO THE BOTTOM OF THE TERMINATOR.

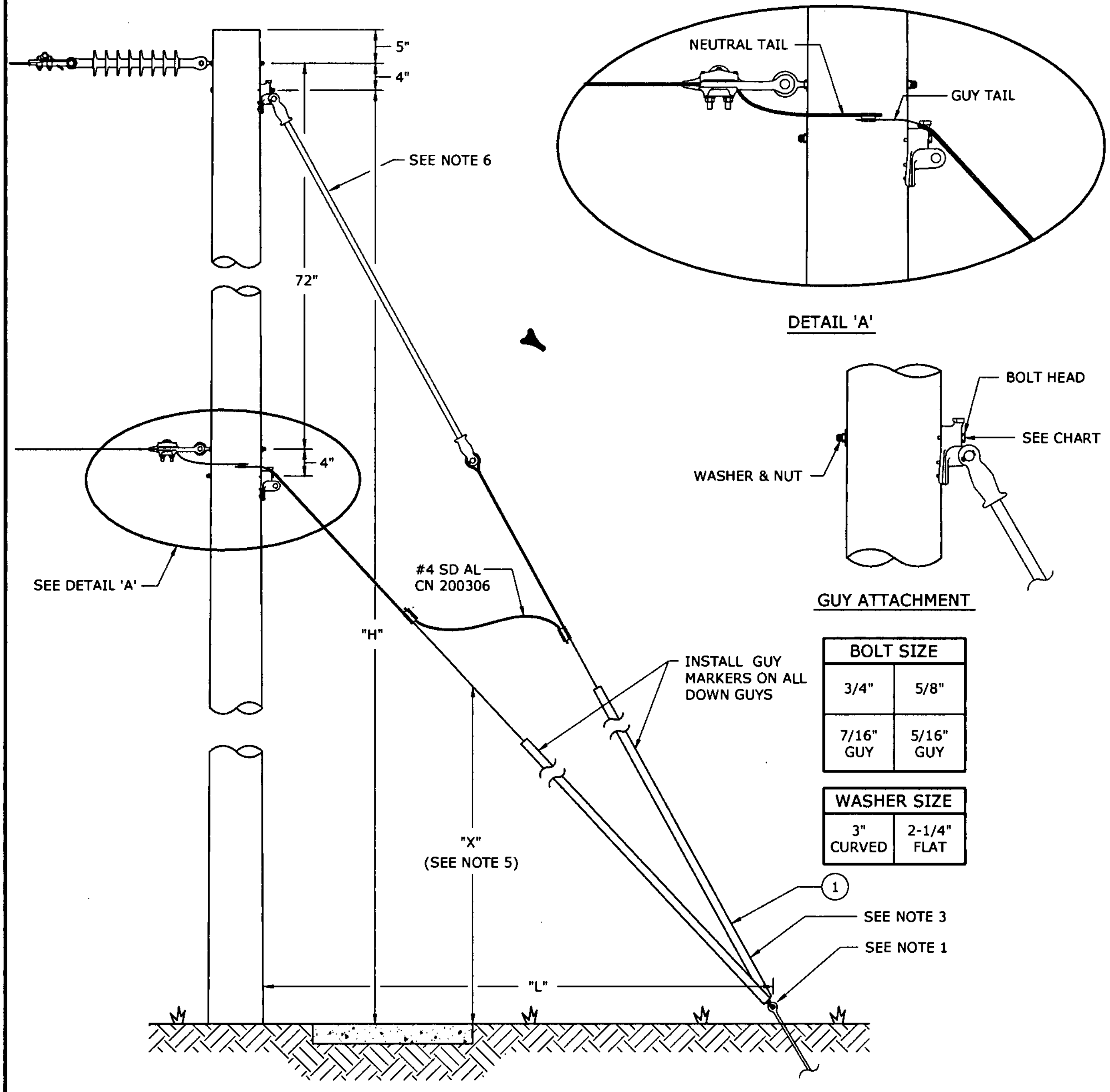
10. GUY INSULATORS MUST BE LOCATED TO ENSURE A MINIMUM OF 8" CLEARANCE EXISTS FOR 12 KV AND 12" CLEARANCE EXISTS FOR 25 KV FROM THE GUY INSULATOR TO THE PRIMARY VOLTAGE ENERGIZED CONDUCTOR OR PART.

3				
2				
1	6/10/11	DANNA	BURLISON	ELKINS
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GUYING - GENERAL CONSTRUCTION NOTES

Duke Energy®

FLA DWG. 02.04-02



BOLT SIZE	
3/4"	5/8"
7/16" GUY	5/16" GUY

WASHER SIZE	
3" CURVED	2-1/4" FLAT

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	GUYGUARDF	1	152171	1	MARKER, GUY, 8', POLY, 1.5" OD, YELLOW

NOTES:

1. ENGINEER TO INSTALL STAKE AT POINT WHERE ANCHOR ROD ENTERS THE GROUND "L" TO BE 2/3 OF "H" UNLESS STAKED OTHERWISE AND NOTED ON WORK ORDER.
2. ALL UNINSULATED ANCHOR GUYS MUST BE GROUNDED TO THE COMMON NEUTRAL.
3. INSTALL GUY MARKERS ON ALL DOWN GUYS REGARDLESS OF LOCATION.
4. IF GUYS ARE INSTALLED DIFFERENTLY THAN ABOVE, MAINTAIN A MINIMUM OF 4" AND A MAXIMUM OF 12" BETWEEN WIRE ATTACHMENT POINT AND GUY ATTACHMENT POINT.
5. IF GUY CROSSES SIDEWALK, IT MUST BE A MINIMUM OF 9.5 FEET ABOVE ALL PARTS OF THE SIDEWALK. USE SIDEWALK GUY IF NECESSARY. AVOID PLACING DOWN GUYS WHERE VEHICLES ARE LIKELY TO CROSS BETWEEN THE POLE AND THE ANCHOR. USE A STUB POLE AND SPAN GUY IN SUCH CASES.
6. ALL GUYS ABOVE NEUTRAL POSITION MUST HAVE A GUY INSULATOR (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST BARE ENERGIZED COMPONENT BY 24".

REVISED		BY	CK'D	APPR.
3	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
2	11/21/11	ROBESON	BURLISON	ELKINS
1	2/14/11	BURLISON	BURLISON	ELKINS
0	11/9/10	CECCONI	GUINN	ELKINS

GUYING - CONSTRUCTION

Duke Energy®

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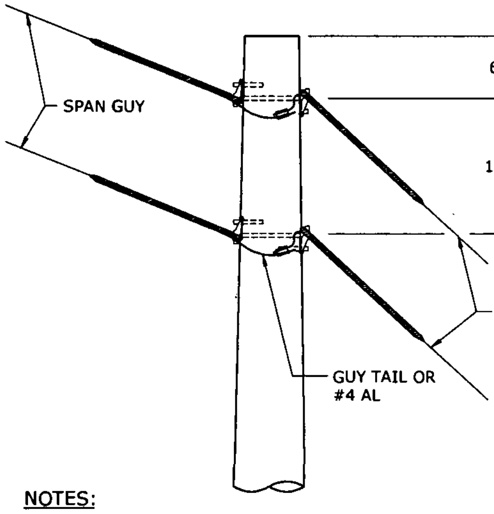
DWG. 02.04-04

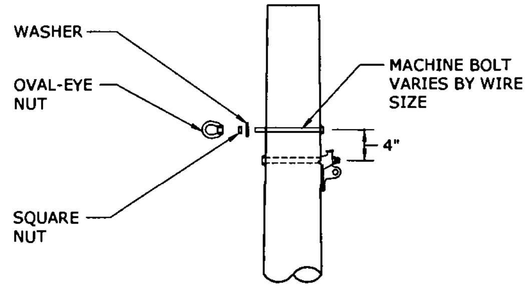
STUB POLE GUY ATTACHMENT

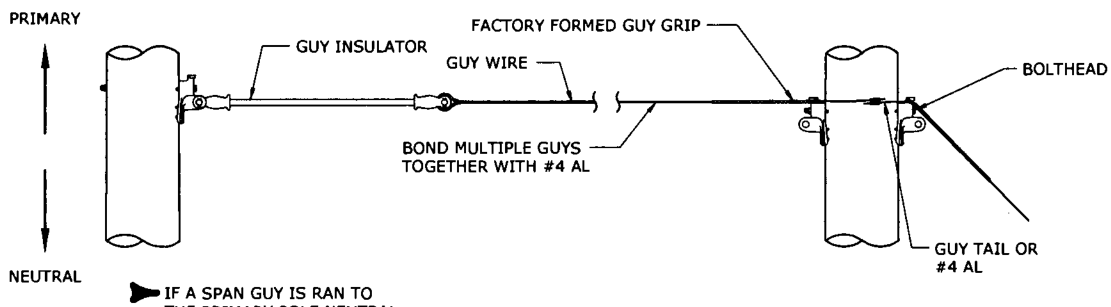


NOTES:

1. INSERT MACHINE BOLT WITH THREADED END OF BOLT ON SPAN GUY SIDE OF POLE
2. ADDITIONAL SPAN GUYS ARE 12" APART
3. ALL SPAN GUYS REQUIRE LAG SCREWS.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

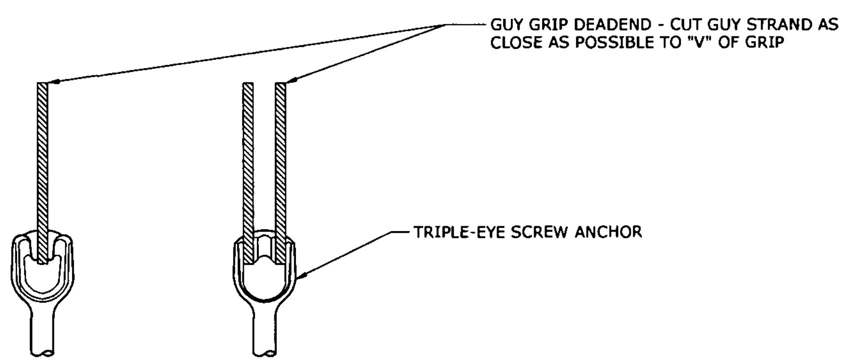
SPAN OR DOWN GUY ATTACHMENT- CONCRETE POLE





IF A SPAN GUY IS RAN TO THE PRIMARY POLE NEUTRAL POSITION, IT SHOULD BE BONDED TO SYSTEM NEUTRAL.

SPAN GUY



3				
2				
1	10/3/12	WOJNAROWSKI	BURLISON	ADCOCK
0	8/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GUYING ATTACHMENTS

Duke Energy®

PGN

DWG. 02.04-06

	5/16 HIGH STRENGTH GUY WIRE		7/16 UTILITIES GRADE GUY WIRE	
	COMPATIBLE UNIT	CATALOG NUMBER	COMPATIBLE UNIT	CATALOG NUMBER
GUY STRAND CN	GUYWIRE516F	210504 (500 FT. COILS)	GUYWIRE716F	210206 (REELS)
GUY GRIP		152160		152162
GUY GRIP COLOR CODE		BLACK		GREEN
78" INSULATOR	FBGL78F	115737	FBGL78F	115737
120" INSULATOR	FBGL120F	115761	FBGL120F	115761
GUY SPLICE		120315		10053502
GUY WIRE HOLDING STRENGTH (POUNDS) - SEE NOTE 1				
GUY WIRE	7200		15,000	

NOTES:

1. RATING OF 5/16 IS 90% OF RATED BREAKING STRENGTH PER NESC. RATING OF 7/16 IS LIMITED TO 15,000 LBS DUE TO USE OF 15,000 LB GUY INSULATORS.
2. USE GUY STRAIN INSULATORS (STICKS) RATED AT 15,000 LBS. FOR ALL GUYS.

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

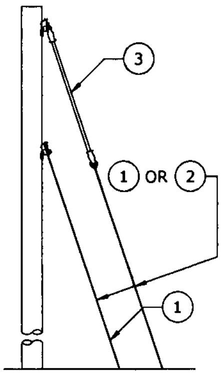
GUY STRAND, GUY GRIPS AND GUY SPLICES

Duke Energy®

FLA DWG. 02.04-10

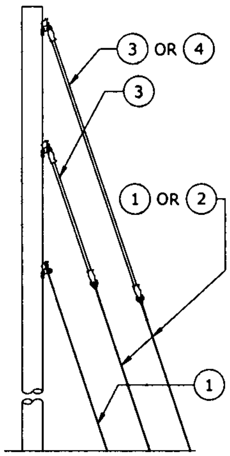
COMPATIBLE UNIT KEY

1	GUYD516F	3	FBGL78F	5	ANRS81553EF	7	ANPI83353EF	9	ANSS3HB1553EX5F
2	GUYD716F	4	FBGL120F	6	ANRS101283EF	8	ANSS2HA1553EX5F		



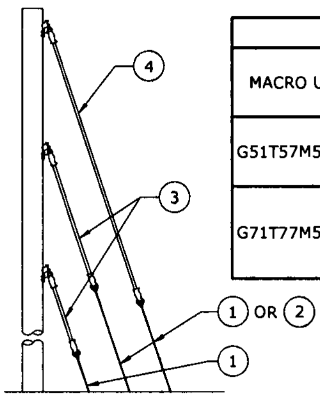
BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T5BFM	GUY MU 5/16 78" TOP 5/16 BOT	1	GUYD516F	2	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
G77T5BFM	GUY MU 7/16 78" TOP 5/16 BOT	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"



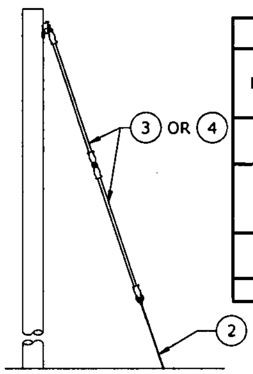
BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T57M5BFM	GUY MU 5/16 78" TOP 5/16 78" MID 5/16 BOT	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
G51T57M5BFM	GUY MU 5/16 120" TOP 5/16 78" MID 5/16 BOT	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
G51T57M57BFM	GUY MU 5/16 120" TOP 5/16 78" MID 5/16 BOT	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
G77T77M5BFM	GUY MU 7/16 78" TOP 7/16 78" MID 5/16 BOT	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
G71T77M5BFM	GUY MU 7/16 120" TOP 7/16 78" MID 5/16 BOT	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"



BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G51T57M57BFM	GUY MU 5/16 120" TOP 5/16 78" MID 5/16 78" BOT	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
G71T77M57BFM	GUY MU 7/16 120" TOP 7/16 78" MID 5/16 78" BOT	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"



BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G711FM	GUY MU 7/16 120" + 120"	2	GUYD716F	1	GUY DOWN 7/16 HS
		4	FBGL120F	2	FIBERGLASS GUY LINK 15 M 120"
G717FM	GUY MU 7/16 120" + 78"	2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
G777FM	GUY MU 7/16 78" + 78"	2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
THESE SINGLE DOWN GUYS CONTAIN 1 GUY GUARD (CU GUYGUARDF)					

ALL MACROS ON DWGS. 02.04-12A, 02.04-12B AND 02.04-12C CONTAIN 2 GUY GUARDS UNLESS NOTED.
SEE ADDITIONAL GUYING REQUIREMENTS ON DWG. 02.04-04, NOTE 3.

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REVISED		BY	CK'D	APPR.

MACRO UNITS FOR GUY INSTALLATIONS

Duke Energy®

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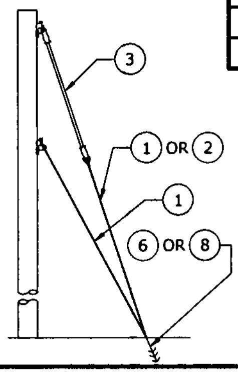
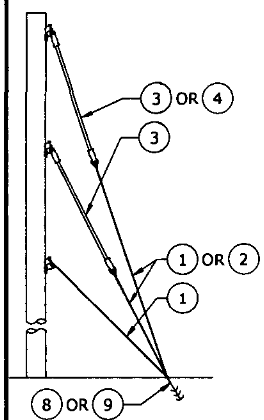
DWG. 02.04-12A

COMPATIBLE UNIT KEY

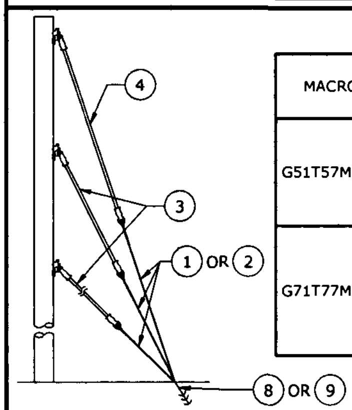
1	GUYD516F	3	FBGL78F	5	ANRS81553EF	7	ANPI83353EF	9	ANSS3HB1553EX5F
2	GUYD716F	4	FBGL120F	6	ANRS101283EF	8	ANSS2HA1553EX5F		



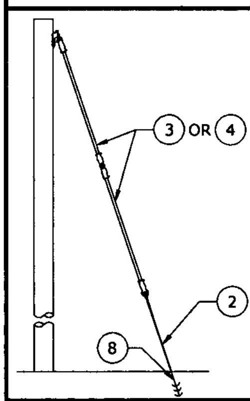
MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T5B10FM	GUY MU 5/16 78I TOP 5/16 BOT RDSCR 10	1	GUYD516F	2	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		6	ANRS101283EF	1	ANCHOR ROUND SCREW SGL HELIX 10" 1-1/4" 8' TPL EYE
G77T5B2HFM	GUY MU 7/16 78I TOP 5/16 BOT SS 2H	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT



MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T57M5B2HFM	GUY MU 5/16 78I TOP 5/16 78I MID 5/16 BOT SS 2H	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G51T57M5B2HFM	GUY MU 5/16 120I TOP 5/16 78I MID 5/16 BOT SS 2H	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G77T77M5B3HFM	GUY MU 7/16 78I TOP 7/16 78I MID 5/16 BOT SS 3H	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		9	ANSS3HB1553EX5F	1	ANCHOR SQ-SHFT SCRW 3-HLX 8"10"12" 1.5" 5' TPL EYE w/5FT EXT
G71T77M5B3HFM	GUY MU 7/16 120I TOP 7/16 78I MID 5/16 BOT SS 3H	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		9	ANSS3HB1553EX5F	1	ANCHOR SQ-SHFT SCRW 3-HLX 8"10"12" 1.5" 5' TPL EYE w/5FT EXT



MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G51T57M57B2HFM	GUY MU 5/16 120I TOP 5/16 78I MID 5/16 78I BOT SS 2H	1	GUYD516F	3	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G71T77M57B3HFM	GUY MU 7/16 120I TOP 7/16 78I MID 5/16 78I BOT SS 3H	1	GUYD516F	1	GUY DOWN 5/16 HS
		2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		9	ANSS3HB1553EX5F	1	ANCHOR SQ-SHFT SCRW 3-HLX 8"10"12" 1.5" 5' TPL EYE w/5FT EXT



MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G7112HFM	GUY MU 7/16 120I+120I SS 2H	2	GUYD716F	1	GUY DOWN 7/16 HS
		4	FBGL120F	2	FIBERGLASS GUY LINK 15 M 120"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G7172HFM	GUY MU 7/16 120I+78I SS 2H	2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G7772HFM	GUY MU 7/16 78I+78I SS 2H	2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT

THESE SINGLE DOWN GUYS CONTAIN 1 GUY GUARD (CU GUYGUARDF)

REVISED		BY	CK'D	APPR.
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MACRO UNITS FOR GUY INSTALLATIONS

Duke Energy

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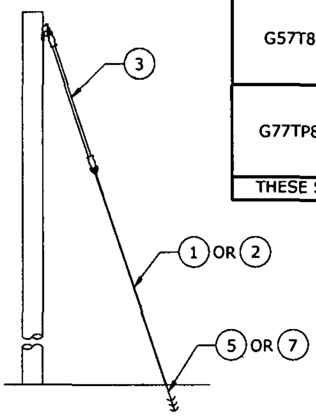
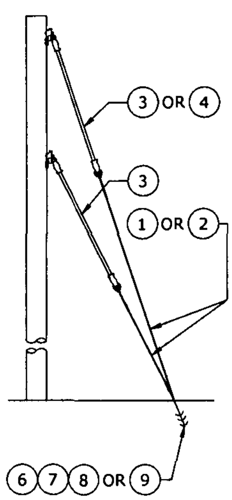
DWG. 02.04-12B

COMPATIBLE UNIT KEY									
1	GUYD516F	3	FBGL78F	5	ANRS81553EF	7	ANPI83353EF	9	ANSS3HB1553EX5F
2	GUYD716F	4	FBGL120F	6	ANRS101283EF	8	ANSS2HA1553EX5F		



BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T8FM	GUY MU 5/16 78I TOP RDSCR 8	1	GUYD516F	1	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		5	ANRS81553EF	1	ANCHOR ROUND SCREW SGL HELIX 8" 1" 5.5' TPL EYE
G77TP8FM	GUY MU 7/16 78I TOP PISA 8	2	GUYD716F	1	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		7	ANPI83353EF	1	ANCHOR PWR INSTALLED SCREW SGL HELIX 8" 3/4" 3.5' TPL EYE
THESE SINGLE DOWN GUYS CONTAIN 1 GUY GUARD (CU GUYGUARDF)					



BILL OF MATERIALS

MACRO UNIT	DESCRIPTION	ITEM NO	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
G57T57M10FM	GUY MU 5/16 78I TOP 5/16 78I MID RDSCR 10	1	GUYD516F	2	GUY DOWN 5/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		6	ANRS101283EF	1	ANCHOR ROUND SCREW SGL HELIX 10" 1-1/4" 8' TPL EYE
G51T57MP8FM	GUY MU 5/16 120I TOP 5/16 78I MID PISA 8	1	GUYD516F	2	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		7	ANPI83353EF	1	ANCHOR PWR INSTALLED SCREW SGL HELIX 8" 3/4" 3.5' TPL EYE
G51T57M10FM	GUY MU 5/16 120I TOP 5/16 78I MID RDSCR 10	1	GUYD516F	2	GUY DOWN 5/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		6	ANRS101283EF	1	ANCHOR ROUND SCREW SGL HELIX 10" 1-1/4" 8' TPL EYE
G77T77M2HFM	GUY MU 7/16 78I TOP 7/16 78I MID SS 2H	2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	2	FIBERGLASS GUY LINK 15 M 78"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G71T77M2HFM	GUY MU 7/16 120" TOP 7/16 78" MID SS 2H	2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		8	ANSS2HA1553EX5F	1	ANCHOR SQ-SHFT SCRW 2-HLX 8"10" 1.5" 5' TPL EYE & 5FT EXT
G71T77M3HFM	GUY MU 7/16 120" TOP 7/16 78" MID SS 3H	2	GUYD716F	2	GUY DOWN 7/16 HS
		3	FBGL78F	1	FIBERGLASS GUY LINK 15 M 78"
		4	FBGL120F	1	FIBERGLASS GUY LINK 15 M 120"
		9	ANSS3HB1553EX5F	1	ANCHOR SQ-SHFT SCRW 3-HLX 8"10"12" 1.5" 5' TPL EYE w/5FT EXT

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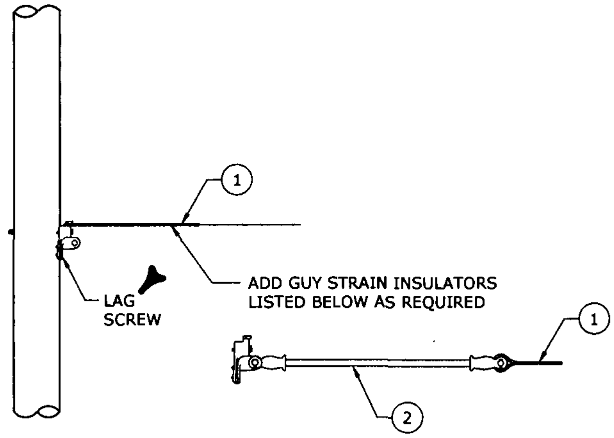
REVISED		BY	CK'D	APPR.

MACRO UNITS FOR GUY INSTALLATIONS

Duke Energy

FLA DWG. 02.04-12C

SPAN GUY DETAIL



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	GUYS516F	1	013308	1	WASHER, SQ., 2-1/4", FLAT, 13/16", HOLE, GALV.
				152106	1	BOLT, MACHINE, 5/8",10", STEEL, A-ASTM A307, GALV
				152160	2	GRIP, GUY, 5/16",DIA,S,BLK
				152180	2	PLATE, GUY, HOOK, UNIV, FOR ALL STRANDS UP TO 7/16"
				153109	1	CONNECTOR,COMP,AL,A=2STR-6SOL,B=2STR-6SOL
				153111	1	CONNECTOR,COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210504	45	WIRE, 5/16", 7, STR, HI, STH, GR, A855M
	1	GUYS716F	1	013346	1	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				152122	1	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307
				152162	2	GRIP, GUY, 7/16", S, GRN
				152180	2	PLATE, GUY, GUY, HOOK PLATE UNIV. GUY HOOK
				153111	1	CONNECTOR,COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR,S DW, #4, TIEWIRE
				210206	45	WIRE, 7/16", UG, 7, STR, UTL, GR, A855M
				11197803	1	CONNECTOR, COMPRESSION, PA, #6SLD-3/0 ACSR
	2	FBGL120F	1	115761	1	LINK, FIBERGLASS, CLEVIS, 120", 15M
	2	FBGL24F	1	115692	1	LINK, FIBERGLASS, CLEVIS, 24", 15M
	2	FBGL78F	1	115737	1	LINK, FIBERGLASS, CLEVIS, 78", 15M

REVISED		BY	CK'D	APPR.
3				
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1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
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SPAN GUYS

Duke Energy®

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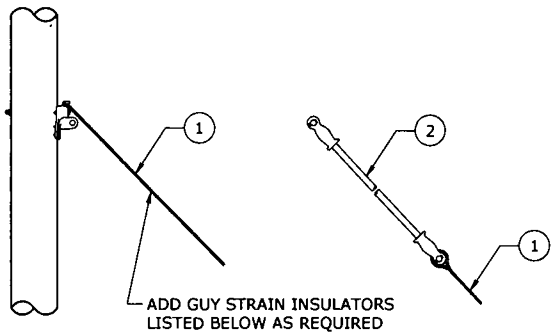
DWG. 02.04-14

DOWN GUY DETAIL



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	GUYD516F	1	013308	1	WASHER, SQ., 2-1/4", FLAT, 13/16", HOLE, GALV.
				152106	1	BOLT, MACHINE, 5/8",10", STEEL, A-ASTM A307, GALV
				152160	2	GRIP, GUY, 5/16",DIA,S,BLK
				152180	1	PLATE, GUY, HOOK, UNIV, FOR ALL STRANDS UP TO 7/16"
				153109	1	CONNECTOR,COMP,AL,A=2STR-6SOL,B=2STR-6SOL
				153111	1	CONNECTOR,COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210504	45	WIRE, 5/16", 7, STR, HI, STH, GR, A855M
-	1	GUYD716F	1	013346	1	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				152122	1	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307
				152162	2	GRIP, GUY, 7/16", S, GRN
				152180	1	PLATE, GUY, GUY, HOOK PLATE UNIV. GUY HOOK
				153111	1	CONNECTOR,COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR,S DW, #4, TIEWIRE
				210206	45	WIRE, 7/16", UG, 7, STR, UTL, GR, A855M
				11197803	1	CONNECTOR, COMPRESSION, PA, #6SLD-3/0 ACSR
	2	FBGL120F	1	115761	1	LINK, FIBERGLASS, CLEVIS, 120", 15M
	2	FBGL24F	1	115692	1	LINK, FIBERGLASS, CLEVIS, 24", 15M
	2	FBGL78F	1	115737	1	LINK, FIBERGLASS, CLEVIS, 78", 15M

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

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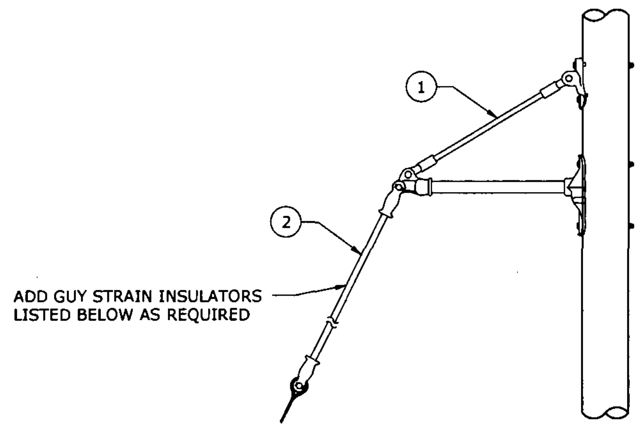
REVISED		BY	CK'D	APPR.

DOWN GUYS

Duke Energy®

FLA DWG. 02.04-16



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	GUYOB516F	1	013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV.
				013308	3	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152106	1	BOLT, MACHINE, 5/8 IN, 10 IN, STEEL, A307, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8"X12"
				152153	1	STRUT, GUY 24" FIBERGLASS
				152160	2	GRIP, GUY, 5/16", DIA, S, BLK
				153109	1	CONNECTOR, COMP,AL,A=2STR-6SOL,B=2STR-6SOL
				153111	1	CONNECTOR, COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210504	45	WIRE, 5/16", 7, STR, HI, STH, GR, A855M
	1	GUYOB716F	1	013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV.
				013308	3	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152106	1	BOLT, MACHINE, 5/8 IN, 10 IN, STEEL, A307, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8"X12"
				152153	1	STRUT, GUY 24" FIBERGLASS
				152160	2	GRIP, GUY, 5/16", DIA, S, BLK
				153109	1	CONNECTOR, COMP,AL,A=2STR-6SOL,B=2STR-6SOL
				153111	1	CONNECTOR, COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210206	45	WIRE, 7/16", UG, 7, STR, UTL, GR, A855M
	2	FBGL120F	1	115761	1	LINK, FIBERGLASS, CLEVIS, 120", 15M
	2	FBGL24F	1	115692	1	LINK, FIBERGLASS, CLEVIS, 24", 15M
	2	FBGL78F	1	115737	1	LINK, FIBERGLASS, CLEVIS, 78", 15M

REVISED		BY	CK'D	APPR.
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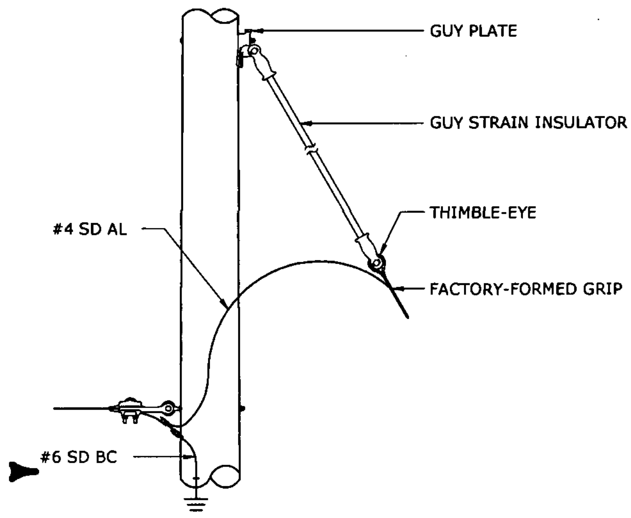
GUY OFFSET BRACKETS

Duke Energy®

FLA DWG. 02.04-17



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	FBGL120F	1	115761	1	LINK, FIBERGLASS, CLEVIS, 120", 15M
	1	FBGL24F	1	115692	1	LINK, FIBERGLASS, CLEVIS, 24", 15M
	1	FBGL78F	1	115737	1	LINK, FIBERGLASS, CLEVIS, 78", 15M

FIBERGLASS GUY STRAIN INSULATORS (LINKS), ARE USED TO INCREASE THE POLE'S BASIC INSULATION LEVEL (BIL), TO PREVENT LIGHTNING FLASHOVER, AND/OR PROTECT AGAINST THE GUY BECOMING ENERGIZED SHOULD IT COME IN CONTACT WITH SUPPLY CONDUCTORS.

➤ THE FIBERGLASS INSULATOR IS VOLTAGE IMPULSE RATED ONLY. UNDER NO CIRCUMSTANCES IS IT TO BE IN CONTACT WITH AN ENERGIZED CONDUCTOR. IT MAY BE TEMPORARILY USED IN SERIES WITH A POLYMER DEAD DURING CONSTRUCTION TO GAIN CLEARANCES BUT MUST BE REMOVED FOR THE PERMANENT INSTALLATION.

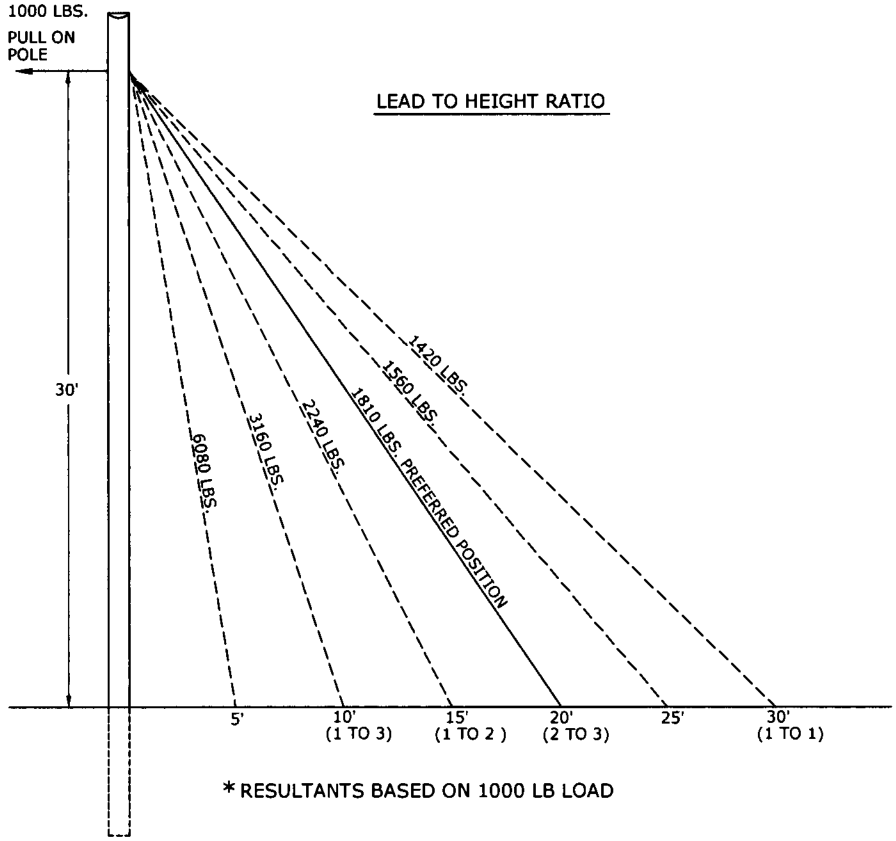
REVISED		BY	CK'D	APPR.
3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/4/10	CECCONI	GUINN	ELKINS

GUY STRAIN INSULATORS

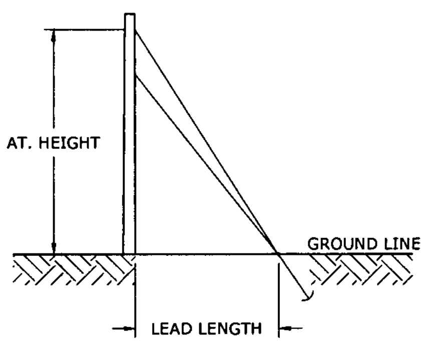
Duke Energy®

FLA

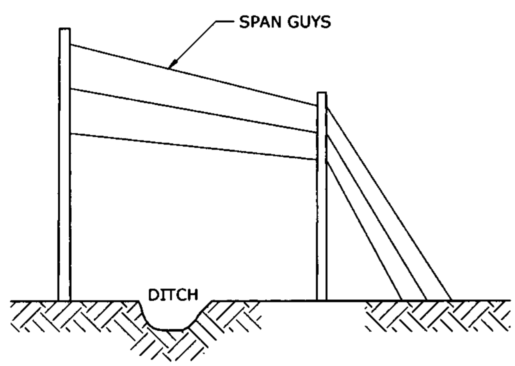
DWG. 02.04-18



MULTIPLE GUYS



MULTIPLE GUYS AND GUY STUBS



NOTES:

1. WHEN MULTIPLE GUYS ARE REQUIRED ON THE SAME ANCHOR, THE LEAD LENGTH IS NOT TO EXCEED THE GUY ATTACHMENT HEIGHT OF THE HIGHEST GUY. UNLESS OTHERWISE SPECIFIED, GUY LEAD LENGTH SHOULD BE 2/3 THE HEIGHT (1.5 TO 1 RATIO). THE MAXIMUM LEADS WILL BE 1:1.

2. IF LEAD LENGTH MUST BE GREATER THAN 1:1, A GUY STUB MUST BE USED.

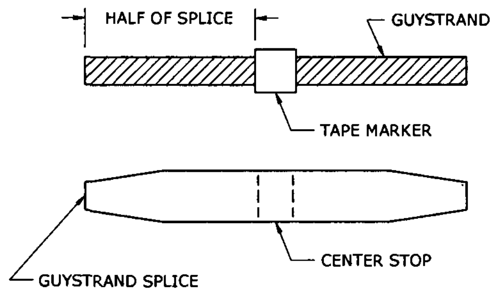
3. CONSTRUCTION ON HILLSIDES OR ROCKFACE IS ONLY EXCEPTION.

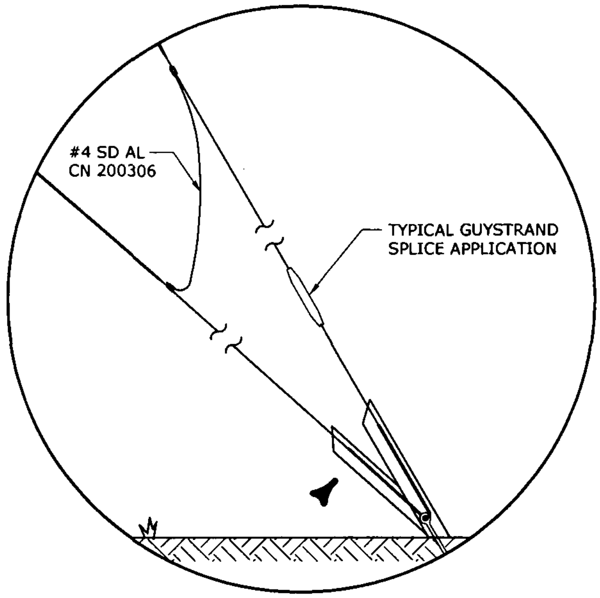
3				
2				
1				
0	7/6/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GUY TENSIONS WITH POINT LOAD, MULTIPLE GUYS AND GUY STUBS

Duke Energy®

PGN DWG. 02.04-20





BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	GUYWIRE516F	1	210504	1	WIRE, 5/16", 7, STR, HI, STH, GR, A855M
	2	GUYWIRE716F	1	210206	1	WIRE, 7/16", UG, 7, STR, UTL, GR, A855M

NOTES:

1. GUYSTRAND SPLICES ARE DESIGNED TO PROVIDE A QUICK AND ECONOMICAL MEANS OF REPAIRING BROKEN OR DAMAGED GUYSTRAND, OR FOR OTHER APPLICATIONS WHERE THE ENTIRE GUY MAY OTHERWISE HAVE TO BE REPLACED.

2. STRAIGHTEN STRAND AND TAPE TO INSURE STRAND STAYING IN LAY WHEN CUTTING. REMOVE TAPE AFTER CUTTING. USING HALF THE LENGTH OF THE OVERALL SPLICE AS A GAUGE, PLACE A SECOND TAPE MARKER ON THE STRAND AT THIS POINT.

3. INSERT STRAND IN PILOT CUP AND THRUST INTO JAW ASSEMBLY UNTIL IT HITS THE BUILT IN CENTER STOP. DO NOT CONSIDER THE INSTALLATION SAFE NOR PROPER UNLESS THE TAPE MARKER IS WITHIN 1/2" FROM END OF SPLICE.

4. SET JAWS BY PULLING STRAND BACK FIRMLY BY HAND.

5. DO NOT ATTEMPT TO REUSE SPLICES.

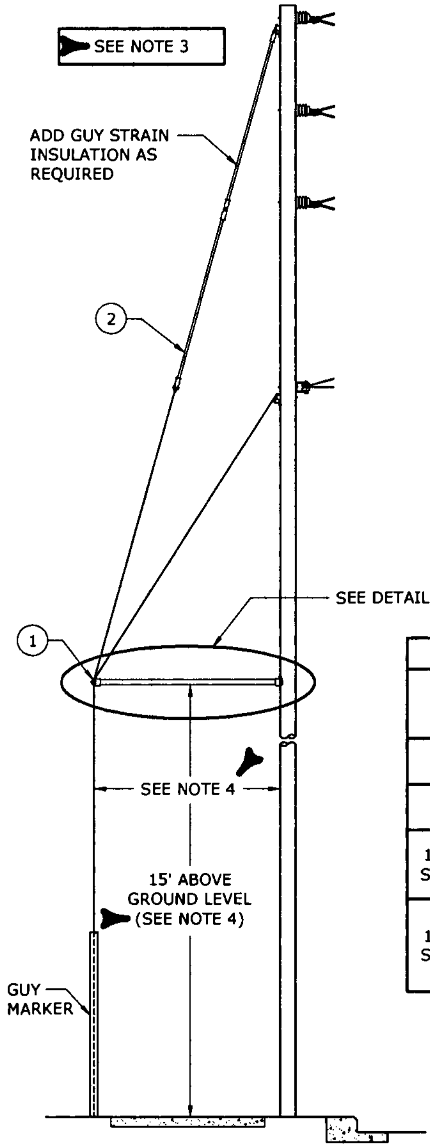
3				
2				
1	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

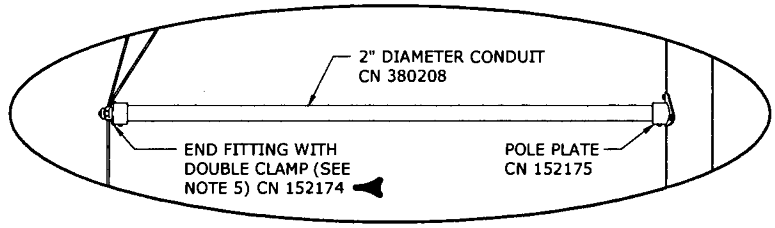
GUYSTRAND SPLICE INSTALLATION

Duke Energy®

FLA

DWG. 02.04-22





DETAIL A

SIDEWALK GUY CONFIGURATION CHART						
WIRE SIZE	# OF PHASES	MAXIMUM ANGLE (DEGREES)	ANGLE (DEGREES)	POLE SIZING	JOINT USE (MAXIMUM)	GUYING (SEE NOTE 5)
795	3	10	5	MIN. 45/4	4.0" JU	7/16" (P) & 5/16" (N)
			5 - 10	MIN. 45/4	1.0" JU	7/16" (P) & 7/16" (N)
336	3	20	<10	MIN. 45/4	3.0" JU	7/16" (P)
			10 - 20	MIN. 45/4	NO JU	7/16" (P) & 7/16" (N)
1/0 AND SMALLER	3	25	<5	MIN. 45/4	4.0" JU	7/16" (P)
			5 - 14	MIN. 45/4	1.5" JU	7/16" (P) & 7/16" (N)
			15 - 25	MIN. 45/4	NO JU	7/16" (P) & 7/16" (N)
1/0 AND SMALLER	1	60, DE	<25	MIN. 40/5	1.0" JU	7/16" (P)
			20 - 40	MIN. 40/5	NO JU	5/16" (P) & 7/16" (N)
			41 - 60	MIN. 40/4	NO JU	7/16" (P) & 7/16" (N)
			DE	MIN. 40/5	NO JU	7/16" (P) & 7/16" (N)

NOTES: POLEFOREMAN EVALUATION REQUIRED FOR ANY DESIGN OUTSIDE THE GUIDELINES OF THIS TABLE. SEE DWG. 02.02-03A FOR STANDARD POLE SIZES. POLES WITH EQUIPMENT ARE TO BE DESIGNED IN ACCORDANCE WITH DWG. 02.02-03B. POLE HEIGHTS TO BE DETERMINED BY CLEARANCES.

NOTE: USE ONLY WHEN PEDESTRIAN TRAFFIC IS EXPECTED BETWEEN POLE AND ANCHOR.

NOTES:

1. FOR USE ONLY WHEN REGULAR GUYING IS IMPRACTICAL. ANY DESIGN DEVIATING FROM THIS DRAWING REQUIRES A POLEFOREMAN ANALYSIS AND SPECIFIC APPROVAL FROM THE AREA ENGINEER AS TO STRENGTH REQUIREMENTS.
2. THIS IS A SPECIAL GUYING SITUATION THAT DEVIATES FROM THE TYPICAL SPLIT GUYING CONFIGURATIONS. WHEN TWO GUY WIRES ARE REQUIRED, THE PRIMARY GUY WIRE SHOULD BE LOCATED IN THE TOP POSITION AS SPECIFIED ON THE APPLICABLE SECTION 03 DRAWING. **THE SECOND GUY SHOULD BE LOCATED AT THE NEUTRAL POSITION.**
3. THIS DRAWING APPLIES TO ALL VERTICAL CONFIGURATIONS WITH MAX ANGLES AS SPECIFIED IN THE ABOVE TABLE. THE CONFIGURATION USED IN THIS DRAWING IS AN EXAMPLE OF ONE OF THE ACCEPTABLE CONSTRUCTION CONFIGURATIONS. REFER TO SECTION 03 FOR ADDITIONAL VERTICAL CONFIGURATIONS.
4. THE LENGTH OF THE STEEL CONDUIT STRUT SHOULD BE LIMITED TO 10'. HOWEVER, 6' TO 8' IS PREFERRED. THE STRUT SHOULD BE LOCATED 15' ABOVE GROUND LINE. DEVIATIONS FROM 15' REQUIRE POLEFOREMAN ANALYSIS.
5. THE END FITTING CLAMP (CN 152174) ACCEPTS TWO GUY WIRES UP TO 7/16" IN SIZE. IT MAY ALSO BE USED FOR SINGLE GUY WIRE APPLICATIONS.
6. SEE DWG. 02.04-24B FOR BILL OF MATERIALS.

REVISED		BY	CK'D	APPR.
3				
2				
1	10/12/12	WOJNAROWSKI	BURLISON	ADCOCK
0	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK

SIDEWALK GUY

Duke Energy

FLA DWG. 02.04-24A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	GUYM516F	1	013308	1	WASHER, SQ., 2-1/4", FLAT, 13/16", HOLE, GALV.
				014114	3	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GALV., 1/2"X4"
				152106	1	BOLT, MACHINE, 5/8", 10", STEEL, A-ASTM A307, GLV,
				152160	2	GRIP, GUY, 5/16", DIA, S, BLK
				152174	1	CLAMP, GUY, SIDEWALK, MAST ARM, 2", DOUBLE END FITTING
				152175	1	FLANGE, GY MST ARM
				152180	1	PLATE, GUY, HOOK PLATE UNIV. FOR ALL STRANDS
				153109	1	CONNECTOR,COMP,AL,A=2STR-6SOL,B=2STR-6SOL
				153111	1	CONNECTOR,COMP,AL,A=2/0STR-2SOL,B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210504	45	WIRE, 5/16", 7, STR, HI, STH, GR, A855M
				380208	8	CONDUIT, STL W/C 2"
	1	GUYM716F	1	013346	1	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				014114	3	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GLV, 1/2"X4"
				152122	1	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307, GLV
				152162	2	GRIP, GUY, 7/16", S, GRN
				152174	1	CLAMP, GUY, SIDEWALK, MAST ARM, 2", DOUBLE END FITTING
				152175	1	FLANGE, GY MST ARM
				152180	1	PLATE, GUY, HOOK PLATE UNIV. FOR ALL STRANDS
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				200306	12	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
				210206	45	WIRE, 7/16", UG, 7, STR, UTL, GR, A855M
				380208	8	CONDUIT, STL W/C 2"
				11197803	1	CONNECTOR, COMPRESSION, PA, #6SLD-3/0 ACSR
	2	FBGL120F	1	115761	1	LINK, FIBERGLASS, CLEVIS, 120", 15M
	2	FBGL24F	1	115692	1	LINK, FIBERGLASS, CLEVIS, 24", 15M
	2	FBGL78F	1	115737	1	LINK, FIBERGLASS, CLEVIS, 78", 15M

NOTES:

1. SEE DWG. 02.04-24A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SIDEWALK GUY

Duke Energy®

FLA

DWG. 02.04-24B

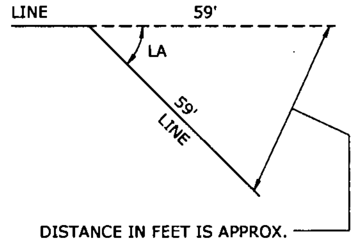
EXAMPLE:

PROBLEM DATA:

GRADE 'C' CONSTRUCTION
THREE-PHASE VERTICAL CONSTRUCTION
795 AAC PRIMARY
1/0 AAAC R/T NEUTRAL
SPAN: 250 FT.
LINE ANGLE: 20 DEGREES
SOIL CLASS: 5
GUY LEAD TO HEIGHT RATIO: 2 TO 3

LEAD TO HEIGHT IS GIVEN IN THIS EXAMPLE
DWG. 02.04-30 SHOWS LEAD TO HEIGHT TABLE

HOW TO DETERMINE LINE ANGLE



DISTANCE IN FEET IS APPROX. EQUAL TO NUMBER OF DEGREES IN LINE ANGLE (LA). IF YOU ARE ONLY ABLE TO STEP OUT 30 FT. THEN MULTIPLY THE DISTANCE BY 2.

DETERMINING GUY WIRE TENSION:

SEE CHART ON DWG. 02.04-34. USING THE PROBLEM DATA ABOVE, DETERMINE THE TENSION IN THE GUY WIRES DUE TO EACH CONDUCTOR.

TENSION 795 AAC: 4,961 LBS
TENSION 1/0 AAAC NEUTRAL: 1,884 LBS
TOTAL TENSION: 3 X 4,961 LBS + (1/2 X 1,884 LBS) = 15,825 LBS

SEE DWG. 02.04-29 FOR GUY LOAD ALLOCATIONS. START WITH TWO GUY CONFIGURATION FIRST.

TENSION IN TOP GUY: 50% X 15,825 LBS = 7,913 LBS
TENSION IN LOWER GUY: 65% X 15,825 LBS = 10,286 LBS

TOP GUY: 7/16" GUY WIRE
LOWER GUY: 7/16" GUY WIRE

KEY	RATING @ 90% OF ULTIMATE
5/16	7,200
7/16	15,000 *

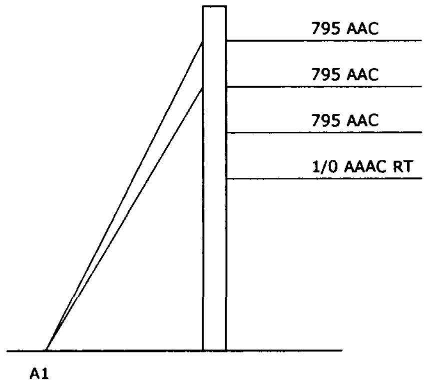
* LIMITED TO 15,000 INTENTIONALLY. 90% OF ULTIMATE IS 16,200.

NOTE: IF EITHER GUY TENSIONS HAD EXCEEDED THE TENSION LIMITS, THE NEXT STEP WOULD HAVE BEEN TO CHECK THE THREE GUY CONFIGURATION ON DWG. 02.04-29.

SELECTING AN ANCHOR:

SEE ANCHOR HOLDING STRENGTH TABLE ON DWG. 02.06-02.

CLASS 5 SOIL
TOTAL LOAD = 15,285 LBS.



THE REQUIRED ANCHOR (A1) TO SUPPORT BOTH GUY WIRES IN CLASS 5 SOIL IS 2 HELIX ANCHOR, WHICH IS RATED AT 18,000 LBS.

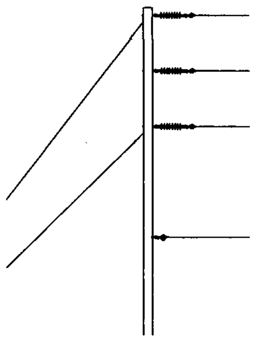
3				
2				
1				
0	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

EXAMPLE GUYING PROBLEM

Duke Energy®

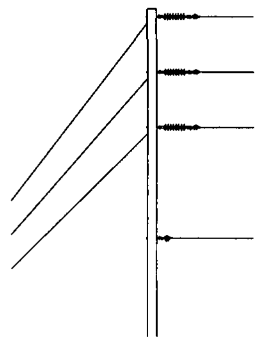
FLA DWG. 02.04-28

TOTAL GUY TENSILE LOAD ALLOCATION FOR STANDARD CONSTRUCTION



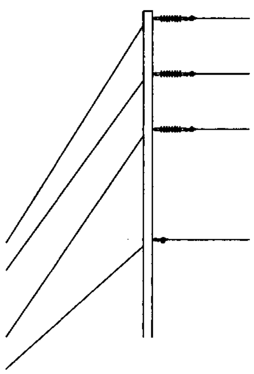
GUYED BELOW A & C PHASES

UPPER GUY	LOWER GUY
50%	65%



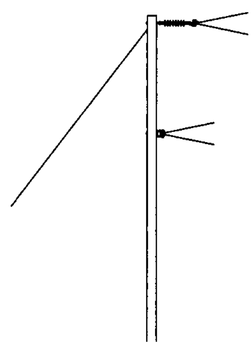
GUYED BELOW A, B & C PHASES

UPPER GUY	MIDDLE GUY	LOWER GUY
30%	40%	50%



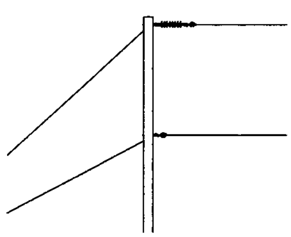
EVERY CONDUCTOR
GUYED INDIVIDUALLY

EACH WIRE TAKES TENSION
FOUND IN GUYING TABLES



GUYED BELOW PRIMARY PHASE

SINGLE GUY WIRE TAKES TOTAL
TENSION FOUND IN GUYING TABLES



EVERY CONDUCTOR
GUYED INDIVIDUALLY

EACH WIRE TAKES TENSION
FOUND IN GUYING TABLES

NOTES:

1. USE POLEFOREMAN FOR CASES WHERE THE CALCULATED GUY WIRE TENSIONS FROM THIS TABLE EXCEED THE MAXIMUM RATINGS ON DWG. 02.04-10.
2. SEE DWGS. 02.04-32 THROUGH DWG. 02.04-48 FOR TOTAL GUY TENSION GUYING TABLES.
3. SEE DWG. 02.06-02 FOR ANCHOR SIZING.

3				
2				
1				
0	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

GUYING LOAD ALLOCATIONS

Duke Energy®

FLA DWG. 02.04-29

DETERMINING LEAD TO HEIGHT RATIO:

IF YOU HAVE A 20 FT. LEAD AND 36 FT. HT. 20 / 36 = .56 USE THE 1/2 RATIO CHART.

IF YOU HAVE A 12 FT. LEAD AND 40 FT. HT. 12 / 40 = .30 THIS EXCEEDS THE 1/2 RATIO IN OUR GUY TABLES, A POLEFOREMAN EVALUATION IS NEEDED.

HEIGHT (FT.)	8.00	10.00	12.00	14.00	16.00	18.00	20.00	22.00	24.00	26.00	28.00	30.00
50.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.36	0.40	0.44	0.48	0.52	0.56	0.60
48.00	[illegible]	[illegible]	[illegible]	[illegible]	0.33	0.38	0.42	0.46	0.50	0.54	0.58	0.63
46.00	[illegible]	[illegible]	[illegible]	[illegible]	0.35	0.39	0.43	0.48	0.52	0.57	0.61	0.65
44.00	[illegible]	[illegible]	[illegible]	[illegible]	0.36	0.41	0.45	0.50	0.55	0.59	0.64	0.68
42.00	[illegible]	[illegible]	[illegible]	0.33	0.38	0.43	0.48	0.52	0.57	0.62	0.67	0.71
40.00	[illegible]	[illegible]	[illegible]	0.35	0.40	0.45	0.50	0.55	0.60	0.65	0.70	0.75
38.00	[illegible]	[illegible]	[illegible]	0.37	0.42	0.47	0.53	0.58	0.63	0.68	0.74	0.79
36.00	[illegible]	[illegible]	0.33	0.39	0.44	0.50	0.56	0.61	0.67	0.72	0.78	0.83
34.00	[illegible]	[illegible]	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.76	0.82	0.88
32.00	[illegible]	[illegible]	0.38	0.44	0.50	0.56	0.63	0.69	0.75	0.81	0.88	0.94
30.00	[illegible]	0.33	0.40	0.47	0.53	0.60	0.67	0.73	0.80	0.87	0.93	1.00
28.00	[illegible]	0.36	0.43	0.50	0.57	0.64	0.71	0.79	0.86	0.93	1.00	1.07
26.00	[illegible]	0.38	0.46	0.54	0.62	0.69	0.77	0.85	0.92	1.00	1.08	1.15
24.00	0.33	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08	1.17	1.25
22.00	0.36	0.45	0.55	0.64	0.73	0.82	0.91	1.00	1.09	1.18	1.27	1.36
20.00	0.40	0.50	0.60	0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50
18.00	0.44	0.56	0.67	0.78	0.89	1.00	1.11	1.22	1.33	1.44	1.56	1.67
16.00	0.50	0.63	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88
	LEAD (FT)											

RATIO LESS THAN 0.33 REQUIRES POLEFOREMAN EVALUATION

USE 1/3 (0.33 - 0.49)

USE 1/2 (0.50 - 0.66)

USE 2/3 (.0.67 - 0.99)

USE 1/1 RATION GREATER THAN 1.0

3				
2				
1				
0	10/4/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

GUYING LEAD TO HEIGHT RATIO

Duke Energy

FLA DWG. 02.04-30

TABLE A

TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

LINE ANGLE DEGREES	4 BC 6 BC 4 ACSR	2 BC 2 ACSR 2AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	336 AAC	4/0 STR CU	795 AAC	LEAD TO HEIGHT
SPAN GUY									
10	417	436	602	628	747	879	1048	1477	SPAN GUY
20	596	618	885	933	1124	1352	1623	2426	
30	772	797	1163	1233	1494	1816	2187	3359	
40	944	971	1433	1524	1854	2268	2737	4268	
50	1109	1139	1694	1806	2201	2705	3267	5146	
60	1268	1300	1944	2076	2534	3122	3775	5987	
DE	1041	1059	1642	1770	2188	2747	3335	5506	
LEAD TO HEIGHT = 1 TO 1									
10	590	616	851	889	1057	1243	1483	2088	1 / 1
20	843	874	1251	1320	1589	1912	2295	3431	
30	1092	1127	1644	1743	2112	2569	3093	4750	
40	1335	1373	2027	2156	2622	3208	3870	6035	
50	1569	1611	2396	2554	3113	3825	4621		
60	1793	1838	2750	2935	3583	4415	5339		
DE	1472	1498	2323	2503	3094	3884	4717		
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)									
10	752	786	1085	1133	1347	1585	1890	2662	3 / 2
20	1075	1114	1595	1683	2026	2437	2926	4373	
30	1392	1437	2096	2222	2693	3274	3943	6055	
40	1701	1751	2584	2748	3342	4089	4934		
50	2000	2053	3055	3256	3968	4876	5890		
60	2285	2343	3505	3742	4567	5629	6806		
DE	1876	1910	2961	3191	3944	4952	6013		
LEAD TO HEIGHT = 1 TO 2									
10	933	974	1346	1405	1671	1965	2344	3302	2 / 1
20	1333	1382	1979	2087	2513	3023	3629	5425	
30	1727	1782	2600	2757	3340	4061	4891		
40	2110	2171	3205	3409	4145	5072	6119		
50	2480	2547	3789	4039	4922	6048			
60	2834	2906	4348	4641	5665	6982		**13388	
DE	2327	2369	3672	3958	4892	6142			
LEAD TO HEIGHT = 1 TO 3									
10	1319	1378	1904	1987	2363	2779	3315	4670	3 / 1
20	1886	1954	2798	2951	3554	4275	5132		
30	2442	2520	3672	3898	4723	5743	6916		
40	2984	3071	4532	4821	5862	7173		**13496	
50	3508	3602	5358	5711	6961			***16274	
60	4008	4110	6149	6564				***18934	
DE	3291	3350	5193	5597	6919			***17410	

** AVOID ON DOUBLE CIRCUIT DESIGN, MAY REQUIRE INCREASE IN POLE CLASS
*** SPECIAL DESIGN: **REQUIRES A POLEFOREMAN EVALUATION**

KEY	RATING @ 90% OF ULTIMATE
5/16 (grey)	7200
(black)	15,000*

* LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

NOTES:

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

		BY	CK'D	APPR.
3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SHORT SPAN GUYING TABLES
- SPANS 200' OR LESS -
GRADE C

Duke Energy®

FLA — DWG. 02.04-32

TABLE B
TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

SPAN LIMIT	400	400	400	400	400	250	400	250	
LINE ANGLE DEGREES	4 BC 6 BC 4 ACSR	2 BC 2 ACSR 2AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	336 AAC	4/0 STR CU	795 AAC	LEAD TO HEIGHT
SPAN GUY									
10	499	544	735	745	905	1086	1242	1775	SPAN GUY
20	692	752	1045	1057	1283	1576	1800	2752	
30	881	954	1349	1363	1653	2055	2347	3709	
40	1064	1151	1644	1660	2012	2521	2878	4640	
50	1241	1341	1929	1946	2357	2968	3389	5538	
60	1410	1521	2200	2219	2686	3395	3876	6395	
DE	1124	1209	1807	1819	2207	2856	3256	5680	
LEAD TO HEIGHT = 1 TO 1									
10	705	770	1039	1054	1279	1536	1756	2511	1 / 1
20	978	1063	1476	1496	1814	2229	2546	3892	
30	1246	1350	1908	1928	2337	2907	3319	5246	
40	1505	1628	2325	2348	2845	3565	4070	6562	
50	1755	1896	2727	2753	3334	4198	4793		
60	1993	2151	3111	3138	3799	4801	5482		
DE	1590	1710	2556	2573	3121	4038	4605		
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)									
10	899	981	1325	1343	1631	1958	2239	3200	3 / 2
20	1247	1355	1884	1906	2313	2841	3246	4961	
30	1588	1721	2432	2458	2980	3705	4231	6687	
40	1919	2075	2964	2993	3627	4544	5188		
50	2237	2417	3477	3509	4250	5351	6110		
60	2541	2742	3966	4001	4843	6120	6988		
DE	2027	2179	3258	3280	3978	5148	5870		
LEAD TO HEIGHT = 1 TO 2									
10	1115	1217	1643	1666	2023	2429	2777	3970	2 / 1
20	1547	1681	2337	2365	2868	3524	4026	6153	
30	1969	2134	3016	3048	3696	4596	5248		
40	2380	2574	3677	3713	4499	5636	6435		
50	2775	2998	4312	4352	5271	6637			
60	3152	3401	4919	4962	6007			**14301	
DE	2514	2703	4041	4068	4934	6385			
LEAD TO HEIGHT = 1 TO 3									
10	1578	1722	2324	2357	2861	3435	3927	5614	3 / 1
20	2188	2377	3305	3344	4056	4984	5693		
30	2785	3018	4266	4311	5227	6499			
40	3366	3641	5199	5251	6362			**14674	
50	3924	4239	6099	6155				***17513	
60	4457	4810	6957	7018				***20224	
DE	3555	3823	5715	5753	6978			***17963	

** AVOID ON DOUBLE CIRCUIT DESIGN, MAY REQUIRE INCREASE IN POLE CLASS
*** SPECIAL DESIGN: **REQUIRES A POLEFOREMAN EVALUATION**

KEY	RATING @ 90% OF ULTIMATE
5/16	7200
(black)	15,000*

*LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

NOTES:

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MEDIUM SPAN GUYING TABLES
- SPANS 400' OR LESS -
GRADE C

Duke Energy®

FLA DWG. 02.04-34

TABLE C

TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

SPAN LIMIT	500	500	600	600	500	500	500	
LINE ANGLE DEGREES	4 BC 4 ACSR	#2 BC	2 ACSR 2 AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	4/0 STR CU	LEAD TO HEIGHT
SPAN GUY								
10	541	552	612	818	803	983	1340	SPAN GUY
20	741	765	846	1159	1117	1362	1893	
30	938	973	1074	1493	1425	1732	2433	
40	1128	1174	1295	1817	1724	2090	2956	
50	1312	1368	1507	2128	2011	2434	3459	
60	1486	1553	1710	2425	2285	2761	3938	
DE	1172	1239	1362	1988	1838	2214	3227	
LEAD TO HEIGHT = 1 TO 1								
10	765	781	866	1157	1135	1390	1896	1 / 1
20	1049	1081	1196	1639	1580	1926	2677	
30	1326	1375	1518	2111	2016	2449	3440	
40	1596	1661	1831	2569	2438	2955	4181	
50	1855	1935	2132	3010	2845	3442	4892	
60	2102	2196	2418	3430	3231	3905	5569	
DE	1657	1752	1926	2811	2599	3131	4564	
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)								
10	975	996	1104	1475	1447	1772	2417	3 / 2
20	1337	1379	1524	2090	2015	2455	3412	
30	1691	1753	1936	2691	2570	3122	4386	
40	2034	2117	2334	3275	3108	3767	5329	
50	2364	2467	2718	3837	3626	4388	6236	
60	2679	2800	3082	4373	4119	4977	7099	
DE	2112	2233	2455	3583	3314	3992	5818	
LEAD TO HEIGHT = 1 TO 2								
10	1209	1235	1369	1830	1795	2198	2997	2 / 1
20	1658	1710	1891	2592	2499	3045	4233	
30	2097	2175	2401	3338	3187	3872	5440	
40	2523	2626	2895	4062	3855	4673	6610	
50	2933	3059	3371	4759	4498	5442		
60	3323	3473	3823	5423	5109	6174		
DE	2620	2770	3045	4445	4110	4951		
LEAD TO HEIGHT = 1 TO 3								
10	1710	1747	1936	2587	2538	3109	4239	3 / 1
20	2345	2418	2674	3665	3534	4306	5986	
30	2966	3075	3395	4720	4508	5476		
40	3568	3713	4095	5745	5452	6609		
50	4147	4327	4767	6730	6361			
60	4699	4911	5407					
DE	3705	3917	4306	6286	5813	7002		

NOTES:

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

KEY	RATING @ 90% OF ULTIMATE
5/16 (grey)	7200
(black)	15,000*

*LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LONG SPAN GUYING TABLES
- SPANS 600' OR LESS -
GRADE C

Duke Energy®

FLA DWG. 02.04-36

<u>TABLE A</u>

TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

LINE ANGLE DEGREES	4 BC 6 BC 4 ACSR	2 BC 2 ACSR 2AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	336 AAC	4/0 STR CU	795 AAC	LEAD TO HEIGHT
				SPAN GUY					
10	609	636	881	920	1095	1290	1540	2178	SPAN GUY
20	878	909	1305	1378	1660	2000	2402	3603	
30	1142	1178	1722	1827	2215	2696	3248	5002	
40	1399	1439	2128	2265	2755	3375	4073	6366	
50	1648	1691	2520	2687	3277	4030	4869		
60	1885	1932	2895	3092	3776	4657	5632		
DE	1561	1589	2463	2655	3282	4120	5003		
				LEAD TO HEIGHT = 1 TO 1					
10	861	899	1245	1301	1549	1825	2177	3081	1 / 1
20	1242	1286	1846	1948	2348	2828	3396	5095	
30	1615	1666	2435	2583	3133	3813	4594	7074	
40	1979	2035	3009	3202	3897	4773	5760		
50	2330	2392	3564	3800	4634	5699	6886		
60	2666	2733	4095	4373	5340	6586			
DE	2207	2247	3484	3755	4641	5827	7075		
				LEAD TO HEIGHT = 2 TO 3 (PREFERRED)					
10	1098	1146	1588	1659	1974	2326	2776	3927	3 / 2
20	1583	1639	2353	2483	2993	3605	4330	6495	
30	2059	2123	3104	3293	3993	4861	5856		
40	2522	2594	3836	4082	4967	6084			
50	2970	3049	4543	4845	5908			** 13853	
60	3399	3484	5220	5574	6807			*** 16130	
DE	2814	2865	4441	4786	5916			** 14888	
				LEAD TO HEIGHT = 1 TO 2					
10	1362	1422	1969	2057	2448	2885	3443	4871	2 / 1
20	1963	2034	2918	3080	3712	4472	5370		
30	2554	2634	3850	4085	4953	6030			
40	3129	3218	4758	5064	6161			** 14235	
50	3684	3782	5635	6009				*** 17183	
60	4216	4321	6474	6914				*** 20006	
DE	3490	3553	5508	5936				*** 18466	
				LEAD TO HEIGHT = 1 TO 3					
10	1926	2011	2785	2909	3463	4080	4869	6889	3 / 1
20	2776	2876	4127	4356	5250	6324			
30	3611	3725	5445	5777	7005			*** 15818	
40	4425	4551	6729	7161				*** 20132	
50	5210	5348					*** 15398	*** 24301	
60	5962	6111				** 14726	*** 17809	*** 28293	
DE	4936	5025				** 13029	*** 15820	*** 26115	

** AVOID ON DOUBLE CIRCUIT DESIGN, MAY REQUIRE INCREASE IN POLE CLASS
*** SPECIAL DESIGN: **<u>REQUIRES A POLEFOREMAN EVALUATION</u>**

<u>NOTES:</u>

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

KEY	RATING @ 90% OF ULTIMATE
5/16	7200
	15,000*

*LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED	BY	CK'D	APPR.	

SHORT SPAN GUYING TABLES
- SPANS 200' OR LESS -
GRADE B

Duke Energy®

FLA | DWG. 02.04-44

TABLE B
TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

SPAN LIMIT	400	400	400	400	400	250	400	250	LEAD TO HEIGHT
LINE ANGLE DEGREES	4 BC 6 BC 4 ACSR	2 BC 2 ACSR 2AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	336 AAC	4/0 STR CU	795 AAC	
SPAN GUY									
10	727	793	1073	1088	1320	1588	1815	2607	SPAN GUY
20	1016	1104	1538	1556	1888	2323	2653	4073	
30	1300	1408	1994	2015	2443	3042	3474	5510	
40	1576	1704	2437	2461	2982	3741	4271	6907	
50	1841	1988	2865	2891	3501	4413	5038		
60	2094	2259	3272	3301	3996	5054	5770		
DE	1686	1813	2711	2729	3310	4283	4884		
LEAD TO HEIGHT = 1 TO 1									
10	1028	1122	1517	1538	1867	2246	2567	3688	1 (height) / 1 (lead)
20	1437	1561	2175	2201	2670	3285	3752	5760	
30	1838	1992	2820	2850	3455	4302	4913		
40	2228	2410	3447	3481	4218	5290	6040		
50	2603	2812	4051	4088	4951	6241	7125		
60	2962	3195	4627	4668	5651	7148		**13495	
DE	2385	2564	3834	3860	4681	6058	6907		
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)									
10	1310	1430	1933	1961	2380	2863	3272	4701	3 (height) / 2 (lead)
20	1832	1990	2773	2805	3403	4187	4783		
30	2344	2539	3595	3633	4404	5484	6263		
40	2840	3072	4394	4437	5376	6744			
50	3319	3585	5164	5211	6312			**14882	
60	3775	4073	5899	5950				***17203	
DE	3040	3269	4887	4920	5967			***15361	
LEAD TO HEIGHT = 1 TO 2									
10	1625	1773	2398	2432	2952	3551	4059	5830	2 (height) / 1 (lead)
20	2273	2469	3439	3480	4221	5194	5933		
30	2907	3149	4459	4506	5463				
40	3523	3810	5450	5503	6669			***15445	
50	4116	4446	6405	6464				***18459	
60	4683	5052						***21338	
DE	3771	4055	6062	6102				***19053	
LEAD TO HEIGHT = 1 TO 3									
10	2299	2508	3392	3439	4175	5022	5740		3 (height) / 1 (lead)
20	3214	3491	4864	4921	5969				
30	4111	4454	6306	6373				***17423	
40	4982	5389					** 13506	***21842	
50	5822	6288				**13956	***15933	***26105	
60	6622	7145				***15983	***18248	***30177	
DE	5333	5734				**13545	***15445	***26945	

** AVOID ON DOUBLE CIRCUIT DESIGN, MAY REQUIRE INCREASE IN POLE CLASS
*** SPECIAL DESIGN: **REQUIRES A POLEFOREMAN EVALUATION**

NOTES:

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

KEY	RATING @ 90% OF ULTIMATE
5/16	7200
	15,000*

*LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED	BY	CK'D	APPR.	

MEDIUM SPAN GUYING TABLES
- SPANS 400' OR LESS -
GRADE B

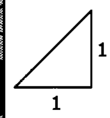
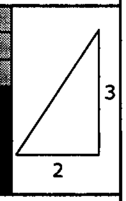
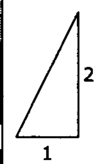
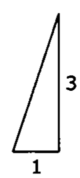
Duke Energy

FLA

DWG. 02.04-46

TABLE C

TENSION IN GUY WIRE FOR ONE CONDUCTOR
(MULTIPLY BY NUMBER OF CONDUCTORS FOR TOTAL GUY TENSION)

SPAN LIMIT	500	500	600	600	500	500	500	
LINE ANGLE DEGREES	4 BC 4 ACSR	#2 BC	2 ACSR 2 AAAC	1/0 ACSR 1/0 AAAC	1/0 STR CU	2/0 STR CU	4/0 STR CU	LEAD TO HEIGHT
SPAN GUY								
10	787	805	892	1194	1170	1432	1956	SPAN GUY
20	1089	1123	1242	1706	1642	2001	2785	
30	1383	1435	1584	2206	2105	2556	3595	
40	1669	1738	1917	2693	2553	3094	4381	
50	1945	2030	2236	3161	2985	3611	5137	
60	2207	2307	2540	3607	3396	4103	5856	
DE	1752	1858	2043	2982	2757	3321	4841	
LEAD TO HEIGHT = 1 TO 1								
10	1113	1138	1262	1689	1654	2026	2766	
20	1539	1589	1757	2412	2323	2829	3938	
30	1956	2030	2241	3120	2976	3615	5085	
40	2361	2458	2710	3808	3611	4376	6196	
50	2750	2870	3162	4470	4221	5107		
60	3121	3263	3592	5101	4802	5802		
DE	2485	2627	2889	4217	3899	4697	6846	
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)								
10	1419	1451	1608	2153	2109	2582	3526	
20	1962	2025	2239	3075	2961	3607	5020	
30	2494	2588	2856	3978	3794	4608	6482	
40	3010	3134	3455	4854	4603	5578		
50	3506	3659	4031	5698	5381	6510		
60	3978	4160	4579	6503	6122			
DE	3168	3349	3683	5375	4971	5988		
LEAD TO HEIGHT = 1 TO 2								
10	1760	1800	1995	2670	2616	3203	4373	
20	2434	2512	2777	3814	3672	4473	6227	
30	3093	3210	3543	4934	4706	5715		
40	3733	3887	4286	6021	5709	6919		
50	4348	4538	5000	7068	6674			
60	4935	5159	5680				** 13095	
DE	3929	4154	4568	6667	6165			
LEAD TO HEIGHT = 1 TO 3								
10	2490	2545	2821	3776	3699	4529	6185	
20	3442	3553	3928	5393	5194	6326		
30	4374	4539	5010	6977	6656			
40	5279	5497	6061				** 13855	
50	6149	6418	7071				***16245	
60	6979						***18519	
DE	5557	5875	6460				***15309	

** AVOID ON DOUBLE CIRCUIT DESIGN, MAY REQUIRE INCREASE IN POLE CLASS
*** SPECIAL DESIGN: **REQUIRES A POLEFOREMAN EVALUATION**

KEY	RATING @ 90% OF ULTIMATE
5/16	7200
	15,000*

*LIMITED TO 15K INTENTIONALLY
90% OF ULTIMATE IS 16200

NOTES:

1. FOR A 1/0 AAAC REDUCED TENSION NEUTRAL, USE 1/2 THE TENSION VALUE SHOWN IN THE TABLE ABOVE FOR THE 1/0 AAAC.

3				
2				
1				
0	11/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LONG SPAN GUYING TABLES
- SPANS 600' OR LESS -
GRADE B

Duke Energy®

FLA DWG. 02.04-48

ANCHOR HOLDING POWER - POUNDS (BASED ON SAFETY FACTOR OF 1.5)

CLASS:	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5	CLASS 6	CLASS 7
TYPE SOIL:	SOLID BED ROCK	LAMINATED ROCK, SANDSTONE	SHALE, HARDPAN	GRAVEL, CLAYPAN	FIRM CLAY, COMPACT COARSE SAND	SOFT CLAY, LOOSE COARSE SAND COMPACT FINE SAND	FILL WET CLAY SILT, LOOSE FINE SAND
PROBE TORQUE (INCH-LBS)	-	OVER 600	500-600	400-500	300-400	200-300	100-200
8" SCREW ANCHOR ANRS81553EF	-	-	-	-	7330	6000	4000
10" SCREW ANCHOR ANRS101283EF	-	-	-	-	8665	6665	4665
8" PISA ANPI83353EF	-	12,000	15,330	12,000	10,000	8000	5000
2 HELIX ANCHOR ANSS2HA1553EX5F	-	27,330	24,000	21,330	18,000	15,330	12,665
3 HELIX ANCHOR ANSS3HB1573EX5F ANSS3HB1573EX7F	-	38,665	34,000	30,665	26,000	21,330	17,330

NOTES:

1. WHEN SELECTING ANCHORS, IT IS MORE ECONOMICAL TO USE ONE ANCHOR RATHER THAN MULTIPLE ANCHORS.
2. INSTALL ANCHORS DEEP ENOUGH, BY USE OF EXTENSIONS, TO PENETRATE CLASS 5, 6, OR 7 SOIL UNDERLYING MUSHY SILT OR QUICKSAND.
3. IF SATISFACTORY PENETRATION CANNOT BE ACHIEVED, REDUCE ANCHOR ONE SIZE AND USE NEXT LOWER SOIL CLASS FOR RATING (ENGINEERING APPROVAL REQUIRED).
4. ANCHORS SHOULD BE INSTALLED SUCH THAT THE ENTIRE ANCHOR ROD IS IN DIRECT LINE WITH THE TENSION ON THE GUY.
5. SEE SECTION 12 FOR COASTAL AND CONTAMINATED AREA APPLICATIONS.
6. ANCHOR HOLDING STRENGTH IS BASED ON MANUFACTURER TEST DATA. THE ANCHOR CAPACITIES IN THE TABLE ABOVE HAVE A SAFETY FACTOR OF 1.5 IN CONSIDERATION OF STRENGTH LOSS DUE TO POSSIBLE LIFETIME MINOR ANCHOR DETERIORATION OR SOIL INCONSISTENCIES.

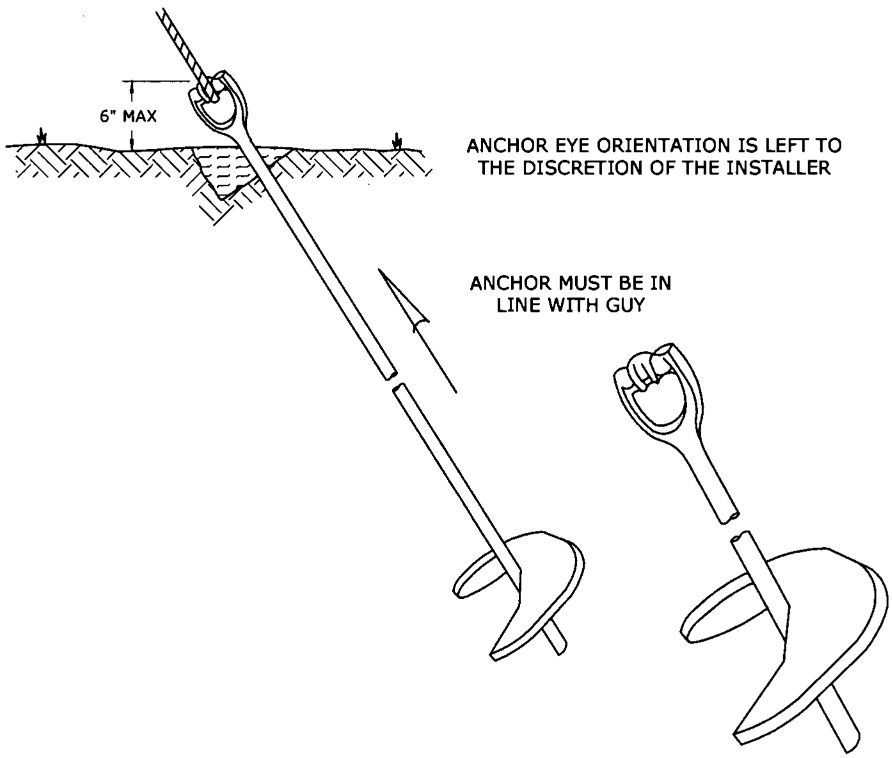
3				
2				
1				
0	11/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ANCHOR HOLDING STRENGTHS AND CONSTRUCTION NOTES

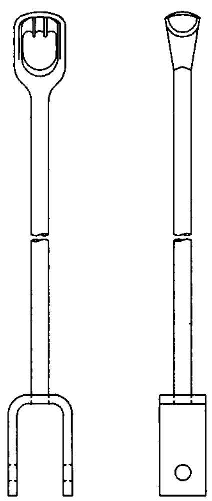
Duke Energy®

FLA DWG. 02.06-02

SCREW ANCHOR



SINGLE HELIX SCREW ANCHOR



6' EXTENSION
CN 40216

BILL OF MATERIALS		
COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION
ANRS81553EF	040108	ANCHOR SCREW, 8", SINGLE HELIX
ANRS101283EF	040110	ANCHOR SCREW, 10" SINGLE HELIX
ANX125X6FTRSTEF	040216	ROD, EXTENSION, ANCHOR, 6'

NOTES:

1. SCREW INTO UNDISTURBED EARTH WITH TURNING BAR OR WITH ADAPTER ON POWER AUGER. USE CARE TO AVOID ANCHOR SPINNING IN A PLACE INSTEAD OF ADVANCING PROPERLY.

3				
2				
1				
0	11/4/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SCREW ANCHORS (NO WRENCH)

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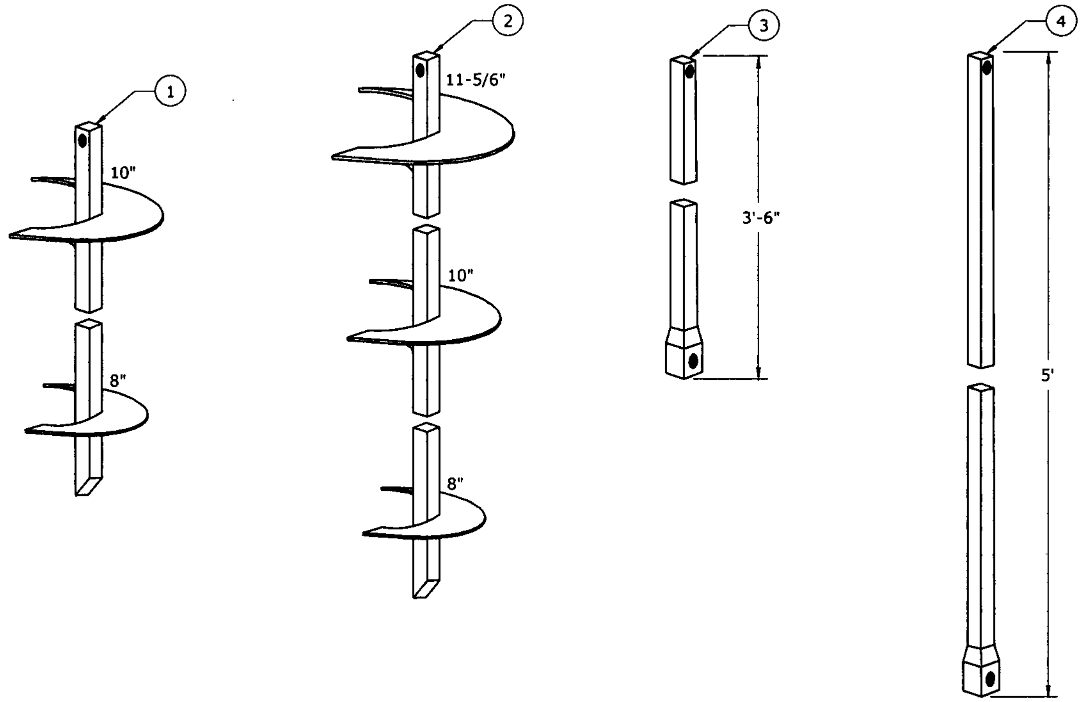
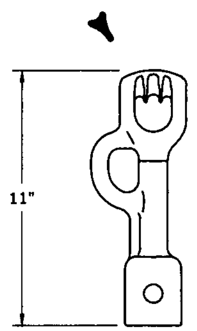
FLA DWG. 02.06-06

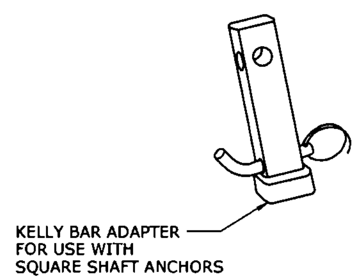


STANDARD EXTENSION



TRIPLE EYE GUY ATTACHMENT
(INCLUDED IN ANCHOR CN)

CN 151226



DOUBLE AND TRIPLE HELIX SQUARE SHAFT ANCHORS

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ANSS2HA1553EX5F	1	040132	1	ANCHOR, DOUBLE HELIX, 8" - 10", TRIPLE EYE INCL
				040204	1	ROD, EXT. ANCHOR, SQUARE SHAFT, 1-1/2" X 5'
	2	ANSS3HB1553EX5F	1	040154	1	ANCHOR, TRIPLE HELIX, 8" - 10" - 12", TRIPLE EYE INCL
				040204	1	ROD, EXT. ANCHOR, SQUARE SHAFT, 1-1/2" X 5'
	3	ANX125X35FTSSF	1	040203	1	ROD, EXT. ANCHOR, SQUARE SHAFT, 1-1/2" X 3.5'
	4	ANX125X5FTSSF	1	040204	1	ROD, EXT. ANCHOR, SQUARE SHAFT, 1-1/2" X 5'

REVISED		BY	CK'D	APPR.
3				
2	10/12/12	WOJNAROWSKI	BURLISON	ADCOCK
1	10/5/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/4/10	CECCONI	GUINN	ELKINS

DOUBLE AND TRIPLE HELIX
SQUARE SHAFT ANCHORS

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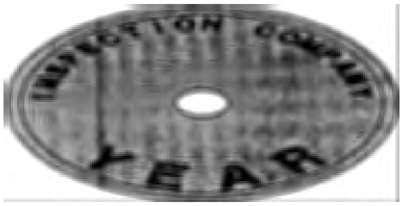
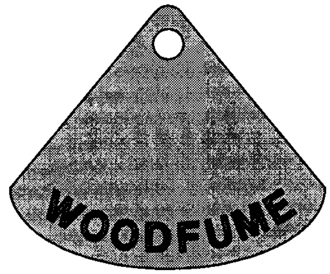
DWG.
02.06-08

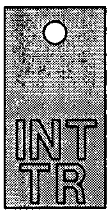


1. VISUAL INSPECTION, SOUND AND BORE, PARTIAL EXCAVATION PERFORMED

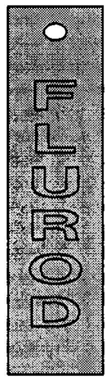
2. GROUND LINE TREATED



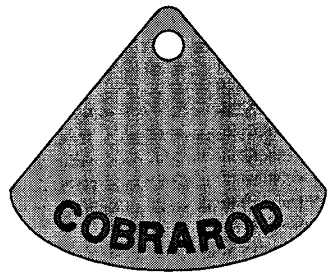
3. WOODFUME APPLIED



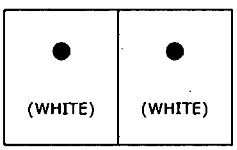
4. INTERNALLY TREATED



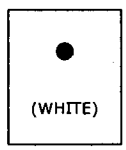
5. FLUROD INSERTED IN BORE HOLES



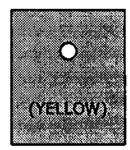
6. COBRAROD INSERTED IN BORE HOLES.



7. REJECT P1 POLE - TWO WHITE TAGS. PRIORITY REPLACEMENT.



8. REJECT P2 POLE - ONE WHITE TAG. REPLACEMENT ONLY. PRIORITY DETERMINED BASED ON CONDITION.



9. REINFORCEMENT TAG - ONE **YELLOW** TAG. POLE IS CANDIDATE FOR REINFORCEMENT.

NOTES:

1. DO NOT CLIMB REJECT P1 OR P2 POLES.
2. ALL OF THE INSPECTION TAGS SHOWN ABOVE SHOULD BE ALUMINUM.
3. INSPECTION TAGS 1, 2, 3, 4, 5 AND 6 CAN BE COMBINED TO INDICATE MULTIPLE TREATMENTS AND/OR INSPECTION PROCEDURES PERFORMED DURING ONE INSTANCE.
4. TAGS 7, 8 AND 9 ARE PAINTED THE COLOR INDICATED INSIDE THE TAG ABOVE.
5. REJECT TAGS 7, 8 AND 9 SHOULD BE LOCATED CENTERED ON EXISTING POLE, JUST BELOW LOCID NUMBER (POLE LABEL).

3				
2				
1				
0	10/5/12	CECCONI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

POLE INSPECTION TAGS (O&M)

Duke Energy

FLA | DWG. 02.08-04

REVISED		BY	CK'D	APPR.
3				
2	11/8/12	KATIGBAK	DANNA	ADCOCK
1	6/10/11	CECCONI	BURLISON	ELKINS
0	11/19/10	CECCONI	GUINN	ELKINS

SECTION 3 - PRIMARY CONSTRUCTION OVERHEAD

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Duke Energy®

FLA DWG. 03.00-00A

03.11 CROSS-ARM/ RURAL CONSTRUCTION

03.12 VERTICAL CONSTRUCTION

03.14 DOUBLE CIRCUIT CONSTRUCTION

03.16 SLACK SPAN CONSTRUCTION

03.18 TAPS

3 4/4/13	KATIGBAK	DANNA	ADCOCK
2 11/8/12	KATIGBAK	DANNA	ELKINS
1 12/2/11	CECCONI	GUINN	ELKINS
0 11/19/10	CECCONI	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

SECTION 3 - PRIMARY CONSTRUCTION OVERHEAD

TABLE OF CONTENTS

DUKE ENERGY.

FLA DWG. 03.00-00B

STANDARD PRIMARY CONSTRUCTION:

SPECIFICATIONS AS OUTLINED IN THIS SECTION ARE CONSIDERED TO BE THE PREFERRED CONSTRUCTION. THE LOCATION OF HARDWARE IS POSITIONED TO BE THE BEST FOR OVERALL APPLICATION. ALTERNATE CONSTRUCTION SHOULD BE CONSIDERED ONLY WHEN ABSOLUTELY NECESSARY. FRAME POLES WITH HARDWARE BEFORE ERECTING WHENEVER POSSIBLE.

VERTICAL PHASE OVER PHASE IS THE STANDARD CONSTRUCTION WITH HORIZONTAL AVAILABLE WHERE ROW IS NOT A FACTOR.

VERTICAL PHASE OVER PHASE SPACING IN THE SPAN:

THE STANDARD PHASE OVER PHASE SPACING AT THE POLE SHALL BE 42" FOR 25KV AND 36" FOR 12KV. THESE VALUES ARE INCREASED ON SOME SPECIFICATIONS AS NOTED TO ACCOMMODATE EQUIPMENT.

NEUTRALS:

1. NEUTRALS SHALL BE MULTI-GROUNDED AND IN A POSITION ON THE POLE COMMON TO BOTH THE PRIMARY AND SECONDARY SYSTEMS, EXCEPT FOR OVERHEAD GROUND WIRE CONSTRUCTION.

CONDUCTORS:

1. OVERHEAD PRIMARY CONDUCTORS WILL BE BARE ON ALL CIRCUITS UNLESS SPECIFIED BY ENGINEERING FOR SPECIAL PURPOSES.
2. PLACE CONDUCTORS ON THE INSULATORS SO THAT THE WIRE TENSION HOLDS IT AGAINST THE INSULATOR (EXCEPT FOR CLAMP TYPE). FACTORY TIES SHALL BE USED WITH THE CONDUCTORS COMPLETELY FREE FROM CONDUCTOR INSULATION UNDER THE TIE.
3. CONDUCTORS MUST BE ACCURATELY SAGGED ACCORDING TO THE CORRECT SPAN LENGTH TABLE TAKING INTO CONSIDERATION THE PREVAILING TEMPERATURE OF THE CONDUCTOR.
4. WHEN SPLICING OR CONNECTING CONDUCTORS, BE SURE TO USE THE PROPER CONNECTOR FOR THE JOB AND ADEQUATELY PREPARE THE WIRE AND CONNECTOR TO ENSURE A SOLID CONNECTION.
5. WHEN COVERED RISER WIRE IS SUPPORTED BY A PORCELAIN INSULATOR, THE INSULATION SHOULD BE REMOVED AT THE INSULATOR AND TIED WITH BARE TIE WIRE.

CUTOUTS:

ARRANGE CUTOUTS SO THAT THE DISCHARGE FROM THE BLOWN FUSE WILL NOT BE DIRECTED TOWARD THE OPERATOR. ENSURE THAT THE FUSE HOLDER IS CLEAR OF ANY ENERGIZED EQUIPMENT WHEN IN THE OPEN POSITION AND REMOVABLE WITHOUT CONTACT TO ANY ENERGIZED CIRCUIT.

GUYING:

GUYING ATTACHMENTS SHOWN ON DRAWINGS ARE TO INDICATE NORMAL POSITIONS WHEN GUYING IS NECESSARY. WHEN THERE IS A DOUBT AS TO THE EXACT LOCATION OF A GUY IT SHOULD BE SPECIFIED BY THE ENGINEER.

ALL GUYS ABOVE THE NEUTRAL MUST HAVE GUY INSULATOR(S) (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST ENERGIZED COMPONENT BY 24".

PRIMARY TO NEUTRAL STATEMENT

72" NEUTRAL SPACING IS PREFERRED TO ACCOMMODATE MAINTENANCE AND SHOULD BE OBTAINED ON NEW CONSTRUCTION OR UPGRADE INVOLVING POLE REPLACEMENT. ON EXISTING POLES WITH 60" NEUTRAL SPACING, THE SPACING NEED NOT BE INCREASED TO 72" WHEN ADDING A TAP LINE IF 72" SPACING CANNOT BE OBTAINED WITHOUT REPLACING THE POLE OR CAUSING CONFLICT WITH COMMUNICATION CABLES.

3				
2				
1	2/14/11	BURLISON	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PRIMARY CONSTRUCTION

Duke Energy®

FLA DWG. 03.00-02

GRADE OF CONSTRUCTION:

THE NORMAL CONSTRUCTION GRADE FOR PROGRESS ENERGY DISTRIBUTION LINE DESIGN IS NESC GRADE C. HOWEVER, SUPPORTS AND STRUCTURES FOR PORTION OF LINES CROSSING OVER RAILROAD TRACKS AND LIMITED-ACCESS HIGHWAYS MUST BE BUILT TO NESC GRADE B. UNLESS OTHERWISE NOTED, THE DRAWINGS GIVE DETAILS FOR GRADE C CONSTRUCTION. FOR SPECIFIC RAILROAD CROSSING DETAILS, SEE DWG. 03.12-17.

CONSTRUCTION REQUIREMENTS FOR GRADE B:

GENERALLY, STANDARD SPECIFICATIONS FOR LINE SUPPORTS MAY BE USED FOR GRADE B APPLICATIONS PROVIDED THE FOLLOWING MODIFICATIONS ARE MADE:

1. THE STRUCTURES AND SUPPORTS ON EACH END OF THE SECTION REQUIRED TO MEET GRADE B MUST BE ABLE TO WITHSTAND BREAKAGE OF A CONDUCTOR ON THE GRADE C SIDE WHEN THERE ARE 8 OR LESS CONDUCTORS. THE CONDUCTOR SELECTED SHOULD BE THE ONE THE CAUSES THE MAXIMUM STRESS IN THE POLE. GENERALLY, THIS REQUIREMENT CAN BE MET BY DOUBLE DEADENDING THE CONDUCTOR AT THESE STRUCTURES AND GUYING THE TOP MOST PRIMARY CONDUCTOR.
2. CROSSARM CONSTRUCTION - USE DOUBLE WOOD ARMS AND PINS.
3. ON VERTICAL TANGENT CONSTRUCTION, USE 35KV HORIZONTAL POST INSULATORS.
4. REFER TO ENGINEERING MANUAL FOR PROPER POLE SIZING AND SECTION 02 OF THE CONSTRUCTION SPECIFICATIONS FOR PROPER GUYING. SIDE GUYING MAY BE USED TO PROVIDE REQUIRED STRENGTH OF STRUCTURES.

WHERE POSSIBLE, UTILIZE POLEFOREMAN TO EVALUATE STRUCTURES IN THE GRADE B SECTION OF LINE. IF THERE ARE ANY QUESTIONS, CONTACT DISTRIBUTION STANDARDS.

THERE ARE ANY QUESTIONS, CONTACT DISTRIBUTION STANDARDS.

TRANSMISSION ENCROACHMENTS

DISTRIBUTION UNDERBUILT ON TRANSMISSION LINES MUST BE APPROVED BY TRANSMISSION THROUGH THE DOCUMENTED PROCESS DESCRIBED IN THE DISTRIBUTION ENGINEERING MANUAL. THIS PROCESS APPLIES ANY TIME NEW DISTRIBUTION LINES ARE TO BE BUILT ON TRANSMISSION RIGHT OF WAY, AS WELL AS IF ANY CHANGES OR UPGRADES ARE TO BE MADE TO EXISTING ENCROACHMENTS. PLEASE REFER TO THE DISTRIBUTION ENGINEERING MANUAL - TRANSMISSION ENCROACHMENT PROCESS SECTION FOR FURTHER DETAILS.

THE PRIMARY CONCERN OF UNDERBUILT DISTRIBUTION IS SUFFICIENT BIL. TO OBTAIN PROPER BIL, UTILIZE THE FOLLOWING:

1. FOR HORIZONTAL CONSTRUCTION, USE 10' WOOD CROSSARMS.
2. FOR VERTICAL CONSTRUCTION ON CONCRETE, STEEL OR WOOD POLES, USE ONE OF THE FOLLOWING:
   a. 35 KV INSULATORS ON 21" FIBERGLASS STANDOFF BRACKET. USE CLAMP TOP INSULATORS FOR ANGLES 5 - 30 DEGREES.
   b. 35 KV INSULATORS ON 31" FIBERGLASS STANDOFF BRACKET
   c. DEADENDS SHOULD BE TWO POLY DEADENDS CONNECTED IN SERIES ON STEEL AND CONCRETE POLES. ON WOOD POLES, ONE POLY DEADEND IS SUFFICIENT.
3. REFER TO DWG. 02.02-07 FOR BONDING AND GROUNDING ON STEEL AND CONCRETE POLES.
4. THE PREFERRED METHOD FOR ATTACHING HARDWARE AND INSULATORS TO UNDERBUILT STRUCTURES IS WITH THROUGH BOLTS IN PREDRILLED HOLES. WHEN HOLES ARE NOT PROVIDED, FIELD DRILLING IS STILL PREFERRED FOR AT LEAST THE TOP HOLE OF A TWO-HOLE BRACKET. THE BOTTOM HOLE MAY BE BANDED WITH A SINGLE STAINLESS STEEL BAND TO HOLD THE BRACKET IN PLACE. FIELD DRILLING REQUIRES PERMISSION FROM TRANSMISSION. IF FIELD DRILLING IN NOT ALLOWED OR IS NOT PRACTICAL, CHAIN BANDS AND BRACKETS MAY BE USED AS SHOWN ON DWG. 03.06-35 FOR CONDUCTOR SUPPORTS. WHEN STAINLESS STEEL FLAT BANDS ARE USED TO MOUNT CONDUCTOR SUPPORTS, THE BAND SHOULD BE DOUBLE WRAPPED ON BOTH THE TOP AND BOTTOM OF THE SUPPORT.
5. FOR A LISTING OF THE CATALOG NUMBERS OF THE VARIOUS BOLT SIZES, SEE BOLT CHART ON DWG. 03.14-22.

LOCKWASHERS:

BOLTS UNDER TENSION, SUCH AS DEADENDS AND GUYS, REQUIRE NO LOCKWASHERS.

WHEN BOLTS ARE NOT UNDER TENSION, SUCH AS INSULATORS, BRACKETS, TRANSFORMERS, AREA LIGHTS, ETC., USE LOCKWASHERS AS FOLLOWS:

1. DOUBLE LOCKWASHERS ON WOOD POLES.
2. SINGLE LOCKWASHERS ON STEEL AND CONCRETE POLES.

COASTAL CONSTRUCTION:

USED IN AREAS OF HIGH AIRBORNE CONTAMINATION (i.e. BEACHES, PAPER PLANTS, PHOSPHATE PROCESSING PLANTS, ETC.) AS IDENTIFIED BY ENGINEERING. SEE SECTION 12 FOR CONSTRUCTION SPECIFICATIONS AND AVAILABLE MATERIAL.

3				
2	8/9/12	BURLISON	BURLISON	ELKINS
1	4/23/12	WOJNAROWSKI	BURLISON	ELKINS
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PRIMARY CONSTRUCTION

Progress Energy

FLA DWG. 03.00-04

TRANSITION FROM HORIZONTAL TO VERTICAL CONSTRUCTION IS NORMALLY MADE MID-SPAN.

FOR CONSTRUCTION REQUIRING ANGLES OF 6° TO 59°, ARMOUR RODS ARE REQUIRED FOR ACSR, AAC AND AAAC TYPE CONDUCTORS. ONCE USED, THESE ARMOUR RODS SHOULD NOT BE RETURNED TO STORES.

POLE GAINS ARE REQUIRED FOR POST INSULATOR INSTALLATION ON WOOD POLES WHEN THE POLE DOES NOT HAVE SLAB GAINS OR WHEN THE CONDUCTOR IS 336.4 KCM OR LARGER. GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS (THIS INCLUDES SLACK SPANS).

FOR POST INSULATOR INSTALLATION ON WOOD POLES, USE A SPRING WASHER AND A 3" CURVED WASHER.

WHEN INSTALLING STAND-OFF BRACKETS ON WOOD POLES, USE A 3" CURVED WASHER FOR WIRE SIZES ABOVE 1/0 AAAC AND 2-1/4" FLAT WASHERS FOR WIRE SIZES 1/0 AAAC AND SMALLER.

CONCRETE POLE CONSTRUCTION:

1. USE 20 OR 30 INCH FIBERGLASS OFFSET BRACKETS.
2. USE 35KV POST INSULATORS.
3. USE FLAT WASHERS IN PLACE OF CURVED WASHERS.
4. USE SINGLE COIL LOCK WASHERS.
5. WHEN INSTALLING STAND-OFF BRACKETS ON CONCRETE POLES, USE 2-1/4" FLAT WASHERS.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/28/11	GUINN	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

PRIMARY CONSTRUCTION -

PROGRESS ENERGY FLORIDA SPECIAL NOTES

Progress Energy

FLA

DWG. 03.00-06

PIN INSULATORS AND PIN INSULATOR SUPPORTS

SUPPORTS FOR PIN INSULATORS (E.G., SHOULDER PINS, POLE-TOP PINS, PIERCE PINS, FIBERGLASS BRACKETS) MAY HAVE LEAD THREADS OR THE STANDARD COMPOSITE NYLON.

PINS WITH NYLON AND LEAD THREADS

THE PROPER WAY TO INSTALL AN INSULATOR ON A POLE-TOP PIN WITH COMPOSITE NYLON THREADS IS AS FOLLOWS:

CAREFULLY THREAD THE INSULATOR INTO THE PIN, KEEPING THE PROPER VERTICAL ALIGNMENT, ENSURING THAT THE INSULATOR SPINS AS FREELY AS POSSIBLE ON THE PIN. SPIN THE INSULATOR CLOCKWISE ONTO THE PIN TO 'SNUG' (THAT POINT WHERE THE INSULATOR WILL NO LONGER SPIN FREELY). FROM THE SNUG POSITION, FURTHER TIGHTEN THE INSULATOR (NOT MORE THAN 1/2 A TURN) TO THE CONDUCTOR ALIGNMENT.

LEAD THREAD NOTES (O&M)

1. INSULATOR INSTALLATION

LEAD IS A SOFTER MATERIAL THAN THE PORCELAIN OF THE PIN INSULATORS. THE PORCELAIN THREADS WILL CUT THE LEAD THREADS TO THE PORCELAIN THREAD'S FORM. TAKE CARE NOT TO CROSS-THREAD THE INSULATOR ONTO THE PIN; OTHERWISE, SUFFICIENT INSULATOR-PIN ENGAGEMENT NECESSARY FOR PROPER SUPPORT WILL NOT BE OBTAINED.

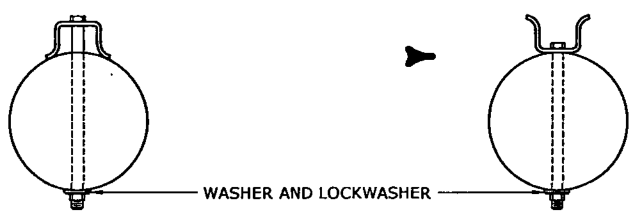
IF TOO MUCH FORCE IS EXERTED IN TURNING THE INSULATOR ON THE PIN, THE INSIDE OF THE LEAD THREAD CAP CAN SHEAR FROM ITS STEEL BASE, ALLOWING THE INSULATOR AND LEAD THREAD CAP TO SPIN FREELY ON THE PIN. THE INSULATOR WILL THEN HAVE TO BE BROKEN TO BE REMOVED. IF THIS OCCURS, NEITHER THE PIN, BRACKET, OR INSULATOR WILL BE RE-USABLE.

2. HANDLING

LEAD IS RELATIVELY SOFT, SO CARE MUST BE TAKEN TO INSURE THAT THE THREADS ARE NOT DEFORMED PRIOR TO INSTALLATION. REMOVE THE THREAD'S PROTECTIVE CARDBOARD COVERING AND INSPECT THREAD CONDITION PRIOR TO THE INSTALLATION ON THE POLE, AND THEN REPLACE THE CARDBOARD COVERING AGAIN UNTIL AFTER THE PIN OR BRACKET IS INSTALLED ON THE POLE OR ARM IS READY TO ACCEPT THE INSULATOR.

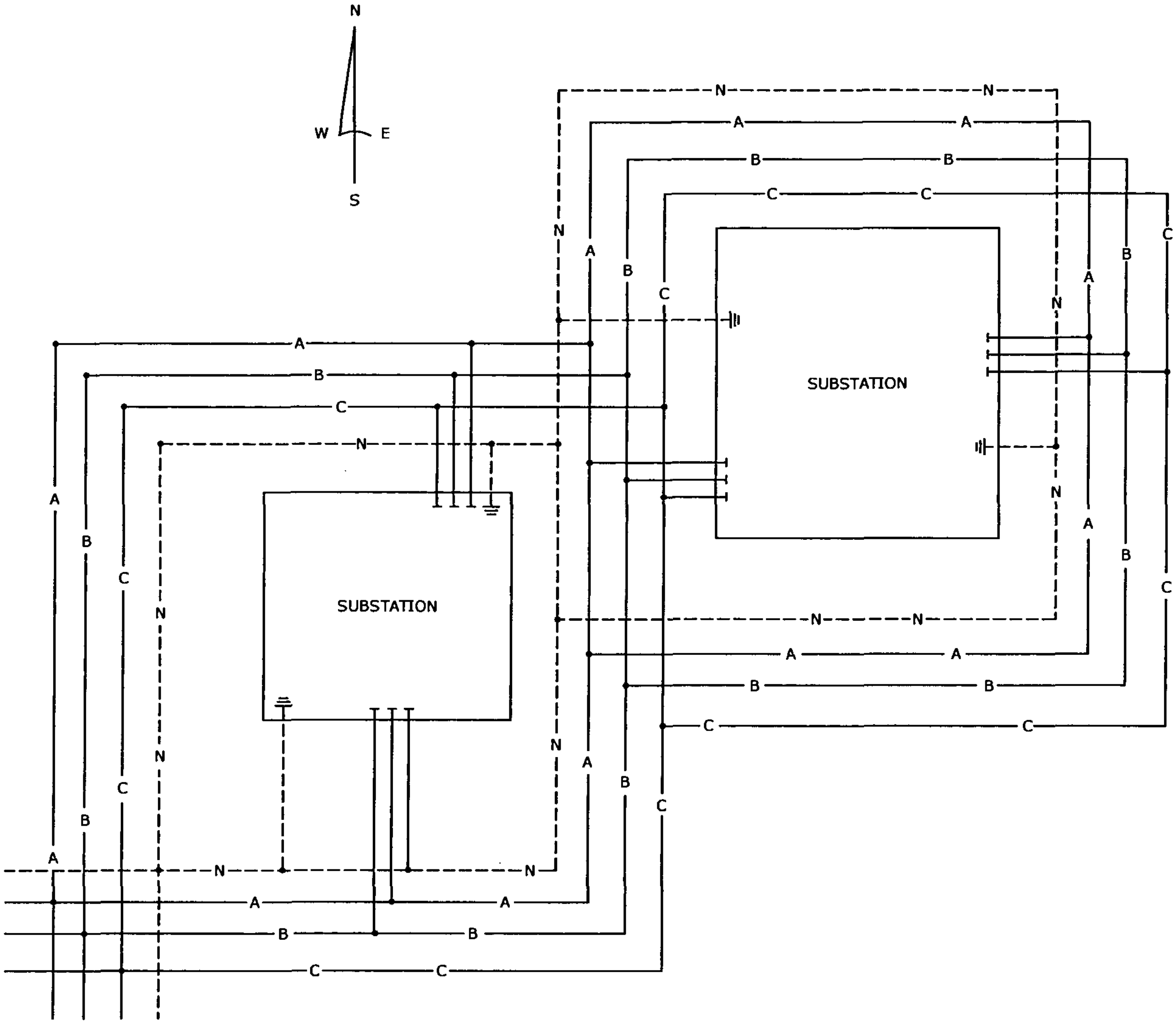
POLE TOP PIN ORIENTATION

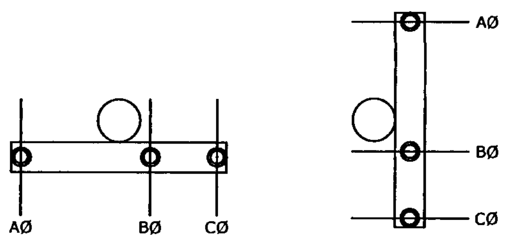
POLE TOP PINS CAN BE INSTALLED ON POLES WITH EITHER ORIENTATION SHOWN BELOW. ORIENTATION 'A' IS PREFERRED.



ORIENTATION 'A'   ORIENTATION 'B'

3					PIN INSULATOR INSTALLATION	Progress Energy	
2							
1	8/15/11	BURLISON	BURLISON	ELKINS		PGN	DWG. 03.00-20
0	6/1/10	CECCONI	GUINN	ELKINS			
REVISED		BY	CK'D	APPR.			





FACING NORTH

FACING WEST

HORIZONTAL CONSTRUCTION
TOP VIEWS

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STANDARD DISTRIBUTION PHASING
FOR ALL AREAS EXCEPT ST. PETERSBURG

Duke Energy

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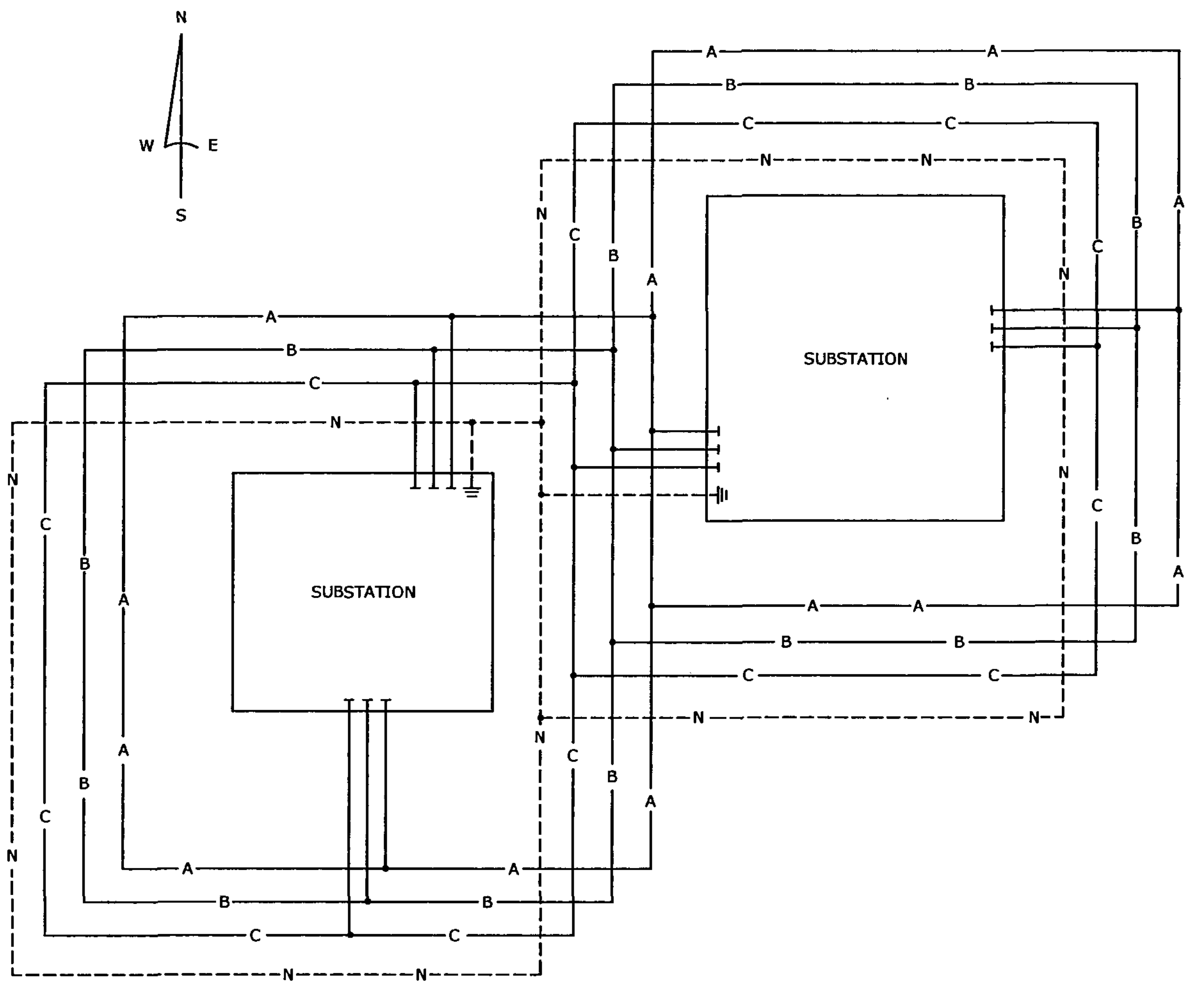
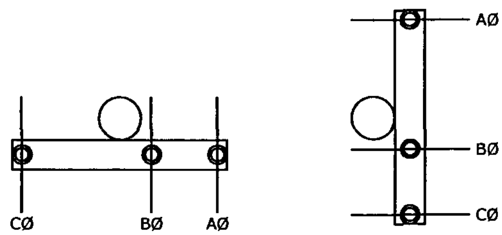
DWG. 03.01-04A

ST. PETERSBURG AREA





FACING NORTH

FACING EAST

HORIZONTAL CONSTRUCTION
TOP VIEWS

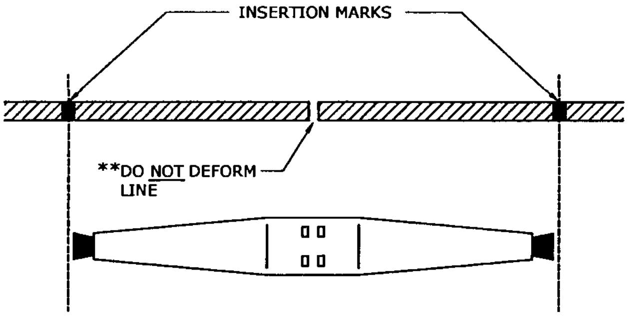
3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.	

STANDARD DISTRIBUTION PHASING
FOR ST. PETERSBURG AREA ONLY

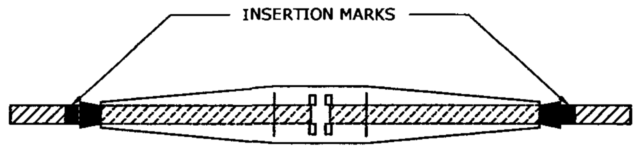
Duke Energy®

FLA

DWG. 03.01-04B



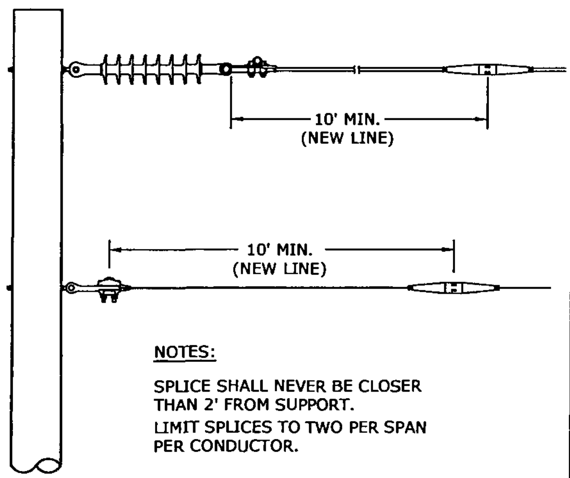
**WIRE BRUSH CONDUCTOR AND CONDUCTOR ENDS CLEAN, BRIGHT AND FREE FROM BURRS. SPLICE MUST ALSO BE CLEAN, FREE FROM DIRT AND JAWS FREE IN HOUSING. MEASURE AND MARK CONDUCTOR FOR INSERTION FROM KNURL TO END OF FUNNEL GUIDE. MARK WITH TAPE OR MARKER.



INSERT CONDUCTORS TO FULL DEPTH: PUSH SLOWLY AND DO NOT TWIST. NEXT, PULL CONDUCTORS TO MAKE SURE JAWS FIRMLY GRIP. CHECK INITIAL GRIP WITH MOMENTARY PULL ON CONDUCTOR PRIOR TO APPLYING LINE TENSION.

NOTES:

1. NO AUTOMATIC SPLICE IS TO BE USED UNLESS CONDUCTOR IS UNDER FULL TENSION.
2. USE CABLE CUTTER OR BOLT CUTTERS TO MAKE A CLEAN WIRE CUT. THE OBJECT IS TO AVOID FLATTENING THE ENDS OF THE CONDUCTOR WHICH CAUSES PARTIAL INSERTION AND FAILURE.
3. SIDE CUTTERS SHOULD NOT BE USED ON SMALLER AAAC OR ACSR CONDUCTORS.



NOTES:

SPLICE SHALL NEVER BE CLOSER THAN 2' FROM SUPPORT.

LIMIT SPLICES TO TWO PER SPAN PER CONDUCTOR.

CONDUCTOR	COLOR CODE	CATALOG NUMBER
	ALUMINUM	
#4 - #2 AAAC, AAC, ACSR	ORANGE/RED	142423
#1/0 AAAC, AAC ACSR	YELLOW	142426
336.4 ACSR (18/1)	GREEN	11144805
	COPPER	
#6 SOLID	-	11143500
#4 SOLID	-	11143609
#2 SOLID	-	9220109732
1/0 STRANDED	-	6714
252 AWA MESSENGER, 1/0	-	9220106228

REVISED	DATE	BY	CK'D	APPR.
3				
2				
1	10/14/11	COX	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

AUTOMATIC SPLICE INSTALLATION

Progress Energy

FLA

DWG. 03.02-01

AUTOMATIC FULL TENSION SPLICES & DEADENDS

FOR AAAC CONDUCTORS ONLY:
CN 142423 - #4 (7) STR. AAAC
CN 142426 - 1/0 (7) STR. AAAC

NOTES:

1. DO NOT INSTALL ON ACSR CONDUCTOR.
2. DO NOT INSTALL AUTOMATIC SLEEVES OR DEADENDS IN SLACK SPAN CONSTRUCTION.
3. DO NOT REUSE AUTOMATIC SLEEVES.
4. FOR #4 (6-1) ACSR, USE SLEEVE CN 142411.
5. FOR 1/0 (6-1) ACSR, USE SLEEVE CN 142414.

INSTALLATION STEPS

SELECT THE PROPER SLEEVE FOR THE CONDUCTOR.

MAKE CERTAIN THE GUIDE CUPS ARE IN PLACE AND FREE OF DIRT.

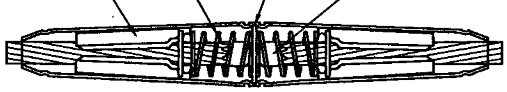
MEASURE AND MARK CONDUCTOR FOR FULL INSERTION. WIRE BRUSH AND SQUARE CUT CONDUCTOR.

REMOVE ANY BURRS. KEEP STRANDS IN LAY AND CONDUCTOR STRAIGHT.

INSERT CONDUCTOR SMOOTHLY TO CENTER STOP. (GUIDE CUP) MUST PASS COMPLETELY THROUGH THE JAWS, BEFORE THE JAWS WILL CLAMP DOWN ON THE CONDUCTOR. DO NOT TWIST CONDUCTOR.

AFTER FULL INSERTION, A FIRM PULL WILL SET THE JAWS. WITH PARTIAL TENSION APPLIED, TAP SLEEVE LIGHTLY WITH HAND TOOL.

GUIDE CUP MUST PASS COMPLETELY THROUGH THE JAWS BEFORE THE JAWS WILL CLAMP DOWN ON THE CONDUCTOR.



JUMPERS: GENERAL

JUMPER CLAMPS ARE RATED FOR 400 AMPS CONTINUOUS MAXIMUM RATING. THIS RATING IS DEPENDENT ON THE RATING OF THE JUMPER CABLES USED WITH THE CLAMPS.

15 KV INSULATED JUMPERS*

SIZE A.W.G.	RATING AMPS
#2	192
1/0	258
2/0	298
4/0	400

PRIMARY LOAD PICKUP JUMPER*

JUMPER HEAD IS RATED AT 200 AMPS CONTINUOUS REGARDLESS OF JUMPER WIRE SIZE. THE LOAD PICKUP JUMPER IS INTENDED FOR USE AS A TEMPORARY JUMPER TO ESTABLISH A CIRCUIT BETWEEN ENERGIZED AND NON-ENERGIZED SECTIONS OF A LINE, AND NOT TO BE USED BETWEEN DIFFERENT PHASES, OR AS A TEMPORARY GROUND.

CAUTION:

*TO AVOID POSSIBLE CABLE DAMAGE AND HIGH LEAKAGE CURRENTS, JUMPER CABLES MUST BE POSITIONED AWAY FROM GROUNDED SURFACES OR ENERGIZED CONDUCTORS OTHER THAN THOSE TO WHICH THEY ARE CONNECTED.

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

AUTOMATIC FULL TENSION SPLICES,
DEADENDS AND JUMPERS

Duke Energy

FLA DWG. 03.02-02

GENERAL:

ALL APPROVED CONNECTORS, COMPRESSION OR BOLTED, SHOULD PERFORM IN A SATISFACTORY MANNER PROVIDED THE CORRECT SIZE IS SELECTED FOR THE APPLICATION AND IS INSTALLED CORRECTLY. THE QUALITY OF THE ELECTRICAL CONNECTION IS GREATLY AFFECTED BY THE SURFACE CONDITION OF THE CONDUCTORS CONTACT AREA TO BE JOINED.

SELECTING A CONNECTOR:

THERE ARE THREE CONSIDERATIONS IN SELECTING A CONNECTOR OR SLEEVE:

1. OBTAIN THE CONNECTOR WITH THE PROPER WIRE OR CABLE RANGE. THE RANGE IS MARKED ON ALL CONNECTORS AND SPLICES.

2. USE ALUMINUM CONNECTORS ON "ALUMINUM TO ALUMINUM" AND "ALUMINUM TO COPPER". USE COPPER OR BRONZE CONNECTORS ON "COPPER TO COPPER".

WHEN COPPER CONNECTORS ARE USED ON ALUMINUM CONDUCTORS, THE INITIAL PRESSURE IS MAINTAINED ONLY AS LONG AS THE TEMPERATURE REMAINS CONSTANT. WHEN THE TEMPERATURE RISES, THE ALUMINUM CONDUCTOR EXPANDS MORE THAN THE COPPER CONNECTOR THAT SURROUNDS IT. AS A RESULT, THE CONNECTOR BECOMES TOO SMALL FOR THE CONDUCTOR, AND DUE TO THE TREMENDOUS PRESSURE, THE ALUMINUM EXTRUDES OUT OF THE CONNECTOR. WHEN THE JOINT COOLS, THE REVERSE ACTION TAKES PLACE. THE ALUMINUM CONDUCTOR CONTRACTS AT A GREATER RATE THAN THE COPPER CONNECTOR, AND THE COPPER CONNECTOR CANNOT SHRINK ENOUGH TO MAKE A GOOD TIGHT CONNECTION ON THE REDUCED DIAMETER ON THE CONDUCTOR. THIS CYCLE, WHEN REPEATED MANY TIMES, RESULTS IN A LOOSE CONNECTION. THE CONNECTOR HEATS UP AND EVENTUALLY FAILS.

3. USE FULL TENSION SLEEVES FOR ALL CONDUCTORS INSTALLED AS LINE CONDUCTOR UNDER SAG TENSION REQUIREMENTS. THIS INCLUDES THE NEUTRAL OF TRIPLEX THAT IS INSTALLED BETWEEN LINE POLES AT LINE TENSION. FOR HAND TENSION APPLICATIONS SUCH AS SERVICE AND SECONDARY TRIPLEX, USE PARTIAL TENSION SLEEVES. SEE DWG. 03.02-10 FOR ADDITIONAL INFORMATION ON THE APPLICATION OF TENSION, PARTIAL AND NON-TENSION SLEEVES.

COMPRESSION TOOL AND DIE:

THE EFFICIENCY OF THE CONNECTOR DEPENDS ON THE PERMANENT "SET" WHICH HAS BEEN INTRODUCED. IF AN IMPROPER DIE IS USED, OR IF THE TOOL IS NOT PROPERLY ADJUSTED, THE CONNECTOR COULD BE OVER OR UNDER DEFORMED RESULTING IN AN INEFFECTIVE JOINT.

TYPES OF DIES:
1. ROUND OR CIRCULAR DIES REQUIRE UNCRIMPED SPACE BETWEEN EACH CRIMP. CRIMPS SHOULD BE APPROXIMATELY 1/16" APART.
2. HEXAGONAL DIES REQUIRE CRIMPS TO BE OVERLAPPED

MARKINGS ON CONNECTORS:
1. CONNECTORS AND SLEEVES ARE STAMPED WITH KNURL MARKS. WHEN CIRCULAR DIES ARE USED, ONE CRIMP SHOULD BE PLACED BETWEEN EACH SET OF KNURL MARKS.
2. DIE AND WIRE SIZES ARE ALSO STAMPED ON EACH CONNECTOR.

WIRE BRUSHING:

THE INVISIBLE ALUMINUM OXIDE FILM THAT FORMS ON ALUMINUM AND THE HARD COPPER OXIDE SCALE THAT FORMS ON COPPER ACT AS INSULATORS. THEY TEND TO INSULATE THE CONDUCTOR STRAND FROM THE CONDUCTOR BODY AND INSULATE THE INDIVIDUAL STRANDS FROM EACH OTHER. THIS OXIDE FILM MUST BE REMOVED BY WIRE BRUSHING THE CONTACT AREA UNTIL THERE IS A FRESH BRIGHT COLOR. A COATING OF INHIBITOR MUST BE APPLIED IMMEDIATELY TO REDUCE THE FORMATION OF ADDITIONAL OXIDES.

TRANSFORMER BLOCKS FOR THREE-PHASE TRANSFORMERS ARE TIN PLATED. TIN PLATING ELIMINATES THE FORMATION OF ALUMINUM OXIDE ON THE BLOCKS. **DO NOT** WIRE BRUSH TIN PLATED BLOCKS OR OTHER TIN PLATED CONNECTORS THAT YOU MAY ENCOUNTER.

3				
2				
1	9/28/11	ROBESON	BURLISON	ELKINS
0	5/21/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION GUIDE FOR CONNECTORS

Progress Energy

PGN DWG. 03.02-04

INHIBITOR

INHIBITORS ARE USED AFTER WIRE BRUSHING. THE APPLICATION OF THE INHIBITOR AND THE NUMBER OF CRIMPS PROPERLY INSTALLED WILL SEAL THE ELECTRICAL CONNECTIONS FROM OXYGEN AND MOISTURE AND STOP THE FORMATION OF OXIDES.

ALUMINUM TO COPPER JOINTS MUST BE SEALED FROM MOISTURE PENETRATION TO PREVENT THE COPPER OXIDES FROM ATTACKING THE ALUMINUM CONNECTOR. THE SEALANT IS THE INHIBITOR PREPACKED IN THE CONNECTOR. ANY CONNECTOR THAT DOES NOT HAVE ENOUGH INHIBITOR TO COMPLETELY COVER THE CONDUCTOR SHOULD HAVE INHIBITOR ADDED WHEN INSTALLED.

WHEN INSTALLING AN ALUMINUM TO COPPER CONNECTOR, ALWAYS PLACE THE ALUMINUM WIRE ABOVE THE COPPER WIRE. THIS REDUCES THE AMOUNT OF CORROSIVE COPPER OXIDES THAT WILL RUN DOWN THE ALUMINUM CONNECTOR. THE ALUMINUM OXIDE WILL NOT CORRODE THE COPPER.

TYPES OF INHIBITORS:
OXIDE INHIBITING COMPOUNDS TYPICALLY CONSIST OF CARRIER GREASE WITH CONDUCTIVE PARTICLES, SUCH AS ZINC, IN SUSPENSION. THE CARRIER GREASE PROTECTS THE ALUMINUM FROM OXIDE FORMATION BY SEALING THE SURFACE FROM THE ATMOSPHERE, WHILE THE ZINC PARTICLES PENETRATE THE OXIDE LAYER ON THE CONDUCTOR AND CONNECTOR. THE CARRIER MAY EITHER BE PETROLEUM OR SYNTHETIC BASE, BUT THE MOST COMMON IS SYNTHETIC DUE TO ITS NOT HAVING AN EFFECT ON RUBBER INSULATING GLOVES. A FEW COMPOUNDS DO NOT HAVE ZINC PARTICLES AND ARE PRIMARILY USED IN MECHANICAL CONNECTORS WHERE THERE IS CONCERN FOR THE PARTICLES GALLING THE THREADS.

BESIDES THE BASIC JOINT COMPOUND DESCRIBED ABOVE, THERE IS A SECOND TYPE WHICH CONTAINS GRIT. THE PURPOSE OF THE GRIT IS TO INCREASE THE TENSILE PERFORMANCE OF THE CONNECTOR IN TENSION APPLICATIONS. OBVIOUSLY MOST OF THESE APPLICATIONS ARE OVERHEAD. EXTREME CARE MUST BE TAKEN WHEN USING THIS TYPE OF COMPOUND AROUND A PAD-TO-PAD APPLICATION. IF ANY OF THIS COMPOUND GETS BETWEEN THE PADS, IT CAN CAUSE FAILURE SINCE THE GRIT IS HARD AND NON-CONDUCTIVE, HOLDING THE SURFACES OF THE PADS APART.

CRIMPING:

INSTALLING THE PROPER NUMBER OF CRIMPS ON A CONNECTOR CANNOT BE OVER-EMPHASIZED. ON SLEEVES, ALL CRIMPS INDICATED ARE REQUIRED IN ORDER TO MEET THE RATED TENSION TEST AND ELECTRICAL TEST. ON "H" BLOCKS, ALL CRIMPS ARE NECESSARY IN ORDER TO PASS THE ELECTRICAL TEST AND TO PROVIDE AN EFFECTIVE MOISTURE SEAL ON THE CONNECTOR. THIS IS ESPECIALLY IMPORTANT IN AN ALUMINUM TO COPPER CONNECTION.

BARREL TYPE CONNECTORS ARE FILLED WITH INHIBITOR AND IT IS SOMETIMES NECESSARY TO TWIST THE CONNECTOR TO ALLOW EASIER AND FULL INSERTION OF THE CONDUCTOR INTO THE BARREL. IT IS SUGGESTED THAT THE CONDUCTOR BE MARKED TO THE DEPTH OF THE BARREL TO INSURE FULL INSERTION. ON LUG TYPE CONNECTORS WITH ONE OPEN END, BEGIN CRIMPING AT THE CLOSED END OF THE COMPRESSION BARREL AND WORK TOWARDS THE OPEN END. ON SLEEVE TYPE CONNECTORS WITH BOTH ENDS OPEN, BEGIN CRIMPING AT THE CENTER OF THE SLEEVE AND WORK OUT TO THE END. DO NOT LEAVE SPACES BETWEEN CRIMPS TO COME BACK AND CRIMP LATER. THIS CAUSES "COLD FLOW" WHICH ESSENTIALLY RELIEVES THE COMPRESSIVE FORCE ON THE ADJACENT CRIMPS. AFTER CRIMPING, "FLASHING" (METAL PROTRUSIONS) CAUSED BY THE COMPRESSION DIE IS SOMETIMES PRESENT ON THE CONNECTOR. THE FLASHING MUST BE FILED OFF SINCE IT COULD CUT THROUGH THE SPLICE OR CABLE INSULATION AND CAUSE A FAILURE.

ALUMINUM COMPRESSION CONNECTORS ON COPPER CONDUCTORS:

USE THE FOLLOWING PROCEDURE:

1. THOROUGHLY CLEAN BOTH CONDUCTORS BY WIRE BRUSHING TO REMOVE OXIDE AND CONTAMINATES.

2. USE THE PROPER SIZE ALUMINUM CONNECTOR. INSPECT THE COMPRESSION CONNECTOR ("SQUEEZE ON") TO BE SURE THAT A SUFFICIENT AMOUNT OF INHIBITOR IS IN EACH GROOVE TO THOROUGHLY COAT THE CONDUCTORS. IF THERE IS NOT A SUFFICIENT AMOUNT OF INHIBITOR, THEN ADD INHIBITOR AVAILABLE FROM THE GENERAL WAREHOUSE (CN 403108).

3. POSITION THE CONDUCTORS SO THAT THE ALUMINUM CONDUCTOR IS LOCATED ABOVE THE COPPER CONDUCTOR TO PREVENT COPPER SALTS FROM ACCUMULATING ON THE CONNECTOR.

4. USE THE PROPER TOOL AND DIE TO COMPRESS THE CONNECTOR, BEGINNING IN THE MIDDLE AND WORKING TO EACH END WITH THE CORRECT NUMBER OF CRIMPS.

NOTE: FOR ALUMINUM TO ALUMINUM CONNECTIONS AND OTHER DETAILS, SEE DWGS. 03.02-09A AND 03.02-09B.

3				
2				
1				
0	2/28/12	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION GUIDE FOR CONNECTORS

Progress Energy

FLA | DWG. 03.02-06

ALUMINUM TO ALUMINUM

1. PREPARE ALUMINUM CONTACT AREAS AND APPLY INHIBITOR COMPOUND. USE GENERAL PURPOSE INHIBITOR (CN 403108).

2. MAKE CONNECTION USING ALUMINUM BOLTS AND TWO FLAT ALUMINUM WASHERS FOR FLAT CONNECTIONS. SINCE ALL METALS USED IN THIS CONNECTION ARE OF THE SAME MATERIAL, NO SPRING OR LOCK WASHERS ARE TO BE USED; HOWEVER, THE BOLT MUST BE TORQUED TO RECOMMENDED VALUES. ALTERNATELY TIGHTEN AND TORQUE THE BOLTS TO RECOMMENDED TORQUE VALUE FOR THE GIVEN BOLT SIZE.

   CAUTION: DO NOT OVERTIGHTEN LUBRICATED BOLTS.

3. DO NOT REMOVE EXCESS COMPOUND THAT SQUEEZES OUT OF THE CONNECTION. IT HELPS KEEP OUT DIRT AND MOISTURE.

4. FOLLOW MANUFACTURER'S INSTRUCTIONS FOR CONNECTORS PREFILLED WITH INHIBITOR COMPOUND.

5. **CAUTION:** DO NOT REUSE ALUMINUM BOLTS. A BOLT THAT HAS BEEN TORQUED CANNOT BE DEPENDED UPON TO GIVE UNIFORM JOINT PRESSURE BECAUSE IT COULD HAVE BEEN DEFORMED (STRETCHED) AND WILL NOT HAVE THE SAME MECHANICAL PROPERTIES AS A NEW ONE.

RECOMMENDED TORQUE FOR ALUMINUM BOLTS		
BOLT SIZE	NON-LUBRICATED	LUBRICATED
5/16"	15 FT.-LBS.	10 FT.-LBS.
3/8"	20 FT.-LBS.	14 FT.-LBS.
1/2"	40 FT.-LBS.	25 FT.-LBS.
5/8"	55 FT.-LBS.	40 FT.-LBS.
3/4"	70 FT.-LBS.	60 FT.-LBS.

NOTE: USE VALUES LISTED IN THIS TABLE ONLY WHEN BOLT TORQUE IS NOT SPECIFIED BY CONNECTOR MANUFACTURER.

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ALUMINUM TO ALUMINUM FLAT CONNECTIONS

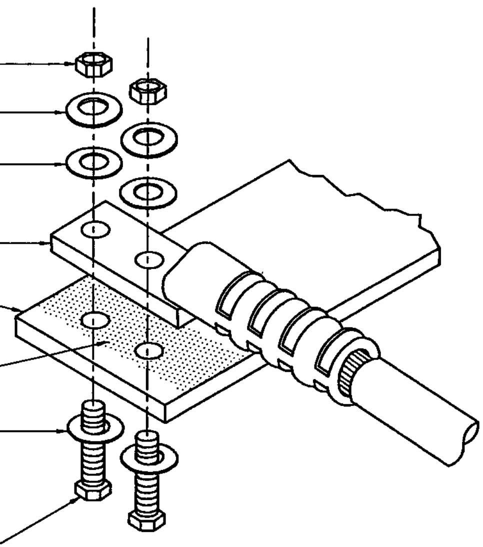
Duke Energy®

FLA DWG. 03.02-09A

ALUMINUM CONNECTIONS TO COPPER BUS ARE MADE WITH STAINLESS STEEL BOLTS, FLAT WASHERS AND BELLEVILLE WASHERS. BELLEVILLE WASHERS ARE NECESSARY TO COMPENSATE FOR THE DIFFERENCE IN EXPANSION AND CONTRACTION OF THE DISSIMILAR METALS. ALWAYS USE A FLAT STAINLESS STEEL WASHER UNDER A BELLEVILLE WASHER TO PREVENT DAMAGE TO THE UNDERLYING METAL.

INHIBITOR IS REQUIRED WHERE AN ALUMINUM TO COPPER JOINT IS MADE. USE GENERAL PURPOSE PURPOSE INHIBITOR (CN 403108).

TORQUE TO 40 FT LBS.



3				
2				
1	5/7/12	DANNA	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ALUMINUM TO COPPER FLAT CONNECTIONS

Progress Energy

FLA DWG. 03.02-09B

STANDARD PROCEDURES BULLETIN

THE FOLLOWING GUIDELINES APPLY TO THE USE OF FULL-TENSION, PARTIAL-TENSION, AND MINIMUM-TENSION SPLICES.

FULL TENSION - (95% RATED BREAKING STRENGTH)

AUTOMATIC SPLICES AND COPPER SLEEVES ARE FULL-TENSION SPLICES. THEY ARE FOR USE ON CONDUCTORS IN FULL-TENSION APPLICATIONS. AUTOMATIC SPLICES SHOULD ALWAYS BE GIVEN AN INITIAL "SET" WHEN INSTALLED. A FIRM PULL BY HAND IS CONSIDERED SUFFICIENT TO "SET" THE SPLICE. THE RATED STRENGTH OF A FULL-TENSION SPLICE IS 95% OF THE CONDUCTOR BREAKING STRENGTH.

AUTOMATIC SPLICES SHOULD NEVER BE CLOSER THAN 10' ON A NEW LINE OR 2' ON AN EXISTING LINE TO THE CONDUCTOR ATTACHMENT POINT. IF A BREAK OCCURS NEARER THE STRUCTURE THAN 2', A SUITABLE LENGTH OF CONDUCTOR SHOULD BE SPLICED IN TO MEET THIS REQUIREMENT. TEMPORARY EMERGENCY REPAIRS MAY BE MADE CLOSER TO THE STRUCTURE THAN 2'.

PARTIAL TENSION - (40% RATED BREAKING STRENGTH)

PARTIAL-TENSION SPLICES (SEMI-TENSION) ARE SLEEVES FOR USE WHEN SPLICING JUMPERS, SLACK SPANS OR TPX/QPX NEUTRALS IF THE TPQ/QPX IS PULLED TO HAND TENSION ONLY. IF TPX IS PULLED BETWEEN PRIMARY LINE POLES AT LINE TENSION, FULL TENSION SLEEVES ARE REQUIRED TO SPLICE THE NEUTRAL. PARTIAL-TENSION SPLICES MAY BE USED FOR REPAIRS OF SLACK SPANS. PARTIAL-TENSION SPLICES SHALL NOT BE USED IN FULL-TENSION APPLICATIONS. THE RATED STRENGTH OF A PARTIAL-TENSION SPLICE IS 40% OF THE CONDUCTOR BREAKING STRENGTH.

CARE SHOULD BE TAKEN TO REDUCE THE POSSIBILITY OF INSULATION ABRASION ON A TPX/QPX SPLICE. LEAVING ADDITIONAL SLACK IN THE PHASE CONDUCTORS AROUND THE SPLICE WILL HELP ALLEVIATE THIS PROBLEM.

MINIMUM TENSION - (5% RATED BREAKING STRENGTH)

MINIMUM-TENSION SPLICES ARE INSULINKS AND SQUEEZONS USED TO CONNECT TPX/QPX PHASE CONDUCTORS. THE RATED STRENGTH OF A MINIMUM-TENSION SPLICE IS 5% OF THE CONDUCTOR BREAKING STRENGTH.

DO NOT INSTALL SPLICES IN RAILROAD CROSSING SPANS OR IN SPANS ADJACENT TO CROSSING SPANS.

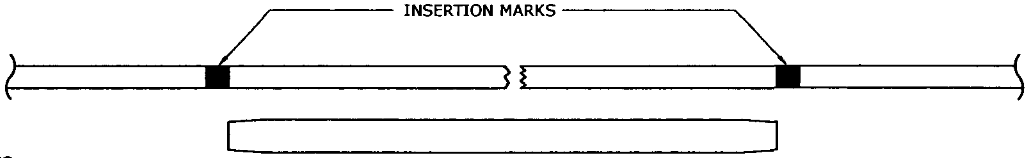
3				
2	9/29/11	ROBESON	BURLISON	ELKINS
1	4/13/11	ROBESON	BURLISON	ELKINS
0	5/21/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OVERHEAD CONDUCTOR SPLICE APPLICATION

Progress Energy

PGN DWG. 03.02-10

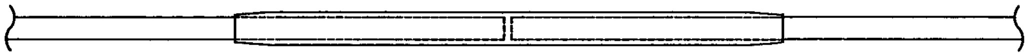
STEP 1



NOTES:

1. SLEEVES ARE MARKED TO INDICATE CONDUCTOR SIZE AND DIE SIZE. REFER TO ALUMINUM OR COPPER TABLE BELOW FOR SLEEVE CATALOG NUMBER.

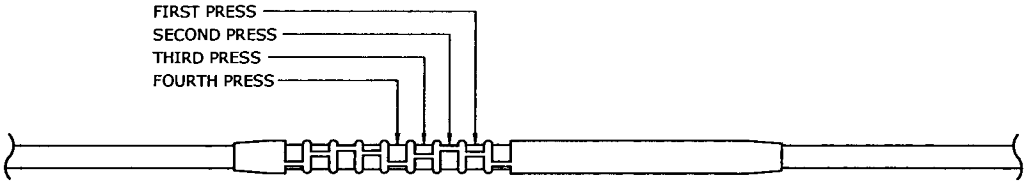
STEP 2



NOTES:

1. WIRE BRUSH CONDUCTOR. SLIP SLEEVE OVER CONDUCTOR UNTIL IT REACHES CENTER STOP IN SPLICE.

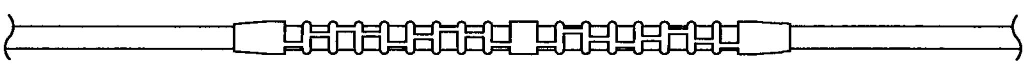
STEP 3



NOTES:

1. COMPRESS SLEEVE OVER ITS ENTIRE LENGTH, START AT MIDDLE AND WORKING TOWARD ENDS, ROTATE TOOL TO AVOID UNNECESSARY STRAIGHTENING.

STEP 4



NOTES:

1. STRAIGHTEN SPLICE TO PREVENT UNDUE STRESS ON CONDUCTOR.

NOTES:

1. SEE DWG. 03.02-12B FOR COMPRESSION SPLICE TABLES.

3				
2				
1				
0	4/13/11	ROBESON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

ONE PIECE COMPRESSION SPLICE
FOR OVERHEAD CONDUCTORS

Duke Energy®

FLA DWG. 03.02-12A

FULL TENSION ALUMINUM SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	SLEEVE CN
KSFN4ALF	CONNECTOR SLEEVE FULL TENSION COMP #4 ALUMINUM	142423
KSFN2ALF	CONNECTOR SLEEVE FULL TENSION COMP #2 ALUMINUM	142412
KSF40ALF	CONNECTOR SLEEVE FULL TENSION COMP #4/0 ALUMINUM	142416
KSF33ALF	CONNECTOR SLEEVE FULL TENSION COMP 336 MCM ALUMINUM	142321
KSF79ALF	CONNECTOR SLEEVE FULL TENSION COMP 795 MCM ALUMINUM	142328

FULL TENSION COPPER SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	SLEEVE CN
KSFN6CUF	CONNECTOR SLEEVE FULL TENSION COMP #6 CU	142109
KSFN4CUF	CONNECTOR SLEEVE FULL TENSION COMP #4 CU	142111
KSF20CUF	CONNECTOR SLEEVE FULL TENSION COMP #2/0 CU	142215
KSF40CUF	CONNECTOR SLEEVE FULL TENSION COMP #4/0 CU	142217

NON TENSION SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	SLEEVE CN
KSN2010F	CONNECTOR SLEEVE NON TENSION COMP #2/0 TO #1/0	9220101181
KSN3310F	CONNECTOR SLEEVE NON TENSION COMP 336 MCM TO #1/0	141130
KSN33ALF	CONNECTOR SLEEVE NON TENSION COMP 336 MCM ALUMINUM	141128
KSN35F	CONNECTOR SLEEVE NON TENSION COMP 350 MCM	9220100598
KSN50ALF	CONNECTOR SLEEVE NON TENSION COMP 500 MCM ALUMINUM	141155
KSN50F	CONNECTOR SLEEVE NON TENSION COMP 500 MCM	326257
KSN79ALF	CONNECTOR SLEEVE NON TENSION COMP 795 MCM ALUMINUM	144229

SEMI-TENSION SLEEVES FOR SERVICE NEUTRALS	
CATALOG NUMBER	CONDUCTOR SIZE
140459	#6 ACSR OR ALLOY
140462	#4 ACSR OR ALLOY
140464	#2 ACSR OR ALLOY
140466	#1/0 ACSR OR ALLOY

NOTES:

1. SEMI-TENSION SLEEVES ARE RATED AT 40% OF CONDUCTOR STRENGTH. THEY CAN ONLY BE USED IN JUMPERS, TPX SERVICE NEUTRALS AND SLACK SPANS.

2. SEE DWG. 03.02-12A FOR SPLICE INSTRUCTIONS.

3				
2				
1				
0	4/13/11	ROBESON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

ONE PIECE COMPRESSION SPLICE

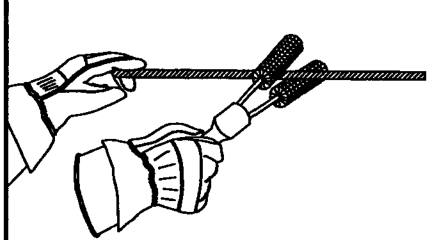
FOR OVERHEAD CONDUCTORS

Duke Energy®

FLA

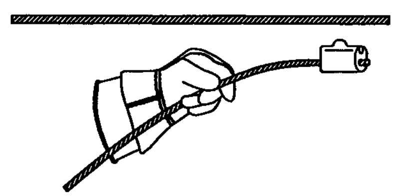
DWG. 03.02-12B

STEP 1



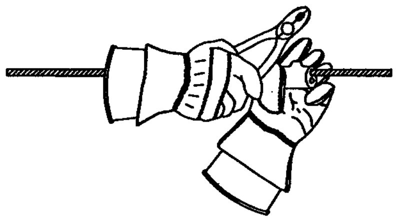
CLEAN BOTH CONDUCTORS THOROUGHLY BY WIRE BRUSHING

STEP 2



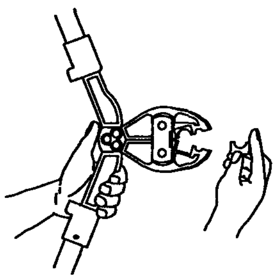
INSERT TAP CONDUCTOR IN TAP SIDE AND BEND TAB OVER CONDUCTOR IF USING DOUBLE TAB SQUEEZON

STEP 3



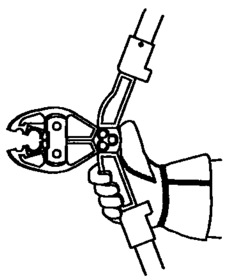
PLACE SQUEEZON ON LINE CONDUCTOR AND BEND TAB OVER CONDUCTOR

STEP 4



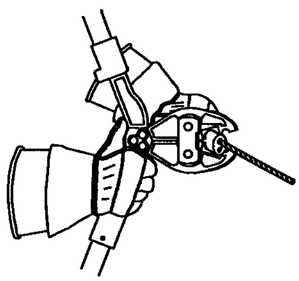
INSERT PROPER DIE TOOL FOR SQUEEZON BEING COMPRESSED

STEP 5



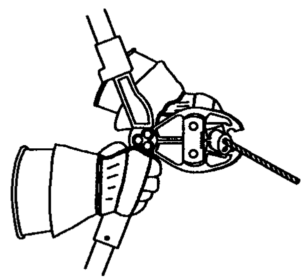
GRIP TOOL WITH THUMB POSITIONED AS SHOWN

STEP 6



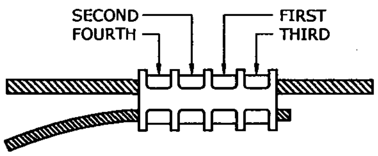
SLIDE TOOL OVER SQUEEZON AND POSITION TOOL TO MAKE CENTER COMPRESSION FIRST

STEP 7



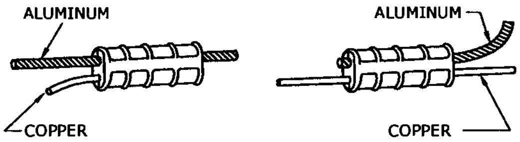
RELEASE THUMB PRESSURE SO THAT TOOL GRIPS SQUEEZON

STEP 8



MAKE COMPRESSIONS FROM CENTER OUT TO ENDS AS SHOWN ABOVE. ALL COPPER SQUEEZONS INSTALLED WITH 0-52-3 TOOL SHALL HAVE 3 COMPRESSIONS. ALUMINUM SQUEEZONS SHALL HAVE 4 OR MORE COMPRESSIONS AS INDICATED ON SQUEEZON.

STEP 9



ALWAYS POSITION SQUEEZON SO THAT ALUMINUM CONDUCTOR IS ABOVE COPPER WHEN CONNECTING ALUMINUM AND COPPER

NOTES:

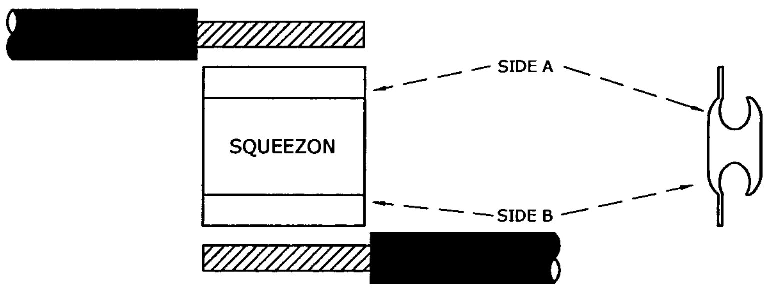
1. THE SAME GENERAL PROCEDURE SHOULD BE FOLLOWED FOR INSTALLING SQUEEZE-ONS WITH THE HYDRAULIC TOOL. EXCEPT FEWER COMPRESSIONS WILL BE REQUIRED AND THE ENTIRE LENGTH OF SQUEEZE-ON IS TO BE COMPRESSED.

3				
2				
1				
0	5/21/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION OF SQUEEZE-ON COMPRESSION CONNECTORS

Progress Energy

PGN DWG. 03.02-14



ALUMINUM COMPRESSION CONNECTORS							
SIDE	CONDUCTOR RANGE	DIAMETER RANGE [MIN] - [MAX]	CONNECTOR CATALOG NUMBER	DIE SIZE			
				BURNDY	KEARNEY	ALCOA	HUSKIE
A B	6 SOL - 2 STR 14 STR - 8 STR	.162 - .316 .064 - .146	153106	W-BG	5/8	5/8	HT58G
A B	6 SOL - 2 ACSR 6 SOL - 2 ACSR	.162 - .332 .162 - .332	153109	O	O	O	HT58AK
A B	2 STR - 2/0 STR 14 SOL - 8 STR	.250 - .419 .064 - .162	153112	O	O	O	HT58AK
A B	2 STR - 1/0 ACSR 6 SOL - 1 STR	.258 - .420 .162 - .332	153111	O	O	O	HT58AK
A B	1/0 ACSR - 3/0 STR 6 SOL - 1STR	.362 - .470 .162 - .332	11197803	D	D	(D)	D
A B	1/0 STR - 3/0 STR 1/0 STR - 2/0 ACSR	.362 - .470 .362 - .470	153125	D	D	(D)	D
A B	3/0 ACSR - 4/0 ACSR 6 SOL - 1 STR	.464 - .563 .162 - .325	153141	D	D	(D)	D
A B	3/0 STR - 4/0 ACSR 1/0 STR - 2/0 ACSR	.464 - .563 .316 - .470	153142	D	D	(D)	D
A B	3/0 STR - 4/0 ACSR 3/0 STR - 4/0 ACSR	.464 - .563 .464 - .563	153146	(N)	-	(N)	(HT41AJ)

NOTES:

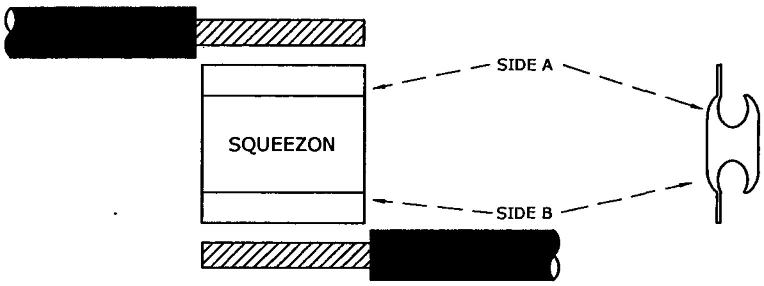
1. W-BG, 5/8, O, HT58G, HT58AK, D INDICATE DIES TO USE IN MECHANICAL CRIMPING TOOLS. (O), (D), (HT41AJ) AND (N) INDICATE DIES TO USE IN HYDRAULIC TOOLS.
2. CONDUCTOR MUST BE THOROUGHLY CLEANED BY WIRE BRUSHING, THE CORRECT SIZE CONNECTOR USED AND THE PROPER NUMBER OF COMPRESSIONS MADE USING THE CORRECT DIE AND TOOL IN PROPER ADJUSTMENT.
3. USE ALUMINUM CONNECTORS FOR ALUMINUM-TO-ALUMINUM, ALUMINUM-TO-COPPER, AND ALUMINUM-TO-STEEL CONNECTIONS.
4. USE THE APPLICABLE COVER SHOWN ON DWG. 03.02-16B.

3				
2				
1				
0	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

COMPRESSION CONNECTORS AND DIE SIZES
FOR ALUMINUM CONNECTORS

Duke Energy

FLA DWG. 03.02-16A



COPPER COMPRESSION CONNECTORS						
CONDUCTOR SIZE		CONNECTOR CATALOG NUMBER	DIE SIZE			
SIDE A	SIDE B		BURNDY	KEARNEY	ALCOA	HUSKIE
6 - 4	6 - 4	152191	W-KT	B, T	-	-
2 - 1/0	2 - 1/0	152192	(U249)	-	(O)	HW41DW

COMPRESSION CONNECTOR COVERS			
CATALOG NUMBER	DESCRIPTION	USAGE RANGE	
		GROOVE A	GROOVE B
156103	COVER, INSULATING, INSULATOR FOR O DIE H-BLOCK CONNECTORS	#6 - 2/0	#6 - 2/0
156109	COVER, INSULATING, INSULATOR FOR D DIE H-BLOCK CONNECTORS	2/0 - 4/0	#6 - 4/0

NOTES:

1. USE BURNDY, HUSKIE OR KEARNEY CRIMPING TOOL TO COMPRESS CONNECTORS USED ON CONDUCTOR SIZE (6-4, 6-4).
2. DIES LISTED IN "( )" INDICATE DIES TO USE IN HYDRAULIC TOOLS. WHERE DIES FOR BOTH TOOLS ARE SHOWN UNDER A CONNECTOR, EITHER TOOL MAY BE USED. WHERE DIE FOR HYDRAULIC ONLY IS SHOWN, HYDRAULIC TOOL MUST BE USED.
3. USE COPPER SQUEEZONS FOR COPPER-TO-COPPER CONNECTIONS ONLY.
4. CONDUCTORS MUST BE THOROUGHLY CLEANED BY WIRE BRUSHING, THE CORRECT SIZE CONNECTORS USED, AND THE PROPER NUMBER OF COMPRESSIONS MADE USING THE CORRECT DIE AND TOOL IN PROPER ADJUSTMENT/CALIBRATION.
5. USE THE APPLICABLE COVER SHOWN IN THE TABLE ABOVE.

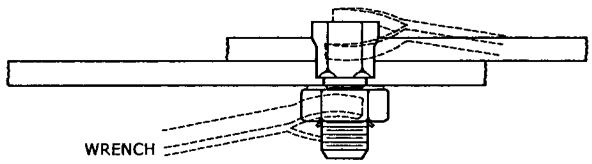
3				
2				
1				
0	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

COMPRESSION CONNECTORS AND DIE SIZES FOR COPPER CONNECTORS

Duke Energy

FLA | DWG. 03.02-16B

INSTALLATION OF SPLIT BOLT CONNECTION
NO.2 COPPER AND SMALLER



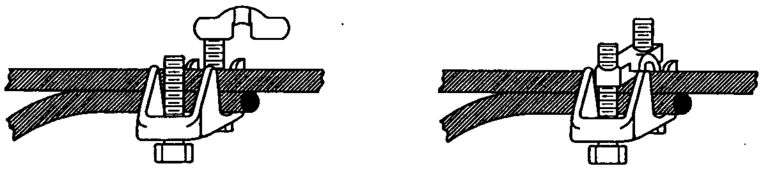
NOTES:

1. BE SURE CONDUCTORS ARE CLEAN AND FREE FROM SCALE.

2. USE TWO WRENCHES.

3. TIGHTEN UNTIL CONDUCTORS SHOW FIRST TENDENCY TO TWIST OUT OF PARALLEL LAY.

INSTALLATION OF TWO BOLT CONNECTION
1/0 COPPER AND LARGER

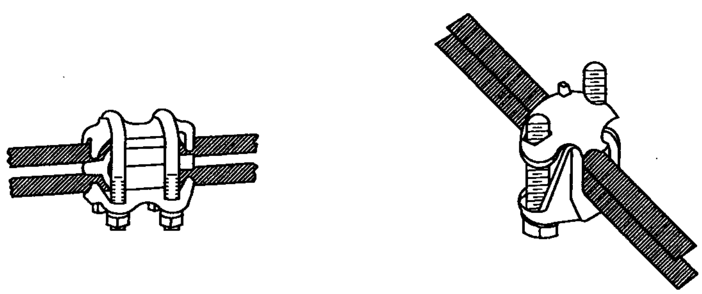


NOTES:

1. BE SURE CONDUCTORS ARE CLEAN AND FREE FROM SCALE.

2. DRAW UP CAP SCREWS EQUALLY UNTIL CONNECTOR IS SECURELY TIGHTENED.

INSTALLATION OF LARGE SERVICE CONNECTOR
336.4-1000 MCM AL, ACSR OR COPPER



NOTES:

1. BE SURE CONDUCTORS ARE CLEAN AND FREE FROM SCALE.

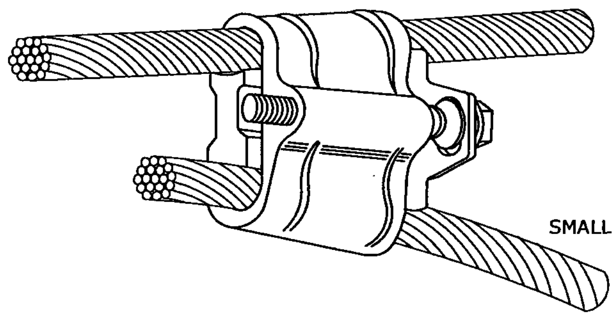
2. DRAW UP CAP SCREWS EQUALLY UNTIL CONNECTOR IS SECURELY TIGHTENED.

3				
2				
1				
0	5/21/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SOLDERLESS CONNECTORS

Progress Energy

PGN DWG. 03.02-20



NOTES:

1. CLEAN BOTH CONDUCTORS THOROUGHLY BY WIRE BRUSHING.
2. NEW CONNECTORS COME WITH INHIBITOR.
3. POSITION CONNECTOR.
4. TIGHTEN BOLT UNTIL TORQUE CONTROL NUT SHEARS OFF.

WEDGE CONNECTOR WIRE TABLE		
COMPATIBLE UNIT	CONDUCTOR SIZE	CATALOG NUMBER
KW3310F	CONNECTOR WEDGE 336 MCM TO #1/0	165230
KW3320F	CONNECTOR WEDGE 336 MCM TO #2/0	165233
KW3333F	CONNECTOR WEDGE 336 MCM TO 336 MCM	165242
KW3340F	CONNECTOR WEDGE 336 MCM TO #4/0	165239
KW33N2F	CONNECTOR WEDGE 336 MCM TO #2	165227
KW33N6F	CONNECTOR WEDGE 336 MCM TO #6	165221
KW5010F	CONNECTOR WEDGE 500 MCM TO #1/0	165255
KW5033F	CONNECTOR WEDGE 500 MCM TO 336 MCM	165261
KW5040F	CONNECTOR WEDGE 500 MCM TO #4/0	165258
KW5050F	CONNECTOR WEDGE 500 MCM TO 500 MCM	165262
KW50N2F	CONNECTOR WEDGE 500 MCM TO #2	165254
KW7910F	CONNECTOR WEDGE 795 MCM TO #1/0	165266
KW7920F	CONNECTOR WEDGE 795 MCM TO #2/0	165267
KW7933F	CONNECTOR WEDGE 795 MCM TO 336 MCM	165272
KW7940F	CONNECTOR WEDGE 795 MCM TO #4/0	165269
KW7950F	CONNECTOR WEDGE 795 MCM TO 500 MCM	165274
KW7975F	CONNECTOR WEDGE 795 MCM TO 750 MCM	165277
KW79N2F	CONNECTOR WEDGE 795 MCM TO #2	165265
KWP4H79F	CONNECTOR WEDGE TO 4 HOLE PAD 795 MCM	165288
KWS33F	CONNECTOR WEDGE STIRRUP 336 MCM	131512
KWS79F	CONNECTOR WEDGE STIRRUP 795 MCM	131514

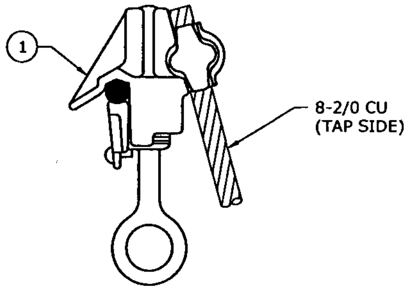
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/8/10	GUINN	GUINN	ELKINS

WEDGE CONNECTORS

Duke Energy

FLA DWG. 03.02-21

HOT LINE CLAMP



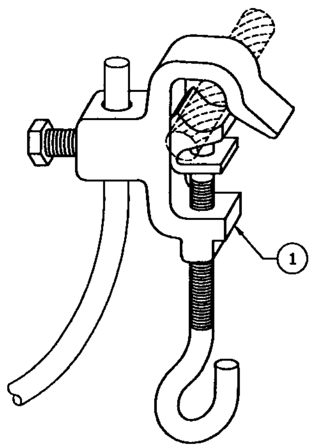
BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	➤ KH10N2F	1	130102	1	CLAMP, HOT LINE, SM, BRONZE

NOTES:

1. USE STIRRUP FOR TAP JUMPERS.

➤ 2. NO LONGER PURCHASED; OKAY TO USE IF IN STOCK OR FOR TRANSFERS.

ALUMINUM HOT LINE CLAMP (NO STIRRUP REQUIRED)



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	KHLC40N6F	1	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
	1	KHLC7933F	1	9220184794	1	CLAMP, HOT LINE, ALUM, LARGE, 336-795

NOTES:

1. CLAMPS ARE APPLIED DIRECTLY ON ALUMINUM OR COPPER CONDUCTORS WITHOUT A STIRRUP. USE WITH ARRESTERS AND WITH CUTOUTS WHERE CUTOUT WILL PICK UP THE LOAD. CLAMPS MAY ALSO BE USED ON STIRRUPS. A STIRRUP IS REQUIRED WHERE A JUMPER WITH A HOT LINE CLAMP IS USED.

2. USE #6 WP CU FOR TRANSFORMERS. USE #4 CU FOR CUTOUTS.

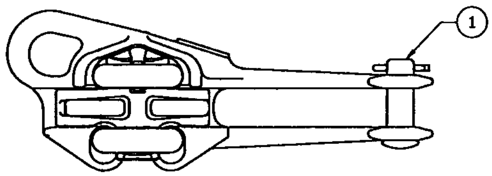
3. WIRE BRUSH CONDUCTOR BEFORE INSTALLING AND TIGHTENING CLAMP.

REVISED		BY	CK'D	APPR.
3				
2	3/8/13	MCCONNELL	DANNA	ADCOCK
1	10/4/11	GUINN	BURLISON	ELKINS
0	8/6/10	BURLISON	GUINN	ELKINS

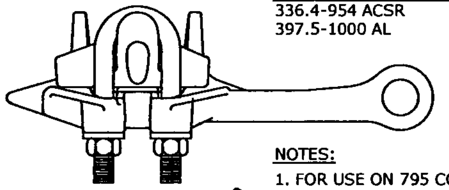
HOT LINE CLAMPS

Duke Energy®

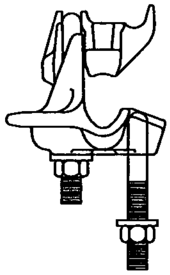
FLA DWG. 03.03-03



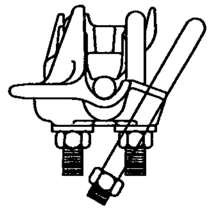
CONDUCTOR RANGE (0.680-1.16)
336.4-954 ACSR
397.5-1000 AL



NOTES:
1. FOR USE ON 795 CONDUCTOR.
2. TORQUE TO 45 FT. LBS.

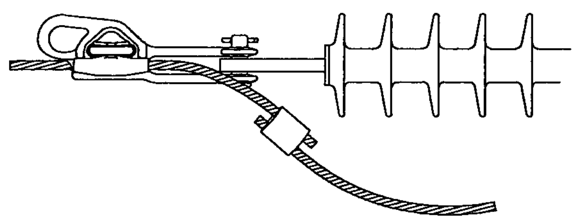


OPEN POSITION



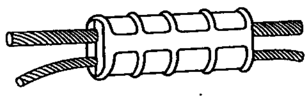
CLOSED POSITION

PREFERRED LOCATION FOR JUMPER CONNECTIONS

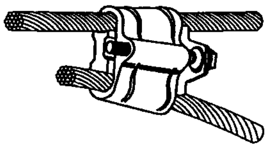


CONNECT JUMPER TO TAIL OF PRIMARY ON BACK SIDE OF DEADEND CLAMP

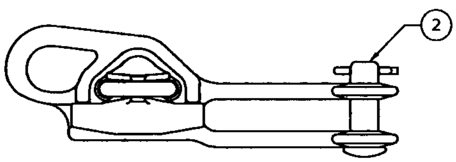
CONNECTOR DETAILS



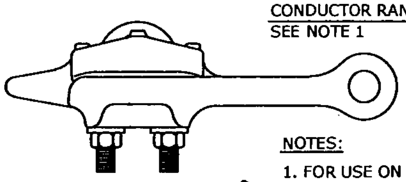
SEE DWG. 03.02-14



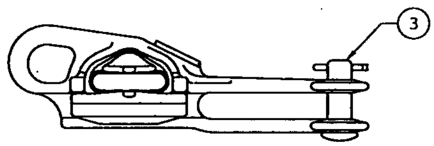
SEE DWG. 03.02-21



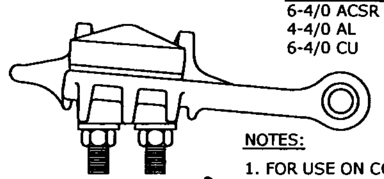
CONDUCTOR RANGE (0.410-0.880)
SEE NOTE 1



NOTES:
1. FOR USE ON 336.4.
2. TORQUE TO 45 FT. LBS.



CONDUCTOR RANGE (0.160-0.570)
6-4/0 ACSR
4-4/0 AL
6-4/0 CU



NOTES:
1. FOR USE ON CONDUCTORS #6 TO 4/0.
2. TORQUE TO 45 FT. LBS.

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	DECLMP740AAACF	1	101125	1	CLAMP, DE, SO, 336.4-954 ACSR, 397.5-1000 AL
		DECLMP795AACF	1	101125	1	CLAMP, DE, SO, 336.4-954 ACSR, 397.5-1000 AL
	2	DECLMP336AACF	1	101119	1	CLAMP, DE, SO, 2/0-556.5 ACSR, 2/0-556.5AL
		DECLMP394AAACF	1	101119	1	CLAMP, DE, SO, 2/0-556.5 ACSR, 2/0-556.5AL
	3	DECLMPN4AAACF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMPN2AACF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMP10AAACF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMPN6CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMPN4CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMPN2CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMP10CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMP20CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
		DECLMP40CHDF	1	100708	1	CLAMP, DE, SO, 6-4/0 ACSR, 6-4/0 CU, 4-4/0 AL
	4	SLCLMPN2AAACF	1	101392	1	CLAMP, STRAIN, SLACK, SPAN, 1/0, ALUMINUM, 0.30" - 0.62"
		SLCLMP10AAACF	1	101392	1	CLAMP, STRAIN, SLACK, SPAN, 1/0, ALUMINUM, 0.30" - 0.62"
		SLCLMP40AAACF	1	101392	1	CLAMP, STRAIN, SLACK, SPAN, 1/0, ALUMINUM, 0.30" - 0.62"
		SLCLMP336AACF	1	101397	1	CLAMP, STRAIN, SLACK, SPAN, 795, ALUMINUM, 0.62" - 1.25"
		SLCLMP795AACF	1	101397	1	CLAMP, STRAIN, SLACK, SPAN, 795, ALUMINUM, 0.62" - 1.25"

3				
2				
1	3/28/11	CROWDER	BURLISON	ELKINS
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PRIMARY AND NEUTRAL
DEAD END ASSEMBLIES

Duke Energy®

FLA

DWG.
03.03-04

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	TRCLAMPN4AAACF	1	112459	1	CLAMP, ANGLE, LINE, POST, ANGLE, ALUMINUM, RANGE, 0.50-1.06"
	2	TRCLAMPN2AAACF	1	112459	1	CLAMP, ANGLE, LINE, POST, ANGLE, ALUMINUM, RANGE, 0.50-1.06"
	3	TRCLAMPN2CHDF	1	112543	1	CLAMP, LINE, POST, STRAIGHT, STEEL, RANGE, 0.25-0.56"
	4	TRCLAMP10AAACF	1	9220177156	1	CLAMP, GRIP, CUSHION, POST, LINE, 1/0-4/0, 0.375"-0.563"
	5	TRCLAMP10CHDF	1	112543	1	CLAMP, LINE, POST, STRAIGHT, STEEL, RANGE, 0.25-0.56"
	6	TRCLAMP20CHDF	1	112543	1	CLAMP, LINE, POST, STRAIGHT, STEEL, RANGE, 0.25-0.56"
	7	TRCLAMP40CHDF	1	112543	1	CLAMP, LINE, POST, STRAIGHT, STEEL, RANGE, 0.25-0.56"
	8	TRCLAMP336AACF	1	9220177098	1	CLAMP, GRIP, GRIP, CUSHION, POST, LINE, 266-477, 0.564"-0.883"
	9	TRCLAMP394AAACF	1	9220177098	1	CLAMP, GRIP, GRIP, CUSHION, POST, LINE, 266-477, 0.564"-0.883"
	10	TRCLAMP740AAACF	1	112462	1	CLAMP, ANGLE, CUSHION GRIP, LINE POST, ANGLE, ALUM, .887-1.1
	11	TRCLAMP795AACF	1	112462	1	CLAMP, ANGLE, CUSHION GRIP, LINE POST, ANGLE, ALUM, .887-1.1
	12	SCLMPN6CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	13	SCLMPN4AAACF	1	090306	1	CLAMP, ANGLE, SUSPENSION, ANGLE, ALUMINUM, 0.25-0.75"
	14	SCLMPN4CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	15	SCLMPN2AAACF	1	090306	1	CLAMP, ANGLE, SUSPENSION, ANGLE, ALUMINUM, 0.25-0.75"
	16	SCLMPN2CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	17	SCLMP10AAACF	1	090306	1	CLAMP, ANGLE, SUSPENSION, ANGLE, ALUMINUM, 0.25-0.75"
	18	SCLMP10CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	19	SCLMP20CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	20	SCLMP40CHDF	1	090802	1	CLAMP, ANGLE, SUSPENSION, ANGLE, STEEL, 0.16-0.60
	21	SCLMP336AACF	1	9220183513	1	CLAMP, SUSP, GRIP, CUSH, 0.661"-0.709"
	22	SCLMP394AACF	1	9220183511	1	CLAMP, SUSP, GRIP, CUSH, 0.710"-0.755"
	23	SCLMP740AACF	1	9220067202	1	CLAMP, SUSPENSION-CUSHION GRIP- RANGE 0.981" TO 1.027"
	24	SCLMP795AACF	1	9220067202	1	CLAMP, SUSPENSION-CUSHION GRIP- RANGE 0.981" TO 1.027"

3				
2				
1				
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

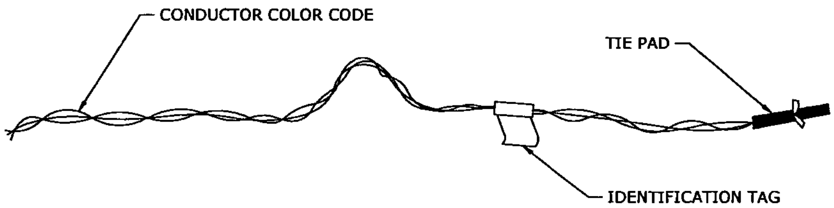
SUSPENSION ANGLE, LINE POST ANGLE

AND STRAIGHT LINE CLAMPS

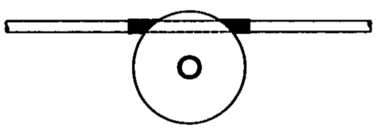
Duke Energy®

FLA

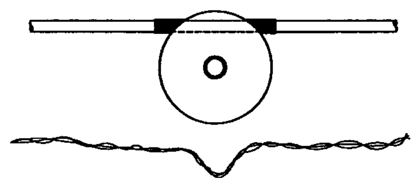
DWG. 03.03-06



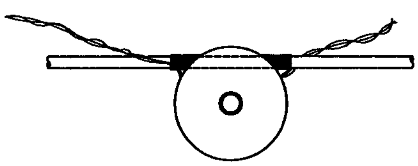
EZ-WRAP SPOOL TIE AS RECEIVED IN THE FIELD



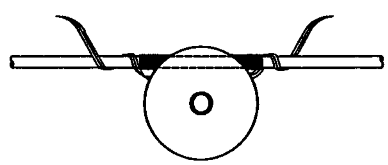
STEP 1: APPLY TIE PAD ON THE CONDUCTOR AND POSITION IT BETWEEN THE CONDUCTOR AND INSULATOR, MAKING SURE THE SLIT DOES NOT FACE THE INSULATOR.



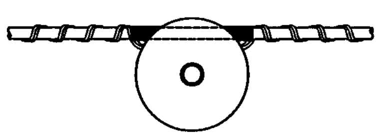
STEP 2: POSITION THE TIE LOOP UNDER THE INSULATOR SO THE LEGS ARE PARALLEL TO THE CONDUCTOR AS SHOWN.



STEP 3: PLACE THE LOOP TIGHTLY UP AGAINST THE INSULATOR'S GROOVE AND POSITION THE TIE LEGS, AS SHOWN, SO THEY CAN BE APPLIED TO THE CONDUCTOR.



STEP 4: APPLY THE LEGS BY WRAPPING THEM AROUND THE CONDUCTOR. MAKE SURE TO SNAP THE LEG ENDS INTO PLACE TO COMPLETE THE APPLICATION. MAKE SURE THE TIE LOOP IS TIGHT ON THE INSULATOR NECK.



STEP 5: COMPLETED APPLICATION OF EZ-WRAP SPOOL TIE

REVISED		BY	CK'D	APPR.
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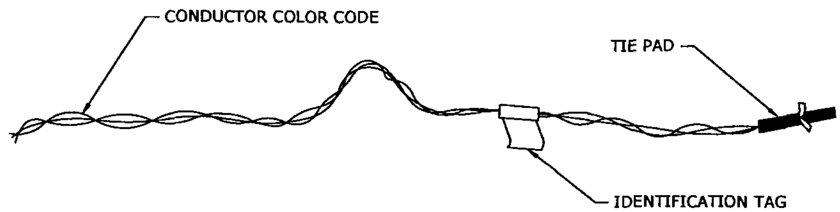
INSTALLATION GUIDE -
EZ-WRAP SPOOL TIE
HORIZONTAL POSITION

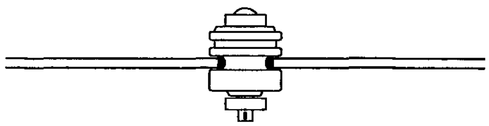
Progress Energy

PGN

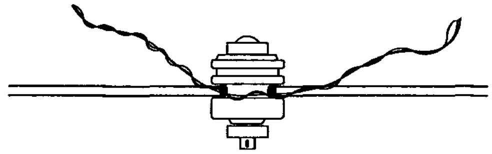
DWG. 03.04-02



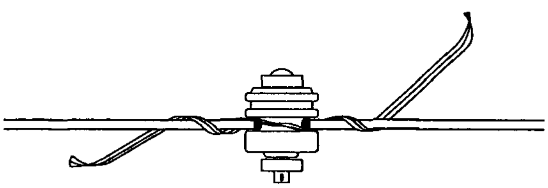
EZ-WRAP SPOOL TIE AS RECEIVED IN THE FIELD



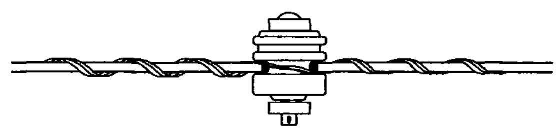
STEP 1: IN MOST CASES THE CONDUCTOR SHOULD BE PLACED BETWEEN THE INSULATOR AND THE STRUCTURE SO IT IS INSIDE THE CLEVIS, AS SHOWN. APPLY THE TIE PAD ON THE CONDUCTOR AND POSITION IT BETWEEN THE CONDUCTOR AND INSULATOR, MAKING SURE THE SLIT DOES NOT FACE THE INSULATOR.



STEP 2: POSITION THE TIE LOOP TIGHTLY AGAINST THE INSULATOR'S GROOVE, ON THE OPPOSITE SIDE FROM THE CONDUCTOR, AS SHOWN.



STEP 3: APPLY THE LEGS BY WRAPPING THEM AROUND THE CONDUCTOR. MAKE SURE TO SNAP THE LEG ENDS INTO PLACE TO COMPLETE THE APPLICATION. MAKE SURE THE TIE LOOP IS TIGHT ON THE INSULATOR NECK.



STEP 4: COMPLETED APPLICATION OF EZ-WRAP SPOOL TIE

NOTES:

1. IF IT IS NECESSARY TO POSITION THE CONDUCTOR ON THE OUTSIDE OF THE CLEVIS AND INSULATOR, SUCH SUCH AS WHEN LINE ANGLES TURN INTO THE POLE, POSITION THE TIE ON THE INSIDE OF THE CLEVIS PRIOR TO APPLICATION. OTHERWISE FOLLOW THE SAME STEPS AS BEFORE.

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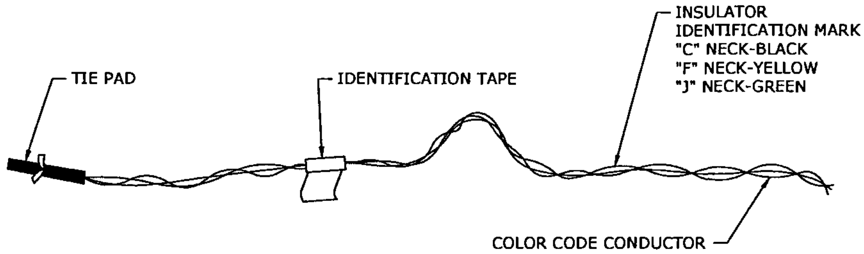
REVISED		BY	CK'D	APPR.

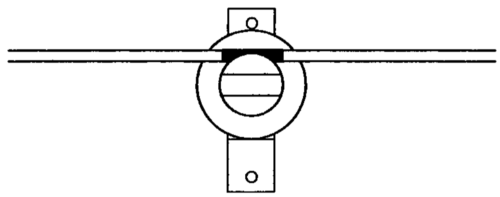
INSTALLATION GUIDE
EZ-WRAP SPOOL TIE
VERTICALLY MOUNTED INSULATORS

Duke Energy®

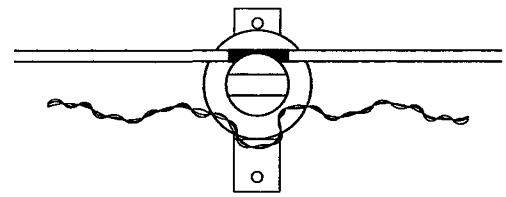
PGN DWG. 03.04-03



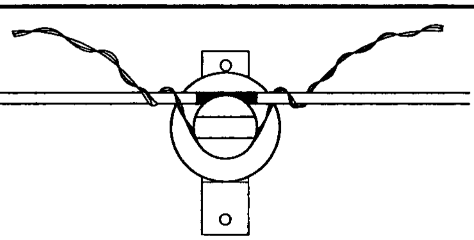
EZ-WRAP SIDE TIE AS RECEIVED IN THE FIELD



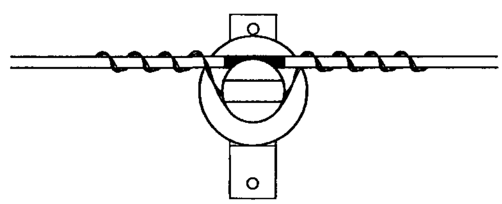
STEP 1: APPLY TIE PAD ON TO CONDUCTOR, SLIT FACING UP SO THAT CONDUCTOR DOES NOT COME INTO DIRECT CONTACT WITH THE INSULATOR.



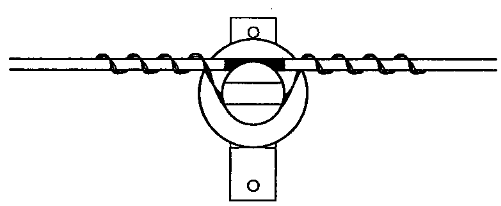
STEP 2: ALIGN THE EZ-WRAP SIDE TIE WITH THE CONDUCTOR. MAKE SURE THE TIE LOOP OF THE EZ-WRAP SIDE TIE IS FACING AWAY FROM THE CONDUCTOR AS SHOWN.



STEP 3: PLACE THE EZ-WRAP SIDE TIE IN POSITION AND START WRAPPING THE LEGS. NOTICE ONE LEG GOES OVER THE CONDUCTOR WHILE THE OTHER GOES UNDER THE CONDUCTOR.



STEP 4: WRAP BOTH LEGS COMPLETELY, SNAPPING THE ENDS IN PLACE WITH THUMB PRESSURE. MAKE SURE THE TIE LOOP IS TIGHT ON INSULATOR NECK AND UNDER INSULATOR HEAD.



STEP 5: COMPLETED APPLICATION OF EZ-WRAP SIDE TIE

3				
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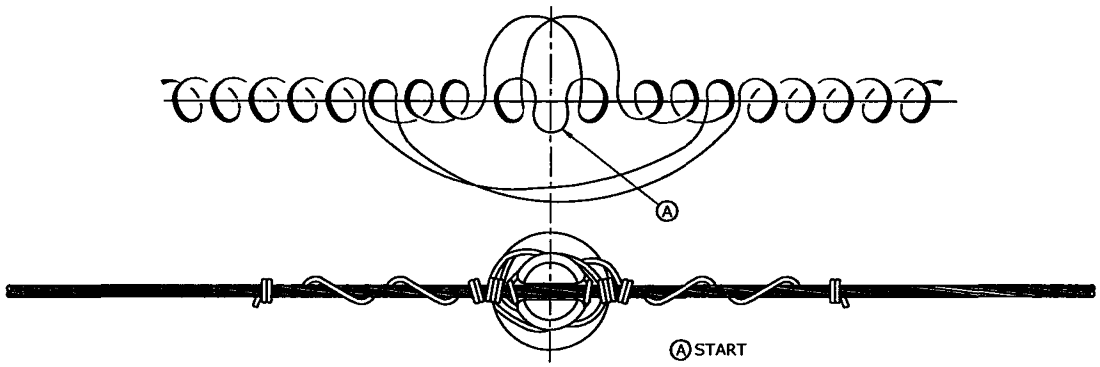
REVISED		BY	CK'D	APPR.

INSTALLATION GUIDE -
PRIMARY EZ-WRAP SIDE TIES

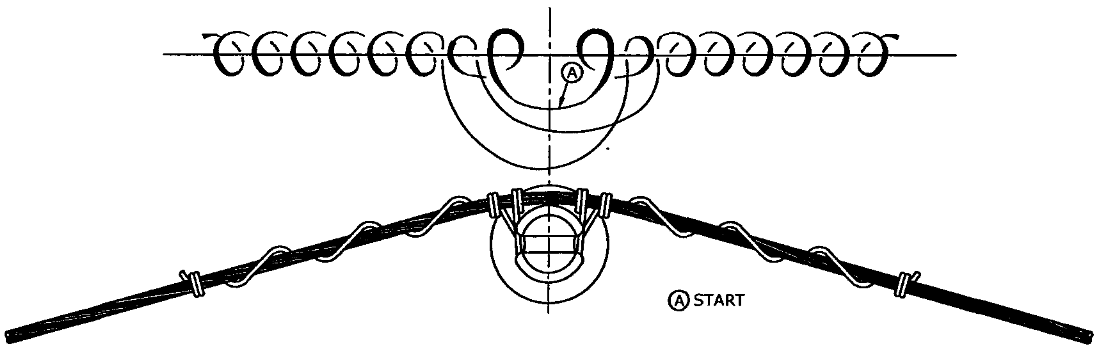
Progress Energy

PGN DWG. 03.04-04

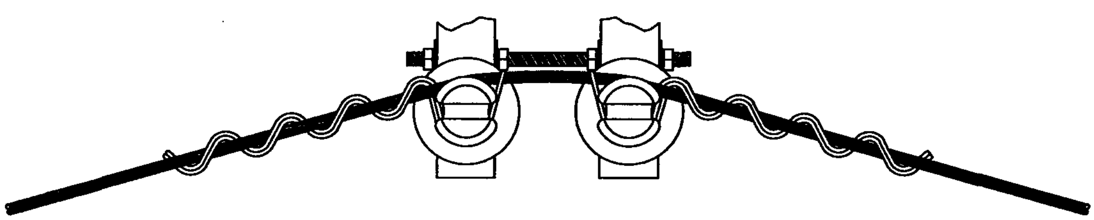
TOP GROOVE TIE

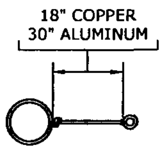


SIDE GROOVE TIE

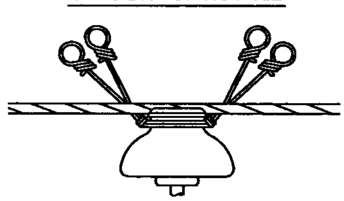


SIDE OR TOP GROOVE - TWO INSULATORS

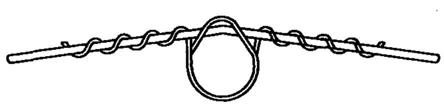




SIDE OR TOP HOT TIE



SPOOL TIE



NOTES:

1. FACTORY FORMED TIES ARE THE PREFERRED METHOD FOR ATTACHING PRIMARY CONDUCTORS WHEN ACCESSIBLE BY TRUCK.
2. ON ALL HAND/HOT TIES MAKE FIRST WRAP AS CLOSE TO INSULATOR AS POSSIBLE, AND MAKE A MINIMUM OF 4 WRAPS ON EACH SIDE OF THE INSULATOR.
3. TIE WIRE: CU - #6 SD CU.
   AL - #4 SD AL.

HAND TIES		
COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION
HTIEN4AACF	200306	WIRE, AL, SLD, BR, SDW, #4, TIEWIRE
HTIEN6CSDF	190404	WIRE, CU, BR, SDW, SLD, #6

3					
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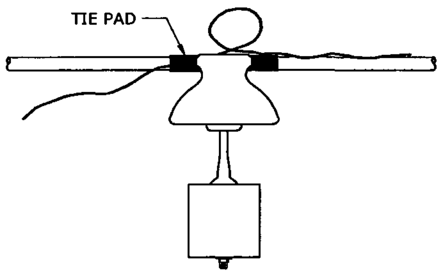
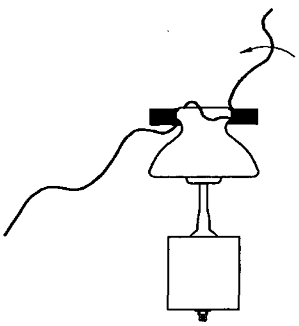
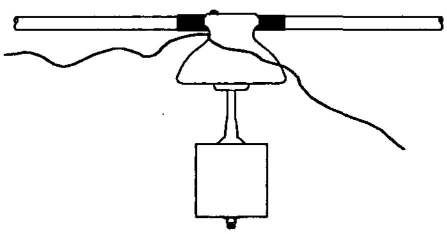
1				CONDUCTOR HAND TIES	Duke Energy
0	11/8/10	CECCONI	GUINN	ELKINS	FLA DWG. 03.04-07
REVISED		BY	CK'D	APPR.	



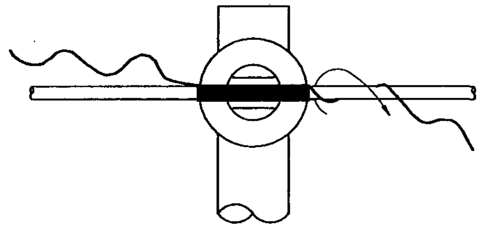
1. POSITION DISTRIBUTION TIE ON INSULATOR AS SHOWN, WITH BOTH LEGS PARALLEL TO THE CONDUCTOR.



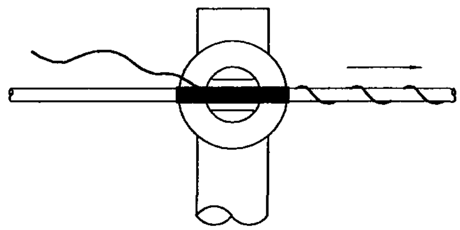
2. ROTATE THE DISTRIBUTION TIE IN A COUNTER-CLOCKWISE DIRECTION, MAKING CERTAIN THAT BOTH LEGS GO UNDER THE CONDUCTOR AS SHOWN.



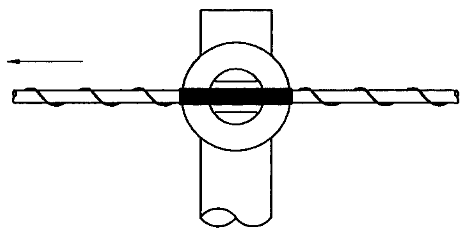
3. CONTINUE TO ROTATE THE LEGS AND THE DISTRIBUTION TIE WILL SEAT ITSELF AS SHOWN.



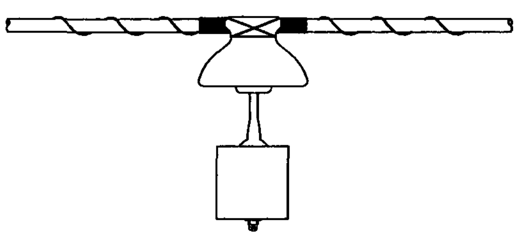
4. START TO WRAP ON ONE LEG OF THE DISTRIBUTION TIE AS SHOWN.



5. CONTINUE TO APPLY THE FIRST LEG TO COMPLETION. BE SURE TO SNAP THE END OF THE LEG INTO PLACE WITH SLIGHT THUMB PRESSURE.



6. WRAP ON THE OTHER LEG OF THE DISTRIBUTION TIE AS SHOWN AND SNAP THE LEG INTO POSITION IN THE SAME MANNER.



7. COMPLETED APPLICATION OF THE DISTRIBUTION TIE.

3					TOP TIE	Progress Energy
2						
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0	7/7/10	CECCONI	GUINN	ELKINS		PGN DWG. 03.04-08
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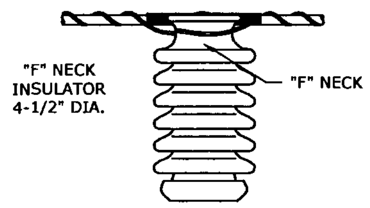
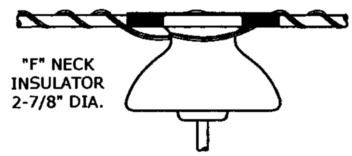
TOP TIE
ROUND BASE INSULATOR



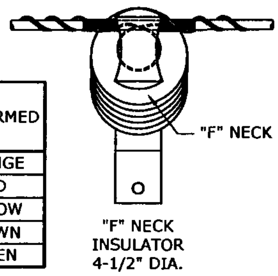
COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION	CHANCE	PREFORMED
TTIEF10ALF	121415	TIE, TOP F NECK 1/0 AL	YELLOW	YELLOW
TTIEF336ALF	121417	TIE, TOP F NECK 336 AL	BROWN	BROWN
TTIEF394ALF	121417	TIE, TOP F NECK 336 AL	BROWN	BROWN
TTIEF740ALF	121418	TIE, TOP F NECK 795 AL	GREEN	GREEN
TTIEF795ALF	121418	TIE, TOP F NECK 795 AL	GREEN	GREEN
TTIEFN2ALF	11148400	TIE, TOP, F NECK, #2 AL	-	RED
TTIEFN4ALF	121411	TIE, TOP F NECK 4 AL	ORANGE	ORANGE
TTIEF500COVALPF	9220068094	TIE, PLASTIC, 2-7/8", F-NECK, INS	-	RED

NOTE: COLOR CODE DESIGNATES WIRE SIZE

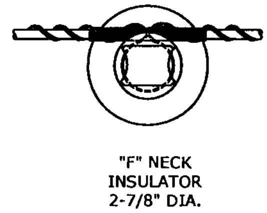
TOP TIE
PIN INSULATOR



SIDE TIE
ROUND BASE INSULATOR



SIDE TIE
PIN INSULATOR

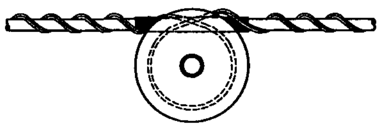


NOTE: 795 WILL NOT FIT IN THE SIDE GROOVE OF THIS PIN INSULATOR

COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION	CHANCE	PREFORMED
STIEFN4ALF	121423	SIDE TIE, F NECK, #4 ALUMINUM	ORANGE	ORANGE
STIEFN2ALF	11158102	SIDE TIE, F NECK, #2 ALUMINUM	-	RED
STIEF10ALF	121426	SIDE TIE, F NECK, 1/0 ALUMINUM	YELLOW	YELLOW
STIEF336ALF	121429	SIDE TIE, F NECK, 336 KCM ALUMINUM	-	BROWN
STIEF795ALF	121434	SIDE TIE, F NECK, 795 KCM ALUMINUM	-	GREEN

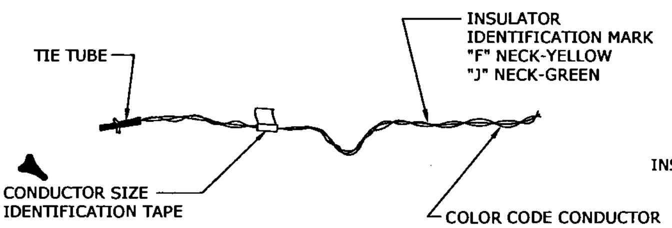
NOTE: COLOR CODE DESIGNATES WIRE SIZE

COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION	CHANCE	PREFORMED
NEUSPTIEN4ALF	121463	FORMED SPOOL TIE, #4 ALUMINUM	ORANGE	ORANGE
NEUSPTIEN2ALF	9220109798	FORMED SPOOL TIE, #2 ALUMINUM	RED	RED
NEUSPTIE10ALF	121466	FORMED SPOOL TIE, 1/0 ALUMINUM	YELLOW	YELLOW

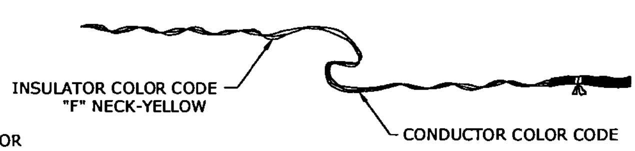


NOTE: COLOR CODE DESIGNATES WIRE SIZE

EZ-WRAP
PRIMARY SIDE AND SPOOL TIE



TOP TIE



NOTES:

1. FACTORY FORMED TIES ARE SUITABLE FOR USE ON ALL SPAN LENGTHS.
2. ALL TIES SHOULD FIT TIGHTLY AROUND THE INSULATOR.
3. POSITION SPLIT IN PAD AWAY FROM PORCELAIN ON FACTORY TIES.
4. USE HAND TIES ON NEUTRAL, SECONDARY, AND PRIMARY CONDUCTORS OTHER THAN ALUMINUM.
5. ATTACHMENT OF ALUMINUM PRIMARY CONDUCTORS TO DISTRIBUTION POST AND PIN INSULATORS WILL BE MADE USING A FACTORY-FORMED GRIP WITH A PROTECTIVE PAD. THIS PREFERRED METHOD OF CONDUCTOR ATTACHMENT PROVIDES BOTH MAXIMUM HOLDING STRENGTH AND CONDUCTOR PROTECTION, WHICH ENSURES LONG-LASTING CONSTRUCTION. IF A FACTORY-FORMED GRIP IS NOT AVAILABLE, THEN A HAND TIE WITH AN ARMOR ROD MUST BE USED. ARMOR RODS SHALL ALSO BE USED WHEN INSTALLING ALUMINUM PRIMARY CONDUCTORS IN CLAMP-TYPE INSULATORS (EXCEPT FOR SLACK SPANS).

3				
2				
1	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

FACTORY FORMED CONDUCTOR TIES

Duke Energy

FLA

DWG.
03.04-09

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ARN2AAACF	1	11150208	1	ROD, ARMOR,#2AAAC, ARMOR ROD SET, 0.136 INCH DIAMETER
	2	AR10AAACF	1	121117	1	ROD, ARMOR,#1/0AAAC, ARMOR ROD SET, 0.167 INCH DIAMETER
	3	AR336AACF	1	121157	1	ROD, ARMOR,336.4AAC, ARMOR ROD SET, 0.666 INCH DIAMETER
	4	AR795AACF	1	121167	1	ROD, ARMOR,795AAC, ARMOR ROD SET, 1.026 INCH DIAMETER

NOTES:

1. CONDUCTOR DIAMETER WITH ARMOR RODS WILL BE CONDUCTOR DIAMETER PLUS TWO TIMES ARMOR ROD DIAMETER.
2. DO NOT RE-USE ARMOR RODS AFTER INITIAL INSTALLATION.

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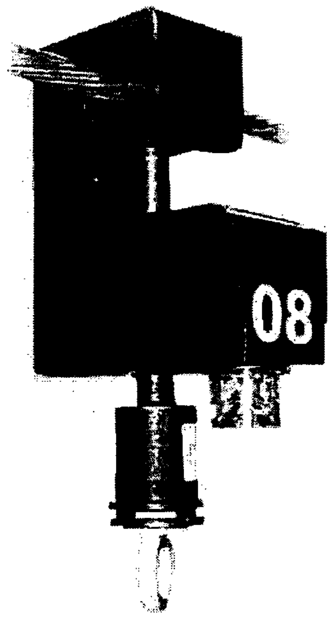
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ARMOR RODS

Duke Energy®

FLA

DWG. 03.04-11



INDICATOR TRIP (AMPS)	COMPATIBLE UNIT	CATALOG NUMBER	PHASE	RESET CURRENT (AMPS)
*300 DI/DT	FCIORDLE8AFF	323469	A	8
*300 DI/DT	FCIORDLE8BFF	323470	B	8
*300 DI/DT	FCIORDLE8CFF	323471	C	8

*SEE NOTE 4

DESCRIPTION AND OPERATION

1. FAULT INDICATOR - INDICATOR LED WILL LIGHT UP WHEN FAULTED. MAY ALSO BE LOCATED WITH RADIO RECEIVER UNIT (CN 323473), WHICH RECEIVES SIGNALS FROM TRANSMITTER IN FAULT INDICATOR THAT IS PRE-PROGRAMMED FOR EACH PHASE.

2. RESET - INDICATOR RESETS IF 8A OR MORE OF CURRENT IS RESTORED, AFTER 4 HOURS IF POWER IS NOT RESTORED, OR IF RESET MANUALLY (MANUAL TRIP AND RESET TOOL IS HOOKSTICK OPERATED).

3. MOUNTING - HOTSTICK MOUNTED WITH AUTOMATIC TORQUE LIMITER.

4. ADAPTIVE TRIP - INDICATOR USES AN ADAPTIVE TRIP, WHICH TRIPS WHEN A CHANGE IN CURRENT OF 300A OR GREATER IS INDICATED IN A 150 MSEC. TIME FRAME FOLLOWED BY A LOSS OF CURRENT.

5. OPERATING POWER - BATTERY REPLACEMENT REQUIRED EVERY 5 YEARS.

APPLICATION

6. OVERHEAD FEEDERS ON VOLTAGES UP TO 38 KV - AS DIRECTED BY ENGINEERING.

7. INDICATOR IS CALIBRATED FOR USE ON #6 THROUGH 795 ALUMINUM CONDUCTORS AND #6 THROUGH 750 COPPER CONDUCTORS (.14 THROUGH 1.2 DIAMETER CONDUCTORS).

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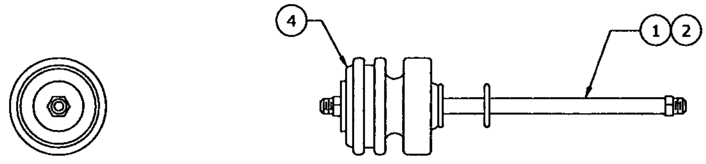
1				
0	10/5/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

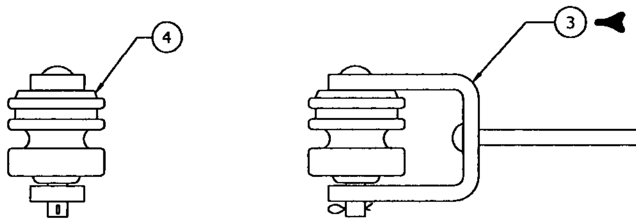
FAULT INDICATOR, SINGLE-PHASE, OVERHEAD, AUTO-RESET

Duke Energy®

FLA

DWG. 03.05-01





BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	NSSB10F	1	011280	1	BOLT, SPOOL, 5/8" X 10", GALV, DUI WASHERS, W/ALL HARDWARE
			1	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			1	013308	1	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
	2	NSSB12F	1	011282	1	BOLT, SPOOL, 5/8" X 12", GALV, DUI WASHERS, W/ALL HARDWARE
			1	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			1	013308	1	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
	3	NSSCF	1	013308	1	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
			1	070402	1	BRACKET, ONE WIRE, NO, INSULATOR, GALVANIZED
			1	152107	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
	4	ISPLF	1	080403	1	INSULATOR, SPOOL, 3"

REVISED		BY	CK'D	APPR.
3				
2				
1	9/14/12	GUINN	BURLISON	ADCOCK
0	11/8/10	CECCONI	GUINN	ELKINS

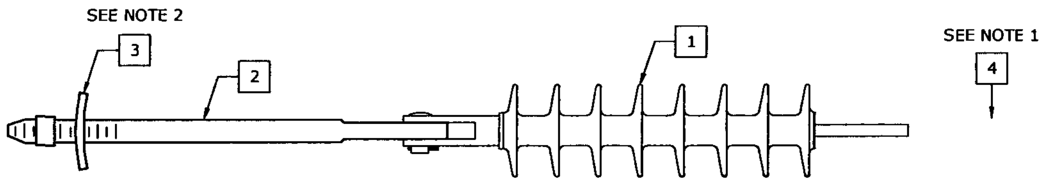
NEUTRAL SPOOL

Duke Energy

FLA

DWG. 03.06-01

27 KV POLYMER



COMPATIBLE UNIT	COMPATIBLE UNIT DESCRIPTION	ITEM NO	CATALOG NUMBER	DESCRIPTION	QTY
ISEYEBOLT5810F	INSULATOR SUPPORT EYEBOLT 5/8" X 10"	2	011708	BOLT, OVAL EYE, 5/8" X 10"	1
		3	013346	WASHER, 3" SQ., CURVED, 13/16" HOLE	1
ISEYEBOLT5812F	INSULATOR SUPPORT EYEBOLT 5/8" X 12"	2	011709	BOLT, OVAL EYE, 5/8" X 12"	1
		3	013346	WASHER, 3" SQ., CURVED, 13/16" HOLE	1
ISEYEBOLT5814F	INSULATOR SUPPORT EYEBOLT 5/8" X 14"	2	011710	BOLT, OVAL EYE, 5/8" X 14"	1
		3	013346	WASHER, 3" SQ., CURVED, 13/16" HOLE	1
ISEYEBOLT5816F	INSULATOR SUPPORT EYEBOLT 5/8" X 16"	2	011711	BOLT, OVAL EYE, 5/8" X 16"	1
		3	013346	WASHER, 3" SQ., CURVED, 13/16" HOLE	1
ISEYENUT58F	INSULATOR SUPPORT, EYENUT, 5/8"	2	012210	NUT, OVAL EYE, GALV, 5/8", 1-1/2X1-3/4	1

COMPATIBLE UNIT	COMPATIBLE UNIT DESCRIPTION	ITEM NO	CATALOG NUMBER	DESCRIPTION	QTY
IDES25PF	INSULATOR DEADEND/SUSPENSION 25 KV POLY	1	080577	INSULATOR, POLYMER, 25KV, DE, SI, RATED 15K	1

COMPATIBLE UNIT	COMPATIBLE UNIT DESCRIPTION	ITEM NO	CATALOG NUMBER	DESCRIPTION	QTY
DECLMPN6CHDF	DEADEND CLAMP #6 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMPN4CHDF	DEADEND CLAMP #4 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMPN2CHDF	DEADEND CLAMP #2 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMP10CHDF	DEADEND CLAMP 1/0 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMP20CHDF	DEADEND CLAMP 2/0 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMP40CHDF	DEADEND CLAMP 4/0 CU HARD DRAWN	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMPN4AAACF	DEADEND CLAMP #4 AAAC	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMPN2AAACF	DEADEND CLAMP #2 AAAC	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMP10AAACF	DEADEND CLAMP 1/0 AAAC	4	100708	CLAMP, DE, SO, 6-4/0 CU, 4-4/0 AL	1
DECLMP336AACF	DEADEND CLAMP 336 KCM AAC	4	101119	CLAMP, DE, SO, 2/0-556.5 ACSR, 2/0-556.5 AL	1
DECLMP394AAACF	DEADEND CLAMP 394 KCM AAAC	4	101119	CLAMP, DE, SO, 2/0-556.5 ACSR, 2/0-556.5 AL	1
DECLMP740AAACF	DEADEND CLAMP 740 KCM AAAC	4	101125	CLAMP, DE, SO, 336.4-954 ACSR, 397.5-1000AL	1
DECLMP795AACF	DEADEND CLAMP 795 KCM AAC	4	101125	CLAMP, DE, SO, 336.4-954 ACSR, 397.5-1000AL	1

COMPATIBLE UNIT	COMPATIBLE UNIT DESCRIPTION	ITEM NO	CATALOG NUMBER	DESCRIPTION	QTY
SCLMPN6CHDF	SUSPENSION CLAMP #6 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMPN4CHDF	SUSPENSION CLAMP #4 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMPN2CHDF	SUSPENSION CLAMP #2 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMP10CHDF	SUSPENSION CLAMP 1/0 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMP20CHDF	SUSPENSION CLAMP 2/0 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMP40CHDF	SUSPENSION CLAMP 4/0 CU HARD DRAWN	4	090802	CLAMP, SUSPENSION, ANGLE, 0.16-0.60	1
SCLMPN4AAACF	SUSPENSION CLAMP #4 AAAC	4	090306	CLAMP, SUSP, ANGLE, ALUMINUM, 0.25-0.75"	1
SCLMPN2AAACF	SUSPENSION CLAMP #2 AAAC	4	090306	CLAMP, SUSP, ANGLE, ALUMINUM, 0.25-0.75"	1
SCLMP10AAACF	SUSPENSION CLAMP 1/0 AAAC	4	090306	CLAMP, SUSP, ANGLE, ALUMINUM, 0.25-0.75"	1
SCLMP336AACF	SUSPENSION CLAMP 336 KCM AAC	4	9220183513	CLAMP, SUSP, GRIP, CUSH, 0.661"-0.709"	1
SCLMP394AACF	SUSPENSION CLAMP 394 KCM AAAC	4	9220183511	CLAMP, SUSP, GRIP, CUSH, 0.710"-0.755"	1
SCLMP740AACF	SUSPENSION CLAMP 740 KCM AAAC	4	9220067202	CLAMP, SUSP, GRIP, CUSH, 0.981"-1.027"	1
SCLMP795AACF	SUSPENSION CLAMP 795 KCM AAC	4	9220067202	CLAMP, SUSP, GRIP, CUSH, 0.981"-1.027"	1

NOTES:

1. DEADEND AND SUSPENSION CLAMP NOT SHOWN.
2. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC CONDUCTOR AND SMALLER AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.

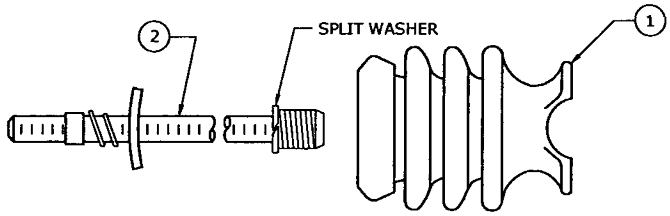
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/4/10	GUINN	GUINN	ELKINS

POLYMER DEADEND COMPATIBLE UNIT

Duke Energy

FLA DWG. 03.06-02

INSULATOR, POST 15 KV

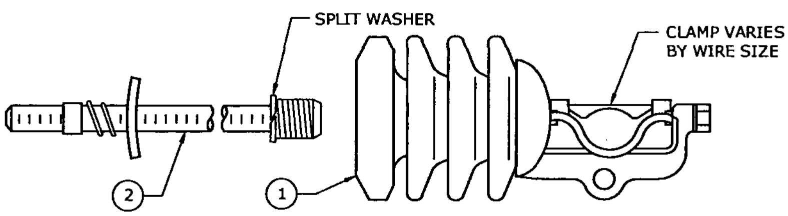


BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPTT15F	1	080212	1	INSULATOR, POST TIE 3/4 15 KV
	2	ISSTUDBOLT5810F	1	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"

NOTES:

1. POLE GAINS (ISGAINGRIDF) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE SLAB GAINS (NEW POLES DO NOT HAVE SLAB GAINS) OR WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER. GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS.

INSULATOR, CLAMP TOP, 15 KV



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPCLT15F	1	080232	1	INSULATOR, POST CLAMP, HORIZONTAL, 15 KV
	2	ISSTUDBOLT5810F	1	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"

NOTES:

1. POLE GAINS (ISGAINGRIDF) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE SLAB GAINS (NEW POLES DO NOT HAVE SLAB GAINS) OR WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER. GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS.

3				
2				
1				
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

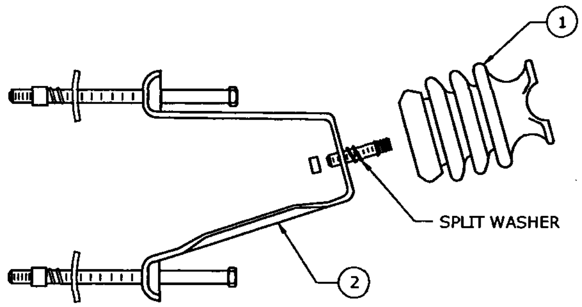
INSULATORS

Duke Energy

FLA

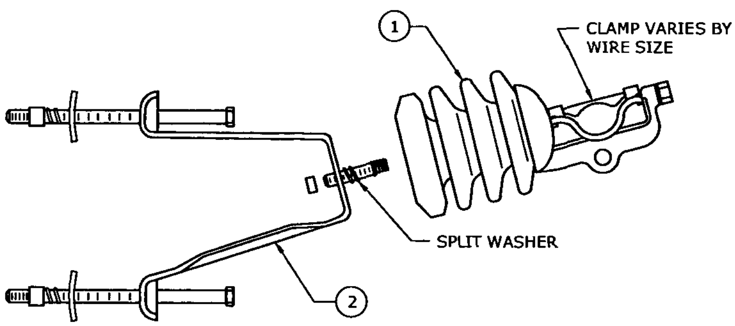
DWG. 03.06-04

INSULATOR, POST 15 KV WITH STANDOFF BRACKET



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPTT15F	1	080212	1	INSULATOR, POST, TIE-TOP, 15KV, WITHOUT STUD
	2	BKTSPISF	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				070424	1	BRACKET, POST, INSULATOR, MOUNTING (CHICKEN WING)
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"

CLAMP TOP, 15 KV WITH STANDOFF BRACKET



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPCLT15F	1	080232	1	INSULATOR, POST, CLAMP, HORIZONTAL
	2	BKTSPISF	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				070424	1	BRACKET, POST, INSULATOR, MOUNTING (CHICKEN WING)
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS

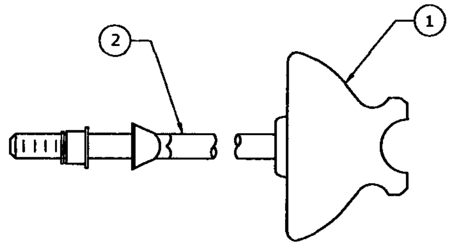
INSULATORS

Duke Energy®

FLA

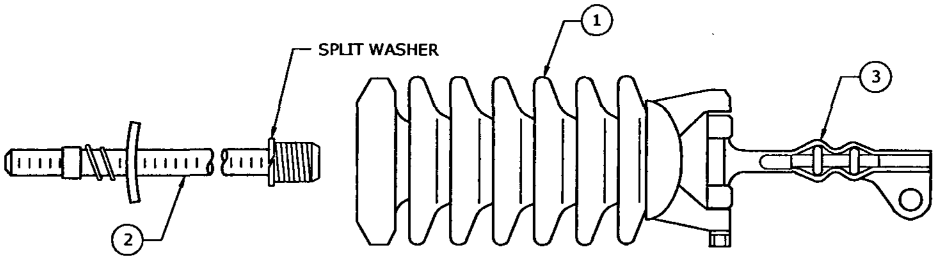
DWG. 03.06-06

INSULATOR, PIN TYPE, CLASS B



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IPIN23F	1	080304	1	INSULATOR, PIN, 23KV, CLASS-55-5
	2	PINCARMS586F	1	072306	1	PIN, SHOULDER, 6" X 5/8" X 6-1/2, STEEL

INSULATOR, SLACK SPAN, 35 KV, 1/0, 795 OR 336 CONDUCTOR



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IVPCLT35F	1	080375	1	INSULATOR, POST, LINE, VERTICAL, 35 KV, CLAMP TOP
	2	ISSTUDBOLT5812F	1	013264	1	WASHER, SPRING COIL, STEEL, FOR 5/8" BOLT, GALV.
				072367	1	STUD, LINE POST, 5/8" X 12"
	3	SLCLMP336AACF	1	101397	1	CLAMP, STRAIN, SLACK SPAN, 795 AL, 0.62" - 1.25"
		SLCLMP10AAACF	1	101392	1	CLAMP, STRAIN, SLACK SPAN, 1/0 AL, 0.30" - 0.62"

NOTES:

1. 1/O DEADEND CLAMP TO BE USED ON CONCRETE POLE CONSTRUCTION.

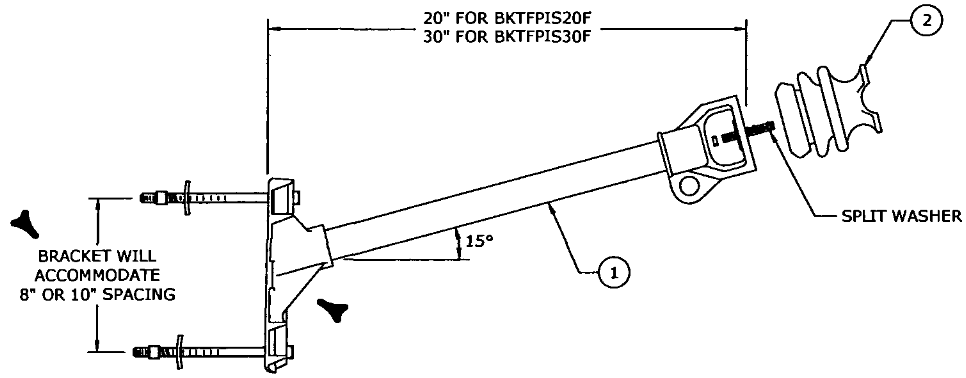
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/10/10	GUINN	GUINN	ELKINS

INSULATORS

Duke Energy®

FLA

DWG. 03.06-08



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	BKTFPIS20F	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16"
				070430	1	BRACKET, FIBERGLASS, STAND-OFF, 20" (BALL BAT)
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	1	BKTFPIS30F	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16"
				070431	1	BRACKET, FIBERGLASS, STAND-OFF, 30" (BALL BAT)
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	2	IHPTT15F	1	080212	1	INSULATOR, POST, TIE TOP, 15KV, WITHOUT STUD

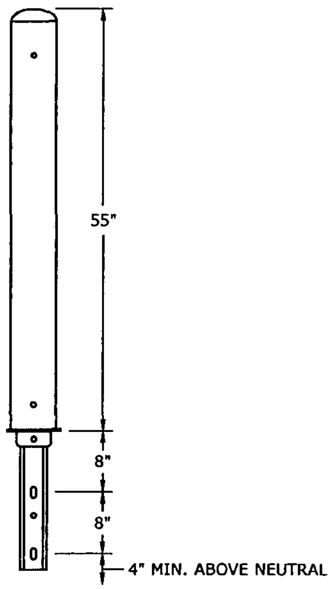
STANDOFF HORIZONTAL POST INSULATOR BRACKETS ARE AVAILABLE IN 20" AND 30" LENGTHS. THEY MAY BE USED ON TANGENT FLAT CONSTRUCTION WHERE RIGHT-OF-WAY IS AN ISSUE AND THE POLE MUST BE SET OUT OF LINE OR FOR SMALL ANGLES (15° OR LESS) USING A CLAMP TOP INSULATOR THE 20" OR 30" BRACKET MAY BE USED FOR DISTRIBUTION UNDERBUILD ON STEEL, CONCRETE AND WOOD TRANSMISSION POLES. DO NOT INSTALL WHERE A DIFFERENCE IN ELEVATION BETWEEN STRUCTURES WILL CREATE AN EXCESSIVE DOWNWARD FORCE ON THE BRACKET. IF THERE ARE ANY QUESTIONS, CONTACT DISTRIBUTION STANDARDS.

REVISED		BY	CK'D	APPR.
3				
2	12/12/11	GUINN	BURLISON	ELKINS
1	11/10/11	BURLISON	BURLISON	ELKINS
0	11/4/10	GUINN	GUINN	ELKINS

STANDOFF HORIZONTAL POST INSULATOR BRACKETS

Progress Energy

FLA DWG. 03.06-10



FRONT VIEW

SIDE VIEW

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	BKTPTE54FBGF	1	9220139630	1	EXTENSION, POLE TOP, FIBERGLASS, 54"
				152107	2	BOLT, MACH, SQ, 5/8"
				013308	2	WASHER, SQUARE, FLAT
				013264	2	WASHER, SPRING COIL, STEEL, 5/8", GALV.

NOTES:

1. POLE TOP EXTENSION IS FOR POLE TOP EMERGENCY REPAIR. AN ENGINEERING EVALUATION IS REQUIRED IF EXTENSION IS TO REMAIN PERMANENTLY INSTALLED.
2. FOR USE ON SINGLE-PHASE LINES ONLY.
3. BRACKET WILL ACCOMMODATE A 7"-11" POLE TOP.
4. EXTENSION CAN BE DRILLED TO MOUNT HARDWARE.
5. DO NOT TIGHTEN BOLTS WITH IMPACT DRILL - THIS WILL CAUSE CRACKING.
6. USE A MINIMUM OF A 2" FLAT WASHER TO MOUNT EQUIPMENT.

3				
2				
1				
0	11/8/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

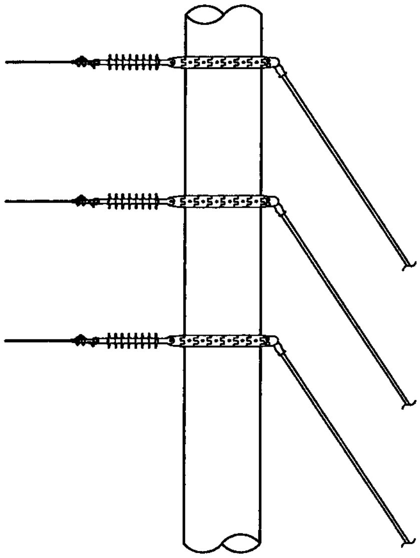
FIBERGLASS POLE TOP EXTENSION

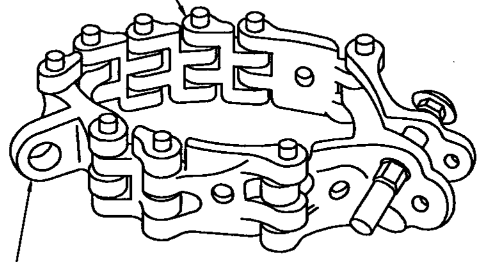
Duke Energy®

FLA DWG. 03.06-34

CHAIN FOR 30" DIA. POLE WITH 2 EYES

RATED 15,000 LBS.



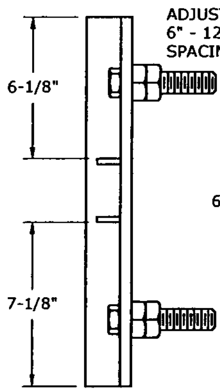


NOTE: CHAIN LINK COMES WITH TWO EYE LINKS. FOR ADDITIONAL EYE LINKS, CALL FOR CU OHCHAINEYEF

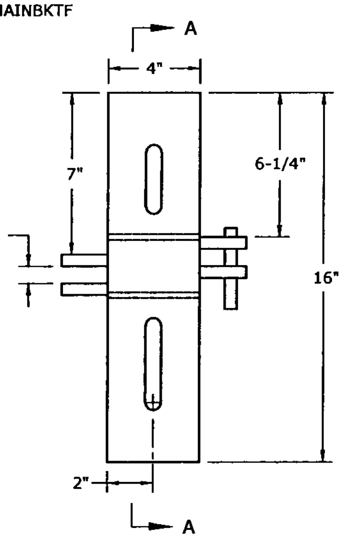
IF BINDING OF THE INSULATOR AT THE EYE LINK IS AN ISSUE, UTILIZE A CLEVIS-CLEVIS 90 - CN 113145 AND A TWISTED CHAIN LINK - CN 115428.

NEW MACLEAN BRACKET FOR CHAIN FOR EQUIPMENT AND INSULATOR BRACKETS

CN 9220222876
CU OHCHAINBKTF



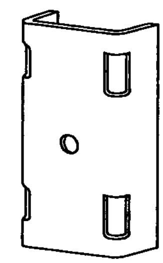
SECTION 'A-A'



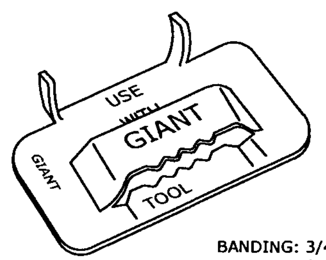
FRONT VIEW

FOR MOUNTING LIGHTNING ARRESTER

CN 070423
CU BKTSPIBANDF



BUCKLE AND BANDING



BANDING: 3/4" - CN 434122
1-1/4" - CN 434124

BUCKLE: 3/4" - CN 434142
1-1/4" - CN 434145

NOTES:

1. THE PREFERRED METHOD FOR ATTACHING TO TRANSMISSION POLES IS TO BOLT ALL DISTRIBUTION HARDWARE TO THE POLE. BOLT HOLES CAN BE MADE AVAILABLE BY THE POLE MANUFACTURER WITH PROPER PLANNING.

2. IF HOLES ARE NOT AVAILABLE, THE DISTRIBUTION PLANNER SHOULD EXPLORE DRILLING OPTIONS WITH TRANSMISSION ENGINEERING PRIOR TO RELEASING THE WORK REQUESTS.

3. WHEN HOLES ARE NOT AVAILABLE AND DRILLING IS NOT AN OPTION, BANDING MAY BE USED.

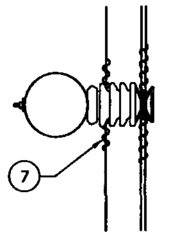
3				
2				
1	1/27/12	BURLISON	BURLISON	ELKINS
0	6/10/11	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

BANDING FOR DEADENDS, BRACKETS, GUYS AND EQUIPMENT ON TRANSMISSION POLES

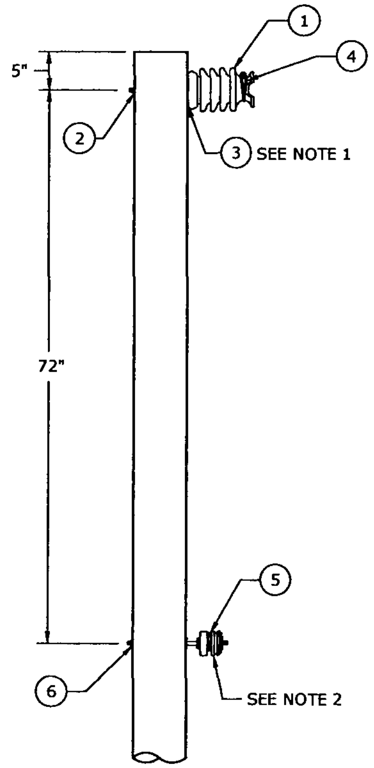
Progress Energy

FLA

DWG. 03.06-35



PLAN VIEW



FRONT VIEW
0° - 5° ANGLE

POLE SIZING CHART					
WIRE SIZE	MAX. SPAN (FT)	POLE CLASS BY HEIGHT			JOINT USE (TOTAL DIAMETER)
		45	50	55	
1/0 & SMALLER	400	4	3	3	≤ 1"
1/0 & SMALLER	340	4	3	3	1" - 2.5"
1/0 & SMALLER	400	3	3	2	1" - 2.5"
1/0 & SMALLER	400	1	1	1	2.5" - 4"

NOTES: THIS TABLE SPECIFIES POLE CLASS ONLY. POLE HEIGHT DETERMINED BY CLEARANCE. SEE DWG. 02.02-03A FOR STANDARD STOCKED POLES. POLEFOREMAN REQUIRED FOR DESIGNS OUTSIDE OF TABLE GUIDELINES. FOR POLES WITH EQUIPMENT, MINIMUM CLASS IN DWG. 02.02-03B MUST ALSO BE MET.

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(VOLTAGE)1TA(WIRE)FM	1	IHPTT15F	1	INSULATOR POST, HORIZONTAL, TIE TOP, STUD BASE 15 KV
	2	ISSTUDBOLT58_F	1	INSULATOR SUPPORT STUD 5/8 X (VARIES BY LENGTH)
	3	ISGAINGRIDF	1	INSULATOR SUPPORT GAINGRID 4X4 INCH ALUMINUM NO TEETH
	3	ISGAINGRID55F	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH
	4	STIE_F	1	SIDE TIE F NECK (VARIES WITH WIRE SIZE)
SCTAN(WIRE)FM	5	ISPLF	1	INSULATOR SPOOL
	6	NSSB_F	1	NEUTRAL AND SECONDARY SPOOL BOLT (10 OR 12) INCH
	7	NEUSPTIE_F	1	FORMED SPOOL TIE (VARIES WITH WIRE SIZE)

NOTES:

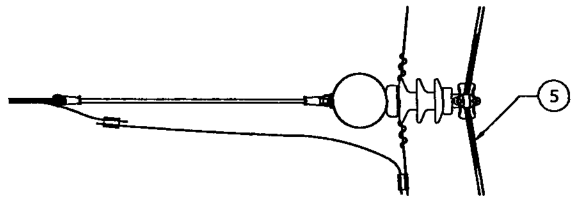
1. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.
2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.

REVISED		BY	CK'D	APPR.
3	3/21/13	McCONNELL	DANNA	ADCOCK
2	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
1	6/10/11	BURLISON	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

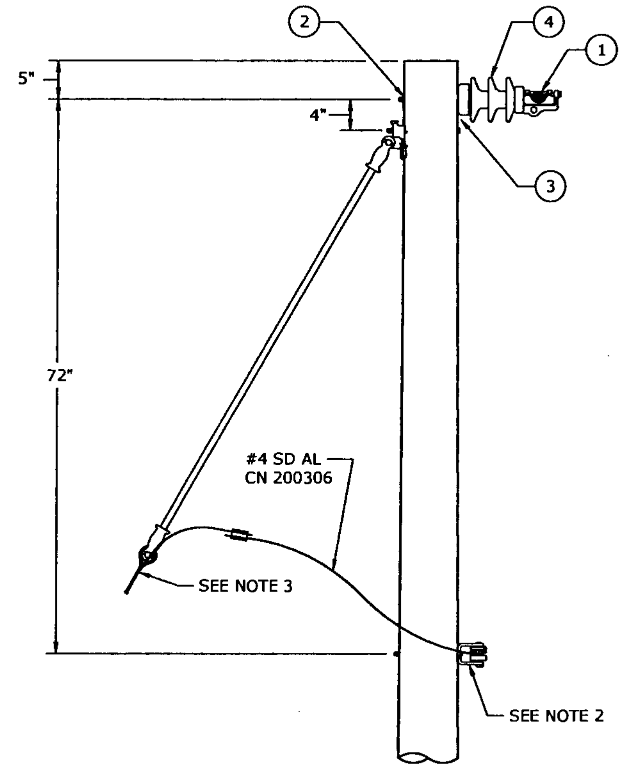
SINGLE-PHASE CONSTRUCTION - TANGENT

DUKE ENERGY.

FLA DWG. 03.08-01



PLAN VIEW



FRONT VIEW
6° - 15° ANGLE

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V1SA(WIRE)FM	1	TRCLAMP(WIRE)F	1	TRUNION CLAMP (WIRE)
	2	ISSTUDBOLT5812F	1	INSULATOR SUPPORT STUDBOLT 5/8 X 12"
	3	ISGAINGRIDF	1	INSULATOR SUPPORT GAINGRID 4 X 4 INCH ALUMINUM NO TEETH
	3	ISGAINGRID55F	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH
	4	IHPCLT(KV)F	1	INSULATOR POST, HORIZ, CLAMP TOP, STUD BASE (KV)
	5	AR(WIRE)F	1	ARMOR ROD (WIRE)

NOTES:

1. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.

2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.

3. TYPICAL INSTALLATION - REFER TO SECTION 02 FOR GUYING DETAILS.

4. PRIMARY AND NEUTRAL MAY BE FRAMED ON GUY SIDE OF POLE AS AN ALTERNATE METHOD TO FACILITATE TRUCK ACCESSIBILITY.

5. SEE DWG. 03.03-06 FOR LINE CLAMPS.

REVISED		BY	CK'D	APPR.
3				
2	3/21/13	McCONNELL	DANNA	ADCOCK
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

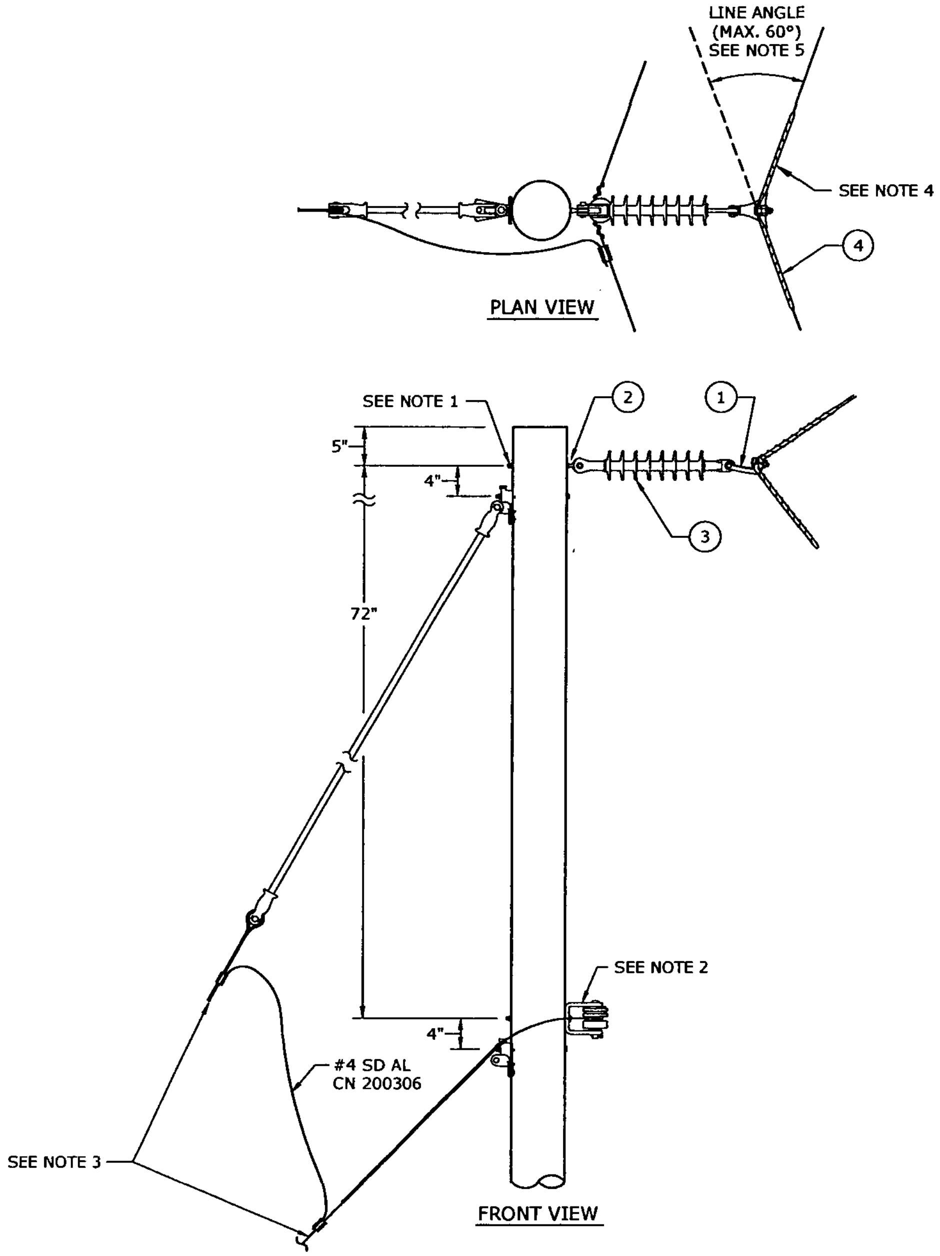
SINGLE-PHASE CONSTRUCTION -

SMALL ANGLE POLES

DUKE ENERGY.

FLA

DWG. 03.08-02



BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V1MA(WIRE)FM	1	SCLMP(WIRE)F	1	SUSPENSION CLAMP (WIRE)
	2	ISEYEBOLT5812F	1	INSULATOR SUPPORT EYEBOLT 5/8 X 12"
	3	IDES(KV)PF	1	INSULATOR DEADEND/ SUSPENSION (KV) POLYMER
	4	AR(WIRE)F	1	ARMOR ROD (WIRE)

NOTES:

1. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
2. TYPICAL INSTALLATION - SEE SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. TYPICAL INSTALLATION - SEE SECTION 02 FOR GUYING DETAILS.
4. ARMOR ROD REQUIRED FOR ANGLE ASSEMBLY FOR ACSR, AAC AND AAAC CONDUCTORS.
5. FOR 15° - 60° ANGLES.
6. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

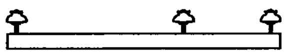
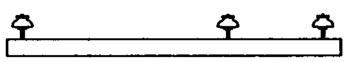
REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

SINGLE-PHASE - DEADENDS AND MEDIUM ANGLES

Progress Energy

FLA

DWG. 03.08-04

CONFIGURATION	WIRE SIZE	SINGLE ARM FOR LINE USE — LIGHT	SINGLE ARM FOR LINE USE — HEAVY	DOUBLE ARM FOR LINE USE — LIGHT	DOUBLE ARM FOR LINE USE — HEAVY
 8' ARM	6	(1) —		(4) —	
	4	(1) —		(4) —	
	2	(1) —			(5) —
	1/0	(1) —			(5) —
	2/0	(2) —			(5) —
	4/0	(2) —			(5) —
		(2) —			
	336.4 KCM	(2) —			(5) —
	795 KCM		(3) —		(5) (—)
 8' ARM	6	(1) —		(4) —	
	4	(1) —		(4) —	
	2	(1) —			(5) —
	1/0	(2) —			(5) —
	2/0	(2) —			(5) —
	4/0	(2) —			(5) —
	336.4 KCM	(2) —			(5) —
	795 KCM		(3) —		(5) (—)
 10' ARM (SEE NOTE 2)	6	(6) —		(9) —	
	4	(6) —		(9) —	
	2	(6) —			(10) —
	1/0	(7) —			(10) —
	2/0	(7) —			(10) —
	4/0	(7) —			(10) —
	336.4 KCM	(7) —			(10) —
	795 KCM		(8) —		(10) (—)
 10' ARM	6	(6) —		(9) —	
	4	(6) —		(9) —	
	2	(6) —			(10) (—)
	1/0	(7) —			(10) (—)
	2/0	(7) —			(10) (—)
	4/0	(7) —			(10) (—)
	336.4 KCM	(7) —			(10) (—)

(—) ARMS AS INDICATED MUST BE GUYED

NOTES:

1. ARMS SUPPORTING CONDUCTORS LARGER THAN 1/O AL OR #2 CU REQUIRE THE USE OF 60" BOW BRACES, ARMS SUPPORTING SMALLER CONDUCTORS REQUIRE FLAT BRACES.
2. USE 10 FOOT CROSSARM FOR ALL HORIZONTAL TRANSMISSION UNDERBUILD.
3. SEE DWG. 03.11-01B FOR BILL OF MATERIALS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS

CROSSARMS FOR ALUMINUM AND COPPER CONDUCTORS

Duke Energy

FLA DWG. 03.11-01A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	ARMS8LW36FSF	1	011209	2	BOLT, CRG 3/8X 4-1/2
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				014114	1	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GLV, LAG, 1/2"X4"
				031113	1	CROSSARM, WD 8' MS-121-F LIGHT
				071306	2	BRACE, FLT GALV STL 36"
				152108	1	BOLT, MACH, SQ, NUT, 5/8"X16"
	2	ARMS8LW60VSF	1	013229	2	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	3	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031113	1	CROSSARM, WD 8' MS-121-F LIGHT
				071206	1	BRACE, BOW ANG STL 60"
				152097	2	BOLT, MACH 1/2X 6
				152106	1	BOLT, MACHINE, 5/8" X 10", STEEL, A-ASTM A307, GALV.
				152108	1	BOLT, MACH, SQ, NUT, 5/8"X16"
	3	ARMS8HW60VSF	1	013229	2	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	3	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031124	1	CROSSARM, WD 8' MS-121-F HEAVY
				071206	1	BRACE, BOW ANG STL 60"
				152098	2	BOLT, MACH, SQ, NUT, 1/2"X7"
				152106	1	BOLT, MACHINE, 5/8" X 10", STEEL, A-ASTM A307, GALV.
				152108	1	BOLT, MACH, SQ, NUT, 5/8"X16"
	4	ARMD8LW36FSF	1	011209	4	BOLT, CRG 3/8X 4-1/2
				011313	3	BOLT, DOUBLE ARMING, 5/8" X 20", STEEL, WITH 4 NUTS
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	10	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				014114	2	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GLV, LAG, 1/2"X4"
				031113	2	CROSSARM, WD 8' MS-121-F LIGHT
				071306	4	BRACE, FLT GALV STL 36"
	5	ARMD8HW60VSF	1	011313	3	BOLT, DOUBLE ARMING, 5/8" X 20", STEEL, WITH 4 NUTS
				013229	4	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	10	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031124	2	CROSSARM, WD 8' MS-121-F HEAVY
				071206	2	BRACE, BOW ANG STL 60"
				152098	4	BOLT, MACH, SQ, NUT, 1/2"X7"
				152106	1	BOLT, MACHINE, 5/8" X 10", STEEL, A-ASTM A307, GALV.
	6	ARMS10LW36FSF	1	011209	2	BOLT, CRG 3/8X 4-1/2
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				014114	1	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GLV, LAG, 1/2"X4"
				031114	1	CROSSARM, WD 10' MS-121-F LIGHT
				071306	2	BRACE, FLT GALV STL 36"
				152108	1	BOLT, MACH, SQ, NUT, 5/8"X16"
	7	ARMS10LW60VSF	1	010439	1	BOLT, MACH, SQ, 5/8"-11 X 14", GALV
				013229	2	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	3	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031114	1	CROSSARM, WD 10' MS-121-F LIGHT
				071206	1	BRACE, BOW ANG STL 60"
				152098	2	BOLT, MACH, SQ, NUT, 1/2"X7"
				152107	1	BOLT, MACH, SQ, NUT, 5/8"X12"
	8	ARMS10HW60VSF	1	013229	2	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031125	1	CROSSARM, 299 WOOD, 4-3/4" X 5-3/4" X 10', HEAVY
				071206	1	BRACE, BOW ANG STL 60"
				152098	2	BOLT, MACH, SQ, NUT, 1/2"X7"
				152107	1	BOLT, MACH, SQ, NUT, 5/8"X12"
				152108	1	BOLT, MACH, SQ, NUT, 5/8"X16"
	9	ARMD10LW36FF	1	011209	4	BOLT, CRG 3/8X 4-1/2
				011312	3	BOLT, DOUBLE ARMING, 5/8" X 20", STEEL, WITH 4 NUTS
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	10	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				014114	2	SCREW, LAG, 1/2 IN X 4 IN, STEEL, GLV, LAG, 1/2"X4"
				031114	2	CROSSARM, WD 10' MS-121-F LIGHT
				071306	4	BRACE, FLT GALV STL 36"
	10	ARMD10HW60VSF	1	011313	3	BOLT, DOUBLE ARMING, 5/8" X 20", STEEL, WITH 4 NUTS
				013229	4	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	10	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				031125	2	CROSSARM, 299 WOOD, 4-3/4" X 5-3/4" X 10', HEAVY
				071206	2	BRACE, BOW ANG STL 60"
				152098	4	BOLT, MACH, SQ, NUT, 1/2"X7"
				152107	1	BOLT, MACH, SQ, NUT, 5/8"X12"

NOTES:

1. SEE DWG. 03.11-01A FOR CROSSARM CONFIGURATIONS.

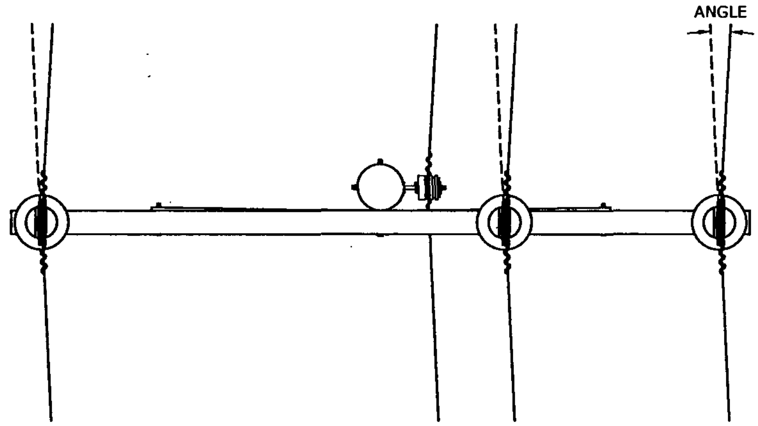
3					
2					
1					
0	11/18/10	CECCONI	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

CROSSARMS FOR ALUMINUM AND COPPER CONDUCTORS

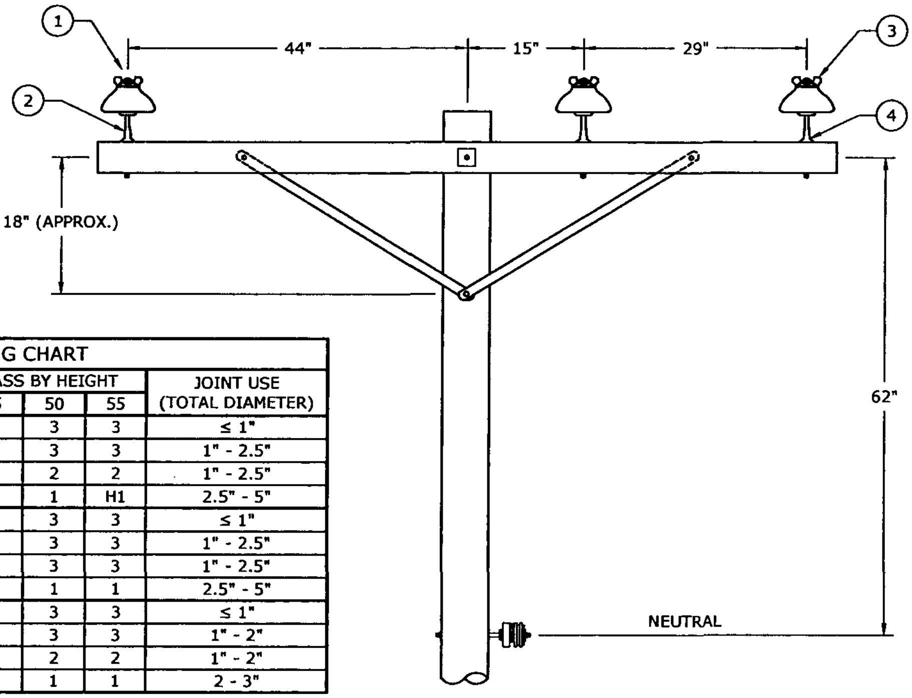
Duke Energy®

FLA

DWG. 03.11-01B



PLAN VIEW



FRONT VIEW

POLE SIZING CHART						
WIRE SIZE	MAX. SPAN (FT)	POLE CLASS BY HEIGHT				JOINT USE (TOTAL DIAMETER)
		40	45	50	55	
795	250	4	4	3	3	≤ 1"
795	180	4	4	3	3	1" - 2.5"
795	250	3	2	2	2	1" - 2.5"
795	250	1	1	1	H1	2.5" - 5"
336	250	5	4	3	3	≤ 1"
336	225	4	4	3	3	1" - 2.5"
336	250	3	3	3	3	1" - 2.5"
336	250	2	1	1	1	2.5" - 5"
1/0 & SMALLER	400	4	3	3	3	≤ 1"
1/0 & SMALLER	300	4	4	3	3	1" - 2"
1/0 & SMALLER	400	3	2	2	2	1" - 2"
1/0 & SMALLER	400	2	1	1	1	2 - 3"

NOTES: THIS TABLE SPECIFIES POLE CLASS ONLY. POLE HEIGHT DETERMINED BY CLEARANCE. SEE DWG. 02.02-03A FOR STANDARD STOCKED POLES. POLEFOREMAN REQUIRED FOR DESIGNS OUTSIDE OF TABLE GUIDELINES. FOR POLES WITH EQUIPMENT, MINIMUM CLASS IN DWG. 02.02-03B MUST ALSO BE MET.

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF12H3TA(WIRE)FM	1	TTIE(WIRE)F	3	TOP TIE F NECK (WIRE)
	2	PINCARMS586F	3	INSULATION PIN CROSSARM SHOULDER 5/8 X 6" X 1" HEAD
	3	IPIN23F	3	INSULATOR PIN 23KV
	4	ARMS8LW36FSF	1	CROSSARM SINGLE 8' X 3.5" X 4.5" WD 36" LONG FLT BRACE STL

NOTES:

1. PLACE CONDUCTOR IN TOP GROOVE.
2. ARMS SUPPORTING CONDUCTOR LARGER THAN 1/0 AL. OR #2 CU. WILL REQUIRE THE USE OF 60" BOW BRACES.
3. SEE DWG 03.06-08 FOR PIN TYPE INSULATORS.

REVISED		BY	CK'D	APPR.
3				
2	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

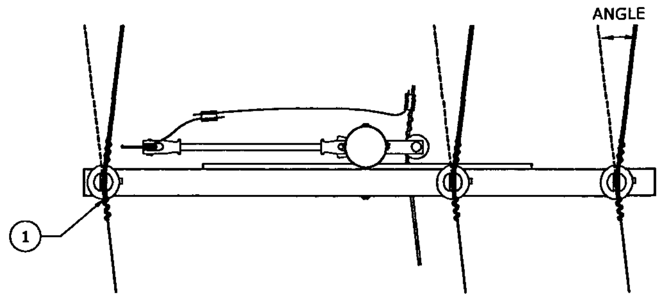
HORIZONTAL CONSTRUCTION -

0 DEGREES TO 5 DEGREES

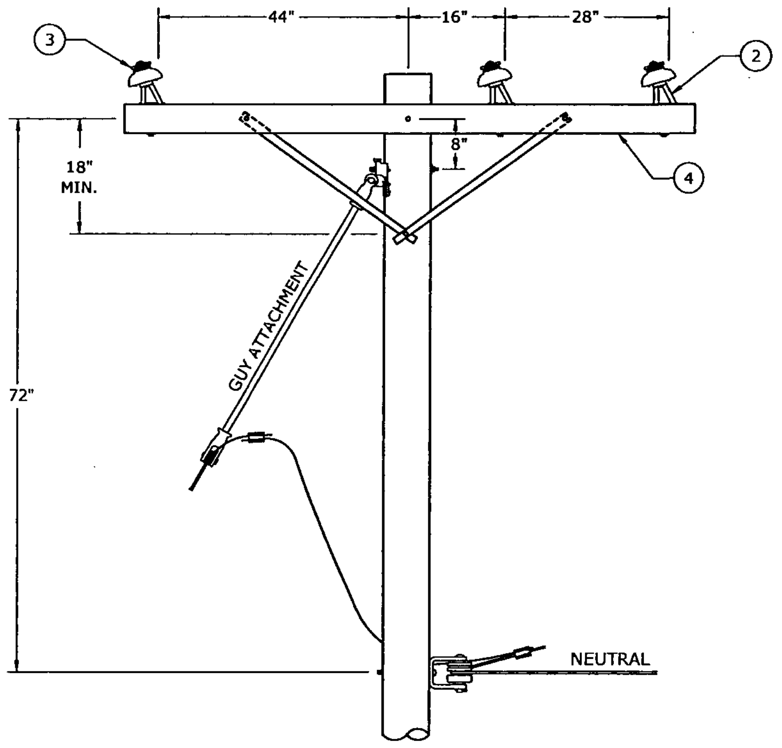
Duke Energy

FLA

DWG. 03.11-02



PLAN VIEW



FRONT VIEW

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF12H3SA(WIRE)FM	1	STIEF(WIRE)F	3	SIDE TIP F NECK (WIRE)
	2	PINCARMA586F	3	INSULATOR PIN CROSSARM ANGLE 5/8X6" X 1" HEAD
	3	IPIN23F	3	INSULATOR PIN 23 KV
	4	ARMS8LW36FSF	1	CROSSARM SINGLE, 8'X3.5"X4.5" WD 36" LONG FLT BRACE STL

NOTES:

1. PLACE CONDUCTOR IN SIDE GROOVE.
2. SEE DWG 03.06-08 FOR PIN TYPE INSULATORS.
3. SEE DWGS. 03.11-01A AND 03.11-01B FOR CROSSARM COMPATIBLE UNITS.

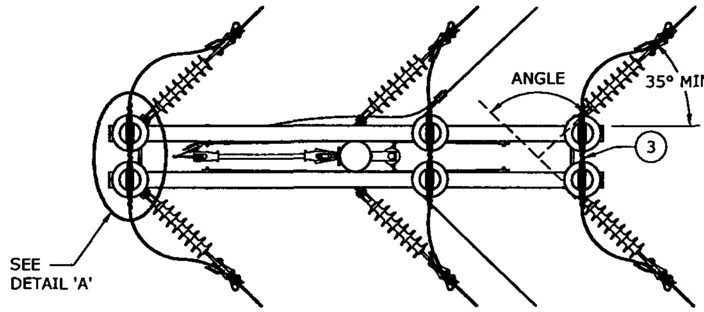
REVISED	DATE	BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

HORIZONTAL CONSTRUCTION -
6 DEGREES TO 15 DEGREES

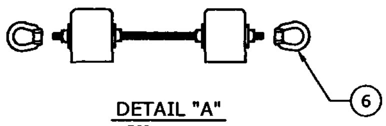
Progress Energy

FLA

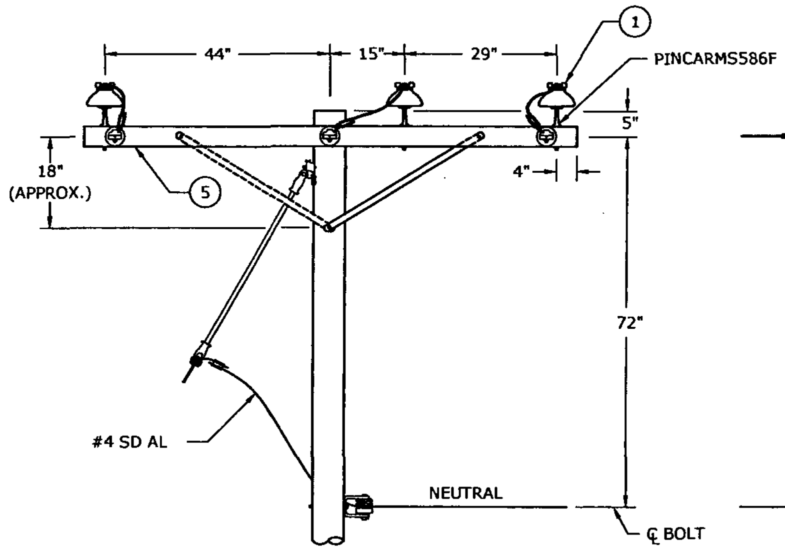
DWG. 03.11-04



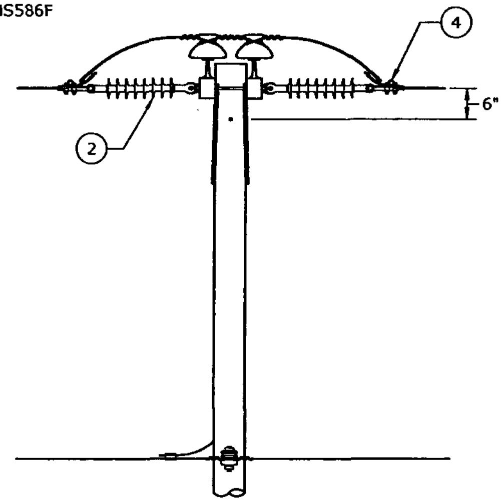
PLAN VIEW



DETAIL "A"
SIDE VIEW
DOUBLE CROSSARM



FRONT VIEW



SIDE VIEW

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF12H3MA(WIRE)FM	1	IPIN23F	6	INSULATOR PIN 23 KV
	2	IDES25PF	6	INSULATOR DEADEND/SUSPENSION 23 KV POLYMER
	3	HTIEN(WIRE)F	24	HAND TIE (WIRE)
	4	DECLMP(WIRE)F	6	DEADEND CLAMP (WIRE)
	5	ARMS8LW36FSF	1	CROSSARM DOUBLE, 8'X3.5"X4.5" WD 36" LONG FLT BRACE STL
	6	ISEYENUT58F	6	INSULATOR SUPPORT EYENUT 5/8

NOTES:

1. SEE DWG. 03.06-02 FOR 15KV AND 27KV DEADEND AND SUSPENSION INSULATORS, BOLTS AND LINE CLAMPS.

2. SEE DWG. 03.06-08 FOR PIN TYPE INSULATORS.

3. SEE DWGS. 03.11-01A AND 03.11-01B FOR CROSSARM COMPATIBLE UNITS.

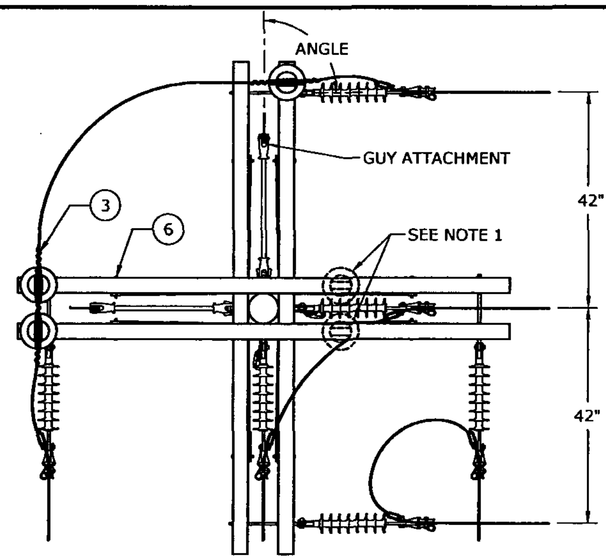
REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

HORIZONTAL CONSTRUCTION -
16 DEGREES TO 59 DEGREES

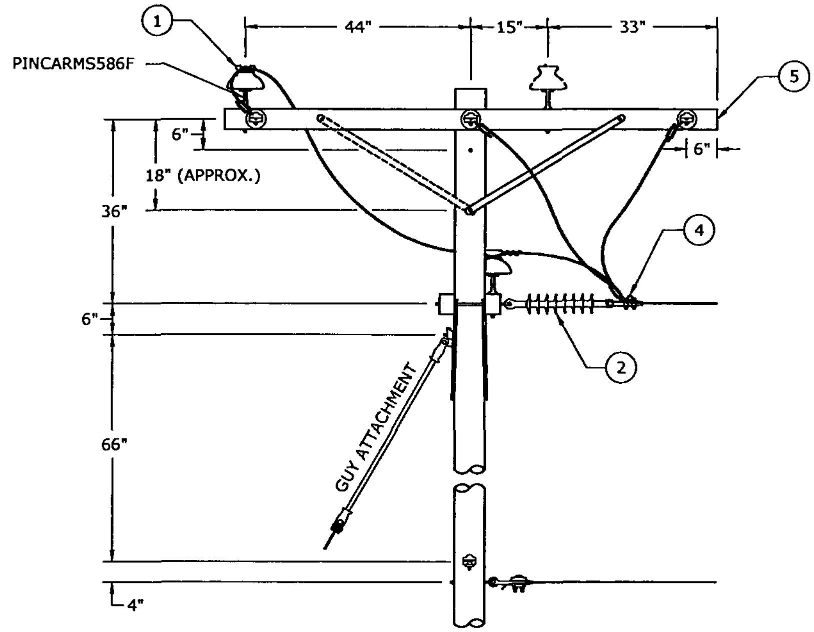
Progress Energy

FLA

DWG. 03.11-06



PLAN VIEW



FRONT VIEW

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF12H3RA(WIRE)FM	1	IPIN23F	5	INSULATOR PIN 23 KV
	2	IDES25PF	6	INSULATOR DEADEND/SUSPENSION 23 KV POLYMER
	3	HTIEN(WIRE)F	40	HAND TIE (WIRE)
	4	DECLMP(WIRE)F	6	DEADEND CLAMP (WIRE)
	5	ARMS8LW36FSF	1	CROSSARM DOUBLE, 8'X3.5"X4.5" WD 36" LONG FLT BRACE STL
	6	ISEYENUT58F	6	INSULATOR SUPPORT EYENUT 5/8

NOTES:

1. USE JUMPER INSULATOR WHEN NECESSARY TO PROVIDE CLEARANCE.
2. SEE DWG. 03.06-08 FOR PIN TYPE INSULATORS.
3. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

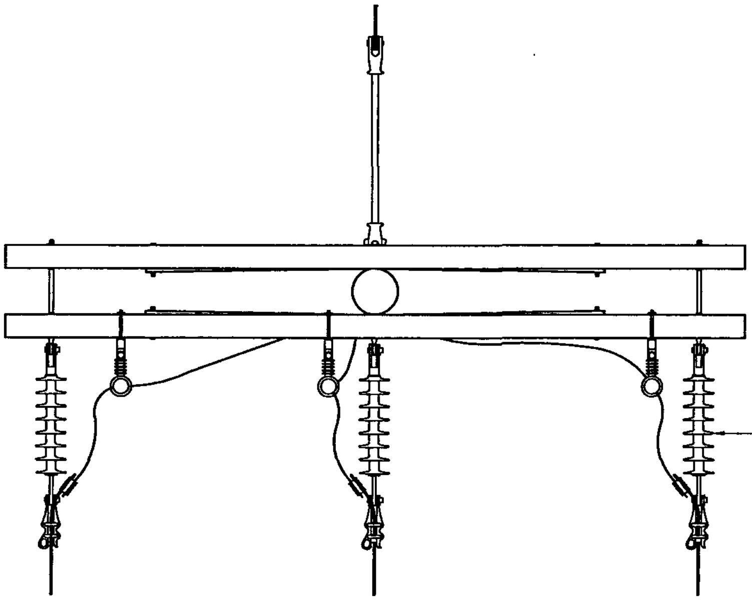
REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

HORIZONTAL CONSTRUCTION -
60 DEGREES TO 90 DEGREES

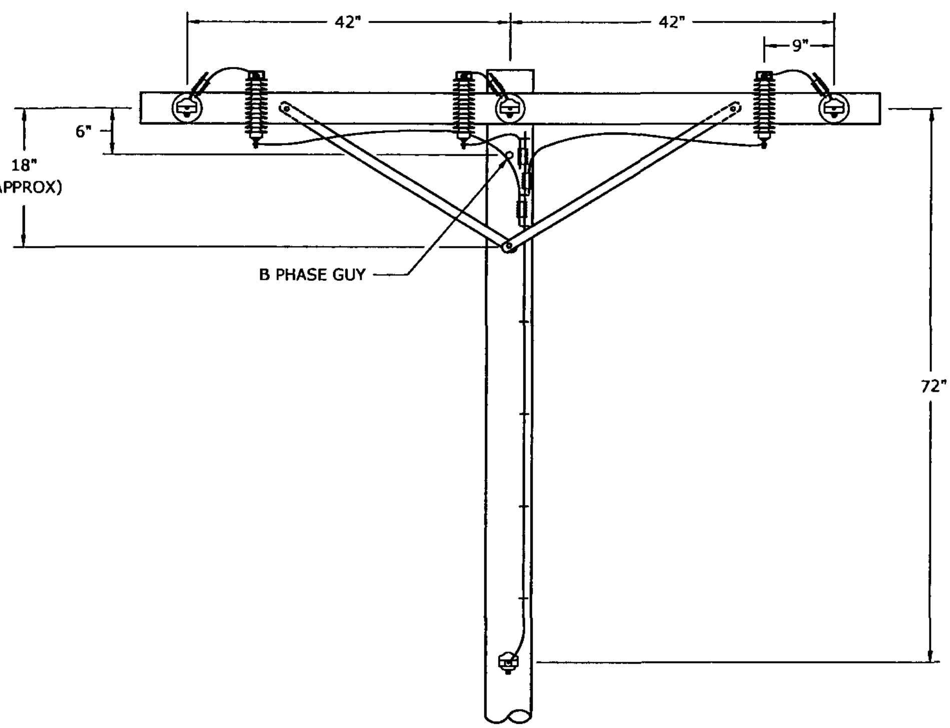
Progress Energy

FLA

DWG. 03.11-10



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS

HORIZONTAL CONSTRUCTION -

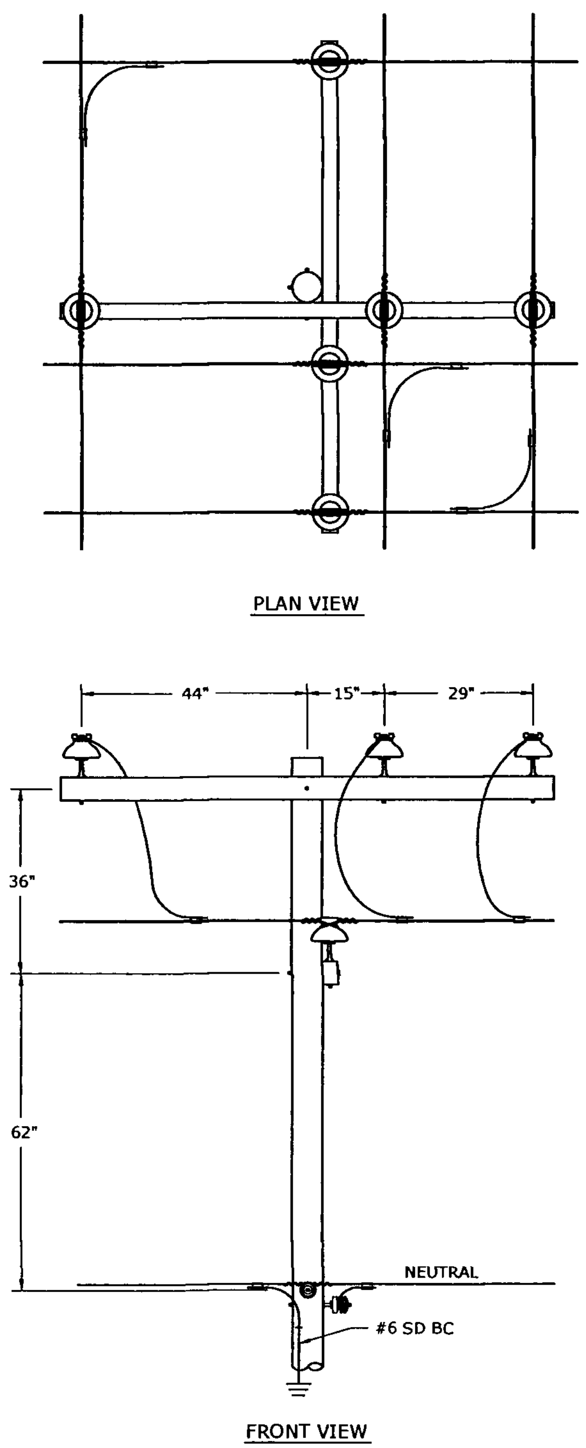
DEADEND

Duke Energy®

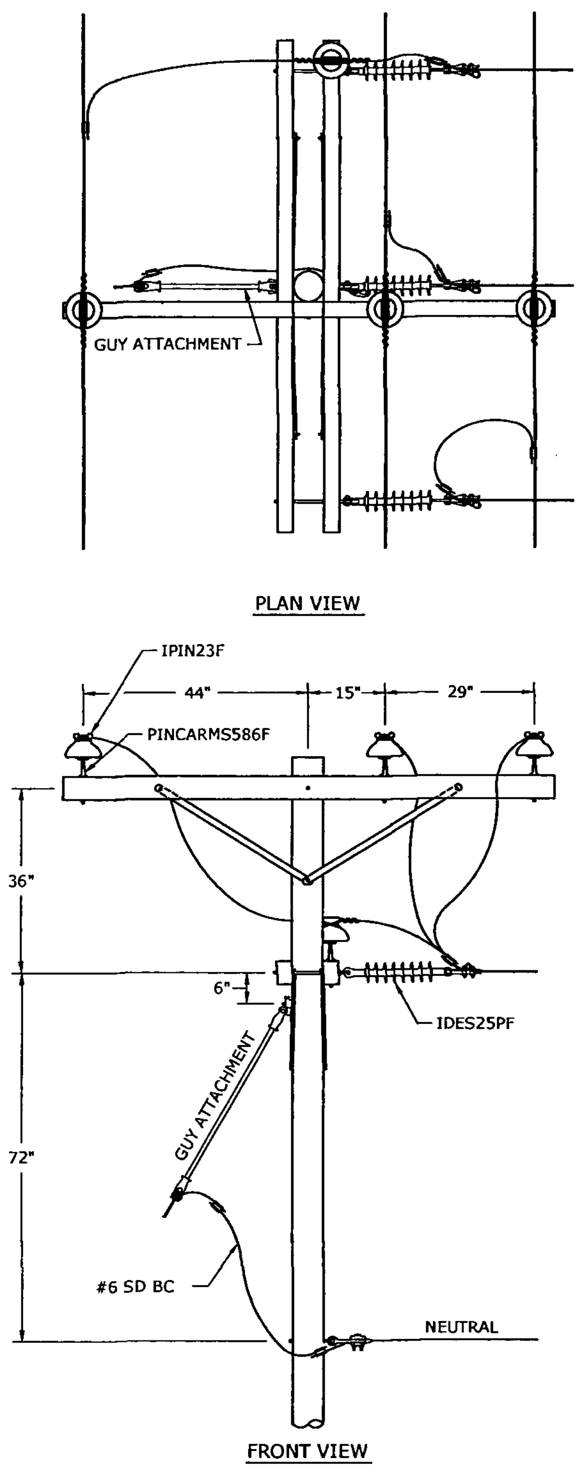
FLA

DWG.
03.11-12

TANGENT CONSTRUCTION



DEADEND CONSTRUCTION



NOTES:

1. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

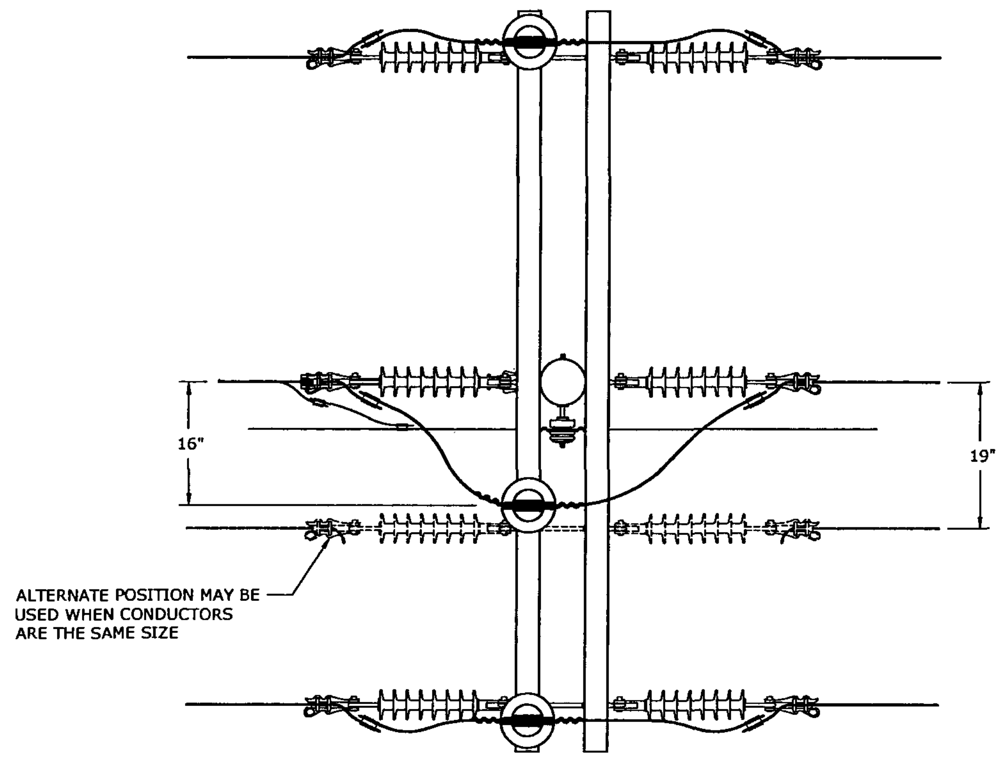
3			
2			
1			
0 11/18/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

HORIZONTAL TANGENT
WITH HORIZONTAL CONSTRUCTION

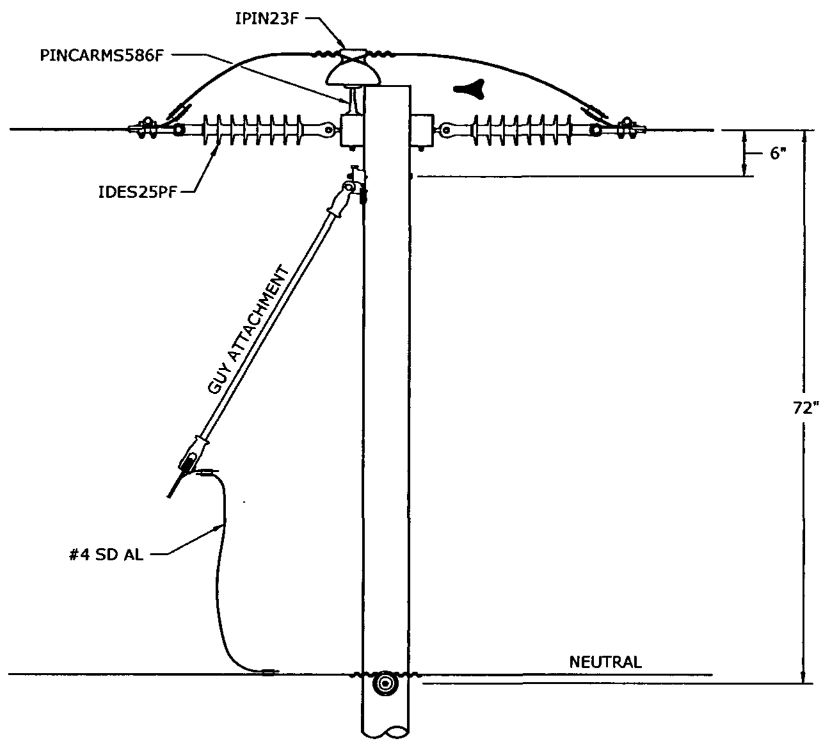
Duke Energy®

FLA

DWG. 03.11-14



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

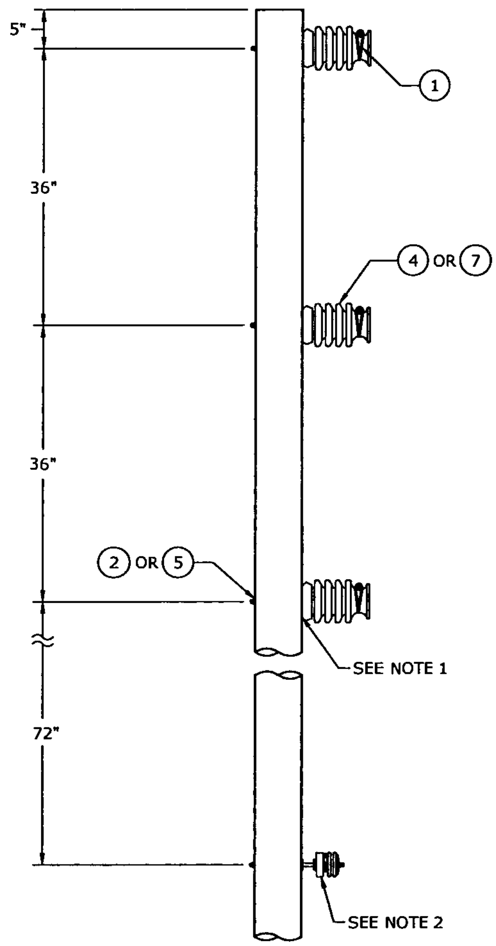
3				
2				
1	9/7/12	BURLISON	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

HORIZONTAL DEADEND
WITH HORIZONTAL DEADEND

Duke Energy

FLA

DWG. 03.11-16



FRONT VIEW
12 KV

POLE SIZING CHART					
WIRE SIZE	MAX. SPAN (FT)	POLE CLASS BY HEIGHT			JOINT USE (TOTAL DIAMETER)
		45	50	55	
795	250	4	3	3	≤ 1"
795	225	4	3	3	1" - 2.5"
795	250	3	2	2	1" - 2.5"
795	250	1	1	1	2.5" - 5"
336	250	4	3	3	< 2.5"
336	175	4	3	3	2.5" - 5"
336	250	2	2	1	2.5" - 5"
1/0 & SMALLER	400	4	3	3	≤ 1"
1/0 & SMALLER	325	3	3	3	1" - 2.5"
1/0 & SMALLER	400	3	2	2	1" - 2.5"
1/0 & SMALLER	400	1	1	H1	2.5" - 5"

NOTES: THIS TABLE SPECIFIES POLE CLASS ONLY. POLE HEIGHT DETERMINED BY CLEARANCE. SEE DWG. 02.02-03A FOR STANDARD STOCKED POLES. POLEFOREMAN REQUIRED FOR DESIGNS OUTSIDE OF TABLE GUIDELINES. FOR POLES WITH EQUIPMENT, MINIMUM CLASS IN DWG. 02.02-03B MUST ALSO BE MET.

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3TA(WIRE)FM	1	STIEF(WIRE)ALF	3	SIDE TIE F NECK (WIRE) ALUMINUM
	2	ISSTUDBOLT5812F	3	INSULATOR SUPPORT STUDBOLT 5/8X12"
	3	ISGAINGRIDF	3	INSULATOR SUPPORT GAINGRID 4X4 INCH ALUMINUM NO TEETH
	3	ISGAINGRID55F	3	INSULATOR SUPPORT GAINGRID 5-1/2 INCH
	4	IHPTT(KV)F	3	INSULATOR POST, HORIZONTAL, TIE TOP, STUD BASE (KV)
PF(KV)V3TA(WIRE)CUFM	5	ISSTUDBOLT5812F	3	INSULATOR SUPPORT STUDBOLT 5/8X12"
	6	ISGAINGRIDF	3	INSULATOR SUPPORT GAINGRID 4X4 INCH ALUMINUM NO TEETH
	7	IHPTT(KV)F	3	INSULATOR POST, HORIZONTAL, TIE TOP, STUD BASE (KV)
	8	HTIEN6CSDF	3	HAND TIE #6 SOFT DRAWN

NOTES:

1. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.

2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.

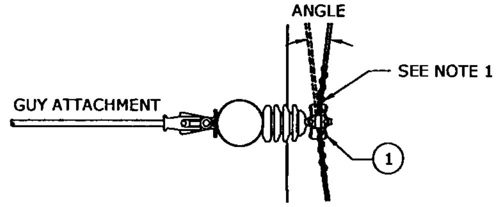
3	3/21/13	McCONNELL	DANNA	ADCOCK
2	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL CONSTRUCTION - TANGENT
795 AAC - 0 DEGREES TO 3 DEGREES,
SMALLER CONDUCTORS - 0 DEGREES TO 5 DEGREES

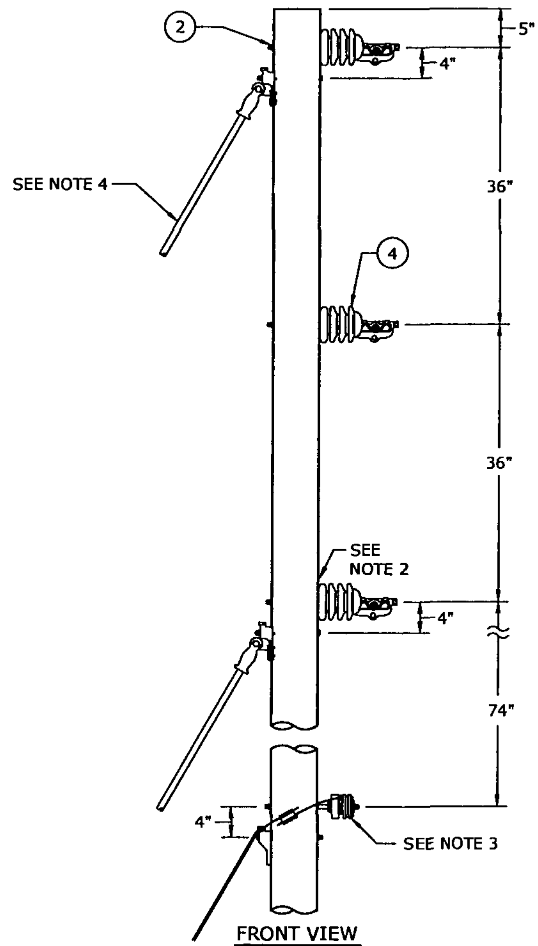
DUKE ENERGY.

FLA

DWG. 03.12-02



PLAN VIEW



FRONT VIEW

6 - 15 DEGREES 12KV

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3SA(WIRE)FM	1	TRCLAMP(WIRE)F	3	TRUNION CLAMP (WIRE)
	2	ISSTUDBOLT5812F	3	INSULATOR SUPPORT STUDBOLT 5/8X12"
	3	ISGAINGRIDF	3	INSULATOR SUPPORT GAINGRID 4X4 INCH ALUMINUM NO TEETH
	3	ISGAINGRID55F	3	INSULATOR SUPPORT GAINGRID 5-1/2 INCH
	4	IHPCLT(KV)F	3	INSULATOR POST, HORIZ, CLAMP TOP, STUD BASE (KV)

NOTES:

1. ARMOR ROD NOT REQUIRED WHEN USING CUSHION GRIP (795 AAC ONLY).
2. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.
3. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
4. TYPICAL INSTALLATION - REFER TO SECTION 02 FOR GUYING DETAILS.
5. SEE DWG. 03.03-06 FOR LINE CLAMPS.

3	3/21/13	McCONNELL	DANNA	ADCOCK
2	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

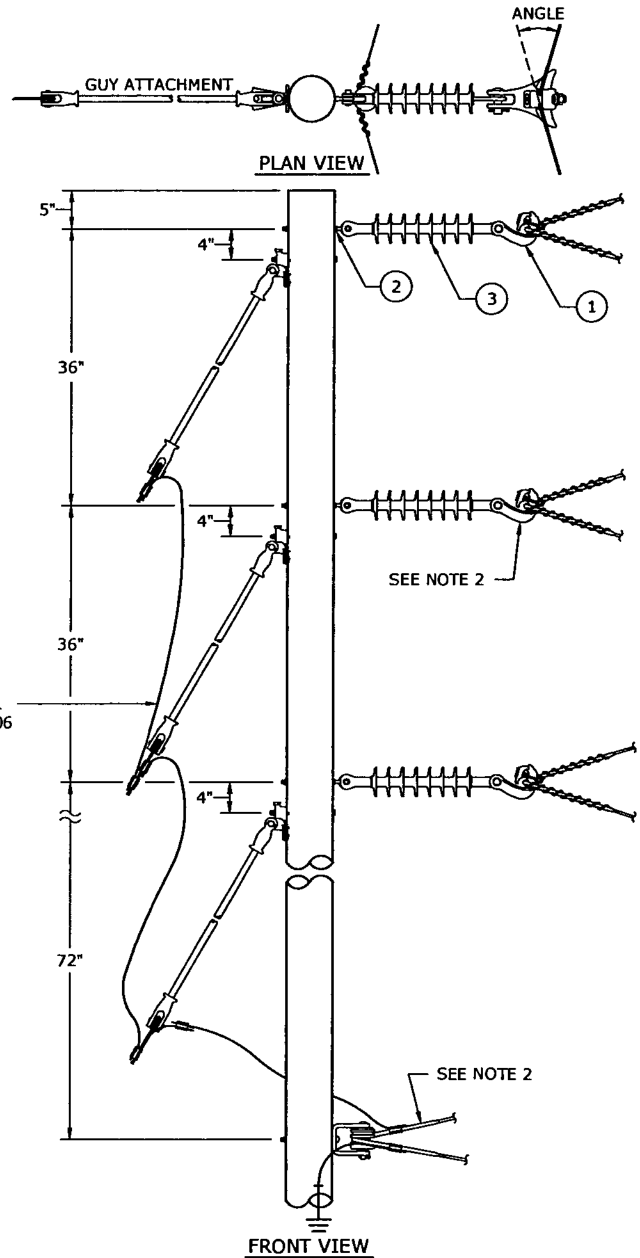
VERTICAL CONSTRUCTION -

SMALL ANGLES

DUKE ENERGY.

FLA

DWG. 03.12-04



16-30 DEGREES FOR 795 AAC
16-60 DEGREES FOR ALL OTHER CONDUCTORS
DOUBLE DEADEND 795 AAC FOR
ANGLES GREATER THAN 30 DEGREES

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3MA(WIRE)FM	1	SCLMP(WIRE)F	3	SUSPENSION CLAMP (WIRE)
	2	ISEYEBOLT5812F	3	INSULATOR SUPPORT EYEBOLT 5/8X12"
	3	IDES(KV)PF	3	INSULATOR DEADEND/SUSPENSION (KV) POLYMER

NOTES:

1. USE 3 OR 4 PRIMARY GUYS AS SPECIFIED ON WORK ORDER.
2. ARMOR ROD REQUIRED ON 1/0 AAAC AND 336 AAC. FOR 795 AAC, AN ARMOR ROD OR CUSHION GRIP IS REQUIRED.
3. SEE DWG. 02.04-18 FOR THE APPROPRIATE APPLICATION OF GUY INSULATORS.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
5. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

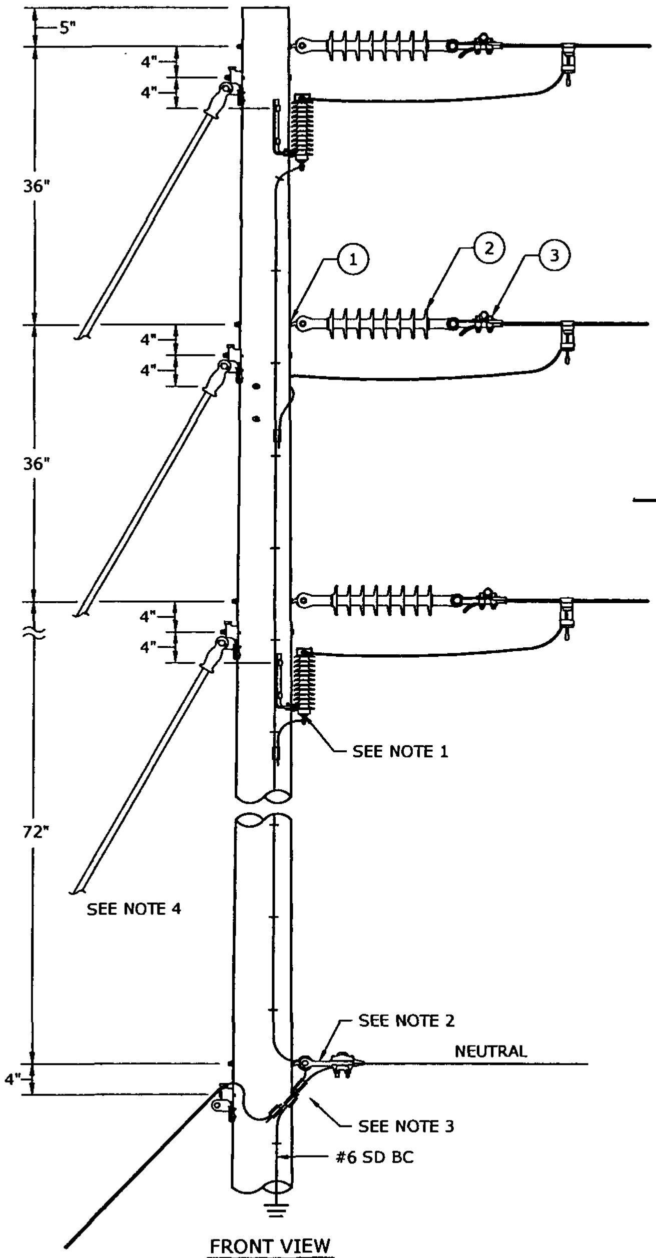
VERTICAL CONSTRUCTION - ANGLE ASSEMBLIES

ANGLES TO 60 DEGREES

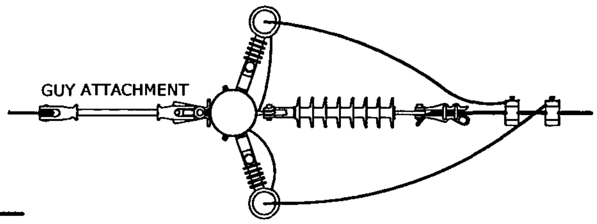
Progress Energy

FLA

DWG. 03.12-06



FRONT VIEW



PLAN VIEW

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3DE(WIRE)FM	1	ISEYEBOLT5812F	3	INSULATOR SUPPORT EYEBOLT 5/8X12"
	2	IDES(KV)PF	3	INSULATOR DEADEND/SUSPENSION (KV) POLYMER
	3	DECLMP(WIRE)F	3	DEADEND CLAMP (WIRE)

NOTES:

1. ARRESTERS ISSUED SEPARATELY - SEE SECTION 08 FOR DETAILS.
2. TYPICAL INSTALLATION - SEE SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
4. TYPICAL INSTALLATION - SEE SECTION 02 FOR GUYING DETAILS.
5. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR. USE 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
6. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

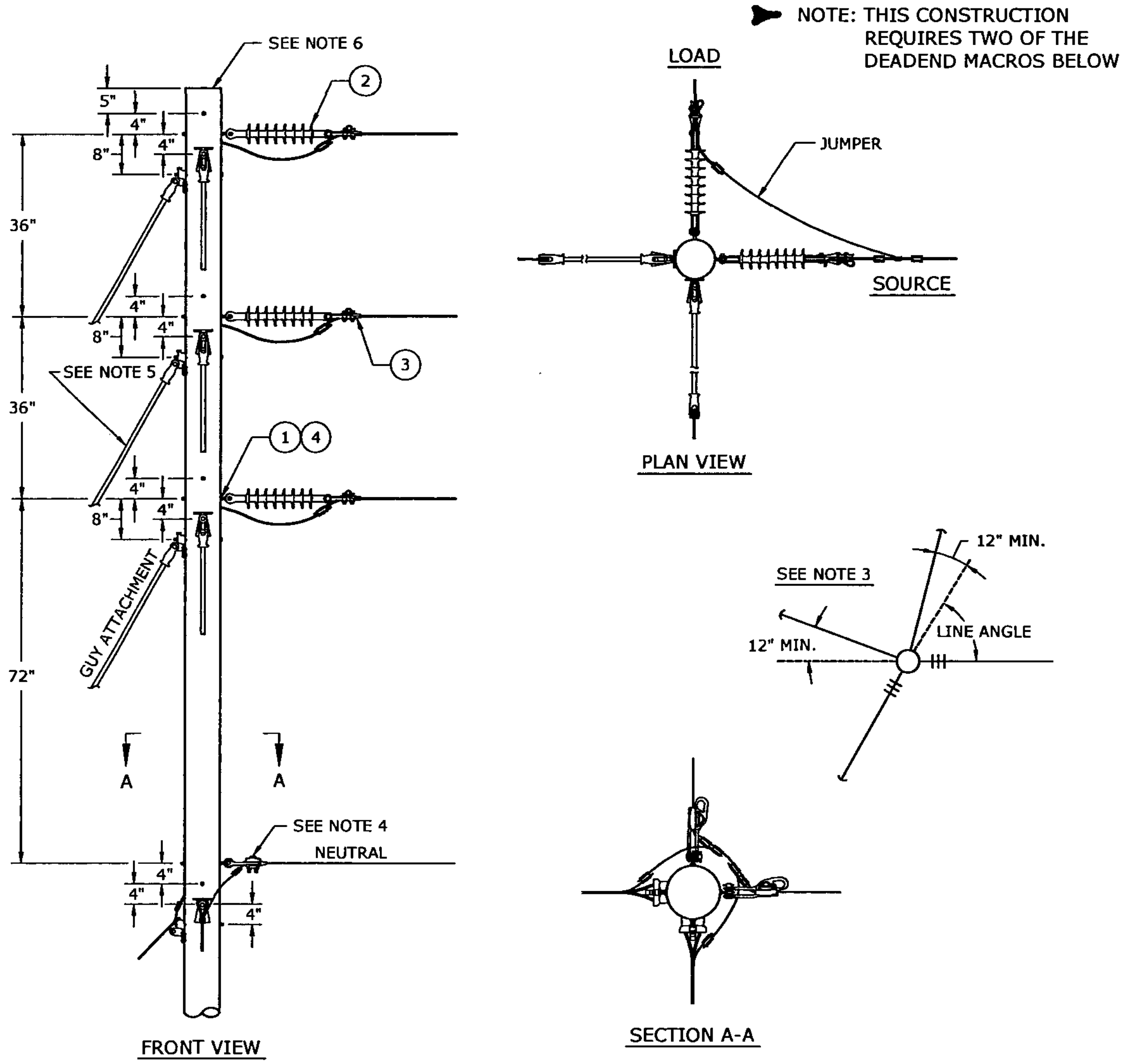
REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

VERTICAL CONSTRUCTION - DEADEND

Progress Energy

FLA

DWG. 03.12-10



BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3DE(WIRE)FM	1	ISEYEBOLT5812F	3	INSULATOR SUPPORT EYEBOLT 5/8 X 12"
	2	IDES(KV)PF	3	INSULATOR DEADEND/SUSPENSION (KV) POLYMER
	3	DECLMP(WIRE)F	3	DEADEND CLAMP (WIRE)

NOTES:

1. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
2. HOTLINE CLAMP AND STIRRUP MAY BE USED FOR SMALL CONDUCTORS. USE SOLID JUMPER FOR LARGE CONDUCTOR (ABOVE 1/0).
3. IF USED FOR LINE ANGLES LESS THAN 60°, OFFSET EACH ANCHOR 12" (SEE ABOVE) OR ADD A BISECTIONAL GUY. CONSIDER BISECTIONAL GUYS WHERE ANGLE PERMITS.
4. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
5. TYPICAL INSTALLATION - REFER SECTION 02 FOR GUYING DETAILS.
6. USE A 45' CLASS 2 POLE FOR 795 AAC CONDUCTOR.
7. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

REVISED	DATE	BY	CK'D	APPR.
3				
2	4/4/13	McCONNELL	DANNA	ADCOCK
1	5/22/12	BROWN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

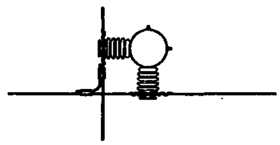
VERTICAL RIGHT ANGLE POLE CONSTRUCTION

THREE-PHASE

DUKE ENERGY.

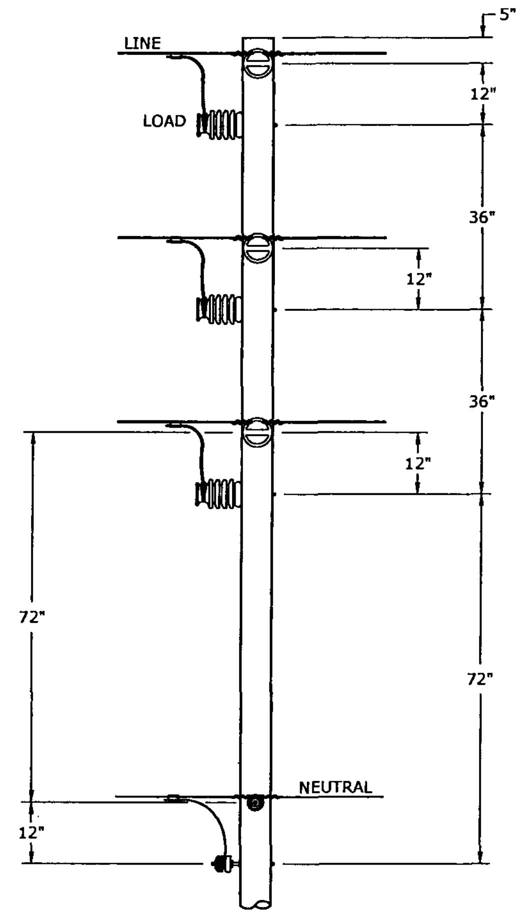
FLA

DWG. 03.12-11



PLAN VIEW

TANGENT CONSTRUCTION



FRONT VIEW

NOTES:

1. THE INTENT OF THIS DRAWING IS TO SHOW PHASE SPACING AND CIRCUIT ARRANGEMENT. PRIMARY SUPPORT CONFIGURATION MAY VARY.

2. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.

3. SEE SPECIFIC CONFIGURATION DRAWINGS FOR ADDITIONAL DETAILS.

3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

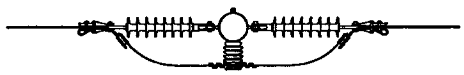
VERTICAL TANGENT CROSSING

DUKE ENERGY.

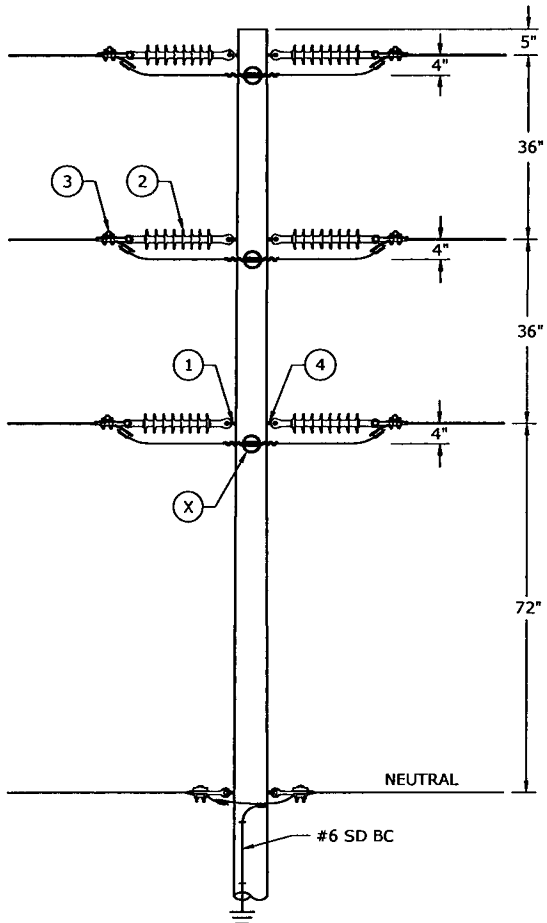
FLA

DWG. 03.12-12

VERTICAL DEADEND WITH VERTICAL DEADEND



PLAN VIEW



FRONT VIEW

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
PF(KV)V3DD(WIRE)FM	1	ISEYEBOLT5812F	3	INSULATOR SUPPORT EYEBOLT 5/8 X 12"
	2	IDES(KV)PF	6	INSULATOR DEADEND/ SUSPENSION (KV) POLYMER
	3	DECLMP(WIRE)F	6	DEADEND CLAMP (WIRE)
	4	ISEYENUT58F	3	INSULATOR SUPPORT EYENUT 5/8

NOTES:

1. DEADEND SMALLER CONDUCTORS ON THE STEEL CROSSARM.
2. ATTACH ARM TO POLE WITH (2) 3/4" MACHINE BOLTS.
3. LOAD LIMITS FOR STEEL CROSSARM:
   A. MAXIMUM LOAD PER PHASE = 5,100 LBS.
   B. TOTAL MAXIMUM LOAD = 10,200 LBS.
4. USE 35KV POST INSULATOR ON STEEL ARM TO IMPROVE BIL.
5. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
6. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.
7. SEE DWG. 03.12-14B FOR ALTERNATE CONSTRUCTION SPECIFICATIONS.

3				
2				
1	4/4/13	McCONNELL	DANNA	ADCOCK
0	8/7/12	ROBESON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL DOUBLE DEADEND CONSTRUCTION

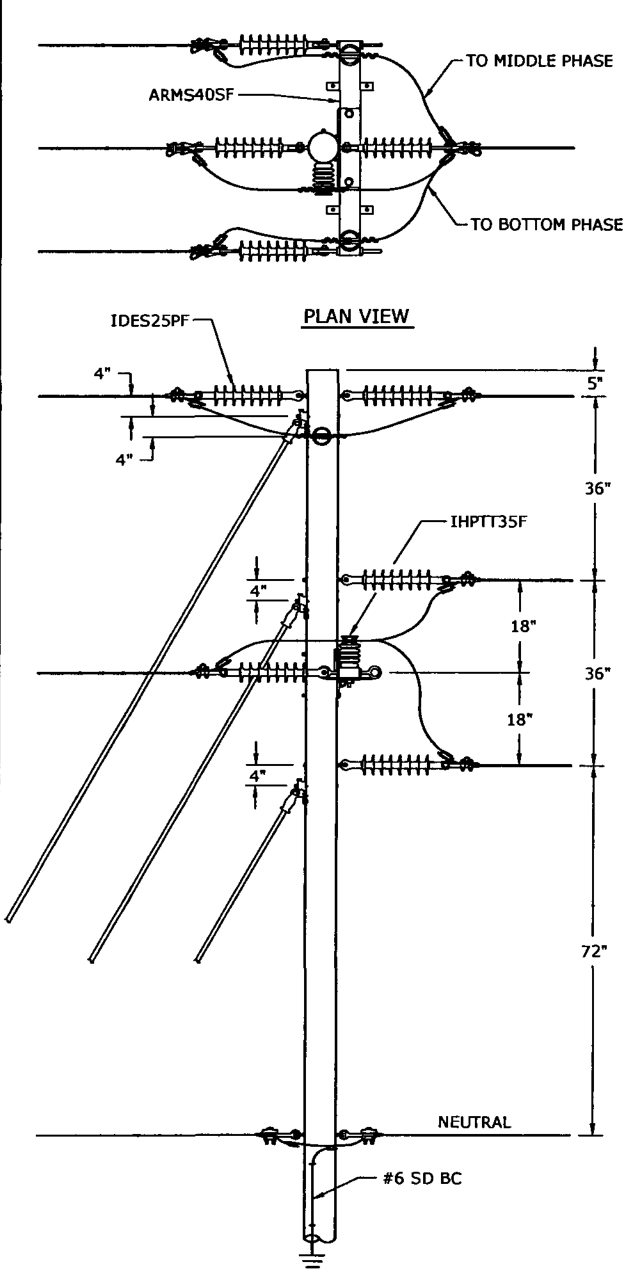
THREE-PHASE

DUKE ENERGY.

FLA

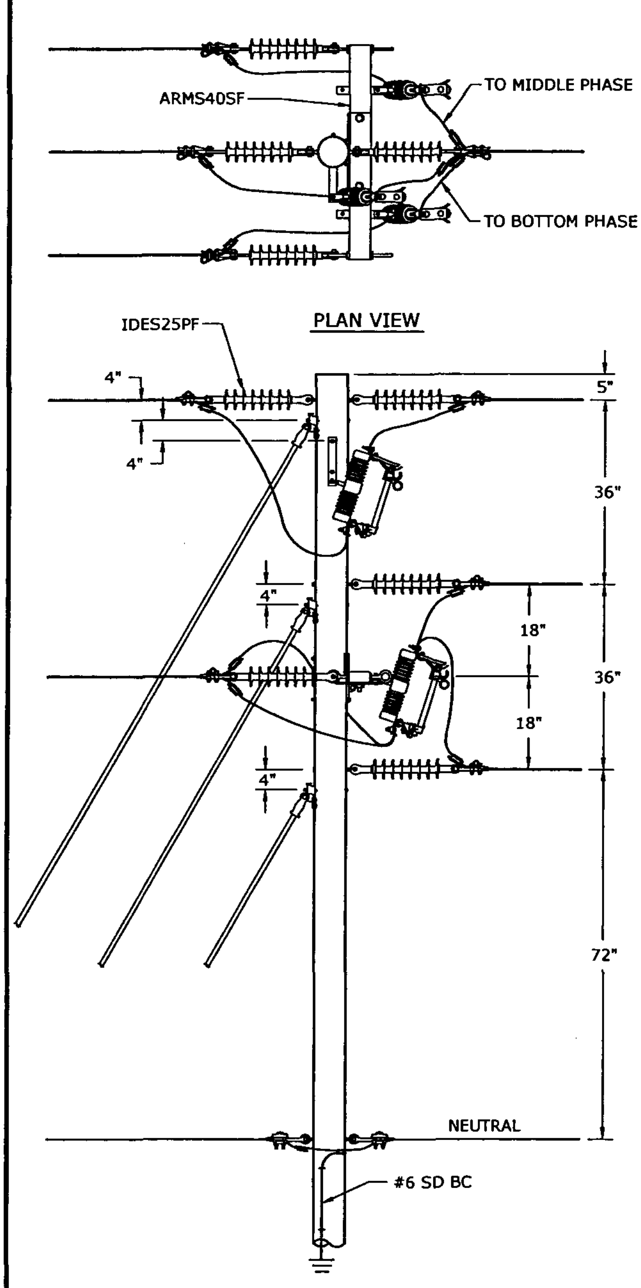
DWG. 03.12-14A

VERTICAL CONSTRUCTION DEADEND
(TRANSITION TO SMALLER CONDUCTOR
WITHOUT FUSE PROTECTION)



FRONT VIEW

VERTICAL CONSTRUCTION DEADEND
(TRANSITION TO SMALLER CONDUCTOR
WITH FUSE PROTECTION)



FRONT VIEW

NOTES:

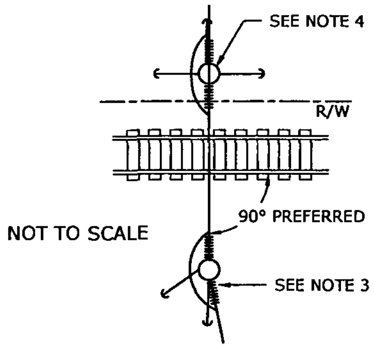
1. DEADEND SMALLER CONDUCTORS ON THE STEEL CROSSARM.
2. ATTACH ARM TO POLE WITH (2) 3/4" MACHINE BOLTS.
3. LOAD LIMITS FOR STEEL CROSSARM:
   A. MAXIMUM LOAD PER PHASE = 5,100 LBS.
   B. TOTAL MAXIMUM LOAD = 10,200 LBS.
4. USE 35KV POST INSULATOR ON STEEL ARM TO IMPROVE BIL.
5. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
6. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

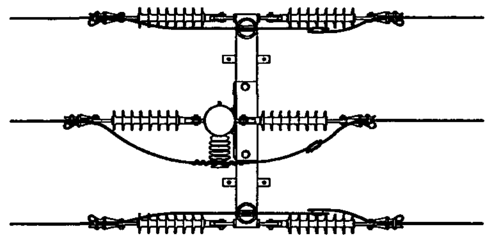
3			
2			
1			
0 8/7/12	ROBESON	BURLISON	ELKINS
REVISED	BY	CK'D	APPR.

TRANSITION TO SMALLER CONDUCTOR
WITH OR WITHOUT
FUSE PROTECTION FOR SMALLER CONDUCTOR

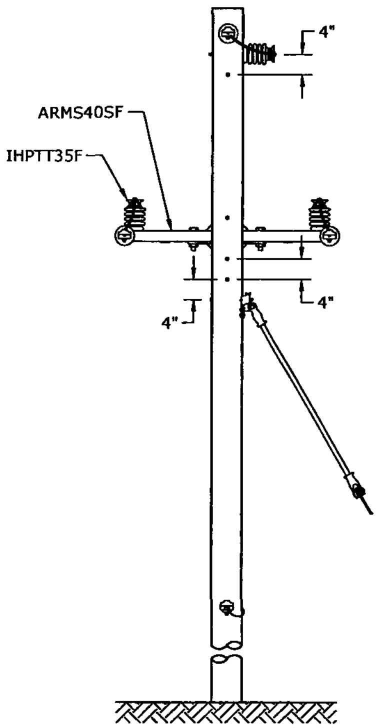
Progress Energy

FLA DWG. 03.12-14B

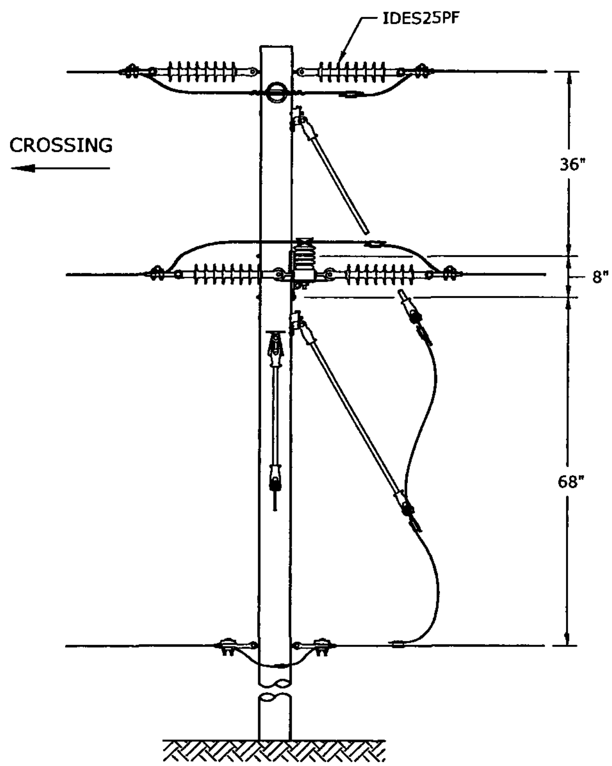




PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. POLES SHOULD BE PLACED 1' OFF R/W AND CROSSING SHOULD BE AT 90° TO RAILS.
2. REFER TO NESC 231.C.1, EXCEPTION 1 FOR MINIMUM POLE DISTANCE TO RR RAILS.
3. WHEN CHANGING FROM GRADE C TO GRADE B FOR CROSSING, USE DEADEND AND ONE SIDE GUY FOR ANGLES GREATER THAN 5°.
4. WHEN CHANGING FROM GRADE C TO GRADE B FOR CROSSING, USE DEADEND GUY AND SIDE GUY BOTH WAYS FOR TANGENT POLES LESS THAN 5°.
5. DO NOT INSTALL SPLICES IN CROSSING SPAN OR ADJACENT SPANS.
6. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

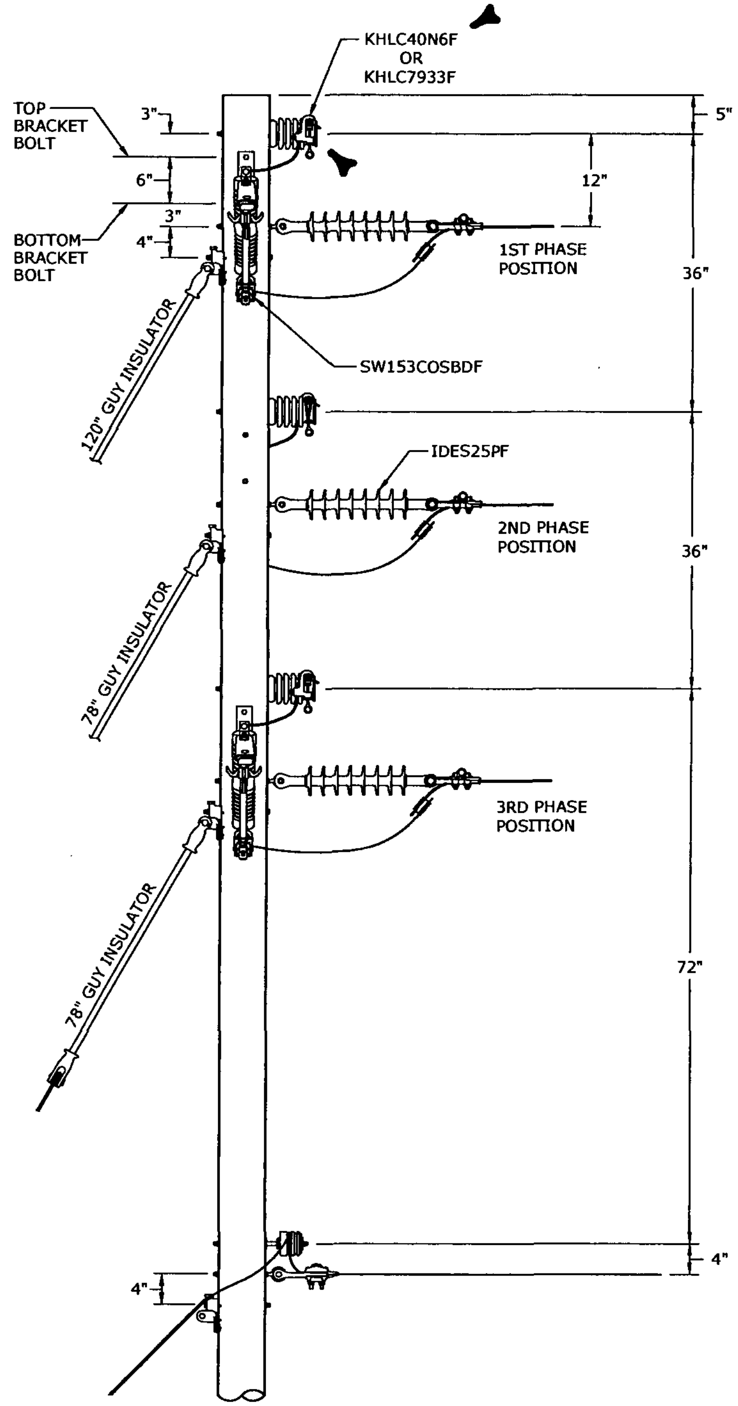
VERTICAL CONSTRUCTION RAILROAD CROSSING

TANGENT AND ANGLES TO 10 DEGREES

Duke Energy®

FLA

DWG. 03.12-17



12 KV

NOTES:

1. MIDDLE CUTOUT CAN BE PLACED ON SAME SIDE OF POLE AS OTHER CUTOUTS.
2. FOR FEEDER TAPS, THE CUTOUTS ARE OMITTED, BUT THE SPACING FOR THE TAP IS THE SAME.
3. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
4. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

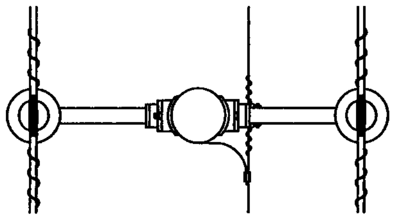
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL CONSTRUCTION - TANGENT
FUSED TAP CONSTRUCTION

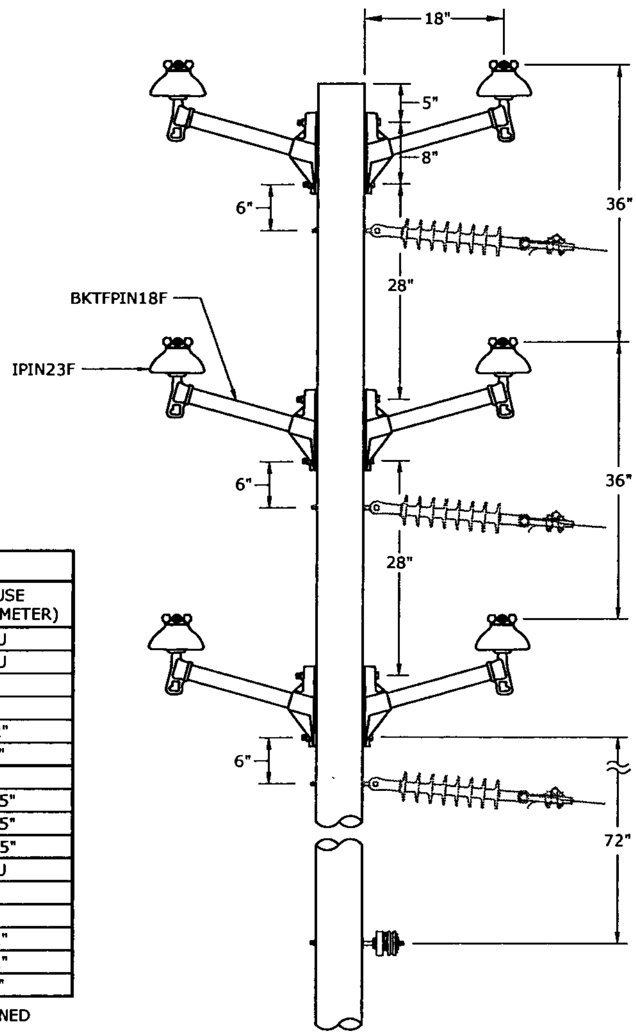
Progress Energy

FLA

DWG. 03.12-20



PLAN VIEW



FRONT VIEW

POLE SIZING CHART					
WIRE SIZE	MAX. SPAN (FT)	POLE CLASS BY HEIGHT			JOINT USE (TOTAL DIAMETER)
		45	50	55	
795	200	4	3	3	NO JU
795	250	3	3	2	NO JU
795	175	4	3	3	≤1"
795	250	2	2	2	≤ 1"
795	250	2	1	1	1" - 2"
795	250	1	1	1	2 - 3"
336	250	4	3	3	≤ 1"
336	200	4	3	3	1" - 2.5"
336	250	3	2	2	1" - 2.5"
336	250	2	1	1	2.5" - 5"
1/0 & SMALLER	400	4	3	3	NO JU
1/0 & SMALLER	350	4	3	3	≤ 1"
1/0 & SMALLER	400	3	3	3	≤ 1"
1/0 & SMALLER	280	2	2	2	1" - 2"
1/0 & SMALLER	400	2	2	2	1" - 2"
1/0 & SMALLER	400	1	1	1	2 - 3"

NOTES: THIS TABLE SPECIFIES POLE CLASS ONLY. POLE HEIGHT DETERMINED BY CLEARANCE. SEE DWG. 02.02-03A FOR STANDARD STOCKED POLES. POLEFOREMAN REQUIRED FOR DESIGNS OUTSIDE OF TABLE GUIDELINES. FOR POLES WITH EQUIPMENT, MINIMUM CLASS IN DWG. 02.02-03B MUST ALSO BE MET.

NOTES:

1. LIMIT SPANS TO 250' MAXIMUM.
2. SPAN CLEARANCES/LIMITS BASED ON 795 AAC PRIMARY AND #1/0 AAAC NEUTRAL.
3. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.

3				
2				
1				
0	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

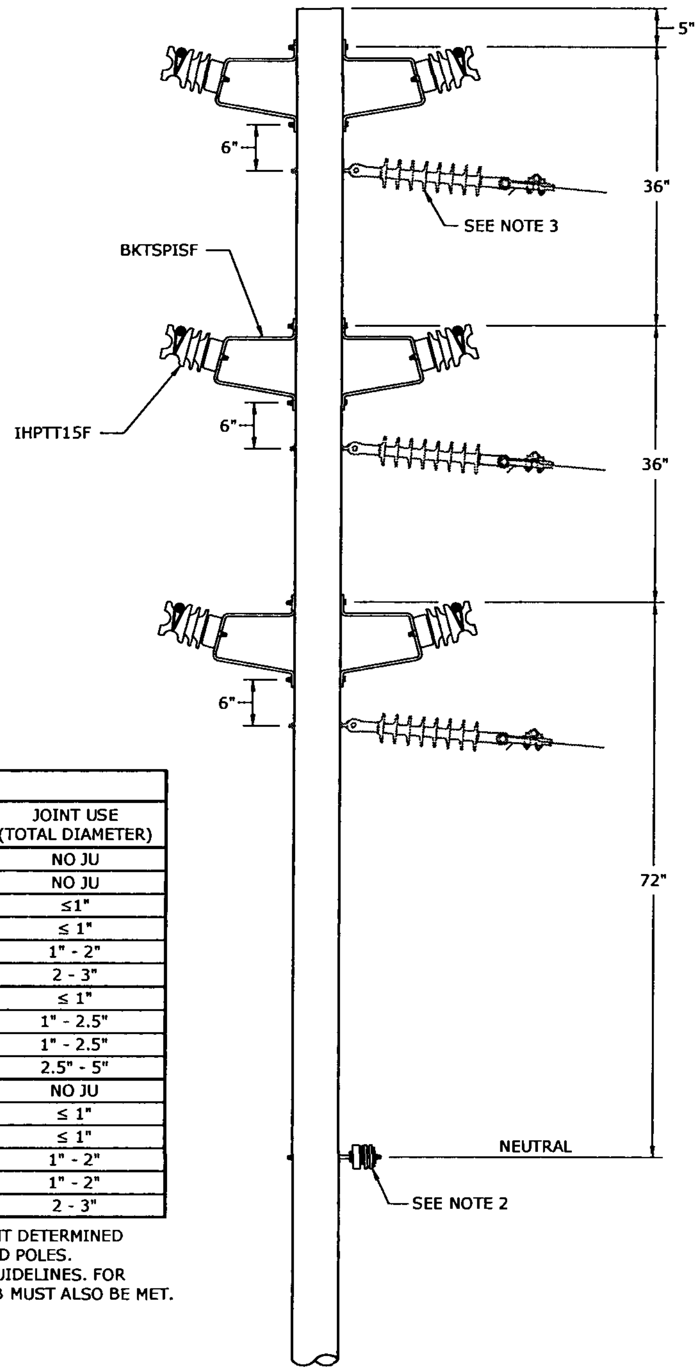
URBAN/BULK FEEDER, THREE-PHASE

DOUBLE CIRCUIT TANGENT CONSTRUCTION

Duke Energy®

FLA

DWG.
03.14-01



FRONT VIEW

POLE SIZING CHART					
WIRE SIZE	MAX. SPAN (FT)	POLE CLASS BY HEIGHT			JOINT USE (TOTAL DIAMETER)
		45	50	55	
795	200	4	3	3	NO JU
795	250	3	3	2	NO JU
795	175	4	3	3	≤1"
795	250	2	2	2	≤ 1"
795	250	2	1	1	1" - 2"
795	250	1	1	1	2 - 3"
336	250	4	3	3	≤ 1"
336	200	4	3	3	1" - 2.5"
336	250	3	2	2	1" - 2.5"
336	250	2	1	1	2.5" - 5"
1/0 & SMALLER	400	4	3	3	NO JU
1/0 & SMALLER	350	4	3	3	≤ 1"
1/0 & SMALLER	400	3	3	3	≤ 1"
1/0 & SMALLER	280	2	2	2	1" - 2"
1/0 & SMALLER	400	2	2	2	1" - 2"
1/0 & SMALLER	400	1	1	1	2 - 3"

NOTES: THIS TABLE SPECIFIES POLE CLASS ONLY. POLE HEIGHT DETERMINED BY CLEARANCE. SEE DWG. 02.02-03A FOR STANDARD STOCKED POLES. POLEFOREMAN REQUIRED FOR DESIGNS OUTSIDE OF TABLE GUIDELINES. FOR POLES WITH EQUIPMENT, MINIMUM CLASS IN DWG. 02.02-03B MUST ALSO BE MET.

NOTES:

1. SEE DWG. 03.14-04 WHEN INSTALLING 795 KCMIL AAC AT 4° TO 5°.
2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. SLACK SPAN TAP INSTALLED AS SHOWN AS NEEDED.

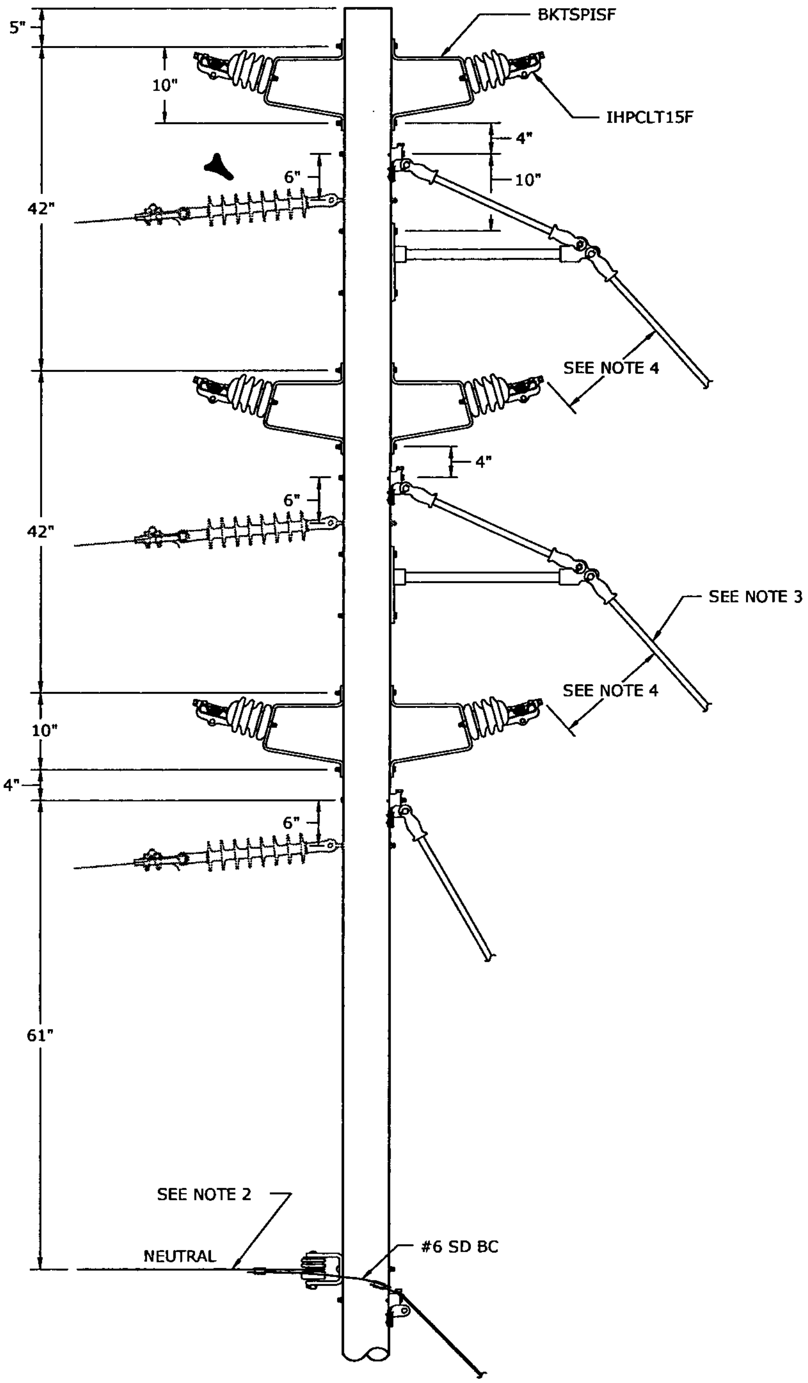
3				
2	10/18/12	WOJNAROWSKI	BURLISON	ADCOCK
1	5/22/12	BURLISON	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

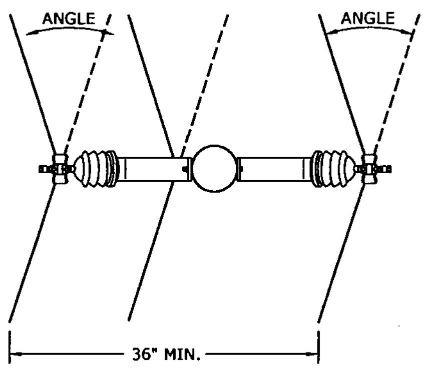
VERTICAL CONSTRUCTION DOUBLE CIRCUIT, THREE-PHASE, 0 DEGREES TO 5 DEGREES

Duke Energy

FLA

DWG. 03.14-02





PLAN VIEW

NOTES:

1. ARMOR ROD NOT REQUIRED WHEN USING CUSHION GRIP (795 AAC ONLY).
2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. TYPICAL INSTALLATION - REFER TO SECTION 02 FOR GUYING DETAILS.
4. MINIMUM SPACING:
   12KV = 8"
   25KV = 12"
5. SEE DWG. 03.03-06 FOR CLAMPS.
6. SLACK SPAN TAP INSTALLED AS SHOWN AS NEEDED.

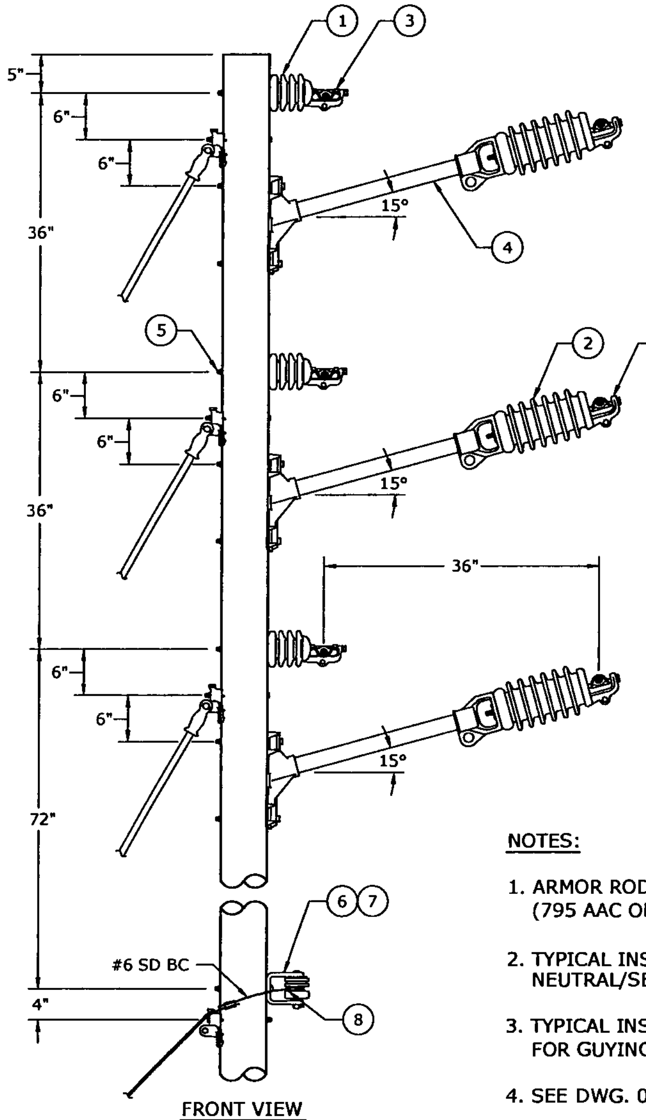
REVISED		BY	CK'D	APPR.
3				
2				
1	5/22/12	BURLISON	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

VERTICAL CONSTRUCTION DOUBLE CIRCUIT, THREE-PHASE, 6 DEGREES TO 15 DEGREES

Progress Energy

FLA

DWG. 03.14-04



FRONT VIEW
1 - 15 DEGREES 12KV

NOTES:

1. ARMOR ROD NOT REQUIRED WHEN USING CUSHION GRIP (795 AAC ONLY).
2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. TYPICAL INSTALLATION - REFER TO SECTION 02 FOR FOR GUYING DETAILS.
4. SEE DWG. 03.03-06 FOR CLAMPS.

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPCLT15F	3	080232	1	INSULATOR, POST, CLAMP HOR
-	2	IHPCLT35F	3	080238	1	INSULATOR, POST, LINE, POST, 35KV, CLAMP, TRUNION
-	3	TRCLAMP_F	3	-	1	TRUNION CLAMP (VARIES WITH SIZE)
-	4	BKTFPIS30F	6	013264	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING,DOUBLE COIL
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16"
				070431	1	BRACKET, FIBERGLASS, STAND-OFF, 30" (BALL BAT)
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
-	5	ISSTUDBOLT5812F	3	013264	1	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING,DOUBLE COIL
				072367	1	STUD, LINE POST, LP 5/8"X 12"
SCANG_FM (VARIES WITH WIRE SIZE)	6	ISPLF	1	080403	1	INSULATOR, SPOOL, 3 INCH SPOOL INSULATOR, GRAY
	7	NSSCF	1	152107	1	BOLT, MACH,SQ,NUT,5/8"X12"
				013308	1	WASHER, SQUARE, 2-1/4", FLAT, 13/16", HOLE, GALV.
				070402	1	BRACKET, BRACKET ONE,WIRE,NO,INSULATOR,GALV.
	8	NEUSPTIE_F	1	-	1	FORMED SPOOL TIE (VARIES WITH WIRE SIZE)

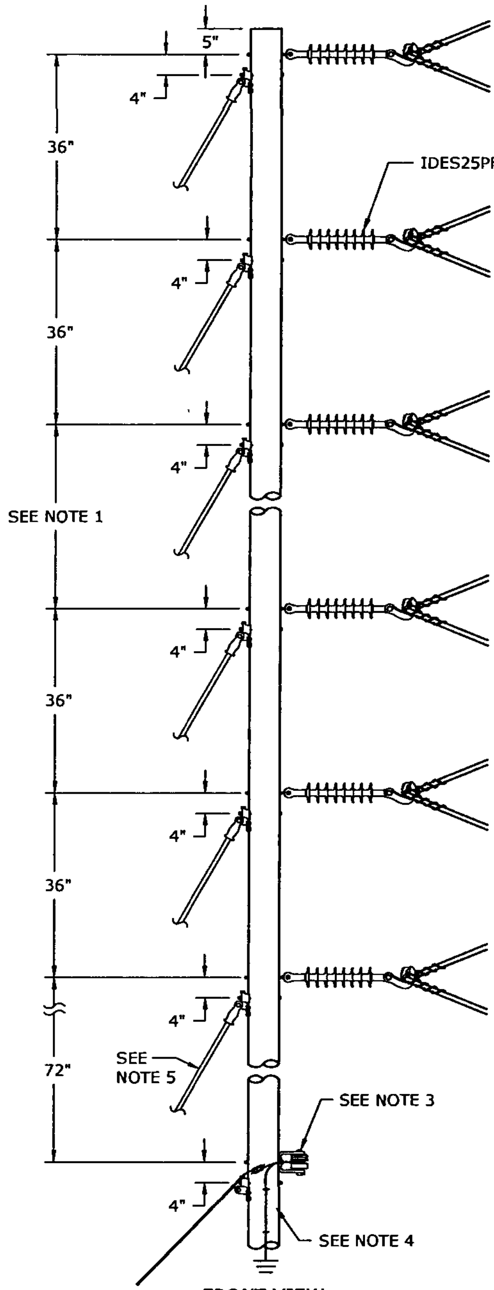
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	5/22/12	BURLISON	BURLISON	ELKINS

VERTICAL CONSTRUCTION DOUBLE CIRCUIT, THREE-PHASE, 1 DEGREE TO 15 DEGREES - 12KV ONLY

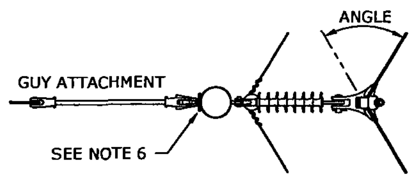
Progress Energy

FLA

DWG. 03.14-05



FRONT VIEW



PLAN VIEW

NOTES:

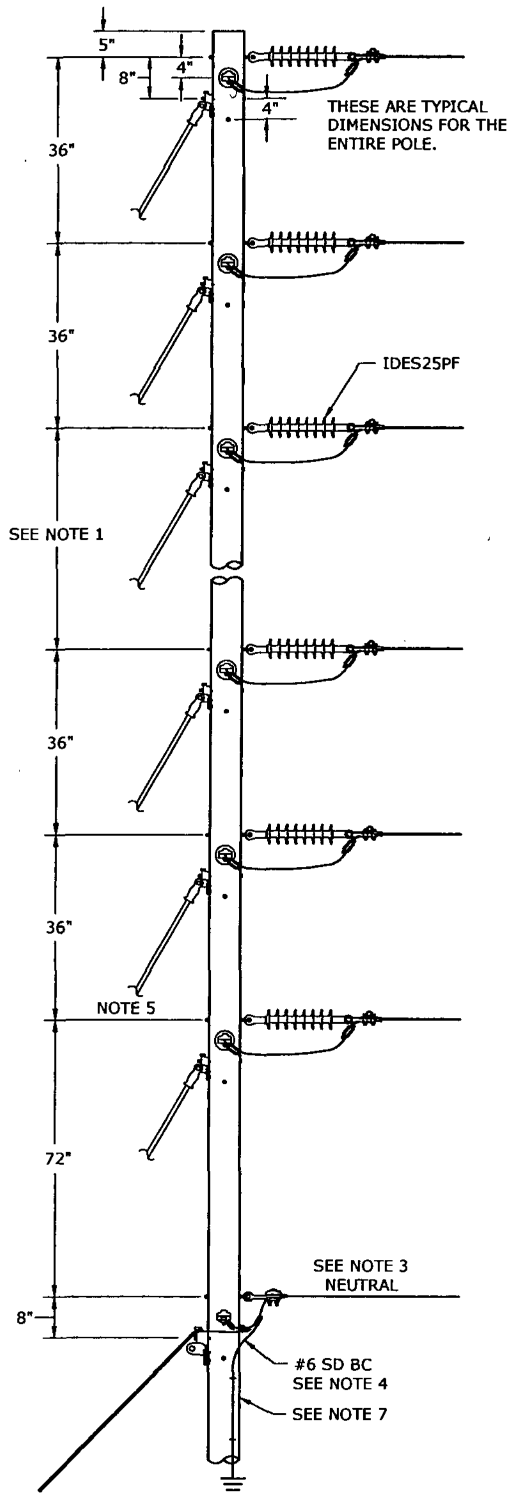
1. USE 6'-0" MINIMUM CIRCUIT SPACING IF SPANS 200 FT. OR LESS WITHIN A 150 FT. RULING SPAN OR 230 FT. OR LESS WITHIN A 200 FT. RULING SPAN. CONTACT DISTRIBUTION STANDARDS FOR OTHER SPANS.
2. 16-30 DEGREES FOR 795 AAC. 16-59 DEGREES FOR ALL OTHER CONDUCTORS. DOUBLE DEADEND 795 AAC FOR ANGLES GREATER THAN 30 DEGREES.
3. TYPICAL INSTALLATION- SEE SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
4. SEE SECTION 01 FOR ADDTIONAL GROUNDING DETAILS.
5. TYPICAL INSTALLATION - SEE SECTION 02 FOR GUYING DETAILS.
6. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
7. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS,

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

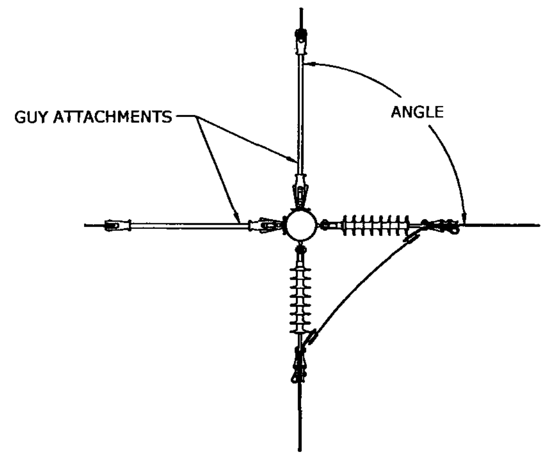
VERTICAL CONSTRUCTION DOUBLE CIRCUIT, THREE-PHASE, 16 DEGREES TO 59 DEGREES

Duke Energy

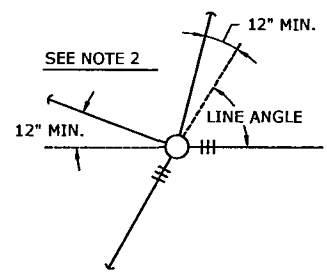
FLA — DWG. 03.14-06



FRONT VIEW



PLAN VIEW



NOTES:

1. USE 6'-0" MINIMUM CIRCUIT SPACING IF SPANS 200 FT. OR LESS WITHIN A 150 FT. RULING SPAN OR 230 FT. OR LESS WITHIN A 200 FT. RULING SPAN. CONTACT DISTRIBUTION STANDARDS FOR OTHER SPANS.
2. IF USED FOR LINE ANGLES LESS THAN 60°, OFFSET EACH ANCHOR 12". (SEE ABOVE) OR ADD A BISECTIONAL GUY. CONSIDER BISECTIONAL GUYS WHERE ANGLE PERMITS.
3. TYPICAL INSTALLATION - SEE SECTION 04 FOR NEUTRAL/ SECONDARY DETAILS.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
5. TYPICAL INSTALLATION - SEE SECTION 02 FOR GUYING DETAILS.
6. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
7. THE CHARTS BELOW SHOW THE MINIMUM CLASS POLES REQUIRED FOR GRADES B AND C CONSTRUCTION WITH LEAD TO HEIGHT RATIOS 1/1 AND 2/3 BASED ON A 200 FOOT RULING SPAN.
8. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

REQUIRED POLE SIZES							
L/H	GRADE B			L/H	GRADE C		
1/1	P502F	P551F	P60H1F	1/1	P503F	P552F	P601F
2/3	P501F	P55H1F	P60H2F	2/3	P502F	P551F	P60H1F

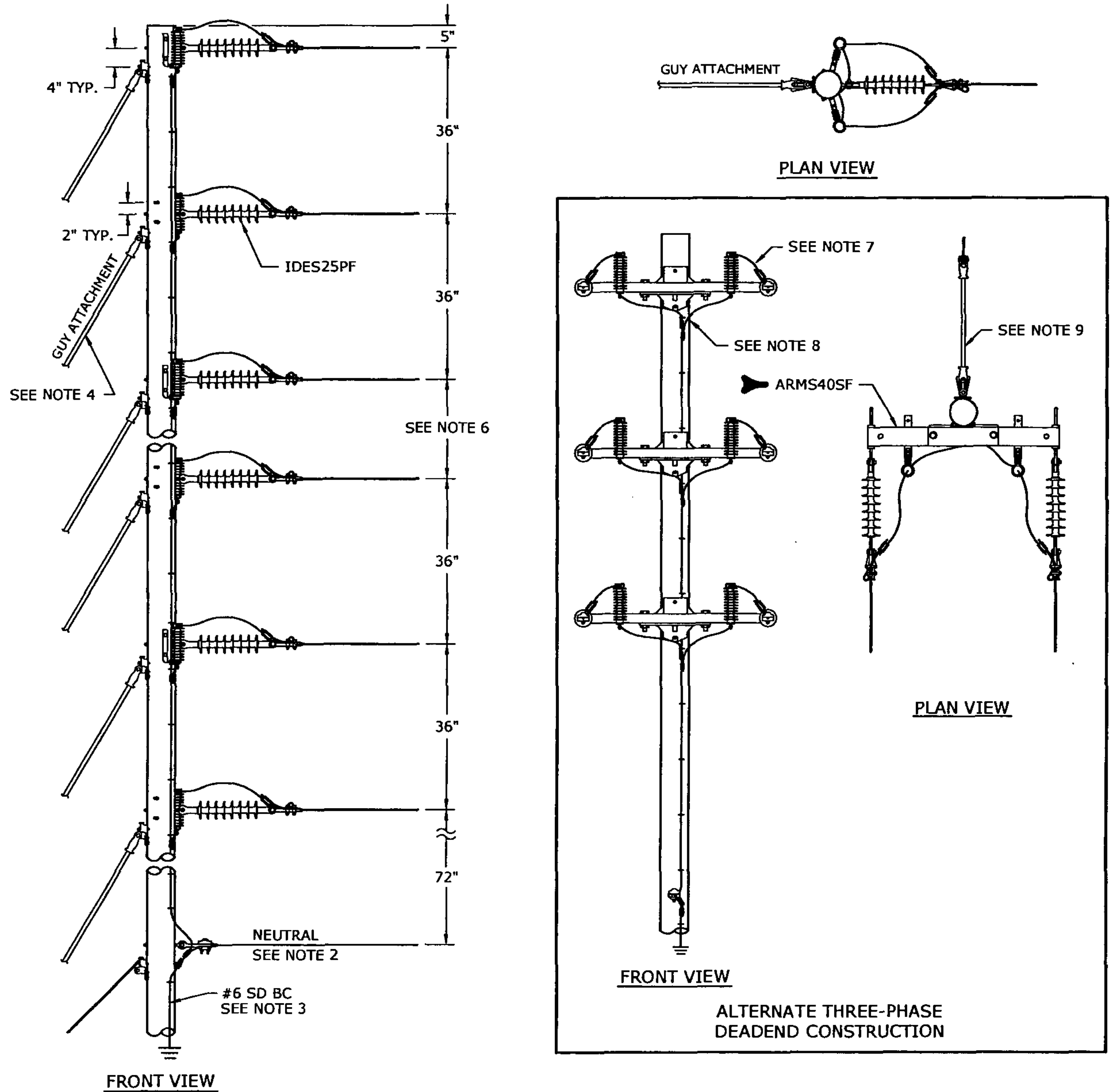
3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL CONSTRUCTION DOUBLE CIRCUIT, THREE-PHASE, 60 DEGREES TO 90 DEGREES

Duke Energy®

FLA

DWG. 03.14-08



NOTES:

1. ARRESTERS ISSUED SEPARATELY. SEE SECTION 08 FOR DETAILS.
2. TYPICAL INSTALLATION: SEE SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.
3. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
4. TYPICAL INSTALLATION: SEE SECTION 02 FOR GUYING DETAILS.
5. USE 2-1/4" SQUARE WASHER ON 1/0 AAAC AND SMALLER CONDUCTOR AND 3" CURVE WASHER FOR CONDUCTORS LARGER THAN 1/0 AAAC.
6. USE 6'-0" MINIMUM CIRCUIT SPACING IF SPANS 200 FT. OR LESS WITHIN A 150 FT. RULING SPAN OR 230 FT. OR LESS WITHIN A 200 FT. RULING SPAN. CONTACT DISTRIBUTION STANDARDS OR OTHER SPANS.
7. ALL CONDUCTORS MUST BE THE SAME SIZE.
8. ATTACH ARE TO POLE WITH TWO 3/4" MACHINE BOLTS.
9. WHEN TWO GUYS PER PHASE ARE REQUIRED, ATTACH THE FIRST GUY TO THE ARM AND THE SECOND GUY TO THE POLE. A) MAXIMUM LOAD PER PHASE = 5,100 LBS. B) TOTAL MAXIMUM LOAD PER ARM = 10,200 LBS.
10. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

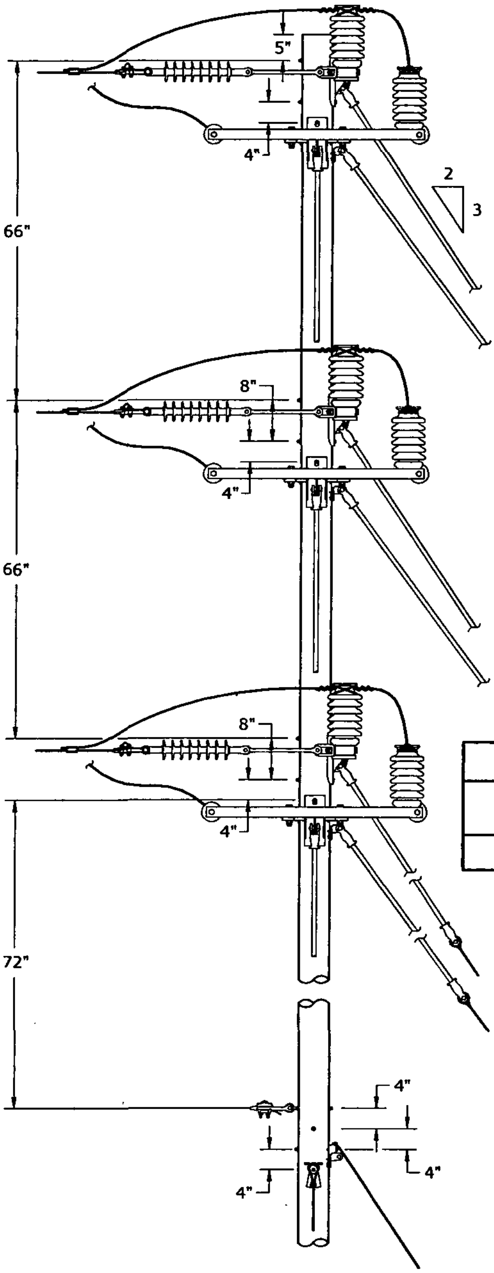
REVISED		BY	CK'D	APPR.
3				
2				
1	3/22/12	GUINN	BURLISON	ELKINS
0	11/18/10	CECCONI	GUINN	ELKINS

VERTICAL CONSTRUCTION DOUBLE CIRCUIT,

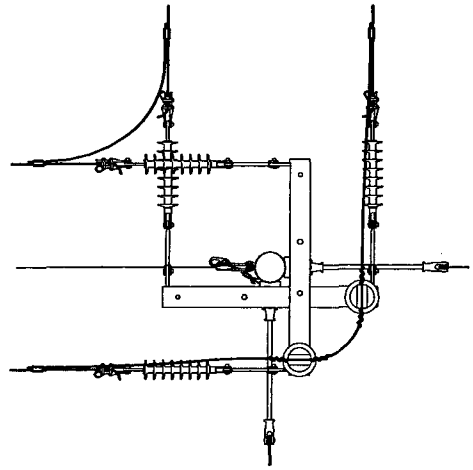
DEADEND

Progress Energy

FLA DWG. 03.14-10



FRONT VIEW



PLAN VIEW

POLE SELECTION TABLE (GRADE C CONSTRUCTION)				
FOR A 2 TO 3 GUY LEAD/HEIGHT RATIO	POLE LENGTH			
	45'	50'	55'	60'
REQUIRED MINIMUM POLE CLASS	3	2	1	H1

NOTES:

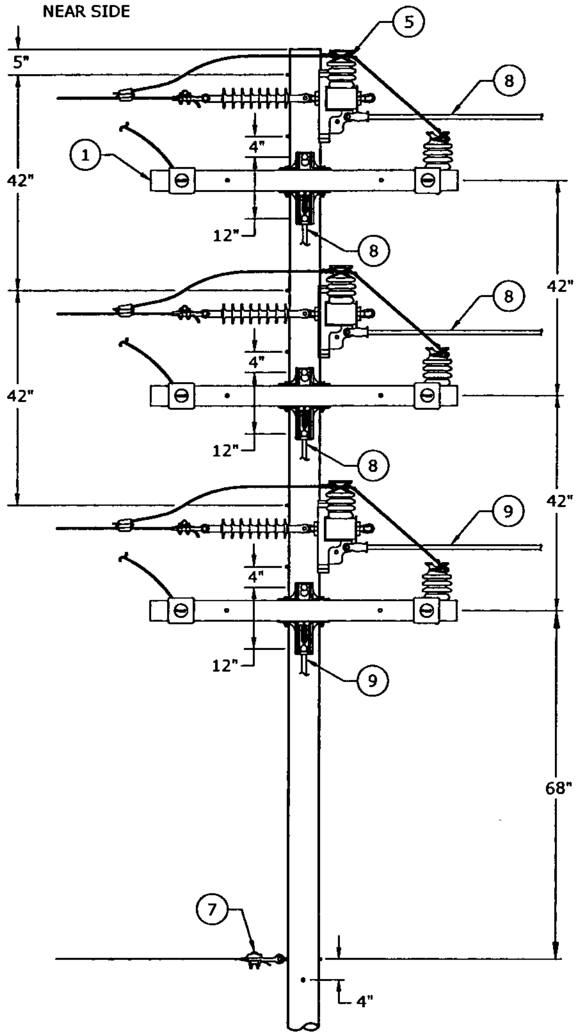
1. POLE SIZES BASED ON 250' MAXIMUM SPANS WITH 6- 795 SAC PRIMARY AND 1-#1/0 ACSR NEUTRAL.
2. GUYS REQUIRED ARE 2-7/16 PER PRIMARY POSITION AND 1-5/16 FOR NEUTRAL. LEAD TO HEIGHT RATIO MUST BE 2:3 FOR THIS CONSTRUCTION.
3. SELECT ANCHORS BASED ON SOIL CONDITIONS AT THE SITE.
4. TWO GUY STRAIN INSULATORS (120" & 78") MUST BE LINKED TOGETHER TO OBTAIN THE REQUIRED CLEARANCE FOR THE TOP PRIMARY GUY POSITIONS, 120" FOR THE MIDDLE AND 78" ON THE BOTTOM.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/13/12	GUINN	BURLISON	ELKINS
0	12/2/11	GUINN	BURLISON	ELKINS

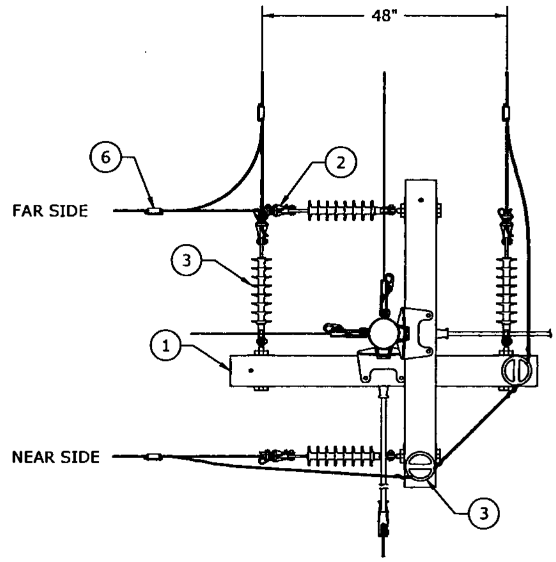
THREE-PHASE DOUBLE CIRCUIT DEADEND
FOR LINE ANGLES GREATER THAN 30 DEGREES

Progress Energy

FLA DWG. 03.14-12



FRONT VIEW



PLAN VIEW

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ARMSDE60FF	6	9220237218	1	CROSSARM SINGLE DEADEND 60" FIBERGLASS
	2	DECLMP795AACF	12	101125	1	DEADEND CLAMP 795 KCM AAC
	3	IDES25PF	12	80577	1	INSULATOR DEADEND / SUSPENSION 25 KV POLYMER
	4	IHPTT15F	6	080212	1	INSULATOR POST, TIE 3/4", 15 KV
	5	TTIEF795ALF	6	121418	1	TOP TIE F NECK 795 MCM TO 795 MCM
	6	KW7979F	6	165277	1	CONNECTOR WEDGE 795 MCM TO 795 MCM
	7	DECLMP10AAACF	2	100708	1	DEADEND CLAMP 1/0 AAAC
	8	FBGL120F	4	115761	1	FIBERGLASS GUY LINK 15 M 120"
	9	FBG78F	2	115737	1	FIBERGLASS GUY LINK 15 M 78"

NOTES:

1. GUYS ARE SPAN GUYS.
2. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.
3. ALL PRIMARY GUYS SHOULD BE 5/16.

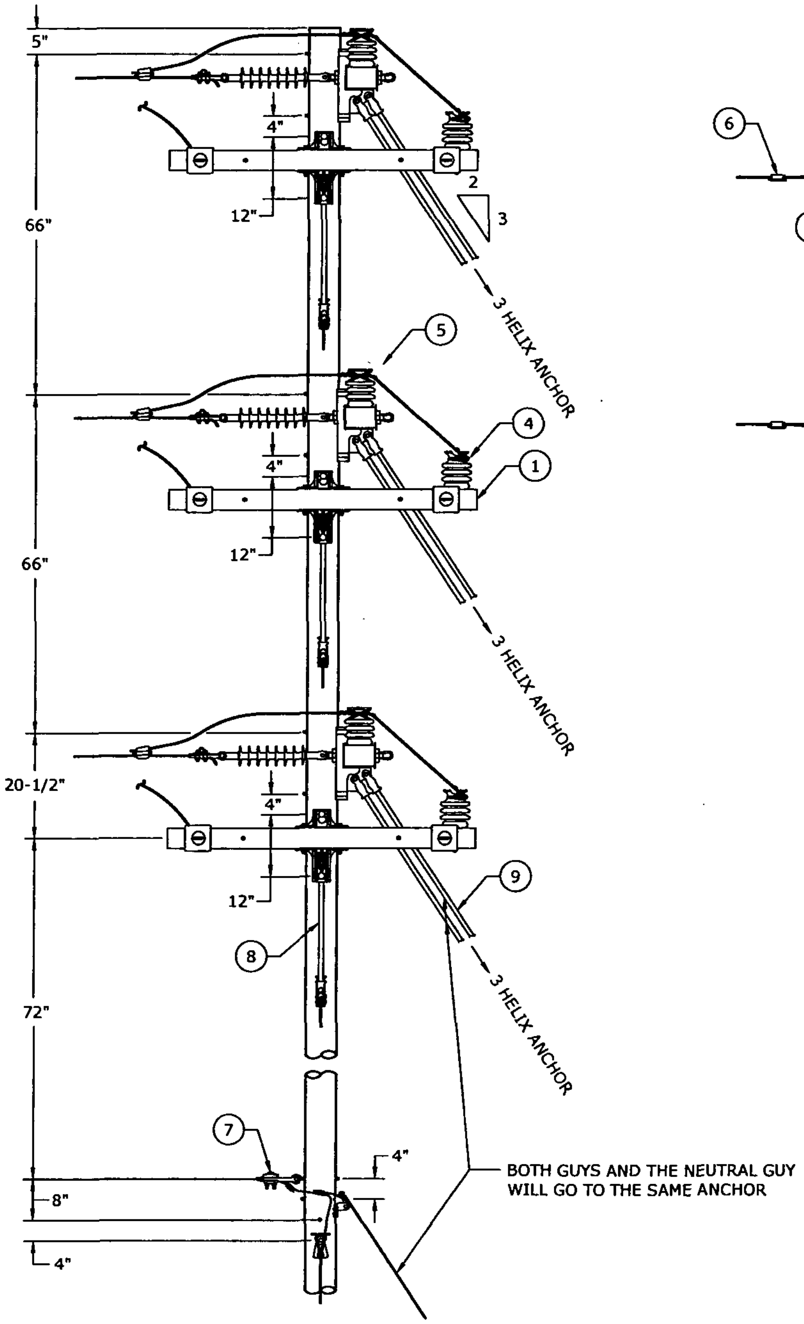
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	5/22/12	GUINN	BURLISON	ELKINS

THREE-PHASE DOUBLE CIRCUIT DEADEND FOR LINE ANGLES 30 TO 90 DEGREES - SPAN GUYED

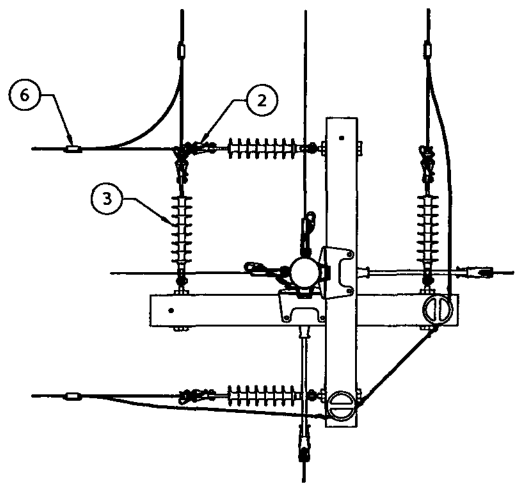
Progress Energy

FLA

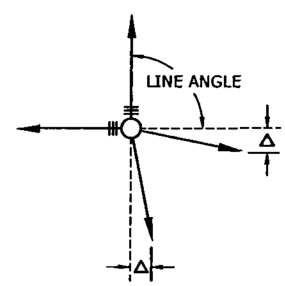
DWG. 03.14-17



FRONT VIEW



PLAN VIEW



DETAIL 'A' - MAXIMUM GUY OFFSET

NOT TO SCALE

Δ MAX = 12" FOR 2 TO 3 GUY LEAD

POLE SELECTION TABLE (GRADE C CONSTRUCTION)				
FOR A 2 TO 3 GUY LEAD/HEIGHT RATIO	POLE LENGTH			
	45'	50'	55'	60'
REQUIRED MINIMUM POLE CLASS	3	2	1	H1

NOTES:

1. SEE DWG. 03.14-18B FOR BILL OF MATERIAL AND NOTES.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	5/22/12	GUINN	BURLISON	ELKINS

THREE-PHASE DOUBLE CIRCUIT DEADEND

FOR LINE ANGLES 30-90 DEGREES

Progress Energy

FLA

DWG. 03.14-18A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	ARMSDE60FF	6	9220237218	1	CROSSARM SINGLE DEADEND 60" FIBERGLASS
	2	DECLMP795AACF	13	101125	1	DEADEND CLAMP 795 KCM AAC
	3	IDES25PF	12	80577	1	INSULATOR DEADEND / SUSPENSION 25 KV POLYMER
	4	IHPTT15F	6	080212	1	INSULATOR POST, TIE 3/4 15 KV
-	5	TTIEF795ALF	6	121418	1	TOP TIE F NECK 795 MCM TO 795 MCM
	6	KW7979F	6	165277	1	CONNECTOR WEDGE 795 MCM TO 795 MCM
	7	DECLMP10AAACF	2	100708	1	DEADEND CLAMP 1/0 AAAC
	8	FBGL120F	6	115761	1	FIBERGLASS GUY LINK 15 M 120"
	9	FBG78F	6	115737	1	FIBERGLASS GUY LINK 15 M 78"

NOTES:

1. GUY LEAD TO HEIGHT RATIO **MUST BE 2:3** FOR THIS CONSTRUCTION.
2. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.
3. TWO GUY STRAIN INSULATORS (120" & 78") MUST BE LINKED TOGETHER TO OBTAIN THE REQUIRED CLEARANCE FOR THE TOP PRIMARY GUY POSITIONS, 120" FOR THE MIDDLE AND 78" ON THE BOTTOM.
4. GRADE B CONSTRUCTION REQUIRES POLEFOREMAN EVALUATION.
5. ALL PRIMARY GUYS SHOULD BE 7/16 AND NEUTRAL GUYS SHOULD BE 5/16.
6. SEE DWG. 03.14-18A FOR CONSTRUCTION

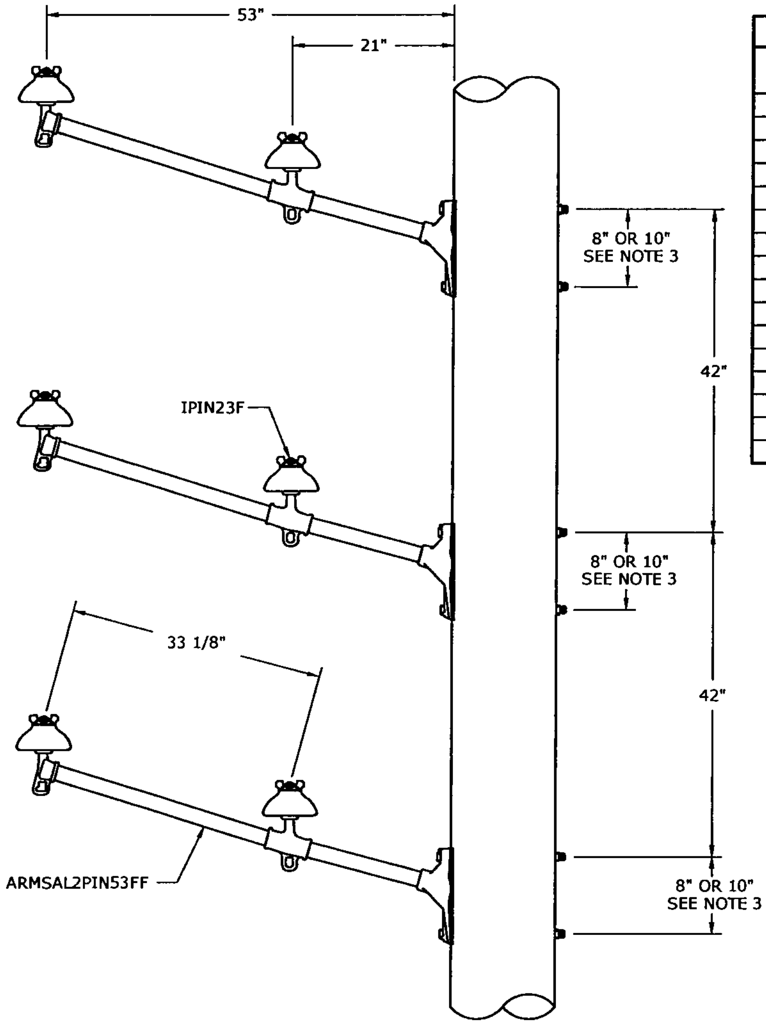
3			
2			
1			
0 5/22/12	GUINN	BURLISON	ELKINS
REVISED	BY	CK'D	APPR.

THREE-PHASE DOUBLE CIRCUIT DEADEND

FOR LINE ANGLES 30-90 DEGREES

Progress Energy

FLA DWG. 03.14-18B



BOLT TABLE	
CATALOG NUMBER	DESCRIPTION
152103	BOLT, MACH, SQ, NUT, 5/8" X 1-1/2"
152106	BOLT, MACH, SQ, NUT, 5/8" X 10"
152107	BOLT, MACH, SQ, NUT, 5/8" X 12"
010439	BOLT, MACH, SQ, NUT, 5/8" X 14"
152108	BOLT, MACH, SQ, NUT, 5/8" X 16"
152109	BOLT, MACH, SQ, NUT, 5/8" X 18"
152110	BOLT, MACH, SQ, NUT, 5/8" X 20"
152111	BOLT, MACH, SQ, NUT, 5/8" X 22"
010451	BOLT, MACH, SQ, NUT, 5/8" X 26"
152112	BOLT, MACH, SQ, NUT, 5/8" X 28"
152113	BOLT, MACH, SQ, NUT, 5/8" X 30"
152114	BOLT, MACH, SQ, NUT, 5/8" X 32"
152115	BOLT, MACH, SQ, NUT, 5/8" X 34"
152116	BOLT, MACH, SQ, NUT, 5/8" X 36"
010460	BOLT, MACH, SQ, NUT, 5/8" X 38"
152117	BOLT, MACH, SQ, NUT, 5/8" X 40"

NOTES:

1. THIS IS A NON-STOCK ITEM. REQUIRES SPECIAL ORDER. CHECK WITH PURCHASING FOR LEAD TIME.
2. TANGENT CONSTRUCTION ONLY WITH 795, NO ANGLES.
3. BRACKET HAS 8" AND 10" SPACING.
4. MAXIMUM SPAN ON EITHER SIDE IS 200 FEET.

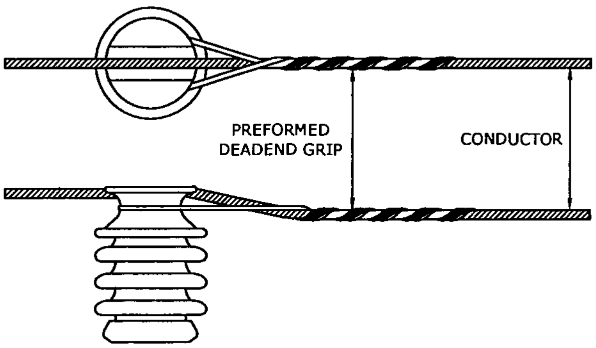
3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DOUBLE CIRCUIT FIBERGLASS ALLEY ARM

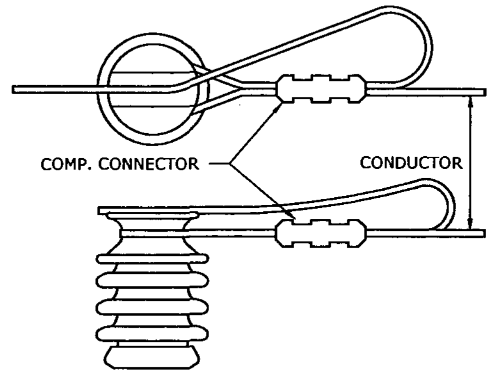
Duke Energy®

FLA

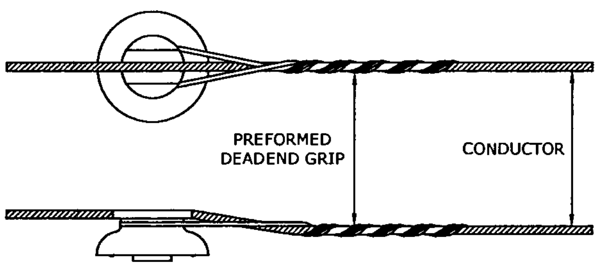
DWG. 03.14-22



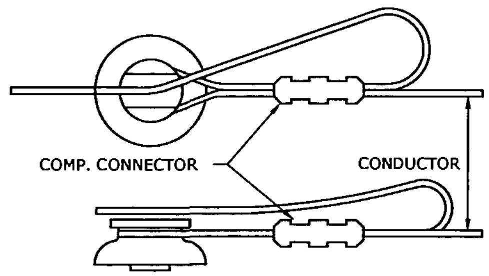
4-1/0 AL. DEADEND ON
POST INSULATOR



6 CU DEADEND ON
POST INSULATOR



4-1/0 AL. DEADEND ON
PIN TYPE INSULATOR



6 CU-2 CU DEADEND ON
PIN TYPE INSULATOR

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SLGRIP10AAACF	1	9220118700	1	GRIP, SLACK SPAN, #1/0 AAC & AAAC, FACTORY FORMED
	1	SLGRIPN2AAACF	1	9220118699	1	GRIP, SLACK SPAN, #2 AAC & AAAC, FACTORY FORMED

NOTES:

1. A SLACK SPAN MAY BE ATTACHED TO THE POLE UTILIZING A DEAD-END POLYMER INSULATOR PROVIDED THE CONSTRUCTION IS CONFIGURED AS IF IT WERE GUYED AND MEETS ALL REQUIRED CLEARANCES AND SPACING.

3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

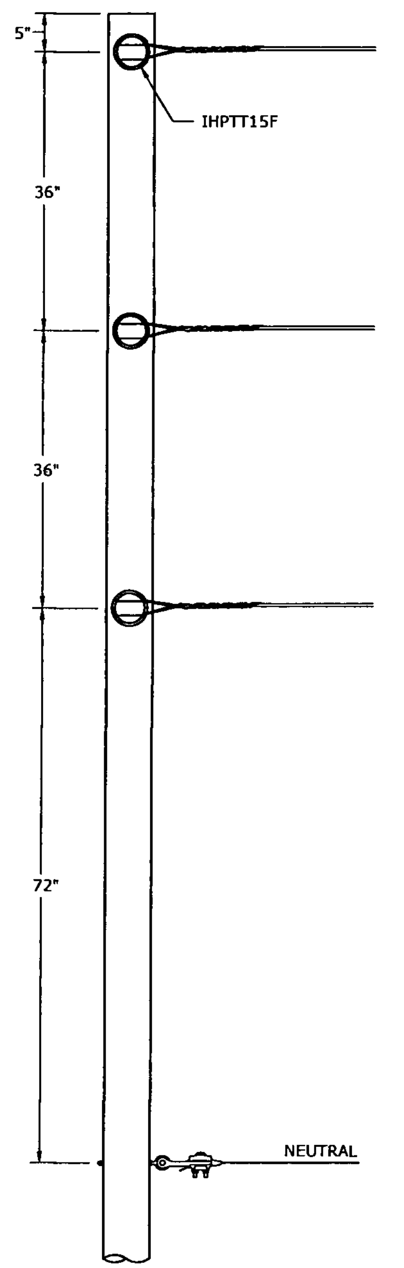
SLACK SPAN,

DETAILS FOR ATTACHMENT TO INSULATOR

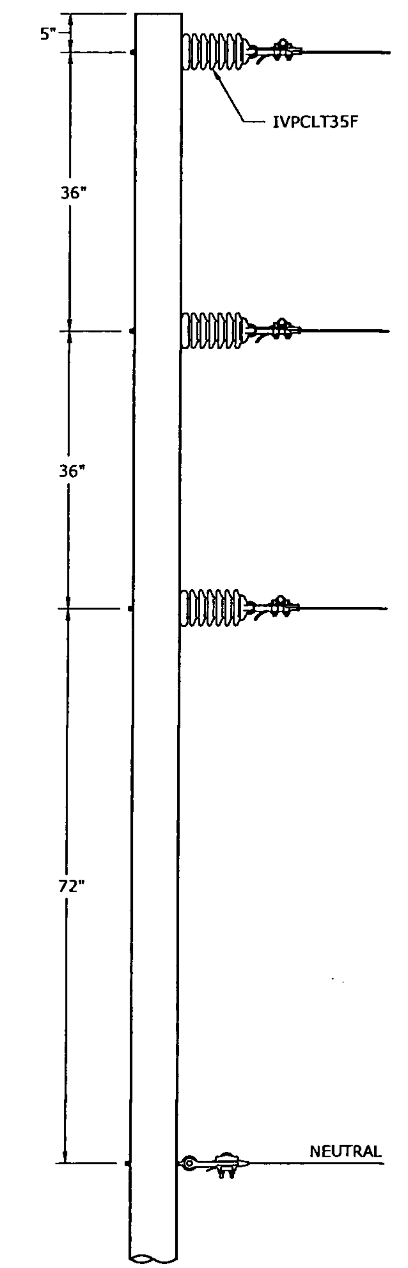
Duke Energy®

FLA

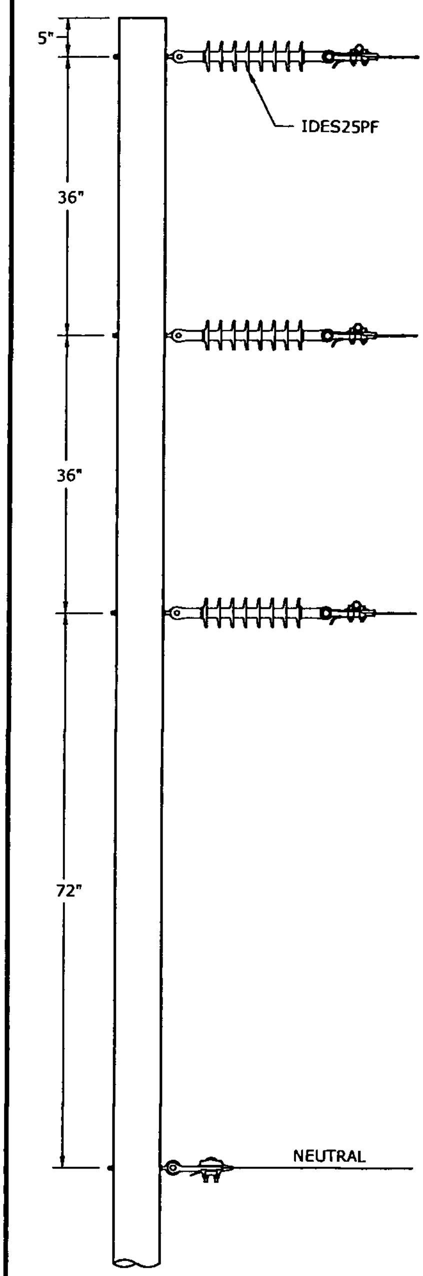
DWG.
03.16-00



FOR #2 AND #1/0 CONDUCTORS



FOR #4/0 THROUGH 795



FOR #2 THROUGH 795

NOTES:

1. SEE DWG. 03.06-04 FOR POST TYPE INSULATORS.
2. SEE DWG. 03.06-08 FOR PIN TYPE INSULATORS.
3. SEE DWG. 03.03-04 FOR SLACK SPAN CLAMPS.
4. SEE DWG. 03.16-00 FOR SLACK SPAN GRIPS.

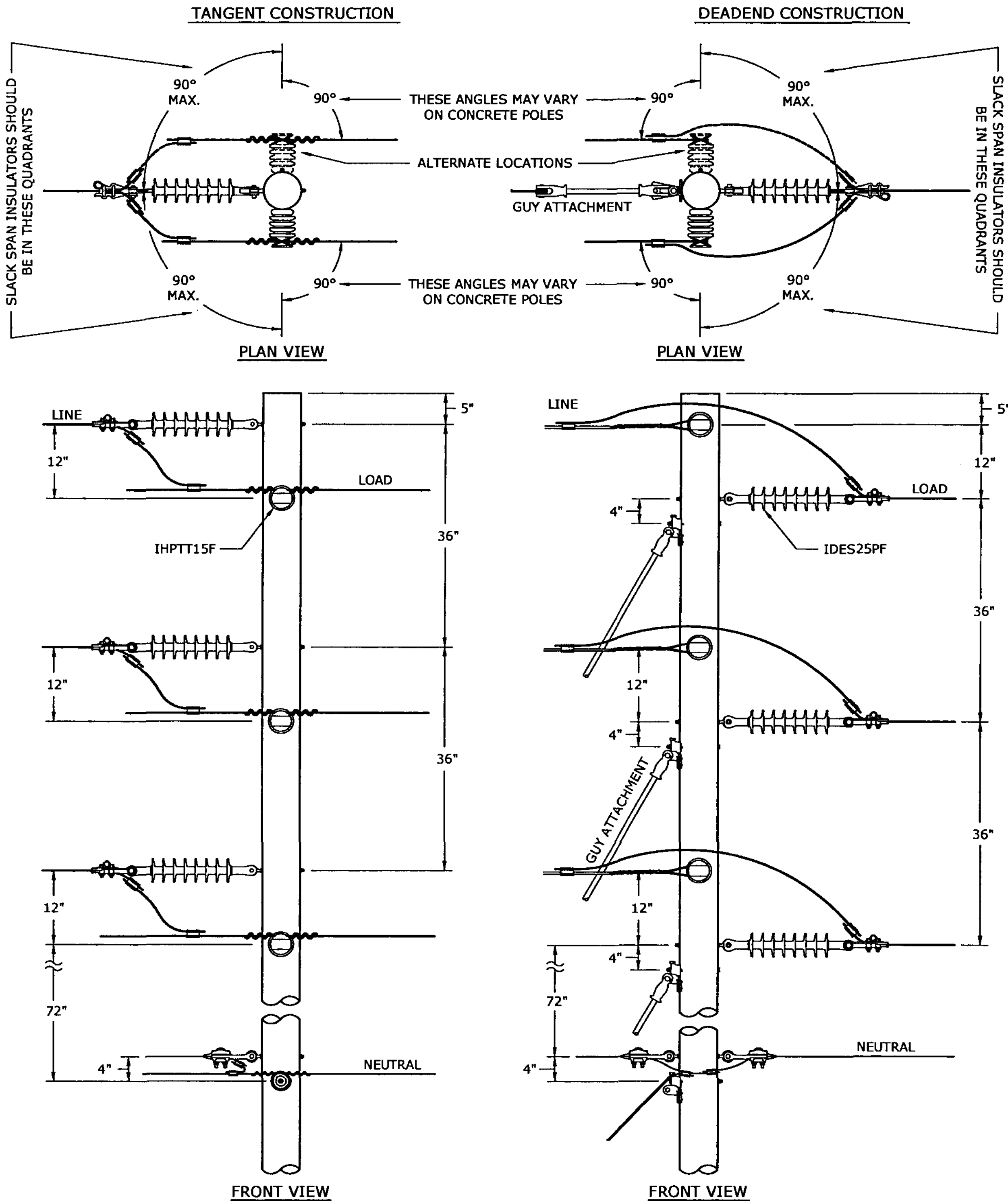
3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL CONSTRUCTION - SLACK SPAN

Duke Energy®

FLA

DWG. 03.16-02



NOTES:

1. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.
2. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.
3. SEE DWG. 03.16-00 FOR SLACK SPAN GRIPS.

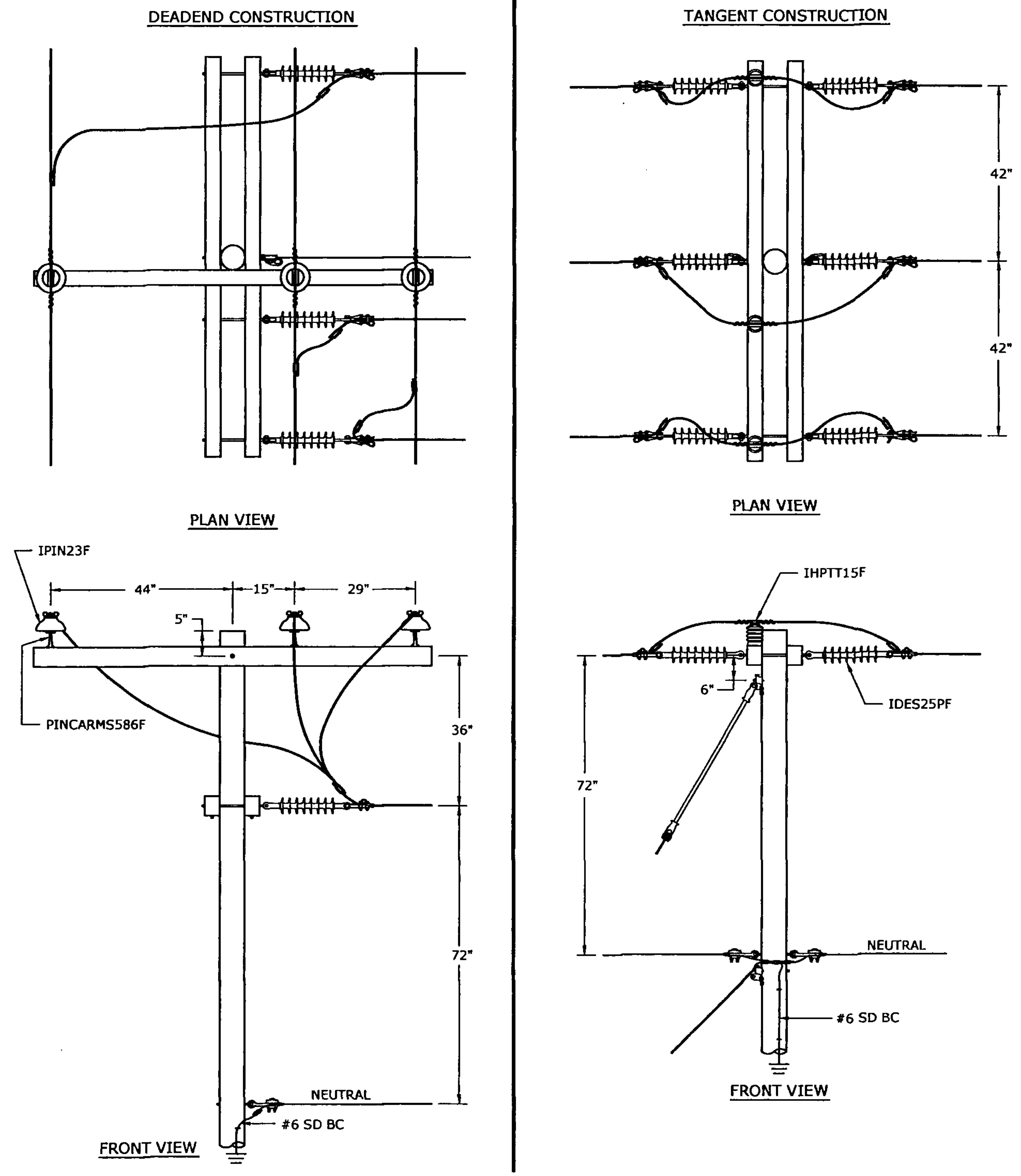
REVISED		BY	CK'D	APPR.
3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	11/18/10	CECCONI	GUINN	ELKINS

VERTICAL SLACK SPAN
WITH VERTICAL CONSTRUCTION

DUKE ENERGY.

FLA

DWG. 03.16-04



HORIZONTAL SLACK SPAN WITH HORIZONTAL CONSTRUCTION

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
2. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.
3. SEE DWG. 03.16-00 FOR SLACK SPAN GRIPS.

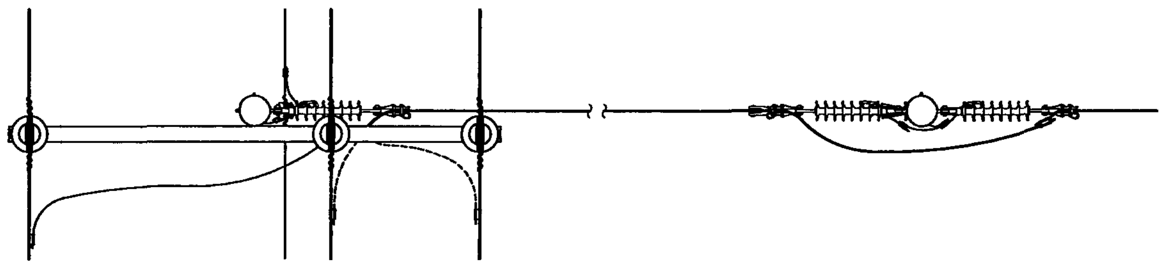
3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SLACK SPAN

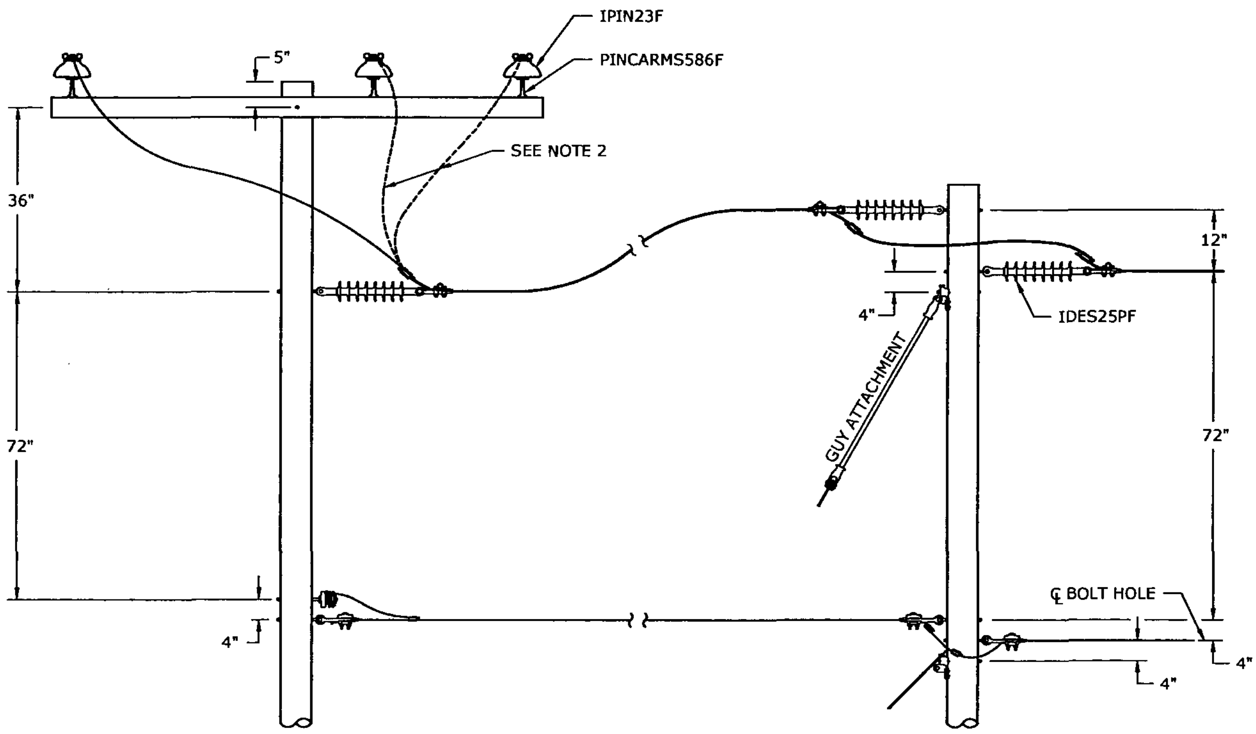
Duke Energy

FLA

DWG. 03.16-30A



PLAN VIEW



FRONT VIEW
1Ø SLACK SPAN TAP FROM 3Ø HORIZONTAL LINE

NOTES:

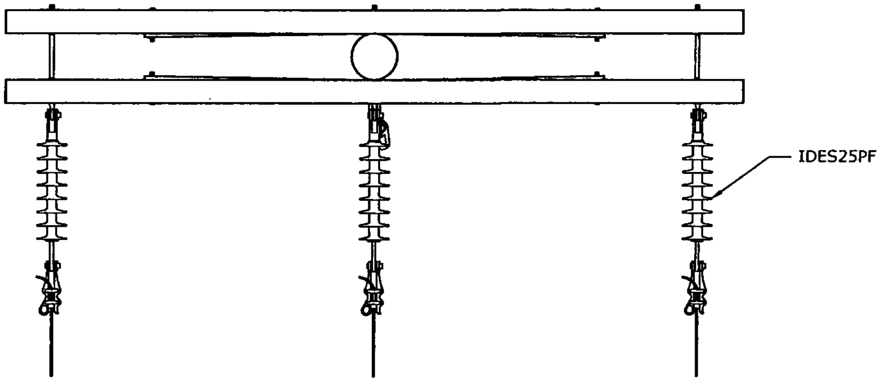
1. SLACK SPAN TAP CAN BE CONNECTED TO ANY PHASE AS DESIGNATED BY THE ENGINEER.
2. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.
3. SEE DWG. 03.16-00 FOR SLACK SPAN GRIPS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS

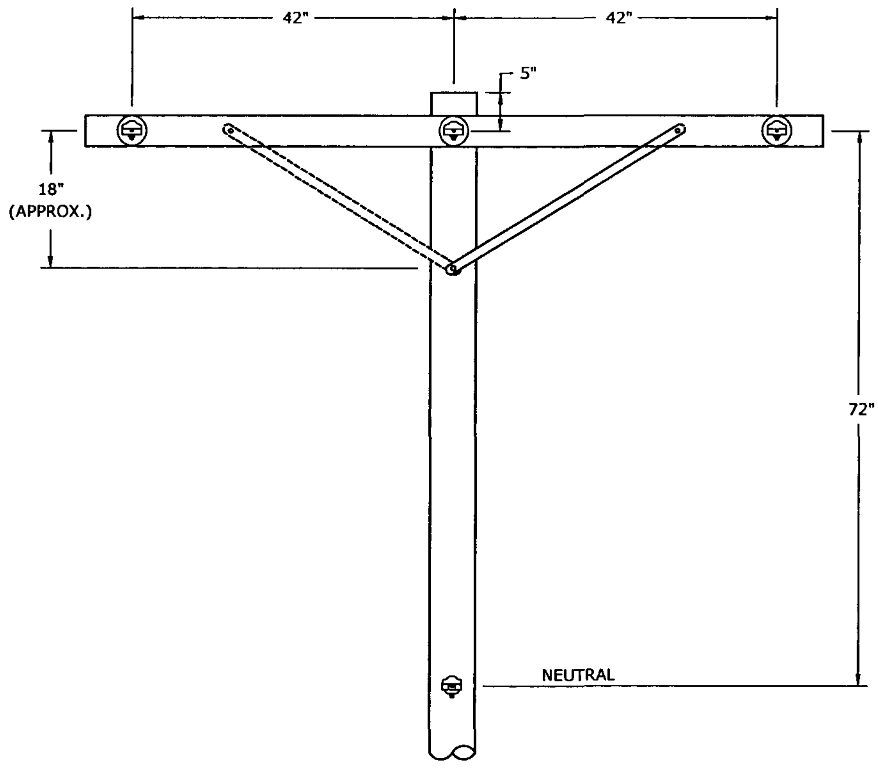
SLACK SPAN

Duke Energy

FLA DWG. 03.16-30B



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

3				
2				
1				
0	11/18/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

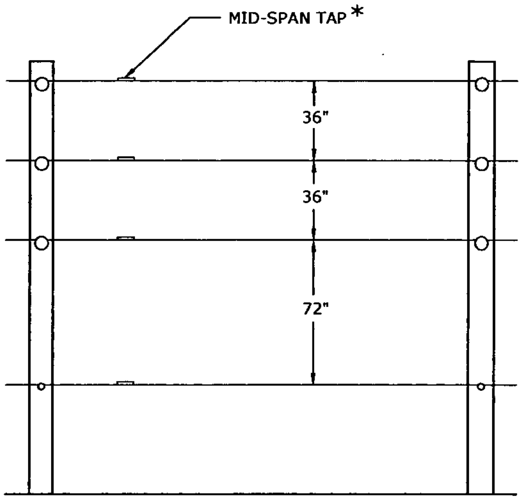
HORIZONTAL CONSTRUCTION - SLACK SPAN

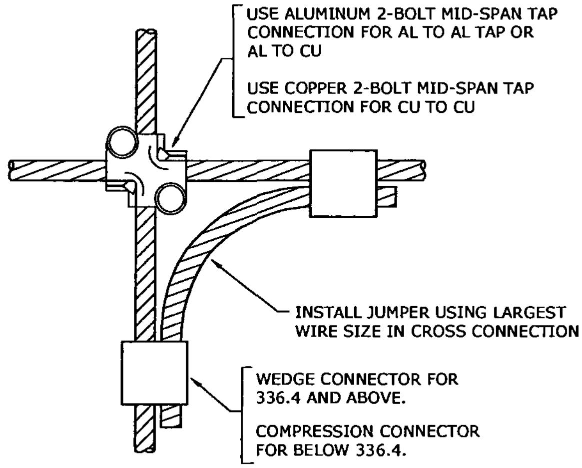
Duke Energy

FLA

DWG. 03.16-32

MIDSPAN TAP CONNECTION





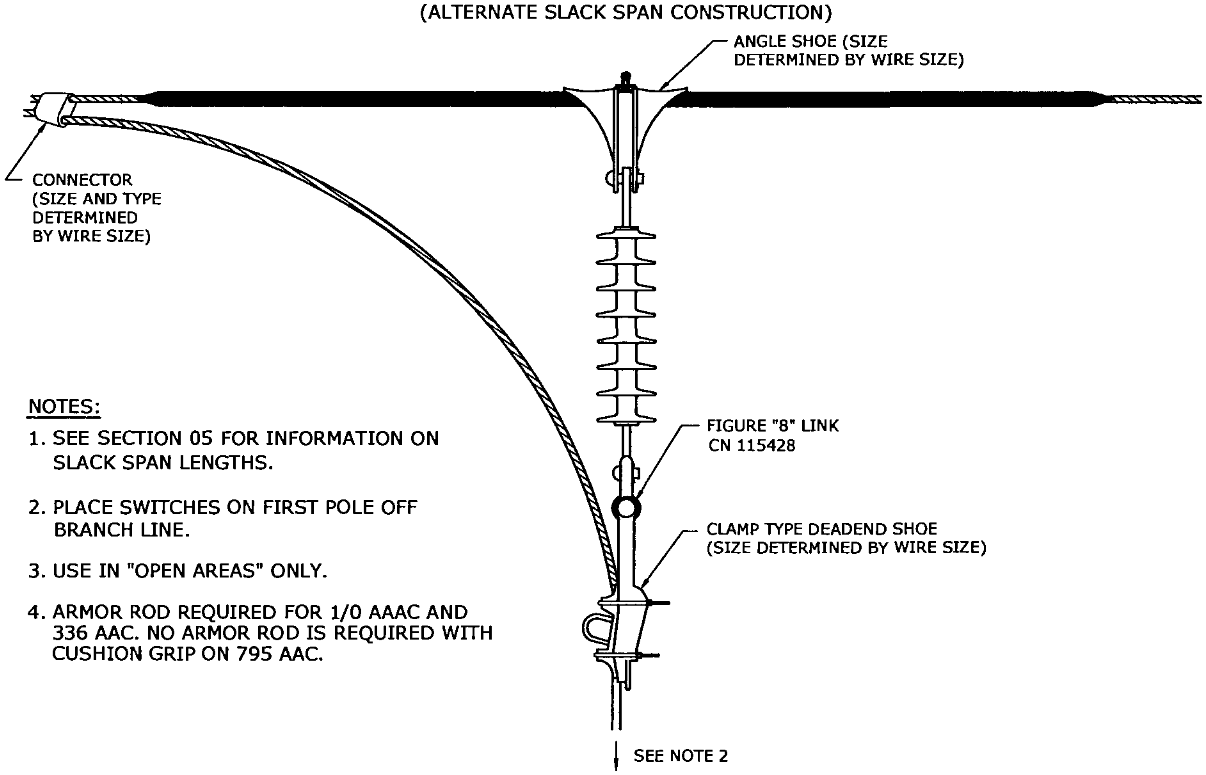
NOTES:

*1. CROSSING SPANS SHOULD BE OF APPROXIMATELY THE SAME LENGTH.

2. CONNECTED CONDUCTORS SHOULD BE OF THE SAME SIZE AND TYPE, OR SHOULD BE AS CLOSE AS POSSIBLE TO TWO NEAREST CROSSING POLES IF NOT OF SAME SIZE AND TYPE.

3. CONNECTING CONDUCTORS MUST ESSENTIALLY BE TOUCHING EACH OTHER. ONE CONDUCTOR IS NOT TO SUPPORT THE OTHER.

PRIMARY "T" TAP
(ALTERNATE SLACK SPAN CONSTRUCTION)



NOTES:

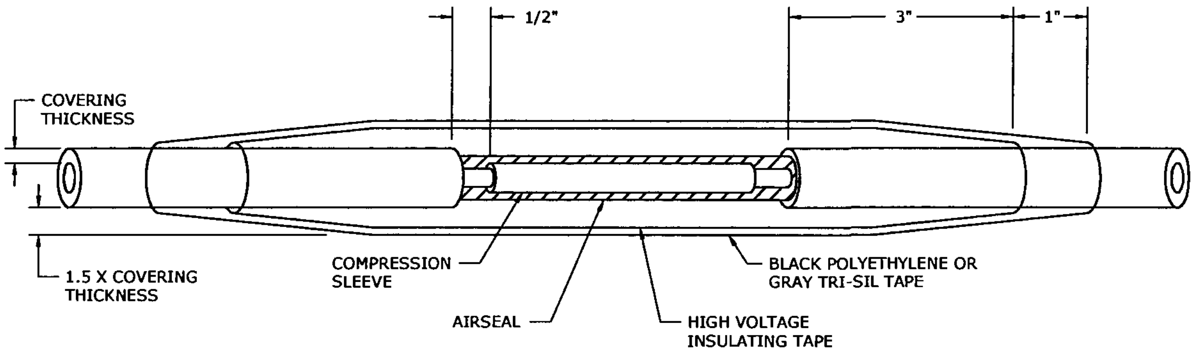
1. SEE SECTION 05 FOR INFORMATION ON SLACK SPAN LENGTHS.
2. PLACE SWITCHES ON FIRST POLE OFF BRANCH LINE.
3. USE IN "OPEN AREAS" ONLY.
4. ARMOR ROD REQUIRED FOR 1/0 AAAC AND 336 AAC. NO ARMOR ROD IS REQUIRED WITH CUSHION GRIP ON 795 AAC.

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MIDSPAN TAP CONNECTION &
PRIMARY "T" TAP
(ALTERNATE SLACK SPAN CONSTRUCTION)

Duke Energy®

FLA — DWG. 03.18-03



NOTES:

1. REMOVE COVERING FROM EACH CONDUCTOR END. THE LENGTH OF COVERING TO BE REMOVED IS EQUAL TO THE DEPTH OF THE COMPRESSION SLEEVE PLUS APPROXIMATELY ONE-HALF INCH AS SHOWN ON THE FIGURE ABOVE.
2. CLEAN BARE CONDUCTOR USING WIRE BRUSH AND INSERT CONDUCTOR INTO THE COMPRESSION SLEEVE.
3. COMPRESS THE SLEEVE, FOLLOWING THE RECOMMENDATIONS OF THE SLEEVE AND COMPRESSION TOOL MANUFACTURER(S).
4. WIPE AWAY AND EXUDED OXIDE INHIBITING COMPOUND AND FILE OFF ALL SHARP EDGES RESULTING FROM THE CRIMPING ACTION.
5. APPLY DIELECTRIC COMPOUND (KEARNEY AIR-SEAL CN 402179 OR EQUIVALENT) ON THE EXPOSED CONDUCTOR AND OVER THE COMPRESSION SLEEVE. THE THICKNESS OF THIS LAYER SHOULD BE EQUAL TO ONE HALF THE CABLE COVERING THICKNESS.
6. USING HIGH VOLTAGE INSULATING TAPE (CN 390302 OR EQUIVALENT) APPLIED HALF LAP, BUILD UP SUCCESSIVE LAYERS UNTIL A THICKNESS OF 1.5 TIMES THE CABLE COVERING IS ACHIEVED.
7. TAPER THE TAPE LAYERS AT EACH END OF THE SPLICE SO THAT AT LEAST THREE INCHES OF THE CABLE COVERING IS OVERLAPPED.
8. TO COMPLETE THE SPLICE, WRAP THE ENTIRE SPLICE WITH TWO HALF-LAPPED LAYERS OF BLACK, POLYETHYLENE (**NOT VINYL**) PRESSURE SENSITIVE TAPE OR PLYMOUTH PLY-SIL GRAY TAPE (CN390138).

3					SPACER CABLE SPLICE	Duke Energy
2						
1						FLA — DWG. 03.19-01
0	3/2/11	ROBESON	BURLISON	ELKINS		
REVISED		BY	CK'D	APPR.		

AVIAN PROTECTION

PROGRESS ENERGY CONSTRUCTS AND OPERATES DISTRIBUTION FACILITIES TO SERVE CUSTOMERS. SOME OF THESE FACILITIES ARE CONSTRUCTED ALONG RIVERS, LAKES, COASTLINES, LANDFILLS, AND OTHER ENVIRONMENTS WITH INCREASED EXPOSURE TO AVIAN INTERACTIONS WITH OUR SYSTEM. AVIAN SPECIES WILL UTILIZE DISTRIBUTION POLES AND EQUIPMENT FOR NESTING AND AS A PERCH WHEN HUNTING PREY, ESPECIALLY LARGE RAPTORS. THESE LARGE RAPTORS, WADING BIRDS AND OTHER AVIAN SPECIES CAN INADVERTENTLY CONTACT ENERGIZED EQUIPMENT WITH THEIR LARGE WINGSPAN WHEN PERCHING OR NESTING ON PEF EQUIPMENT, RESULTING IN ELECTROCUTION OF THE BIRD AND POTENTIAL OUTAGES FOR OUR CUSTOMERS.

SPECIFICATIONS CONTAINED IN THIS SECTION HAVE BEEN DEVELOPED FOR CONSTRUCTING AND MAINTAINING PRIMARY DISTRIBUTION FACILITIES IN AREAS WITH ENVIRONMENTS CONDUCIVE FOR LARGE RAPTORS, WADING BIRDS, AND OTHER AVIAN POPULATIONS WITH THE OBJECTIVE OF MINIMIZING AVIAN ELECTROCUTIONS AND OUTAGES. SOME OF THE MORE COMMON CONSTRUCTION TYPES HAVE BEEN ADDRESSED. CONTACT THE DISTRIBUTION STANDARDS UNIT FOR UNIQUE SITUATIONS. AVIAN CONSTRUCTION IS TO BE USED IN AREAS DESIGNATED AVIAN AREAS OF CONCERN BY THE ENVIRONMENTAL SERVICES UNIT'S AVIAN RISK ASSESSMENT. THE HIGH RISK AREAS REQUIRE AVIAN CONSTRUCTION STANDARDS TO BE FOLLOWED AND ARE DENOTED IN GIS BY A GREEN OVERLAY. THESE CONSTRUCTION AND MAINTENANCE OF PRIMARY STANDARDS WILL BE FOLLOWED IN SUPPORT OF PEF'S AVIAN PROTECTION PLAN, ENSURING THE COMPANY REMAINS GOOD ENVIRONMENTAL STEWARDS OF THE NATURAL RESOURCES ENTRUSTED TO OUR CARE. THESE SPECIFICATIONS MAY BE USED OUTSIDE OF DESIGNATED AVIAN AREAS AS NEEDED.

TOTAL CONSTRUCTION COSTS WOULD BE APPLIED AGAINST REVENUE CREDIT TO SERVE A NEW CUSTOMER TO DETERMINE ANY CUSTOMER COST.

IN AREAS DESIGNATED AS AVIAN AREAS OF CONCERN BY ENVIRONMENTAL SERVICE'S AVIAN RISK ASSESSMENT THE FOLLOWING GUIDELINES SHALL BE FOLLOWED:

NEW CONSTRUCTION:

1. VERTICAL CONSTRUCTION IS PREFERRED AND SHOULD BE AT LEAST 36" PRIMARY SPACING.
   - IF 36" SPACING CANNOT BE PROVIDED, AVIAN CONDUCTOR/INSULATOR COVERS MUST BE USED ON AT LEAST THE MIDDLE (B PHASE)
2. HORIZONTAL CONSTRUCTION SHOULD HAVE 60" SPACING BETWEEN PHASES.
   - IF 60" SPACING CANNOT BE PROVIDED, PERCH DETERRENTS SUCH AS TRIANGLES, ZENA X-ARM CONES, OR CONDUCTOR/INSULATOR COVERS SHALL BE USED BETWEEN PHASES.
3. ALL DOUBLE CROSSARM POLES SHALL HAVE PERCH/NEST DETERRENTS ON THEM; OPTIONS INCLUDE THE NEST DEFLECTOR CROSS ARM COVER, MULTIPLE TRIANGLE PERCH DETERRENTS, ZENA X-ARM CONES, OR OTHER APPROVED PERCH DETERRENTS SHOWN IN THIS SPEC.
4. ALL PRIMARY POLES SHALL HAVE POLE TOP CAPS ON THEM TO PREVENT PERCHING.
5. ALL CUTOUT SWITCHES SHALL HAVE AVIAN COVERS INSTALLED.
6. ALL **PRIMARY** TRANSFORMER, RECLOSER, SECTIONALIZER, ARRESTER, CAPACITOR, LINE FUSE, 200A TERMINAL POLE FUSE AND REGULATOR RISERS SHALL BE 600 VOLT POLY COVERED OR COVERED WITH TUBING. JUMPERS ON RIGHT ANGLE POLES SHALL MAINTAIN 36" PHASE SPACING OR SHALL BE COVERED. ALL JUMPERS ON CONCRETE POLES SHALL BE COVERED. 600 AMP TERMINAL POLE RISERS AND RISERS/ JUMPERS ON 600 AMP SINGLE BLADED SWITCHES NEED NOT BE COVERED.
7. JUMPERS AROUND THE POLE SHALL BE INSULATED OR COVERED WITH INSULATED TUBING.
8. ALL ARRESTORS SHALL HAVE CAPS PROPERLY INSTALLED.
9. PRIMARY (H1) BUSHINGS ON OH TRANSFORMERS SHALL HAVE SQUIRREL GUARDS INSTALLED.
10. PRIMARY GUYS SHALL HAVE AN INSULATED GUY STICK PER CONSTRUCTION STANDARDS.
11. THE SWITCH BRACKET ON TOP MOST 600 AMP SINGLE BLADE OR BYPASS SWITCH SHALL HAVE DETERRENT INSTALLED TO ELIMINATE PERCH OR NEST AREA ON THE BRACKET. USE EITHER THE TRIANGLE BIRD PERCH DETERRENT OR THE XENA BIRD DISCOURAGER. SEE DWG. 03.26-02A OR 03.26-02C).

REVISED		BY	CK'D	APPR.
3	1/11/13	BURLISON	DANNA	ADCOCK
2	1/18/12	BURLISON	BURLISON	ELKINS
1	11/15/11	BURLISON	BURLISON	ELKINS
0	6/10/11	BURLISON	BURLISON	ELKINS

AVIAN PROTECTION - OVERVIEW

Duke Energy®

FLA DWG. 03.26-01A

AVIAN PROTECTION (CONT.)

MAINTENANCE

1. WHEN PERFORMING MAINTENANCE CONSTRUCTION OF PRIMARY LINES, BRING STRUCTURE TO AVIAN STANDARD PER NEW CONSTRUCTION GUIDELINES IN AREAS DESIGNATED BY ENVIRONMENTAL AS AVIAN AREAS OF CONCERN AS DESIGNATED IN GIS BY A GREEN OVERLAY.

2. INSTALL NEST PLATFORMS ON STRUCTURES THAT HAVE INACTIVE NEST. (ALTERNATE POLE MAY NEED TO BE SET.) WHEN USING AN ALTERNATIVE POLE, NEST DETERRENTS SHOULD BE PLACE ON ORIGINAL STRUCTURE WHERE THE NEST OCCURRED.

   a. ACTIVE NEST SHOULD NOT BE MOVED UNTIL EGGS HATCH AND YOUNG FLEDGE, UNLESS ENVIRONMENT SPECIALIST PROVIDES APPROVAL DUE TO SIGNIFICANT SAFETY HAZARD FOR BIRDS OR PUBLIC.

   b. CONSIDER USING BIRD FLIGHT DIVERTERS (BFD'S) IN CLOSE PROXIMITY OF THE NEST.

3. REMOVE STICKS AND STARTER NEST FROM STRUCTURES AND ADD DIVERTERS TO STOP NEST BUILDING AT LOCATION.

   a. EVALUATE NEED FOR SIMILAR STRUCTURES 3 SPANS IN BOTH DIRECTIONS OF EXISTING STRUCTURE.

AREAS SUBJECT TO POTENTIAL BIRD STRIKES:

BIRD FLIGHT DIVERTERS (BFD'S) CAN BE USED TO REDUCE AVIAN COLLISIONS WITH POWER LINES IN HIGH RISK AREAS.

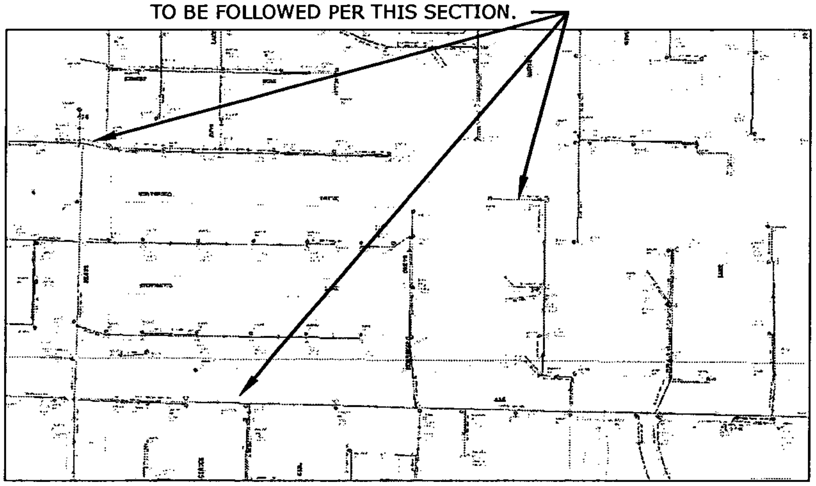
FLIGHT DIVERTERS (BFD'S) SHOULD BE INSTALLED AT INTERVALS OF 50 TO 100 FEET ON TOP CONDUCTOR (A PHASE OR STATIC IF PRESENT) FOR ALL AERIAL PRIMARY WATER CROSSINGS.

ASSESS AREAS FOR RISK OF POTENTIAL BIRD STRIKES AS YOU DESIGN WORK IN HIGH AVIAN RISK AREAS AS DESIGNATED BY PEF'S AVIAN RISK ASSESSMENT. IF A SIGNIFICANT HAZARD FOR BIRD STRIKES EXISTS, BFD'S SHOULD BE UTILIZED. EXAMPLES OF A SIGNIFICANT HAZARD MAY INCLUDE NEW LINE CONSTRUCTION WITHIN 1000 FEET OF A KNOWN EAGLE NEST, IF THE LINE INTERSECTS THE BIRD'S FOOD SOURCE (LAKE) AND ROOSTING HABITAT, AND LINES ADJACENT TO SHORELINE THAT ARE HIGHER THAN SURROUNDING TREES. IN THESE AND SIMILAR SITUATIONS, BFD'S SHOULD BE EVALUATED FOR USE BY THE ENGINEER. IF NEEDED, CONSULT ENVIRONMENTAL FOR MORE GUIDANCE.

IT IS NOT PEF'S INTENT TO REQUIRE BFD'S ON EVERY PRIMARY LINE IN HIGH RISK AREAS, BUT TO EVALUATE THEIR USE AND EFFECTIVENESS FOR REDUCING POTENTIAL BIRD STRIKES BASED ON THE LINE CONSTRUCTION, OBSERVED FIELD CONDITIONS AND PARAMETERS LISTED IN THIS SECTION.

SMALL ALUMINUM PRIMARY CONDUCTORS (1/0 AND SMALLER) AND COPPER PRIMARY CONDUCTORS PRESENT INCREASED RISK FOR POTENTIAL BIRD STRIKES IN THESE SITUATIONS.

GIS SHADED (GREEN) AREA REPRESENTS LEVEL4, (HIGH RISK) AND LEVEL 5 (VERY HIGH RISK) AREAS FOR AVIAN INTERACTION. THESE WILL REQUIRE AVIAN STANDARDS TO BE FOLLOWED PER THIS SECTION.



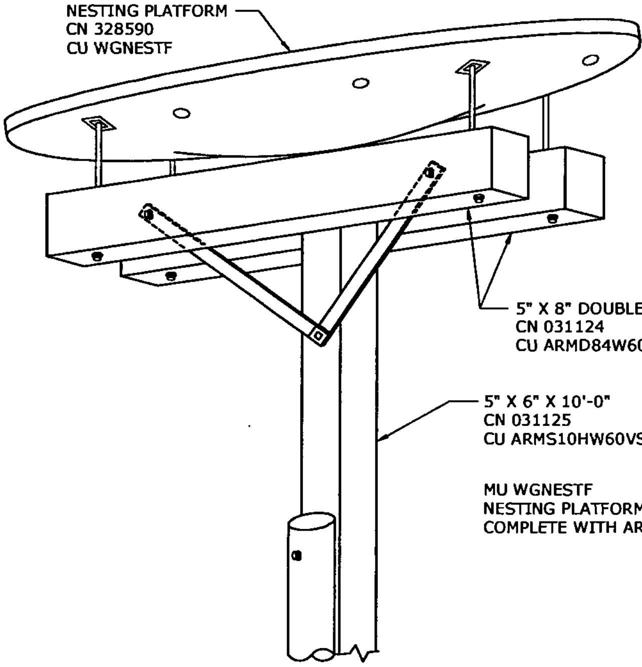
4	1/30/13	BURLISON	DANNA	ADCOCK
3	1/18/12	BURLISON	BURLISON	ELKINS
2	12/20/11	BURLISON	BURLISON	ELKINS
0	6/10/11	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

AVIAN PROTECTION - OVERVIEW

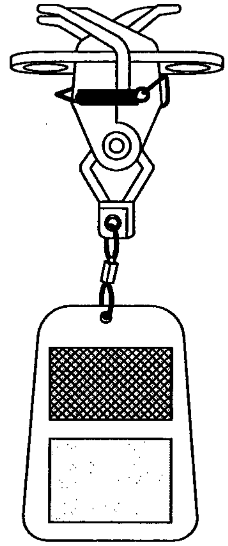
Duke Energy®

FLA DWG. 03.26-01B

NESTING PLATFORM



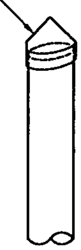
BIRD FLIGHT DETERRENT
FIREFLY CONDUCTOR FLAPPER



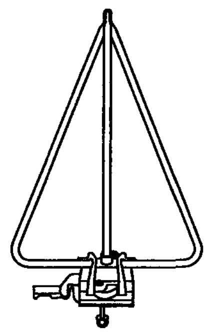
1/0 - 795
CN 9220128460
CU WGFLYDETFLF

100' SPACING - TOP CONDUCTOR ONLY

POLE TOP CAP
BIRD PERCH DETERRENT



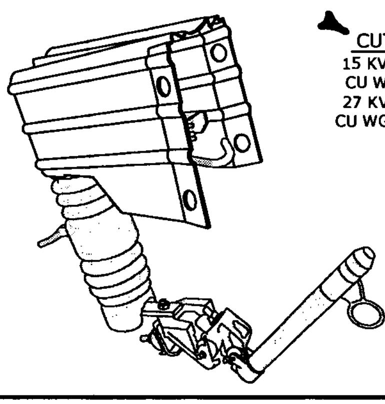
TRIANGLE BIRD PERCH DETERRENT



LIGHT CROSSARMS:
CN 9220197392
CU WGXAPERCHDETLTF

HEAVY CROSSARMS:
CN 9220197398
CU WGXAPERCHDETHDF

CAN ALSO BE MOUNTED TO
BYPASS SWITCH BRACKET

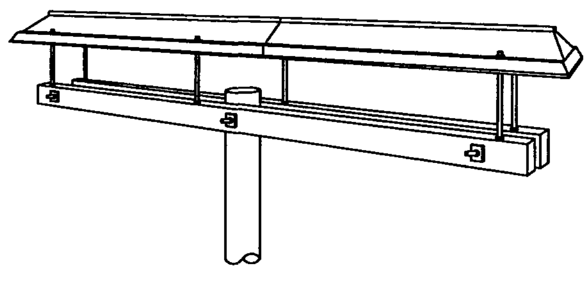


CUTOUT COVER

15 KV CN 9220197382
CU WGCOTOPCOVERF
27 KV CN 9220241925
CU WGCOTOPCOVER27F

CROSSARM COVER

CN 9220203074
CU WGXAPERCHDETTRF



NOTES:

1. COORDINATE RAPTOR NEST RELOCATIONS WITH LOCAL ENVIRONMENTAL SPECIALIST.

2. SEE DWG. 03.26-01A AND DWG. 03.26-01B FOR GENERAL NOTES.

6	8/7/12	BURLISON	BURLISON	ELKINS
5	12/20/11	BURLISON	BURLISON	ELKINS
4	11/15/11	BURLISON	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

AVIAN PROTECTION

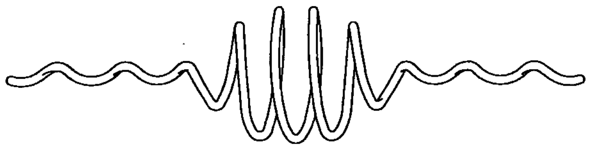
DETERRENT ITEMS FOR DISTRIBUTION

Progress Energy

FLA

DWG. 03.26-02A

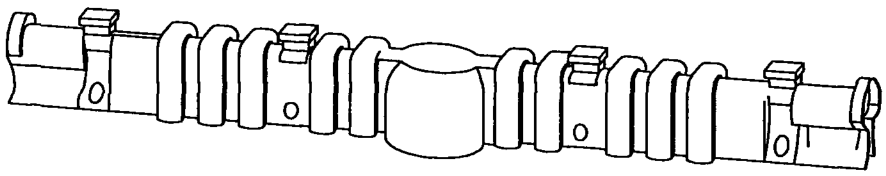
BIRD FLIGHT DETERRENT
CONDUCTOR PRE-FORM DIVERTERS



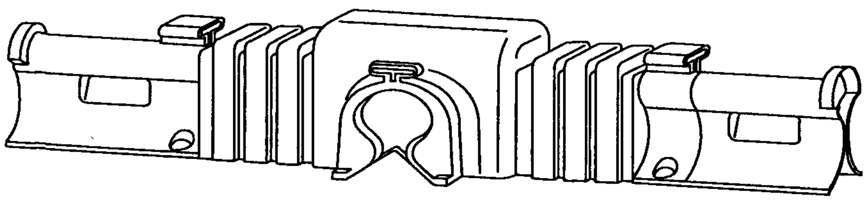
100' SPACING - TOP CONDUCTOR ONLY

CONDUCTOR SIZE	CATALOG NUMBER	COMPATIBLE UNIT
1/0	442011	WGFLYDETSP10F
4/0	442012	WGFLYDETSP40F
336	9220110988	WGFLYDETSP336F
795	9220197883	WGFLYDETSP795F

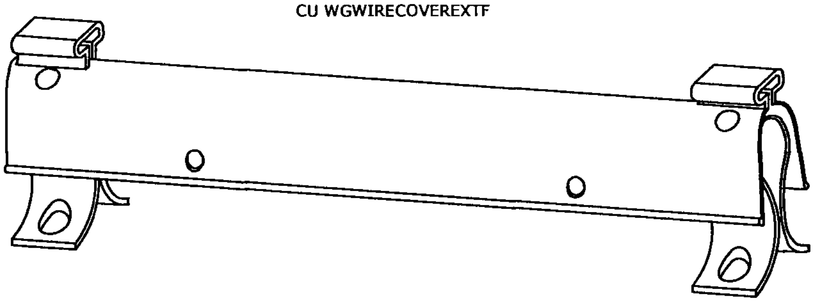
55-2 THRU 55-5 INSULATOR COVER
WIRE SIZE: #2 - 556
CN 9220204211
CU WGPININSF



LINE POST INSULATOR COVER
WIRE SIZE: #6 - 795
CN 9220204212
CU WGPOSTINSF



COVER EXTENSION
WIRE SIZE: #2 - 795
CN 9220204210
CU WGWIRECOVEREXTF



USE WITH CN 9220204211 AND CN 9220204212 AS NEEDED

NOTES:

1. COORDINATE RAPTOR NEST RELOCATIONS WITH LOCAL ENVIRONMENTAL SPECIALIST.

2. SEE DWG. 03.26-01A AND DWG. 03.26-01B FOR GENERAL NOTES.

REVISED		BY	CK'D	APPR.
3				
2	11/15/11	BURLISON	BURLISON	ELKINS
1	6/30/11	CECCONI	BURLISON	ELKINS
0	11/18/10	GUINN	GUINN	ELKINS

AVIAN PROTECTION
DETERRENT ITEMS FOR DISTRIBUTION

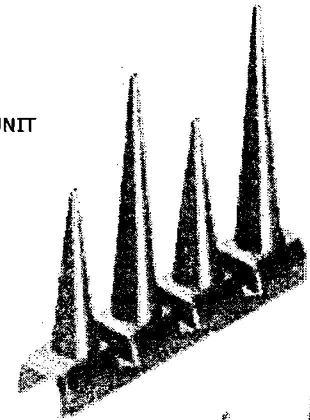
Progress Energy

FLA DWG. 03.26-02B

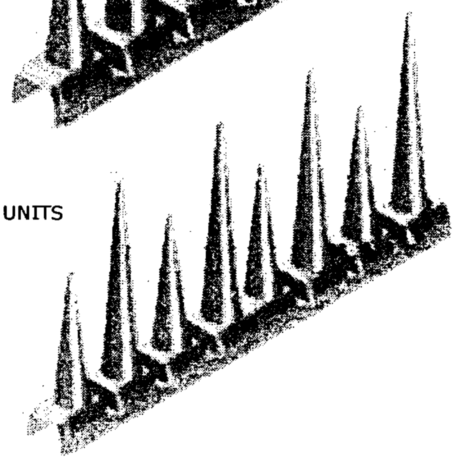
<u>BIRD PERCH DETERRENT</u>

SINGLE UNIT

CN 9220151747



MULTIPLE UNITS



NOTES:

1. THE XENA BIRD DISCOURAGER MAY BE USED AS AN ALTERNATE TO THE DETERRENTS ON DWG. 03.26-02A. IT CAN BE SECURED TO CROSSARMS WITH NAILS. IT MAY BE CUT TO SIZE FOR SWITCH BRACKETS AND SECURED USING ZIP TIES (CN 9220230121).

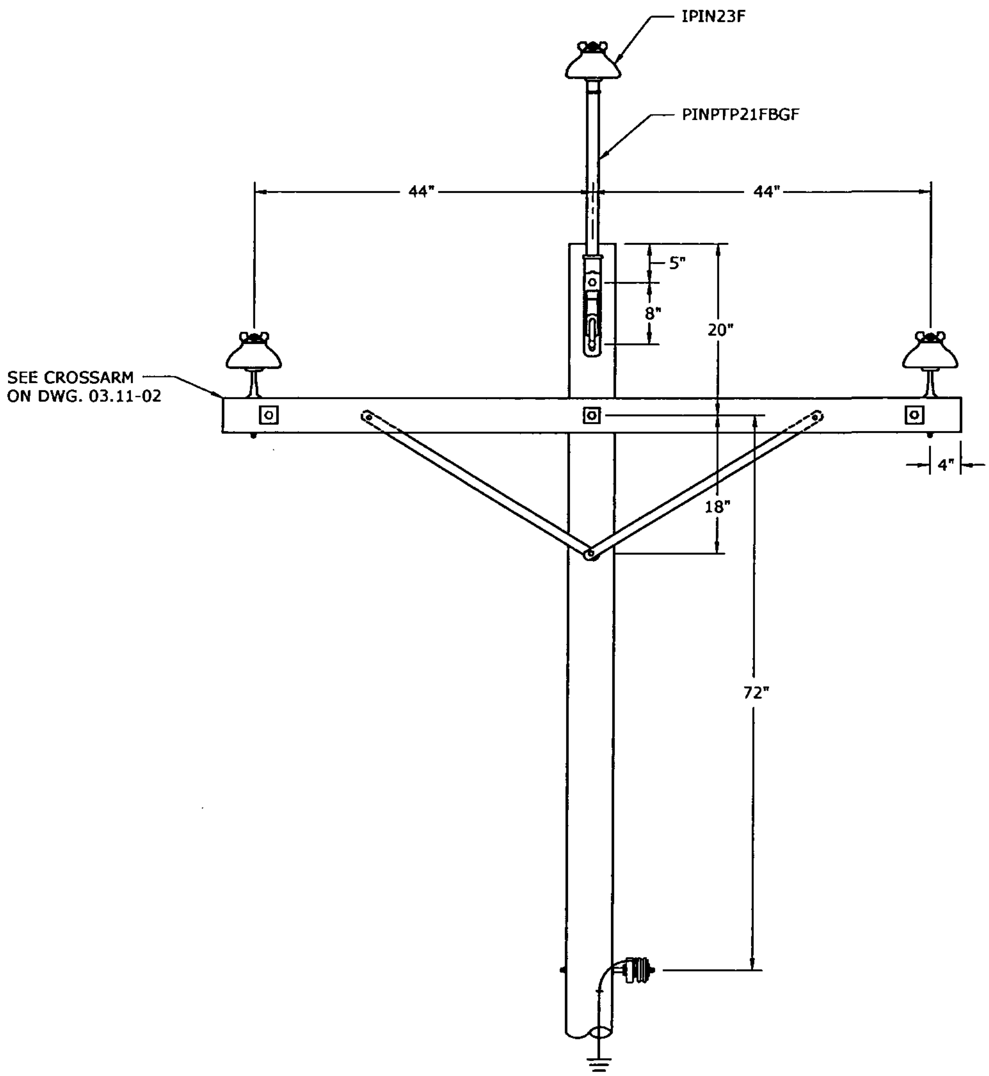
3				
2				
1				
0	1/14/13	BURLISON	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

AVIAN PROTECTION

DETERRENT ITEMS FOR DISTRIBUTION

Duke Energy®

FLA DWG. 03.26-02C



FRONT VIEW

NOTES:

1. SEE DWG. 03.26-01A AND DWG. 03.26-01B FOR GENERAL NOTES.

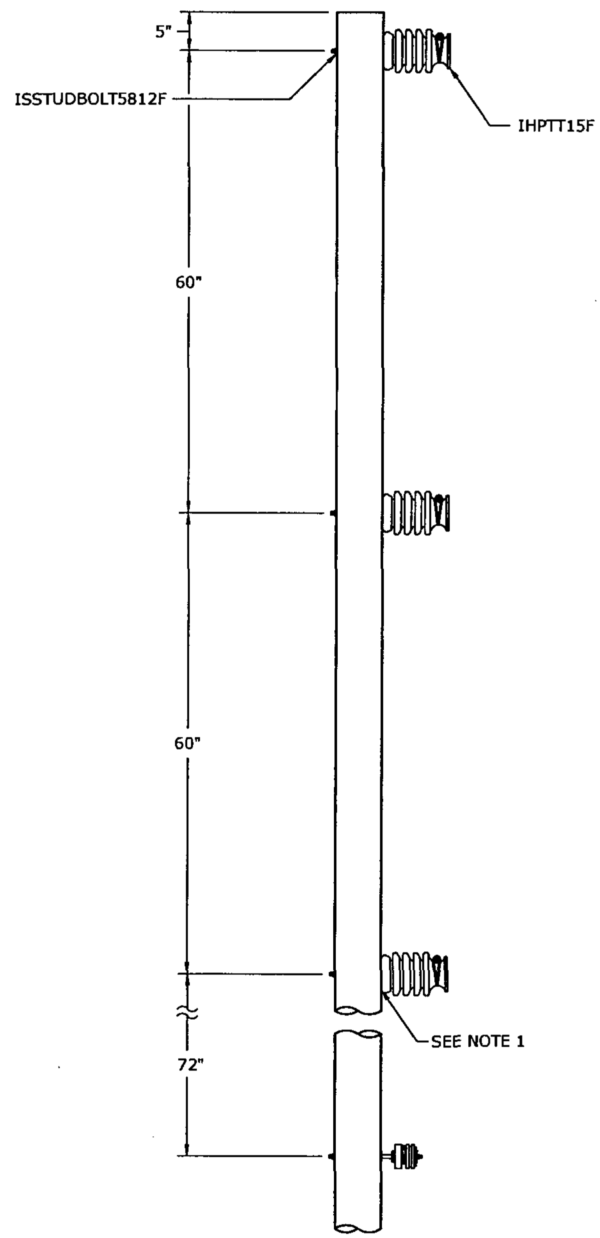
3				
2				
1	6/30/11	CECCONI	BURLISON	ELKINS
0	3/2/11	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

AVIAN PROTECTION
TANGENT LINE
(EXISTING POLE WITH CROSSARMS)

Duke Energy®

FLA

DWG.
03.26-03



FRONT VIEW

NOTES:

1. POLE GAINS (ISGAINGRIDF FOR 15/25KV INSULATORS OR ISGAINGRID55F FOR 35KV INSULATORS) ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN THE POLE DOES NOT HAVE A SLAB GAIN FOR ALL CONDUCTOR SIZES.WHEN THE CONDUCTOR IS 336.4 KCMIL OR LARGER, USE POLE GAIN EVEN IF SLAB GAIN EXISTS. POLE GAINS ARE NOT REQUIRED FOR INSULATORS USED FOR JUMPERS. SLACK SPANS WITH 336 AND 795 CONDUCTORS REQUIRE A POLE GAIN.

2. TYPICAL INSTALLATION - REFER TO SECTION 04 FOR NEUTRAL/SECONDARY DETAILS.

3. USE THESE SPECIFICATIONS FOR CONSTRUCTING NEW LINES IN THE VICINITY OF AQUACULTURE FARMS OR AS DIRECTED BY ENVIRONMENTAL SERVICES ONLY. MAXIMUM SPAN 400' FOR #1/0 AL AND SMALLER CONDUCTORS.

4. EXISTING LINES CAN BE RETROFITTED WITH THIS CONSTRUCTION WHERE ADEQUATE GROUND CLEARANCE CAN BE OBTAINED TO LOWER THE NEUTRAL.

REVISED		BY	CK'D	APPR.
3				
2	3/21/13	McCONNELL	DANNA	ADCOCK
1	12/12/11	BURLISON	BURLISON	ELKINS
0	11/8/10	BURLISON	GUINN	ELKINS

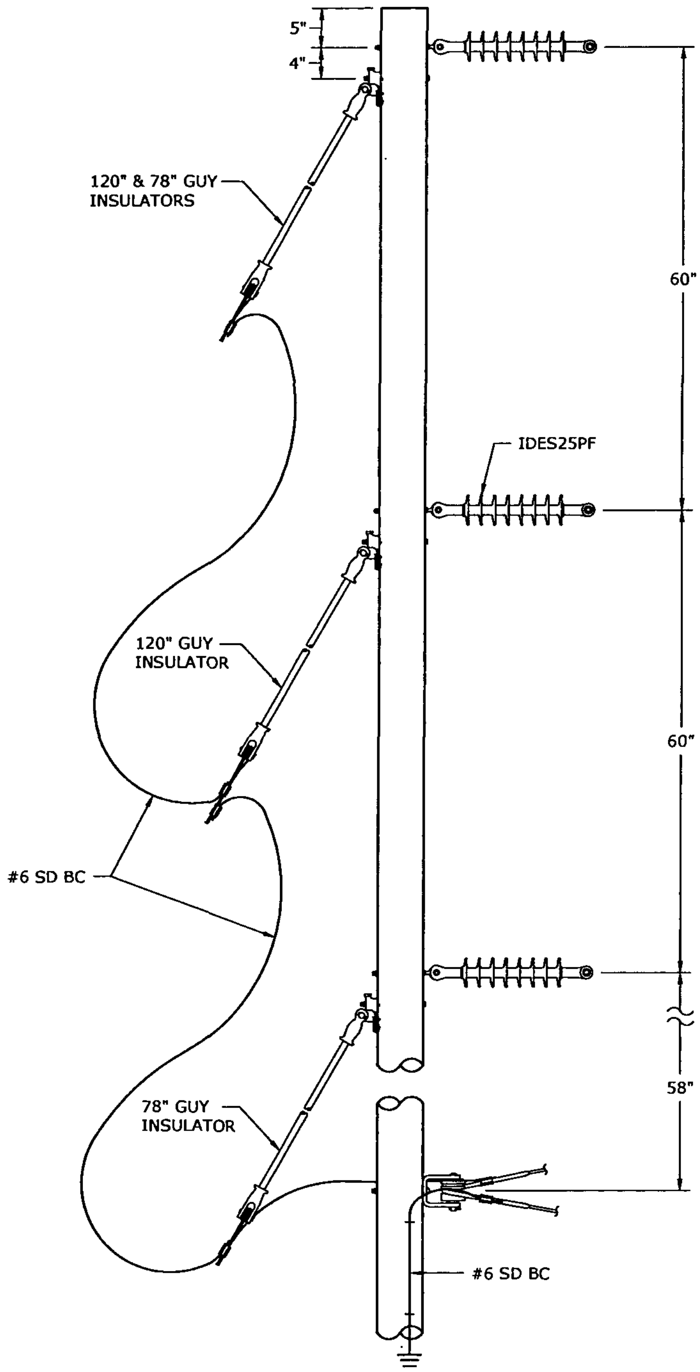
AVIAN PROTECTION - AQUACULTURE FARMS

TANGENT CONSTRUCTION

DUKE ENERGY®

FLA

DWG. 03.26-06



NOTES:

1. USE THESE SPECIFICATIONS FOR CONSTRUCTING NEW 12, 23 OR 34KV LINES IN THE VICINITY OF AQUACULTURE FARMS OR AS DIRECTED BY ENVIRONMENTAL SERVICES ONLY. MAXIMUM SPAN 400' FOR #1/0 AL AND SMALLER CONDUCTORS.

2. EXISTING LINES CAN BE RETROFITTED WITH THIS CONSTRUCTION WHERE ADEQUATE GROUND CLEARANCE CAN BE OBTAINED.

3. SEE DWG. 03.26-01A AND DWG. 03.26-01B FOR GENERAL NOTES.

4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

5. SEE DWG. 03.06-02 FOR BOLTS AND LINE CLAMPS.

3				
2	12/12/11	BURLISON	BURLISON	ELKINS
1	6/30/11	CECCONI	BURLISON	ELKINS
0	11/18/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

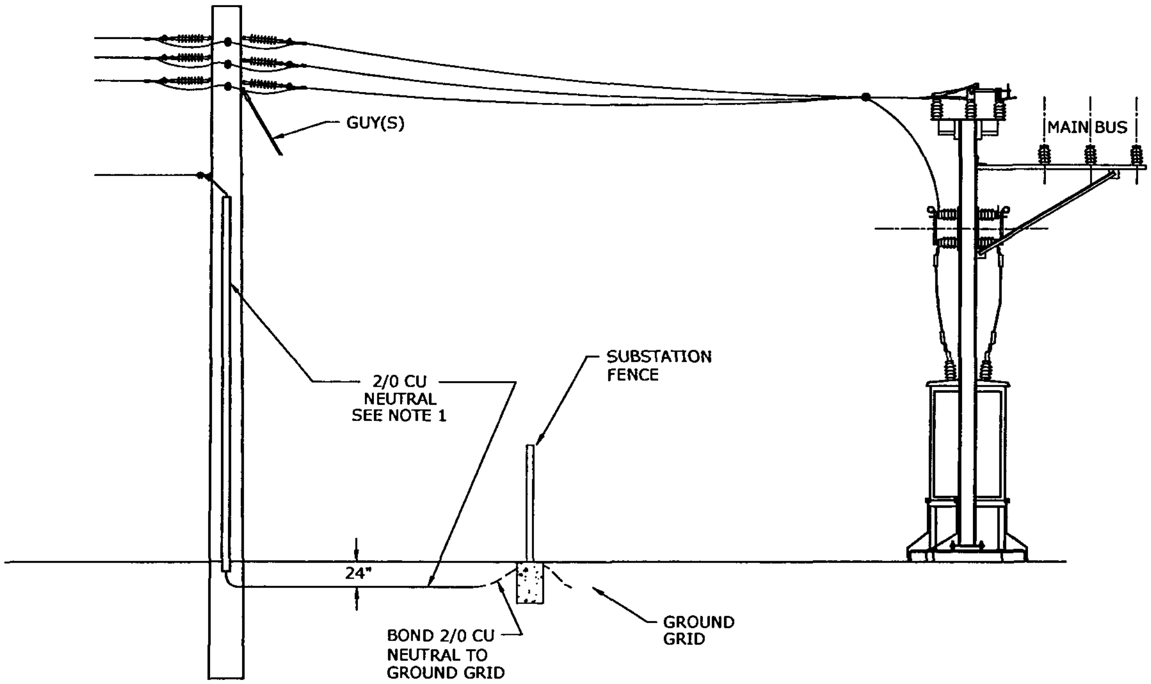
AVIAN PROTECTION - AQUACULTURE FARMS
ANGLE ASSEMBLY (UP TO 60 DEGREES)
AND DEAD END

Progress Energy

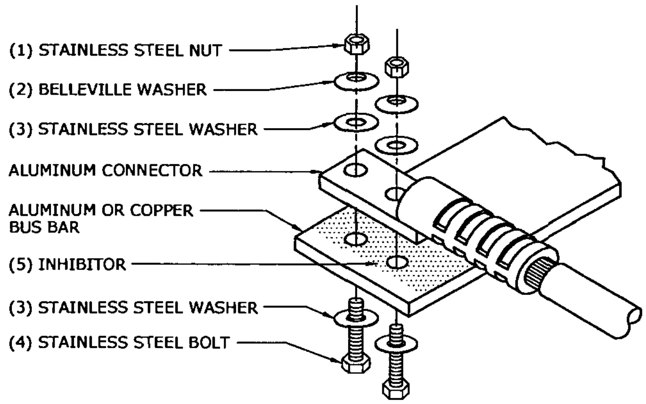
FLA

DWG.
03.26-08

GROUNDING TO SUBSTATION



TERMINATION IN SUBSTATION



SWITCH CONNECTION DETAIL TORQUE TO 40 FT. LBS.

ITEM	DESCRIPTION	
	FOR AL TO AL OR AL TO CU PADS	FOR CU TO CU PADS
1	STAINLESS STEEL NUT	SILICONE BRONZE NUT
2	BELLEVILLE WASHER	SILICONE BRONZE LOCK WASHER
3	STAINLESS STEEL WASHER	SILICONE BRONZE WASHER
4	STAINLESS STEEL BOLT	SILICONE BRONZE BOLT
5	INHIBITOR	INHIBITOR

NOTES:

1. BURY 2/0 CU NEUTRAL FROM STATION GROUND GRID TO BASE OF FIRST FEEDER POLE ON EACH OVERHEAD FEEDER. CONTINUE 2/0 CU UP POLE TO OVERHEAD NEUTRAL CONNECTION. THEN INSTALL 1" U-GUARD OVER 2/0 CU NEUTRAL.
2. DISTRIBUTION PERSONNEL WILL INSTALL CONDUCTORS AND MAKE CONNECTIONS TO L.D. & B.P. SWITCHES.

3				
2				
1				
0	11/18/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OVERHEAD FEEDER TERMINATION IN SUBSTATION

WITH METAL BUS STRUCTURE

Duke Energy

FLA

DWG. 03.28-02

FOR SPECIAL APPLICATIONS ONLY REQUIRING MODIFICATION TO EXISTING SYSTEM. OBTAIN APPROVAL FROM MANAGER - DISTRIBUTION ASSET PERFORMANCE AND MANAGER - DISTRIBUTION ASSET ENGINEERING.

GROUNDING:

1. EACH POLE TO HAVE A DEEP-DRIVEN GROUND. MINIMUM DESIRED RESISTANCE TO BE 25 OHMS.
2. ALL GUYS TO BE BONDED TO THE SYSTEM NEUTRAL AND MESSENGER. (SINCE THE SPACER CABLE SYSTEM IS SUPPORTED BY A GROUNDED MESSENGER, THERE IS NO BENEFIT TO PLACING INSULATORS IN DOWN AND/OR SPAN GUYS.)

ARRESTERS:

1. ARRESTERS ARE GENERALLY INSTALLED ONLY AT EACH LOCATION THE SPACER CABLE INSULATION IS REMOVED FOR TAP AND TRANSFORMER CONNECTIONS. WHERE EXTENDED RUNS GREATER THAN 2000' ARE INSTALLED WITHOUT TAPS OR TRANSFORMER CONNECTIONS, THE CABLE MAY BE TAPPED FOR ARRESTER STATIONS.

CABLE TAPS:

1. WHERE THE CABLE INSULATION IS REMOVED TO TAP THE CABLE, THE MESSENGER IS TO BE COVERED WITH "LINE-DUC" TO PROTECT AGAINST SHORT CIRCUITS TO GROUND. THE COVER IS TO EXTEND 18" EACH SIDE OF THE TAP POINT AND SECURED WITH TIE WIRE.

CONSTRUCTION DRAWINGS:

1. THE DRAWINGS SHOWN ARE FOR 1/0 CONSTRUCTION. USE THE PROPER BOLTED HARDWARE FOR 795 WIRE SIZES.
2. THE CLEARANCES WILL BE THE SAME FOR 1/0 OR 795.
3. PULLING TENSIONS TO BE PROVIDED BY ENGINEERING.
4. 2 Ø AND 3 Ø CONSTRUCTION METHODS ARE IDENTICAL.

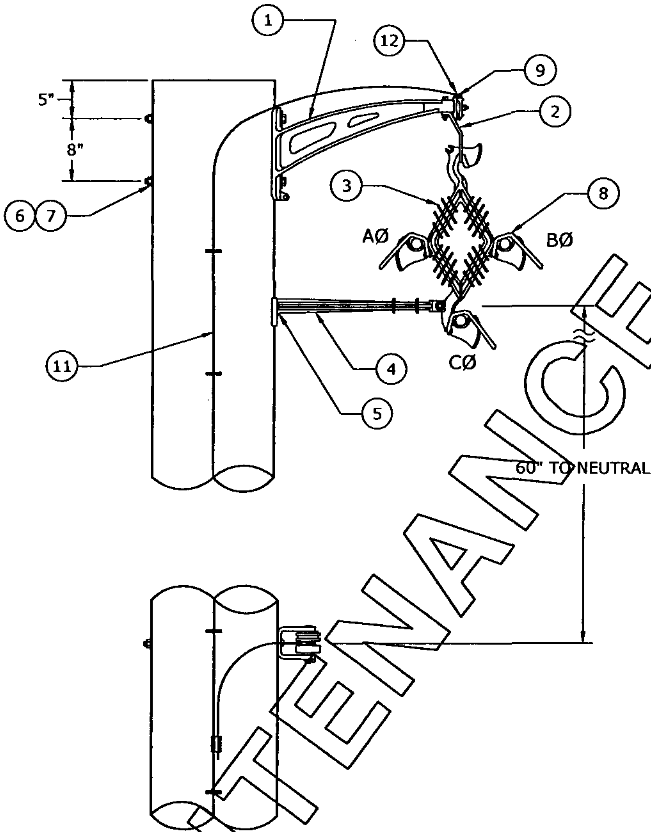
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

15KV SPACER CABLE SYSTEM (FMO)

Duke Energy®

FLA

DWG. 03.19-00



NOTES:

1. SEE DWG. 03.19-02B FOR BILL OF MATERIALS.

3					TYPICAL TANGENT CONSTRUCTION (FMO)
2					
1					
0	12/1/10	GUINN	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

Duke Energy

FLA DWG. 03.19-02A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC301	9220100581	1	MESSENGER BRACKET
2		9220100590	1	STIRRUP, SUPPLIED WITH 1/2" BOLT, FLAT WASHER AND SELF-LOCKING NUT
3		9220100591	1	3 PHASE SPACER
4		9220100580	1	ANTI-SWAY BAR, SUPPLIED WITH PLASTIC BOLT
5		14114	1	LAG SCREW, FETTER DRIVE, 1/2" X 4"
6		10432	2	MACHINE BOLTS, 5/8" X REQUIRED LENGTH
7		13346	2	SQUARE WASHER, 4" X 4" SQUARE CURVED
8*	SC1	-	AS REQ.	HENDRIX AERIAL CABLE, 15KV, 1/0
9*	SC1M	-	AS REQ.	MESSENGER, 1/0
10	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
11	-	-	1	CONNECTOR (SIZE AND TYPE AS REQUIRED, NOT SHOWN)

* SEE DWG. 03.19-00 FOR 795 CONSTRUCTION

NOTES:

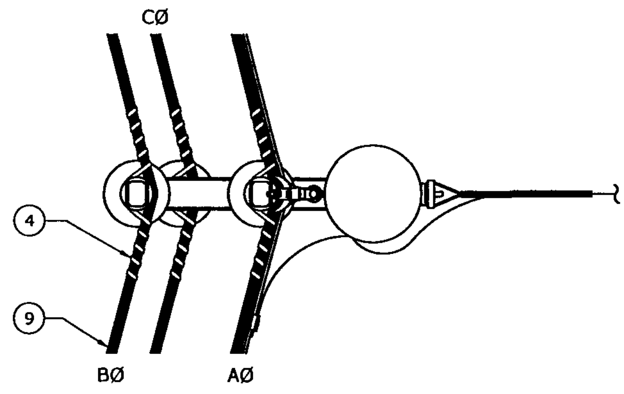
1. TANGENTS ARE DEFINED AS LINE ANGLES UP TO AND INCLUDING 6° FOR SPACER CABLE.
2. ANY HORIZONTAL LOAD CREATED BY A MINOR ANGLE SHOULD BE GUYED FOR PROPER CONSTRUCTION.
3. THE STIRRUP (ITEM 2) SHOULD BE BOLTED THROUGH THE HOLE CLOSEST TO THE END OF THE TANGENT BRACKET, NEAR THE MESSENGER CLAMP.
4. SEE DWG. 03.19-02A FOR DESIGN SPECIFICATIONS.

3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

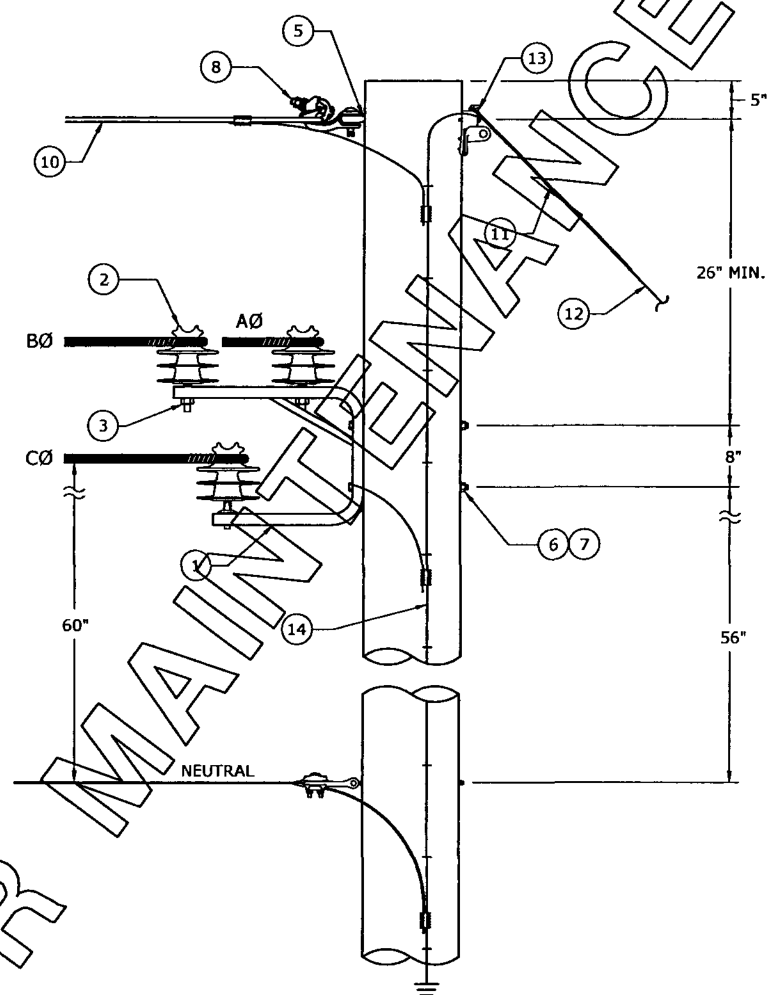
TYPICAL TANGENT CONSTRUCTION (FMO)

Duke Energy®

FLA DWG. 03.19-02B



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.19-04B FOR BILL OF MATERIALS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

7 DEGREE-60 DEGREE OUTSIDE ANGLE CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-04A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC311	9220100579	1	ANGLE BRACKET
2		9220100578	3	INSULATOR, PIN TYPE
3		9220100594	3	INSULATOR PIN
4		9220100589	1	COVERED TIE WIRE, #4 AWG SOLID SOFT DRAWN ALUMINUM WITH .045" THERMOPLASTIC RUBBER, 6 TO 8 FT. LENGTH
5		11708	1	EYE BOLT, 5/8" X REQUIRED LENGTH FOR STANDARD DUTY CONSTRUCTION 3/4" X REQUIRED LENGTH FOR HEAVY DUTY CONSTRUCTION
6		10432	2	MACHINE BOLT, 5/8" AS REQUIRED LENGTH
7		13343	3	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MINIMUM
8		9220100584	1	ANGLE CLAMP
9	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 15KV, 1/0
10	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
11	-	-	AS REQ.	PRESHAPED GUY GRIP, (SIZE AND TYPE AS REQUIRED)
12	-	-	AS REQ.	GUY STRAND, (SIZE AND TYPE AS REQUIRED)
13	-	-	AS REQ.	GUY HOOK
14			AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. FOR MESSENGER TENSIONS GREATER THAN 8000 LB, THE MESSENGER MUST BE DOUBLE DEAD-ENDED.

2. SEE DWG. 03.19-04A FOR DESIGN SPECIFICATIONS.

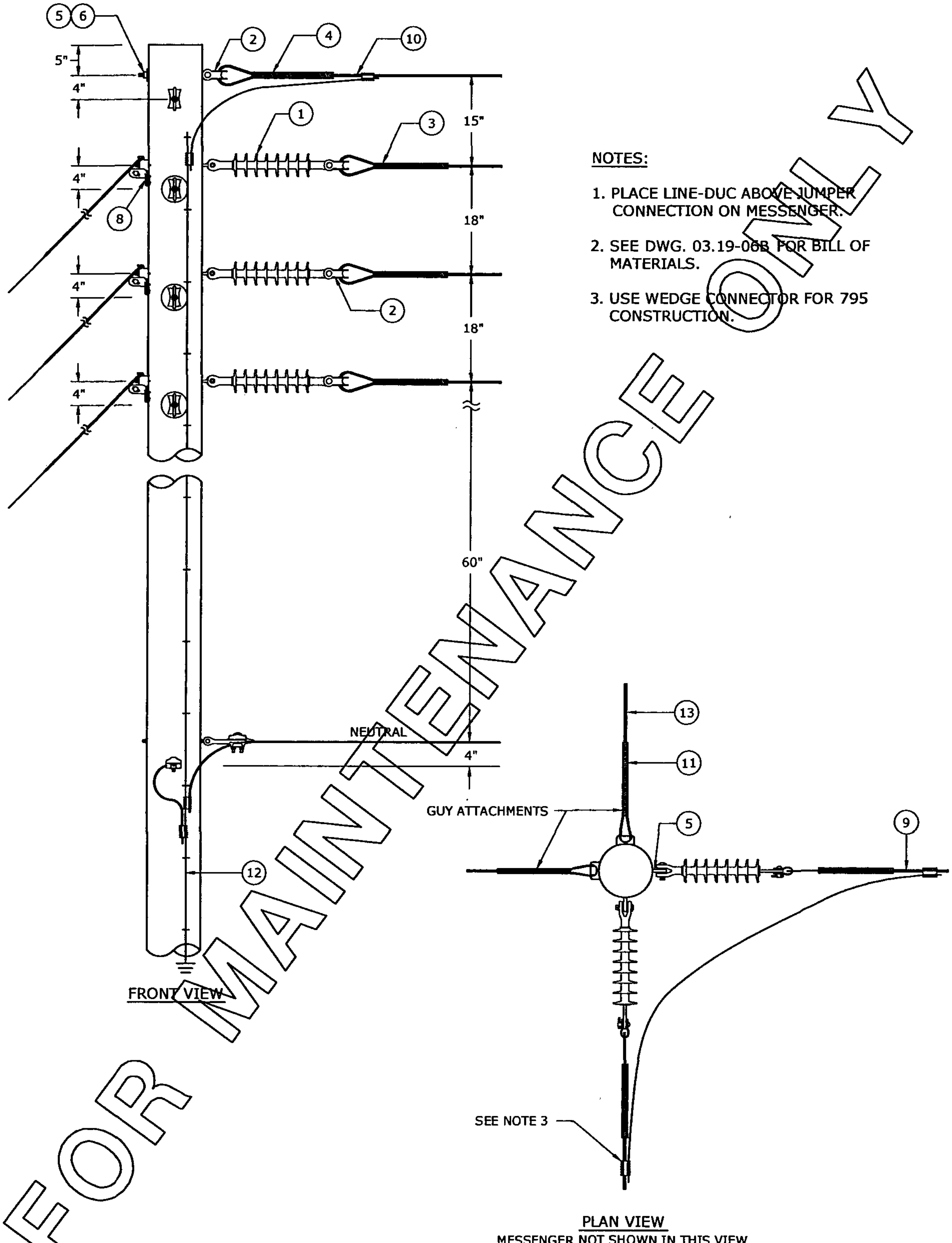
4. SEE DWG. 03.19-00 FOR 795 CONSTRUCTION OF SC1 AND SC1M.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

7 DEGREE - 60 DEGREE OUTSIDE ANGLE CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-04B



PLAN VIEW
MESSENGER NOT SHOWN IN THIS VIEW

NOTES:

1. PLACE LINE-DUC ABOVE JUMPER CONNECTION ON MESSENGER.
2. SEE DWG. 03.19-06B FOR BILL OF MATERIALS.
3. USE WEDGE CONNECTOR FOR 795 CONSTRUCTION.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

DOUBLE DEAD-END
ANGLE CONSTRUCTION
61 - 90 DEGREES (FMO)

Duke Energy®

FLA

DWG. 03.19-06A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC321	80575	6	INSULATOR, POLYMER DEAD-END TYPE
2		9220100585	8	THIMBLE CLEVIS
3		9220100897	6	PRESHAPED TYPE CONDUCTOR GUY GRIP, COATED
4		9220100587	2	PRESHAPED TYPE MESSENGER GRIP
5		11708	8	EYE BOLT, 5/8" X REQUIRED LENGTH
6		13343	8	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
7		9220100586	2	LINE-DUC (NOT SHOWN)
8	-	-	6	GUY HOOK
9	SC1	-	AS REQ.	HENDRIX AERIAL CABLE, 15KV 1/0
10	SC1M	-	AS REQ.	MESSENGER, 1/0
11	-	-	6	PRESHAPED TYPE GUY GRIP
12	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
13	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)

NOTES:

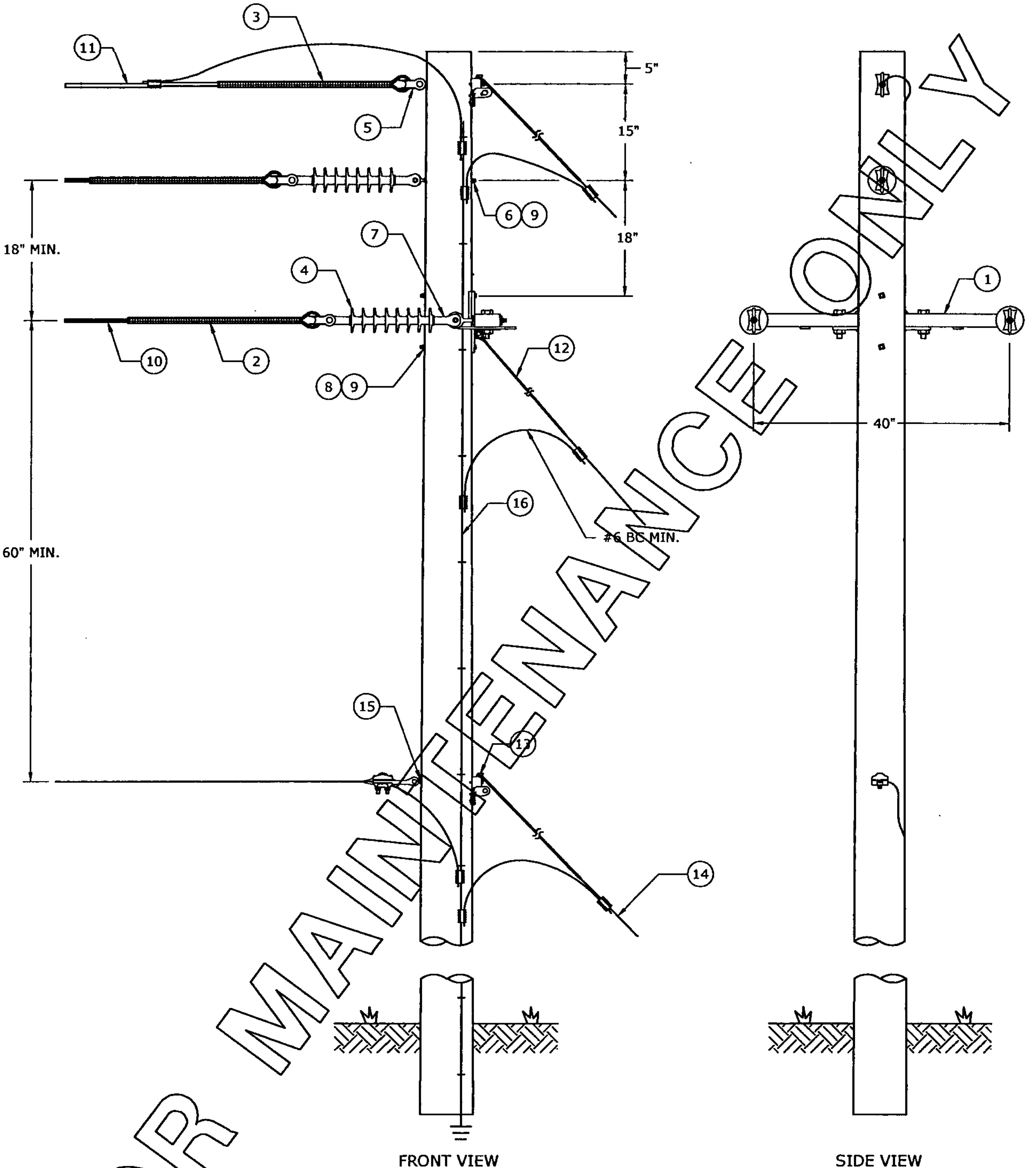
1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.
2. FOR HEAVY DUTY CONSTRUCTION, THE MESSENGER SHOULD BE DEAD-ENDED USING A 3/4" EYEBOLT AND HDTC THIMBLE CLEVIS.
3. SEE DWG. 03.19-06A FOR DESIGN SPECIFICATIONS.
4. SEE DWG. 03.19-00 FOR 795 CONSTRUCTION OF SC1 AND SC1M.

REVISED	DATE	BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

DOUBLE DEAD-END ANGLE CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-06B



NOTES:

1. SEE DWG. 03.19-08B FOR BILL OF MATERIALS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

TYPICAL THREE-PHASE

DEAD-END CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-08A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1		70164	1	40" DOUBLE DEADEND STEEL CROSSARM
2		9220100897	3	PRESHAPED CONDUCTOR GRIP, COATED, 1/0
3		9220100587	1	PRESHAPED MESSENGER GRIP, 1/0
4		80575	3	INSULATOR, POLYMER DEAD-END 25KV
5	SC331	9220100585	4	THIMBLE CLEVIS
6		11707	2	EYE BOLT, 5/8" X 12"
7		11708	2	EYE BOLT, 5/8" X 10"
8		10436	2	MACHINE BOLT, 5/8" X 12"
9		13343	6	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16", MIN.
10	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 15KV, 1/0
11	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
12	-	-	AS REQ.	PRESHAPED GUY GRIP
13	-	-	AS REQ.	GUY HOOK
14	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
15	-	-	1	MACHINE BOLT, 5/8" X REQUIRED LENGTH
16	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG

NOTES:

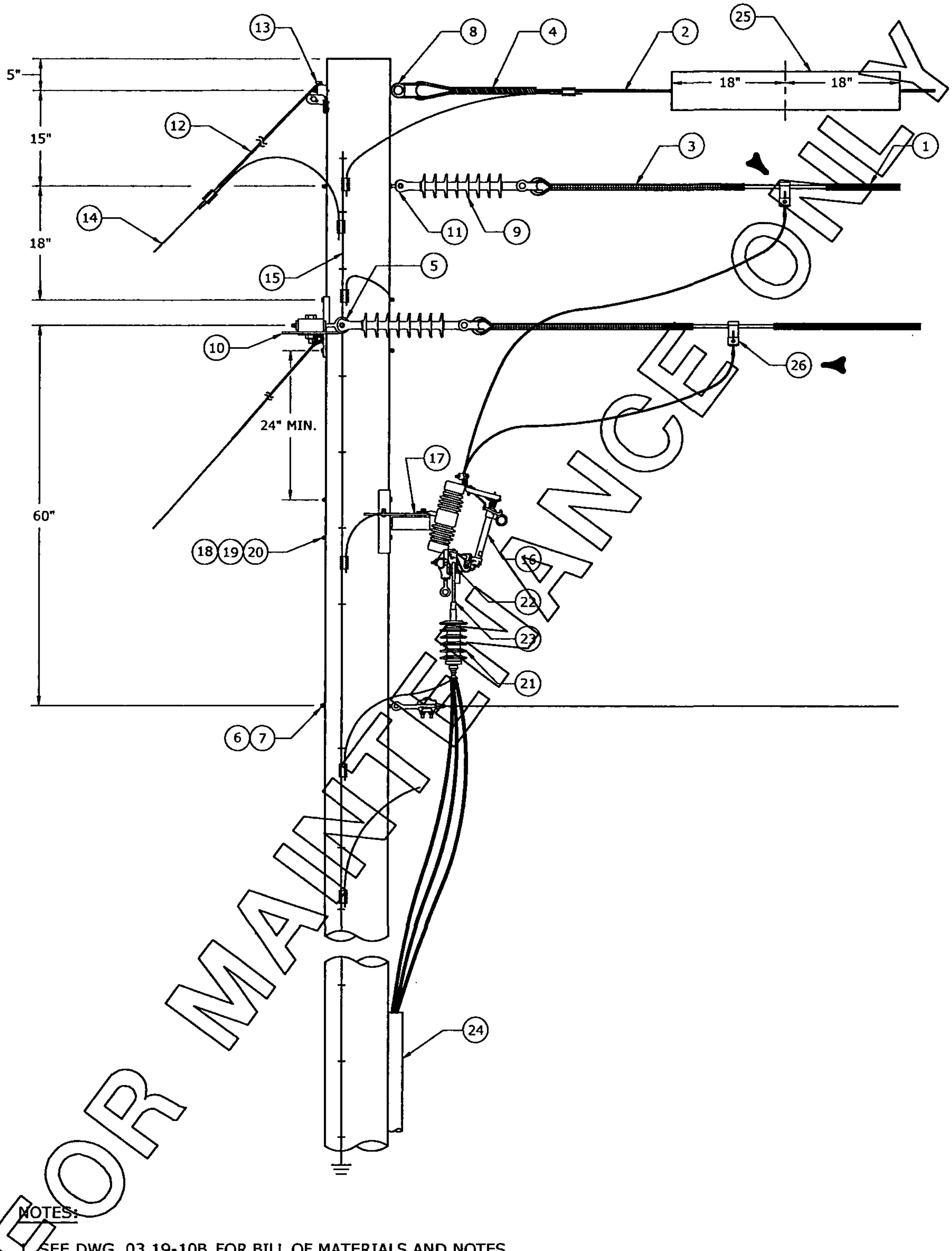
1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.
2. SEE DWG. 03.19-08A FOR DESIGN SPECIFICATIONS.
3. SEE DWG. 03.19-00 FOR 795 CONSTRUCTION OF SC1 AND SC1M.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TYPICAL THREE-PHASE
DEAD-END CONSTRUCTION (FMO)

Duke Energy®

FLA DWG. 03.19-08B



NOTES:

1. SEE DWG. 03.19-10B FOR BILL OF MATERIALS AND NOTES.

REVISED	BY	CK'D	APPR.
3			
2			
1 8/31/11	BURLISON	BURLISON	ELKINS
0 12/1/10	GUINN	GUINN	ELKINS

THREE-PHASE DEAD-END CONSTRUCTION WITH UNDERGROUND RISER (FMO)

Progress Energy

FLA DWG. 03.19-10A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SC1	1	9220100898	AS REQ.	HENDRIX AERIAL CABLE (SIZE AND VOLTAGE RATING AS REQUIRED)
	2	SC1M	1	9220100596	AS REQ.	MESSENGER (SIZE AND TYPE AS REQUIRED)
	3	SC331	1	9220100897	3	PRESHAPED CONDUCTOR GRIP, COATED
	4			9220100587	1	PRESHAPED MESSENGER GRIP
	5			11707	2	EYEBOLT, 5/8" X 8"
	6			10436	2	BOLT, MACHINE, 5/8" X 12"
	7			13343	6	WASHER, SQUARE, CURVED
	8			9220100585	4	THIMBLE CLEVIS
	9			80575	3	15KV POLYMER DEADEND
	10			70164	1	40" DOUBLE DEADEND STEEL CROSSARM
	11			11708	2	EYEBOLT, 5/8" X 10"
	12	-	1	-	AS REQ.	PRESHAPED GUY GRIP
	13	-	1	-	AS REQ.	GUY HOOK
	14	-	1	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
	15	-	1	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG
	16	CA3T	1	221112	3	CUTOUT, 15 KV 100A, 16KA ASYMMETRICAL
	17			70104	1	BRACKET, TRIPLE MOUNTING
	18			10436	2	BOLT, MACHINE, 5/8" X 12"
	19			13308	2	WASHER, SQUARE, 2-1/4"
	20			13264	2	WASHER, SPRING COIL, 5/8"
	21			220208	3	ARRESTER, POLYMER (MOV TERMINAL POLE TYPE)
	22			153534	3	CONNECTOR, STEM FOR UNDERGROUND ARRESTER
	23			130102	3	CLAMP, HOT LINE
	24	-	1	-	AS REQ.	CONDUIT
	25	SCLD	1	9220100586	2 FT.	HENDRIX LINE-DUC WITH METALLIC TIE
	26	KHLC40N6F	1	9220184790	3	CLAMP, HOT LINE, ALUM, SMALL, 4/0
		KHLC7933F	1	9220184794	3	CLAMP, HOT LINE, ALUM, LARGE, 336-795

NOTES:

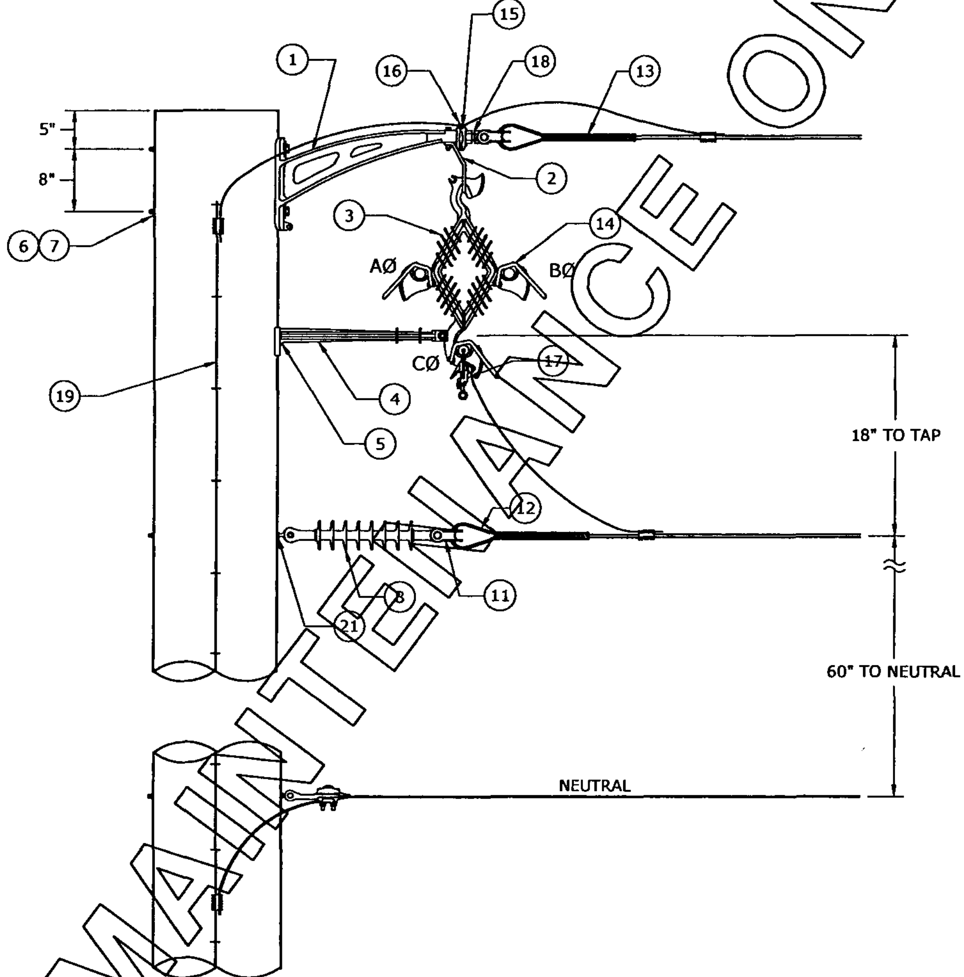
1. TYPES, QUANTITIES AND VOLTAGE RATINGS OF MATERIALS AS WELL AS CLEARANCES FOR VARIOUS VOLTAGE CLASSIFICATIONS ARE TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC SAFETY CODE (NESC) AND THE USER'S STANDARD CONSTRUCTION PRACTICES.
2. SEE DWG. 03.19-10A FOR DESIGN SPECIFICATIONS.
3. SEE DWG. 03.19-00 FOR 795 CONSTRUCTION OF SC1 AND SC1M.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	12/1/10	GUINN	GUINN	ELKINS

THREE-PHASE DEAD-END CONSTRUCTION
WITH UNDERGROUND RISER (FMO)

Progress Energy

FLA DWG. 03.19-10B



NOTES:

1. SEE DWG. 03.19-12B FOR BILL OF MATERIALS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE LATERAL TAP
TANGENT CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-12A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC301	9220100581	1	MESSENGER BRACKET
2		9220100590	1	STIRRUP, SUPPLIED WITH 1/2" BOLT, FLAT WASHER AND SELF-LOCKING NUT
3		9220100591	1	HENDRIX SPACER
4		9220100580	1	ANTI-SWAY BAR, SUPPLIED WITH PLASTIC BOLT
5		14114	1	LAG SCREW, FETTER DRIVE, 1/2" X 4"
6		10432	2	MACHINE BOLTS, 5/8" X REQUIRED LENGTH
7		13346	2	SQUARE WASHER, 4" X 4" SQUARE CURVED
8	SC131	80575	1	INSULATOR, POLYMER 15KV
9		13343	2	SQUARE WASHER, 4" X 4" SQUARE CURVED
10		11708	2	BOLT, OVAL EYE, 5/8" X 10"
11		9220100585	2	THIMBLE CLEVIS
12		9220100897	1	PRESHAPED CONDUCTOR GRIP, COATED TYPE
13		9220100587	1	PRESHAPED MESSENGER GRIP
14	SC1	-	AS REQ.	HENDRIX AERIAL CABLE
15	SC1M	-	AS REQ.	MESSENGER
16	-	-	1	CONNECTOR (SIZE AND TYPE AS REQUIRED, NOT SHOWN)
17	-	-	1	STIRRUP
18	-	-	1	EYE NUT, STANDARD 5/8"
19	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
20	-	-	1	BOLT, OVAL EYE, 5/8" X 10"
21	SCLD	9220100586	2	LINE-DUC (NOT SHOWN)

NOTES:

1. TANGENTS ARE DEFINED AS LINE ANGLES UP TO AND INCLUDING 6° FOR SPACER CABLE.

2. ANY HORIZONTAL LOAD CREATED BY A MINOR ANGLE SHOULD BE GUYED FOR PROPER CONSTRUCTION.

3. THE STIRRUP (ITEM 2) SHOULD BE BOLTED THROUGH THE HOLE CLOSEST TO THE END OF THE TANGENT BRACKET, NEAR THE MESSENGER CLAMP.

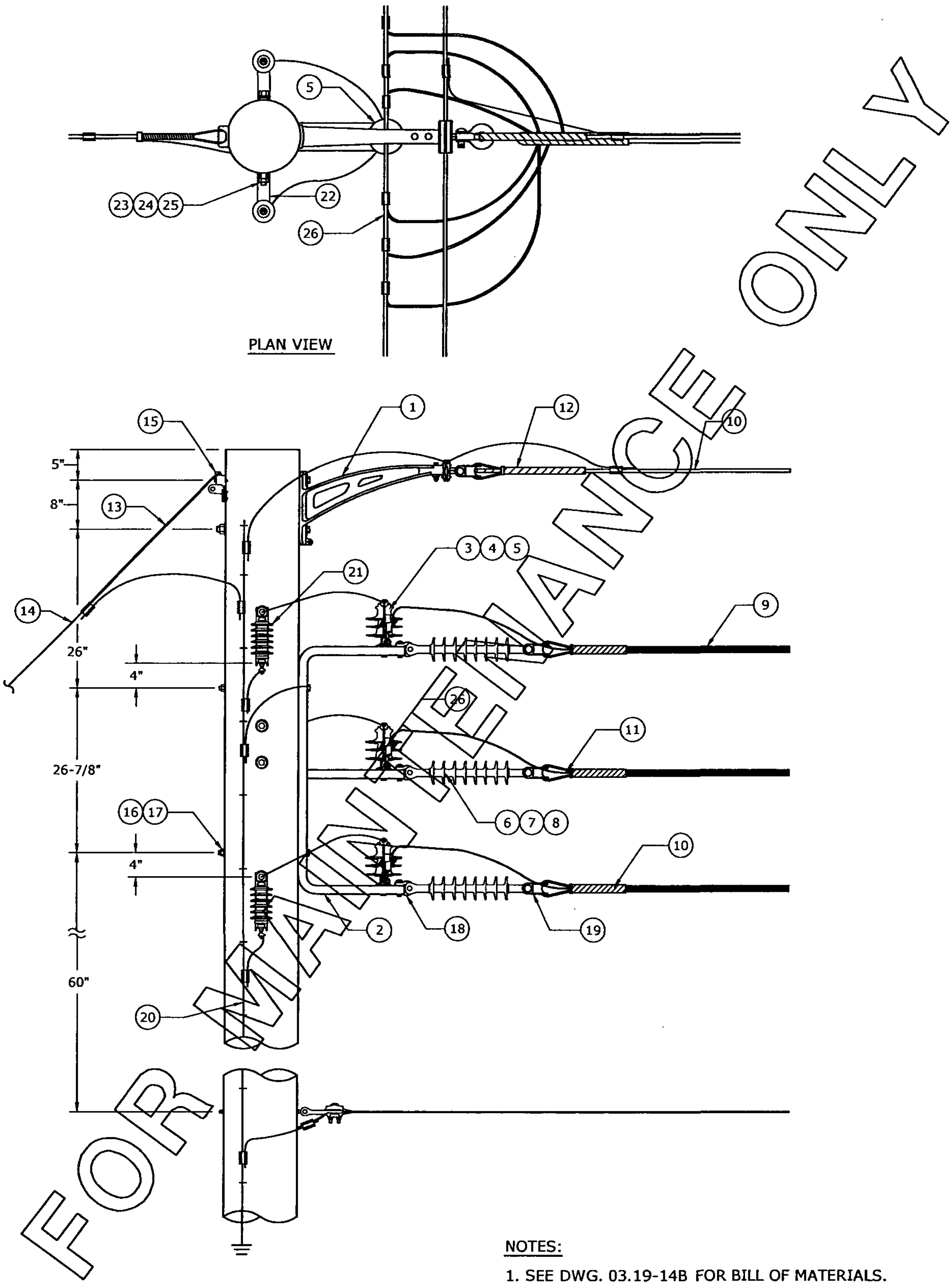
4. SEE DWG. 03.19-12A FOR DESIGN SPECIFICATIONS.

REVISED	DATE	BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE LATERAL TAP
TANGENT CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-12B



NOTES:

1. SEE DWG. 03.19-14B FOR BILL OF MATERIALS.
2. CONNECT ARRESTER TO TAP STIRRUP.

3				
2				
1				
0 12/1/10	GUINN	GUINN	ELKINS	
REVISED	BY	CK'D	APPR.	

THREE-PHASE, LATERAL TAP CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-14A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SCMB	9220100581	1	MESSENGER BRACKET
2	SCTB	9220100582	1	VERTICAL TAP BRACKET
3	SCIP	9220100578	1	INSULATOR, PIN TYPE, 15KV
4		9220100594	1	INSULATOR PIN
5		9220100589	1	HENDRIX COVERED TIE WIRE, #4 AWG SOLID SOFT DRAWN ALUMINUM WITH .045" THERMOPLASTIC RUBBER, 6 TO 8 FT. LENGTH
6	IP	11708	1	BOLT, OVAL EYE, 5/8" X 10"
7		13308	1	WASHER, SQ. FLAT, 2-1/4"
8		80575	1	INSULATOR, POLYMER DEAD-END 15KV
9	SC1	-	AS REQ.	HENDRIX AERIAL CABLE, 1/0
10	SC1M	-	AS REQ.	MESSENGER, 1/0
11	-	9220100897	3	PRESHAPED CONDUCTOR GRIP, COATED
12	-	9220100587	1	PRESHAPED MESSENGER GRIP
13	-	-	AS REQ.	PRESHAPED GUY GRIP
14	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
15	-	-	1	GUY HOOK
16	-	-	4	MACHINE BOLT, 5/8" X REQUIRED LENGTH
17	-	-	3	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16", MIN.
18	-	-	3	SHACKLE CLEVIS
19	-	9220100585	4	THIMBLE CLEVIS
20	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
21	AP1	220202	1	LIGHTNING ARRESTER, DISTRIBUTION, 10 KV
22		311263	1	BRACKET, SINGLE MOUNT
23		152106	2	BOLT, MACHINE, 5/8" X 10"
24		013264	2	WASHER, SPRING COIL, 5/8"
25		013308	2	WASHER, SQ. FLAT, 2-1/4"
26		130102	1	CLAMP, HOTLINE

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.

2. FOR HEAVY DUTY CONSTRUCTION, THE MESSENGER SHOULD BE DEAD-ENDED ON THE POLE, ABOVE THE TANGENT BRACKET, USING A 3/4" EYEBOLT AND HDTC THIMBLE CLEVIS.

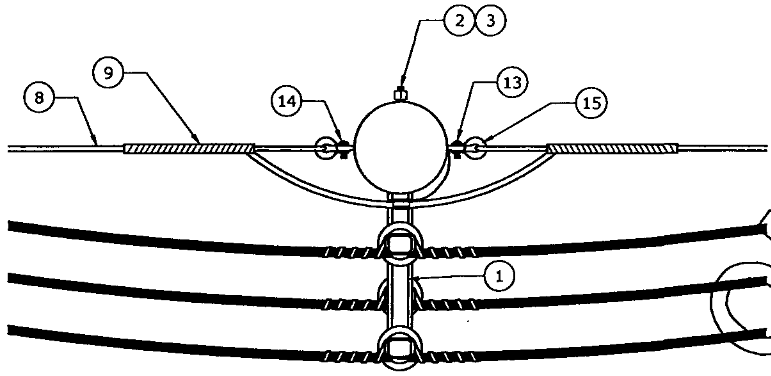
3. SEE DWG. 03.19-14A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

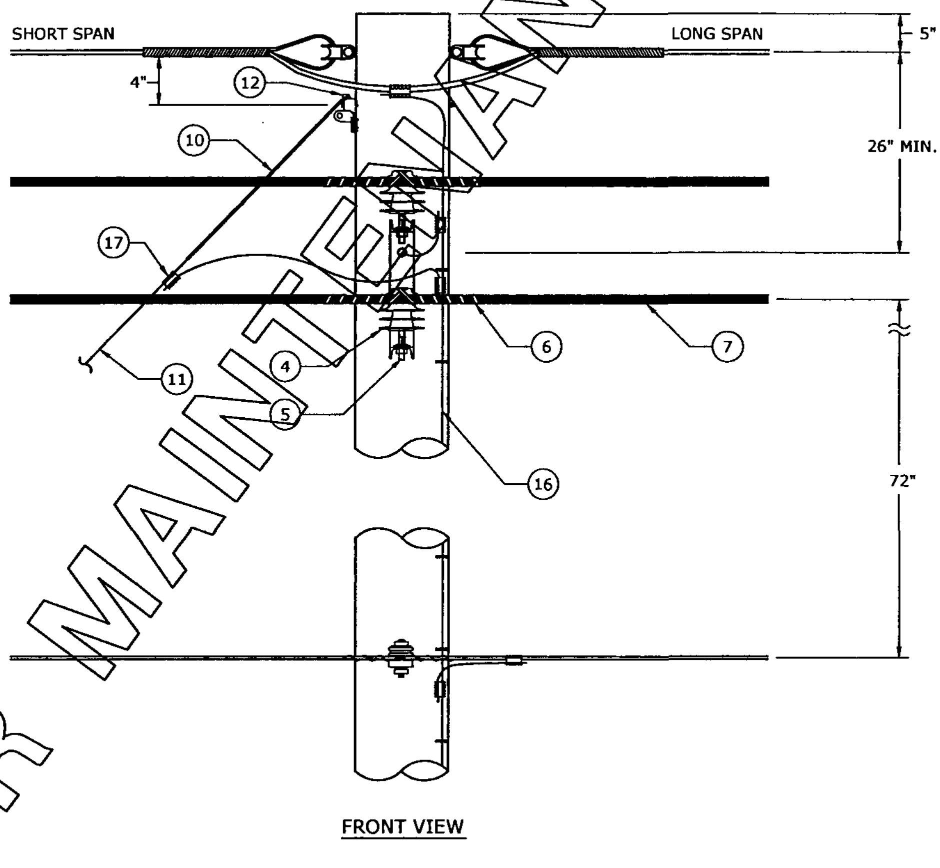
THREE-PHASE, LATERAL TAP CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-14B



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.19-16B FOR BILL OF MATERIALS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TANGENT CONSTRUCTION,
MESSENGER DEAD-END FOR LONG SPANS (FMO)

Duke Energy

FLA DWG. 03.19-16A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SCAB	9220100579	1	ANGLE BRACKET
2		10432	2	MACHINE BOLT, 5/8" X REQUIRED LENGTH
3		13343	2	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
4	SCIP	9220100578	1	INSULATOR, PIN TYPE
5		9220100594	1	INSULATOR PIN
6		9220100589	1	COVERED TIE WIRE, #4 AWG SOLID SOFT DRAWN ALUMINUM WITH .045" THERMOPLASTIC RUBBER, 6 TO 8 FT. LENGTH
7*	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 1/0
8*	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
9	-	9220100587	2	PRESHAPED MESSENGER GRIP
10	-	-	AS REQ.	PRESHAPED GUY GRIP
11	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
12	-	-	AS REQ.	GUY HOOK
13	-	-	1	EYE BOLT, 3/4" X REQUIRED LENGTH
14	-	-	1	EYE NUT, 3/4" STANDARD
15	-	9220100585	2	THIMBLE CLEVIS
16	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
17	-	-	AS REQ.	CONNECTORS (SIZE AND TYPE AS REQUIRED)

*SEE DWG. 03.19-00 FOR 795 CONSTRUCTION

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.
2. FOR STANDARD DUTY CONSTRUCTION, A 5/8" EYE BOLT AND 5/8" EYE NUT CAN BE USED.
3. SEE DWG. 03.19-16A FOR DESIGN SPECIFICATIONS.

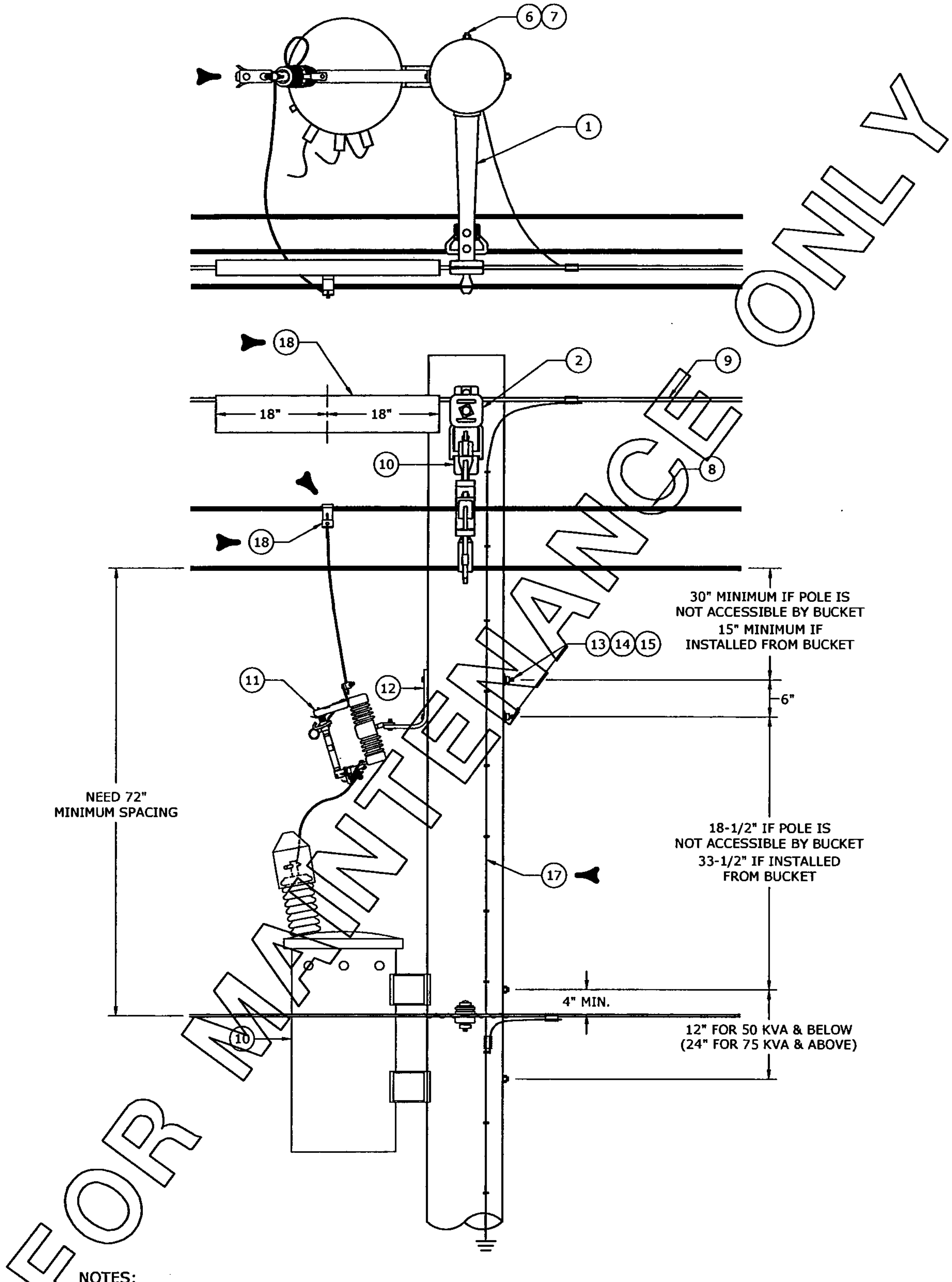
REVISED	DATE	BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

TANGENT CONSTRUCTION,

MESSENGER DEAD-END FOR LONG SPANS (FMO)

Duke Energy

FLA DWG. 03.19-16B



NOTES:

1. SEE DWG. 03.19-18B FOR BILL OF MATERIALS AND NOTES.
2. PLACE LINE-PVC DIRECTLY OVER TAP.

3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRANSFORMER TAP POLE CONSTRUCTION (FMO)

Progress Energy

FLA DWG. 03.19-18A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SC301	1	9220100581	1	MESSENGER BRACKET
	2			9220100590	1	STIRRUP, SUPPLIED WITH 1/2" BOLT, FLAT WASHER AND SELF-LOCKING NUT
	3			9220100580	1	ANTI-SWAY BAR (NOT SHOWN)
	4			9220100591	1	3 PHASE SPACER
	5			14114	1	LAG, FETTER DRIVE, 1/2" X 4" (NOT SHOWN)
	6			152106	2	BOLT, MACHINE, 5/8" X 10"
	7			13346	2	WASHER, 3"
	8*	SC1	1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 1/0
	9*	SC1M	1	9220100596	AS REQ.	MESSENGER, 1/0
	10	-	-	-	1	TRANSFORMER, SINGLE PHASE, TYPE SP (KVA AND VOLTAGE RATING AS REQUIRED)
	11	CP	1	221112	1	CUTOUT, 15 KV 100A, 10KA ASYMMETRICAL
	12			311263	1	BRACKET, SINGLE MOUNT
	13			152106	2	BOLT, MACHINE, 5/8" X 10"
	14			013264	2	WASHER, SPRING COIL, 5/8"
	15			013308	2	WASHER, 2-1/4" SQUARE
	16	-	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
	17	SCLD	1	9220100586	2 FT.	HENDRIX LINE-DUC WITH METALLIC TIE
	18	KHLC40N6F	1	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
		KHLC7933F	1	9220184794	1	CLAMP, HOT LINE, ALUM, LARGE, 336-795

*SEE DWG. 03.19-00 FOR 795 CONSTRUCTION

NOTES:

1. TYPES, QUANTITIES AND VOLTAGE RATINGS OF MATERIALS AS WELL AS CLEARANCES FOR VARIOUS VOLTAGE CLASSIFICATIONS ARE TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC SAFETY CODE (NESC) AND THE USER'S STANDARD CONSTRUCTION PRACTICES.

2. REFER TO DWGS. 03.19-04A AND 03.19-02A FOR TYPICAL TANGENT CONSTRUCTION DETAILS.

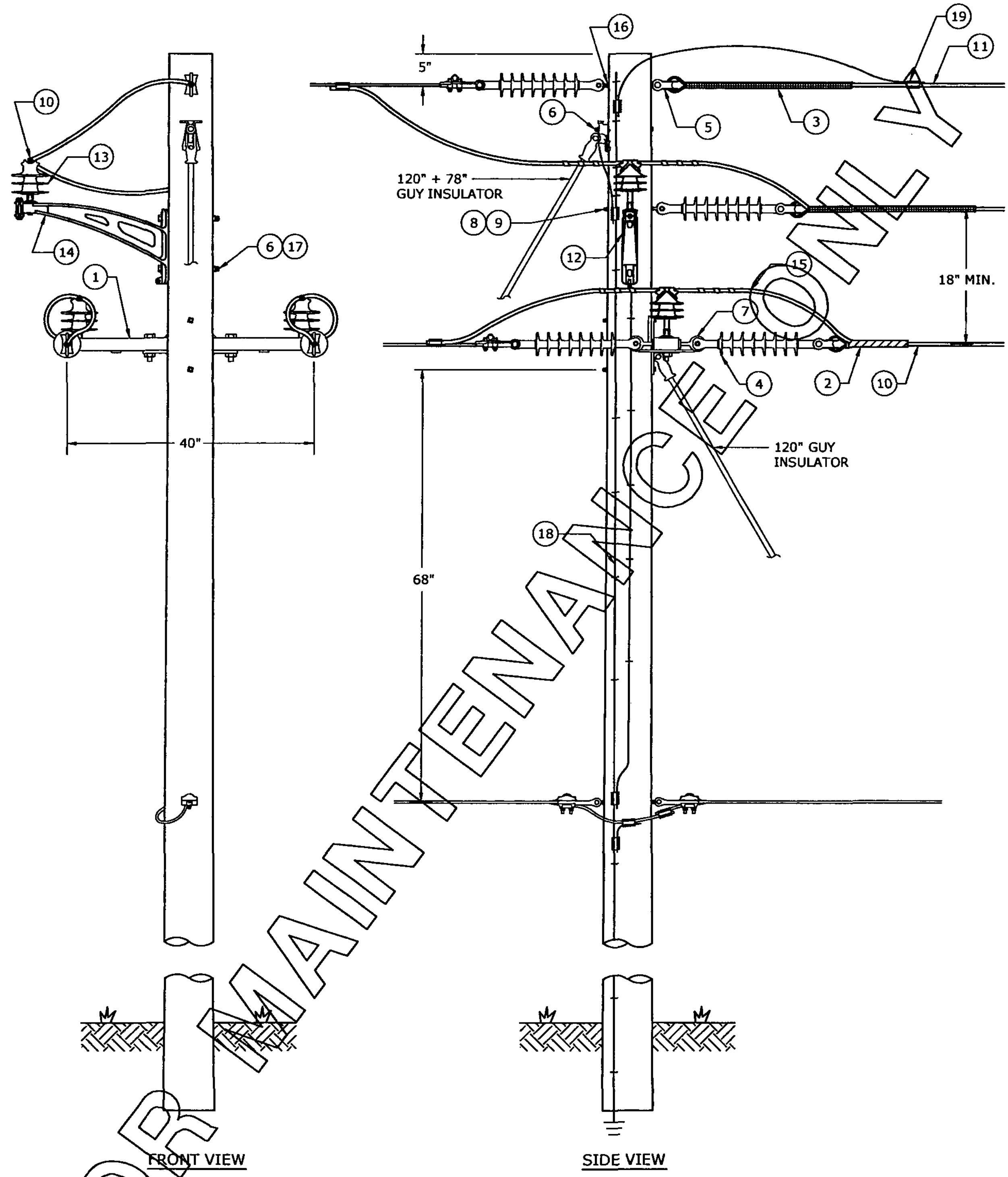
3. SEE DWG. 03.19-18A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	12/1/10	GUINN	GUINN	ELKINS

TRANSFORMER TAP POLE CONSTRUCTION (FMO)

Progress Energy

FLA DWG. 03.19-18B



NOTES:

1. SEE DWG. 03.19-20B FOR BILL OF MATERIALS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TANGENT DOUBLE DEAD-END CONSTRUCTION
BARE TO COVERED WIRE CONVERSION (FMO)

Duke Energy®

FLA DWG. 03.19-20A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC331	070164	1	40" DOUBLE DEADEND STEEL CROSSARM
2		9220100897	3	PRESHAPED CONDUCTOR GRIP, COATED
3		9220100587	1	PRESHAPED MESSENGER GRIP
4		80575	3	INSULATOR, POLYMER DEAD-END 15KV
5		9220100585	4	THIMBLE CLEVIS
6		10436	2	MACHINE BOLT, 5/8" X 12"
7		11707	2	BOLT, OVAL EYE, 5/8" X 8"
8		11708	2	BOLT, OVAL EYE, 5/8" X 10"
9		13343	6	WASHER, SQUARE, CURVED
10	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 1/0
11	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
12	SCMB	9220100581	1	MESSENGER BRACKET
13	SCIP	9220100578	1	INSULATOR PIN TYPE
14		9220100594	1	PIN, INSULATOR, POLYMER, 15KV
15		9220100589	1	WIRE, COVERED, TIE, #4 SOLID AL.
16	-	12210	1	EYENUT, 5/8"
17	-	-	2	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16", MIN.
18	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG
19	-	-	AS REQ.	CONNECTORS (SIZE AND TYPE AS REQUIRED)

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.

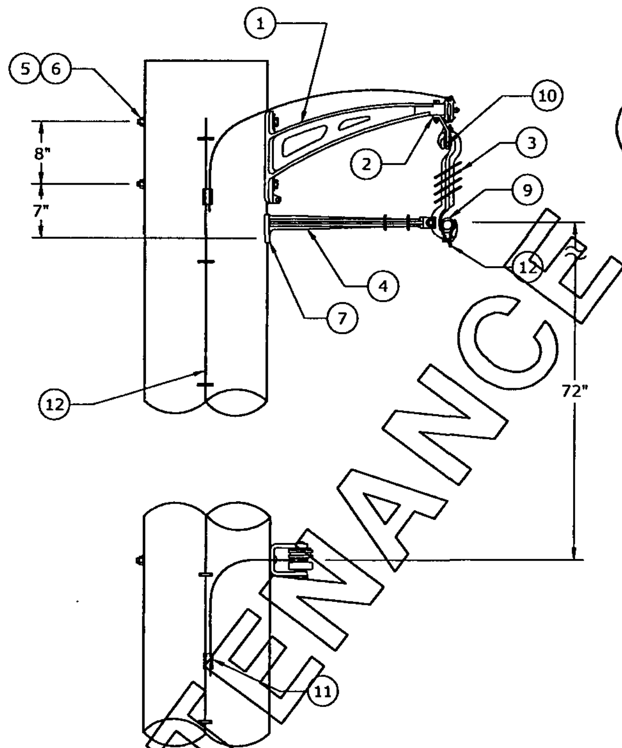
2. SEE DWG. 03.19-20A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

TYPICAL DEAD-END CONSTRUCTION,
25KV-46KV (FMO)

Duke Energy®

FLA | DWG. 03.19-20B



NOTES:

1. SEE DWG. 03.19-24B FOR BILL OF MATERIALS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS

TYPICAL SINGLE-PHASE
TANGENT CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-24A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC101	9220100581	1	MESSENGER BRACKET
2		9220100590	1	STIRRUP, SUPPLIED WITH 1/2" BOLT FLAT WASHER AND SELF-LOCKING NUT
3		9220100592	1	3 PHASE SPACER
4		9220100580	1	ANTI-SWAY BAR, SUPPLIED WITH PLASTIC BOLT
5		10432	2	MACHINE BOLT, 5/8" X REQUIRED LENGTH
6		13346	2	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
7		14114	1	LAG SCREW, 1/2" X 4"
8		92200100593	1	TIE, RING, EPDM RUBBER
9	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 1/0
10	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
11	-	-	1	CONNECTOR (SIZE AND TYPE AS REQUIRED)
12	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.

NOTES:

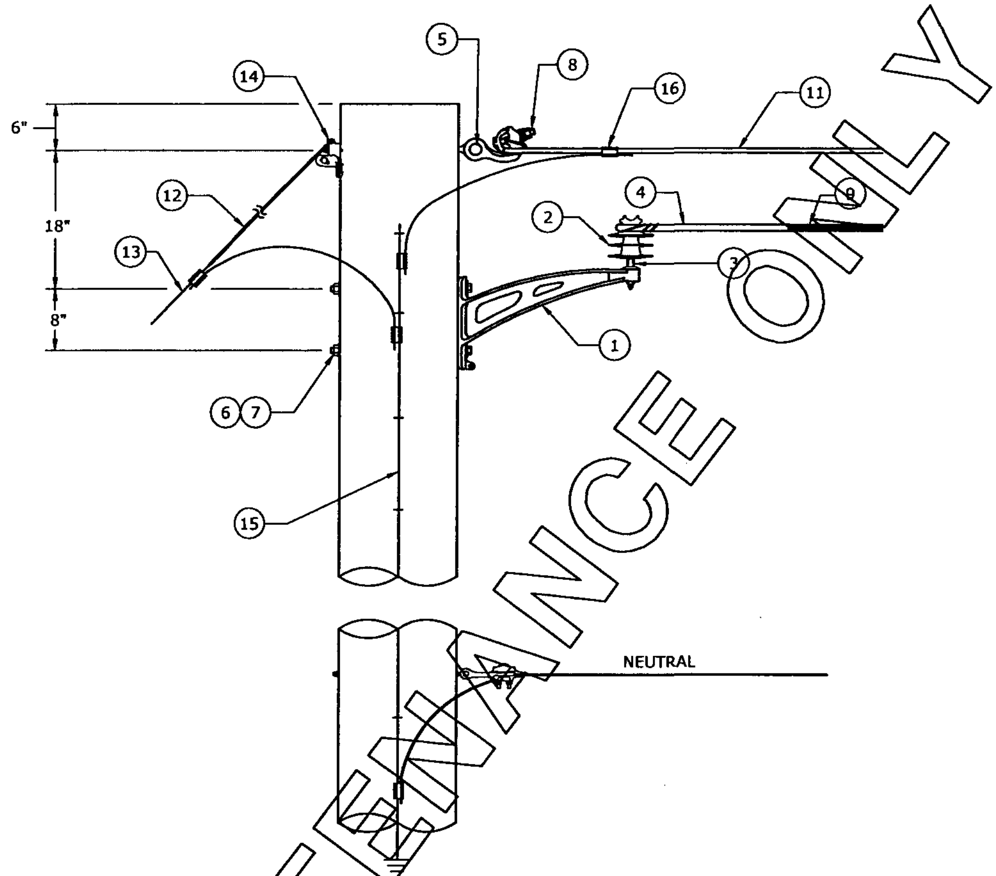
1. TANGENTS ARE DEFINED AS LINE ANGLES UP TO AND INCLUDING 6° FOR HENDRIX SPACER CABLE.
2. ANY HORIZONTAL LOAD CREATED BY A MINOR ANGLE SHOULD BE GUYED FOR PROPER CONSTRUCTION.
3. THE TS-1 STIRRUP SHOULD BE BOLTED THROUGH THE HOLE CLOSEST TO THE END OF THE TANGENT BRACKET, NEAR THE MESSENGER CLAMP.
4. THE USE OF A BAS-14F ANTI-SWAY BRACKET IS RECOMMENDED AT TRANSFORMER TAPS TO MINIMIZE THE STRESS ON CONNECTIONS CAUSED BY MOVEMENT OF THE CIRCUIT.
5. DO NOT INSTALL THE TS-1 STIRRUP OR MAKE GROUND CONNECTIONS UNTIL THE CONDUCTORS ARE INSTALLED.
6. SEE DWG. 03.19-24A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TYPICAL SINGLE-PHASE
TANGENT CONSTRUCTION (FMO)

Duke Energy®

FLA DWG. 03.19-24B



FRONT VIEW

NOTES:

1. SEE DWG. 03.19-26B FOR BILL OF MATERIALS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE, 7 DEGREE - 60 DEGREE
ANGLE CONSTRUCTION (FMO)

Duke Energy

FLA DWG. 03.19-26A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC111	9220100581	1	MESSENGER BRACKET
2		9220100578	1	INSULATOR, PIN TYPE
3		9220100594	1	INSULATOR PIN
4		9220100589	1	HENDRIX COVERED TIE WIRE, #4 AWG SOLID SOFT DRAWN ALUMINUM WITH .045" THERMOPLASTIC RUBBER, 6 TO 8 FT. LENGTH
5		11708	1	EYEBOLT, 5/8" X REQUIRED LENGTH FOR STANDARD DUTY CONSTRUCTION; 3/4" X REQUIRED LENGTH FOR HEAVY DUTY CONSTRUCTION
6		10432	2	MACHINE BOLT, 5/8" X REQUIRED LENGTH
7		13343	3	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
8		9220100584	1	ANGLE CLAMP
9	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 15KV, 1/0
11	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
12	-	-	AS REQ.	PRESHAPED GUY GRIP
13	-	-	AS REQ.	GUY STRAND
14	-	-	AS REQ.	GUY HOOK
15	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
16	-	-	AS REQ.	CONNECTOR (SIZE AND TYPE AS REQUIRED)

NOTES:

1. STRUCTURE DESIGN FOR ANGLES 7° THROUGH 60°. FOR LINE ANGLES GREATER THAN 60°, SEE DWG. 03.19-28A.

2. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION. FOR HEAVY DUTY CONSTRUCTION, THE MESSENGER SHOULD BE DEAD-ENDED ON THE POLE ABOVE THE TANGENT BRACKET USING A 3/4" EYEBOLT AND HDTC THIMBLE CLEVIS.

3. THE BM-5L BRACKET MAY BE USED IN LIGHT LOADING APPLICATIONS WHERE A BRACKET WITH LOWER ULTIMATE VERTICAL STRENGTH WOULD BE MORE COMPATIBLE WITH THE STRENGTH OF LOWER STRENGTH POLES.

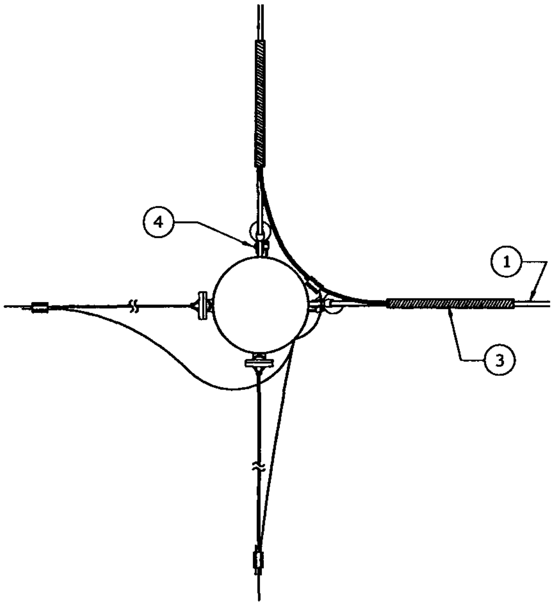
4. SEE DWG. 03.19-26A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

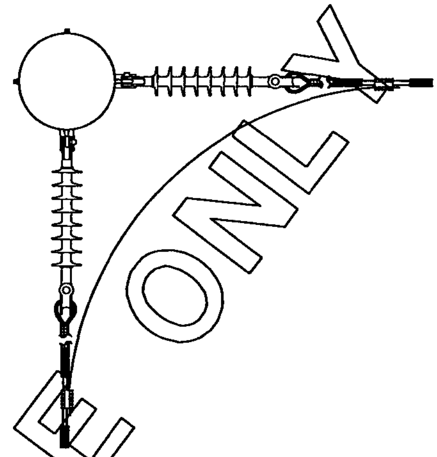
SINGLE-PHASE, 7 DEGREE - 60 DEGREE ANGLE CONSTRUCTION (FMO)

Duke Energy®

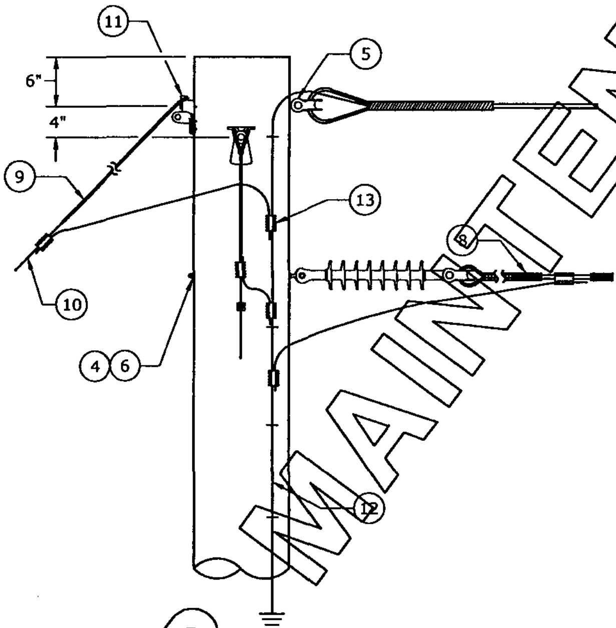
FLA DWG. 03.19-26B



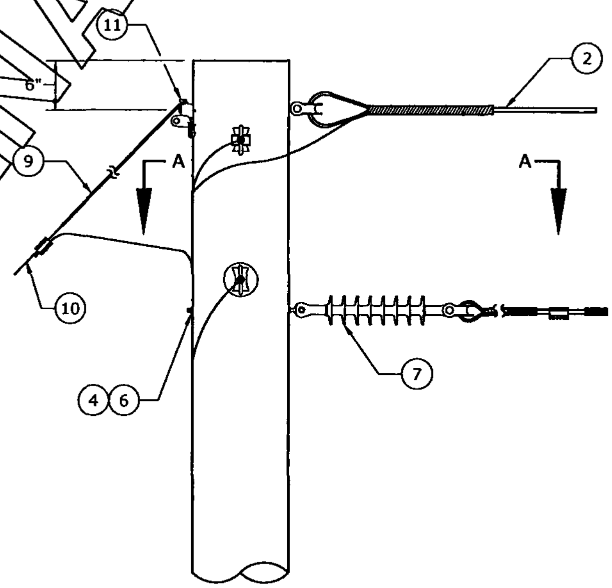
PLAN VIEW



SECTION "A-A"



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.19-12B FOR BILL OF MATERIALS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.	

SINGLE-PHASE, 61 DEGREE - 90 DEGREE ANGLE CONSTRUCTION (FMO)

Duke Energy

FLA | DWG. 03.19-28A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SC1M	9220100596	AS REQ.	MESSENGER (SIZE AND TYPE AS REQUIRED)
2	SC1	9220100898	AS REQ.	HENDRIX AREA CABLE
3	SC121	9220100587	2	PRESHAPED MESSENGER GRIP
4	SC121	11708	4	EYE BOLT, 5/8" X REQUIRED LENGTH FOR STANDARD CONSTRUCTION; 3/4" X REQUIRED LENGTH FOR HEAVY DUTY CONSTRUCTION
5	SC121	922010585	2	THIMBLE CLEVIS
6	SC121	13343	4	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
7	SC121	80575	2	INSULATOR, POLYMER, 15KV
8	SC121	9220100897	2	COND., 1/0 GRIP
9	-	-	AS REQ.	PRESHAPED GUY GRIP
10	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
11	-	-	AS REQ.	GUY HOOK
12	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
13	-	-	AS REQ.	CONNECTOR (SIZE AND TYPE AS REQUIRED)

NOTES:

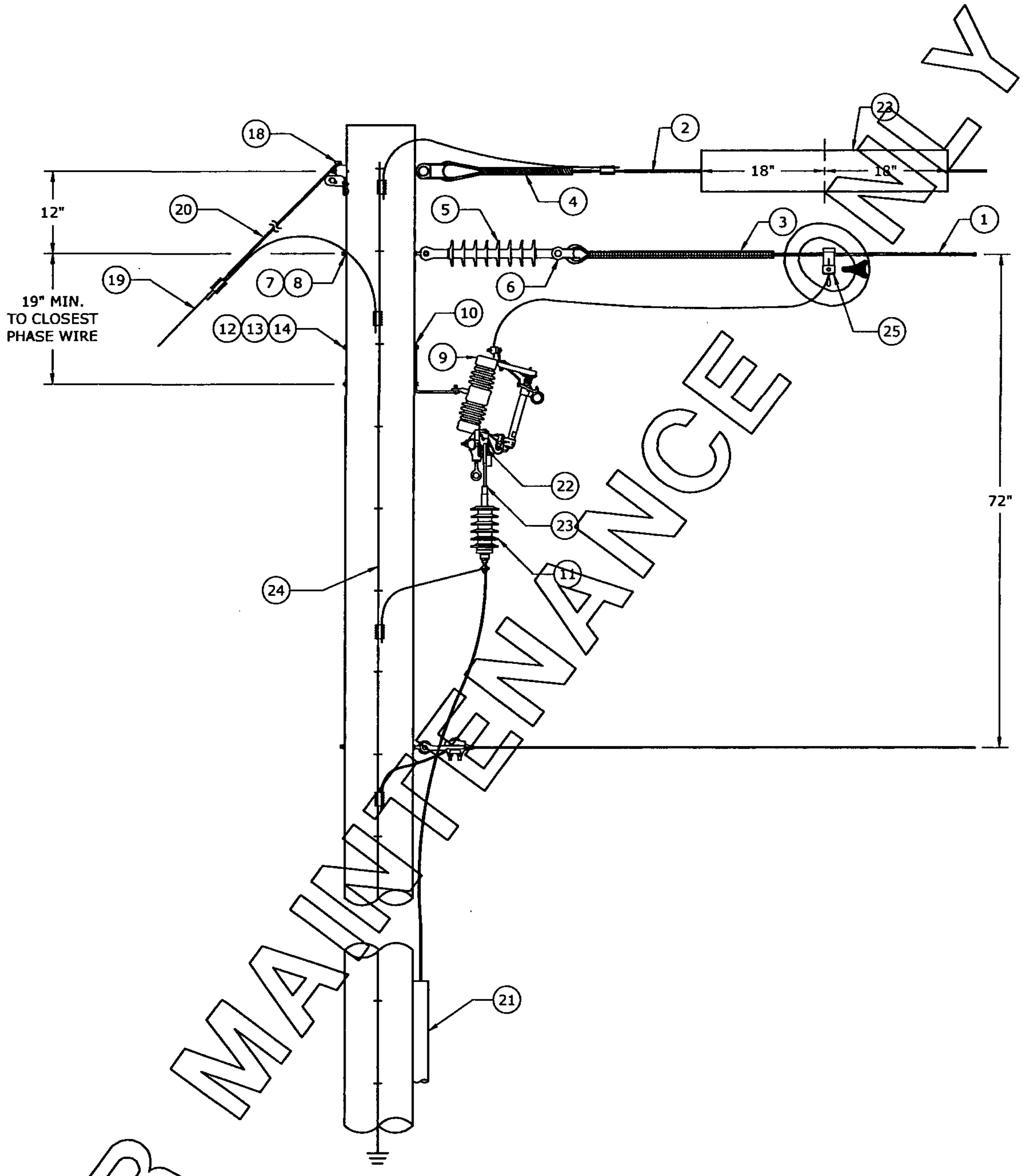
1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.
2. THE BM-5L BRACKET MAY BE USED IN LIGHT LOADING APPLICATIONS WHERE A BRACKET WITH LOWER ULTIMATE VERTICAL STRENGTH WOULD BE MORE COMPATIBLE WITH THE STRENGTH OF LOWER STRENGTH POLES.
3. SEE DWG. 03.19-28A FOR DESIGN SPECIFICATIONS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE,
61 DEGREE - 90 DEGREE CONSTRUCTION (FMO)

Duke Energy®

FLA DWG. 03.19-28B



NOTES:

1. SEE DWG. 03.19-30B FOR BILL OF MATERIALS AND NOTES.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE,

DEAD-END WITH UNDERGROUND RISER (FMO)

Progress Energy

FLA DWG. 03.19-30A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SC1	1	9220100898	AS REQ.	HENDRIX AERIAL CABLE (SIZE AND VOLTAGE RATING AS REQUIRED)
	2	SC1M	1	9220100596	1	MESSENGER (SIZE AND TYPE AS REQUIRED)
	3	SC131	1	9220100897	1	PRESHAPED CONDUCTOR GRIP, COATED
	4			9220100587	1	MESSENGER GRIP
	5			80575	1	INSULATOR, POLYMER DEAD-END TYPE, 15KV
	6			9220100585	2	THIMBLE CLEVIS
	7			11078	2	BOLT, OVAL EYE
	8			13343	2	SQUARE WASHER, 2-1/4" X 2-1/4" X 3/16" MIN.
	9	CA1T	1	221112	1	CUTOUT, 15 KV 100A, 16KA ASYMMETRICAL
	10			311263	1	BRACKET, SINGLE MOUNT
	11			220208	1	ARRESTER, POLYMER (MOV TERMINAL POLE TYPE)
	12			152107	2	BOLT, MACHINE, 5/8" X 12"
	13			13264	2	WASHER, SPRING COIL, 5/8"
	14			13308	2	WASHER, SQUARE, 2-1/4"
	15			153532	1	CONNECTOR, STEM COMP 200 AMP (NOT SHOWN)
	16			153534	1	CONNECTOR, STEM ARRESTER (NOT SHOWN)
	17	SCLD	1	-	2 FT.	HENDRIX LINE-DUC WITH METALLIC TIE (NOT SHOWN)
	18	-	-	-	AS REQ.	GUY HOOK
	19	-	-	-	AS REQ.	GUY STRAND (SIZED AND TYPE AS REQUIRED)
	20	-	-	-	AS REQ.	PRESHAPED GRIP
	21	-	-	-	AS REQ.	CONDUIT
	22	-	-	-	1	CLAMP, HOT LINE
	23	-	-	-	1	CONNECTOR, STEM FOR UNDERGROUND ARRESTER
	24	-	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.
	25	KHLC40N6F	1	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
		KHLC7933F	1	9220184794	1	CLAMP, HOT LINE, ALUM, LARGE, 336-795

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION.

2. TYPES, QUANTITIES AND VOLTAGE RATINGS OF MATERIALS, AS WELL AS CLEARANCES FOR VARIOUS VOLTAGE CLASSIFICATIONS ARE TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC SAFETY CODE (NESC) AND THE USER'S STANDARD CONSTRUCTION PRACTICES.

3. SEE DWG. 03.19-30A FOR DESIGN SPECIFICATIONS.

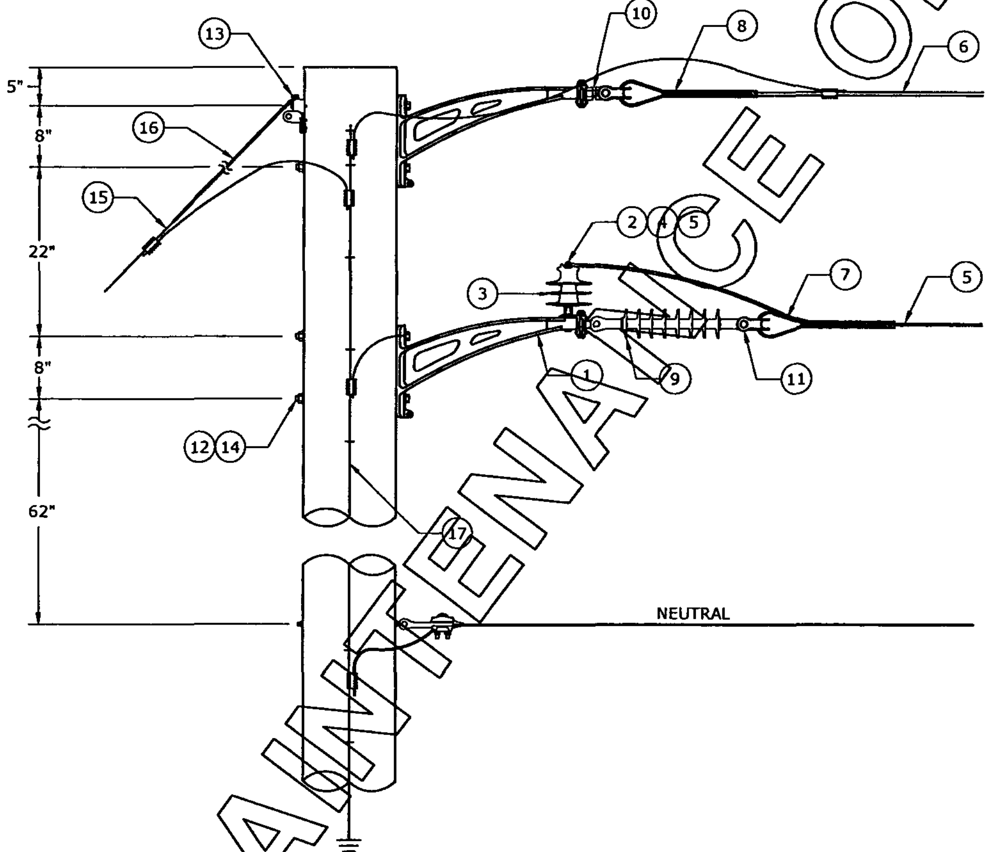
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE,
DEAD-END WITH UNDERGROUND RISER (FMO)

Duke Energy®

FLA

DWG. 03.19-30B



NOTES:

1. SEE DWG. 03.19-32B FOR BILL OF MATERIALS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 12/1/10	GUINN	GUINN	ELKINS

SINGLE-PHASE,

LATERAL TAP USING TANGENT BRACKETS (FMO)

Duke Energy

FLA

DWG. 03.19-32A

BILL OF MATERIALS				
ITEM NO.	COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
1	SCMB	9220100581	1	MESSENGER BRACKET
2	SCIP	9220100578	1	INSULATOR, PIN TYPE
3		9220100594	1	INSULATOR PIN
4		9220100589	1	HENDRIX COVERED TIE WIRE, #4 AWG SOLID SOFT DRAWN ALUMINUM WITH .045" THERMOPLASTIC RUBBER, 6 TO 8 FT. LENGTH
5	SC1	9220100898	AS REQ.	HENDRIX AERIAL CABLE, 1/0
6	SC1M	9220100596	AS REQ.	MESSENGER, 1/0
7	SC131	9220100897	1	PRESHAPED CONDUCTOR GRIP, COATED TYPE
8		9220100587	1	PRESHAPED MESSENGER GRIP
9		80575	1	INSULATOR, POLYMER DEAD-END TYPE, 15KV
10		11708	2	BOLT, OVAL EYE, 5/8" X 10"
11		9220100585	2	THIMBLE CLEVIS
12		13343	2	WASHER, SQUARE, CURVED
13	-	-	2	GUY HOOK
14	-	-	4	MACHINE BOLT, 5/8" X REQUIRED LENGTH
15	-	-	AS REQ.	GUY STRAND (SIZE AND TYPE AS REQUIRED)
16	-	-	AS REQ.	PRESHAPED GUY GRIP
17	-	-	AS REQ.	GROUND WIRE, SOFT DRAWN COPPER, SOLID, #6 AWG MIN.

NOTES:

1. STANDARD DUTY CONSTRUCTION - 8000 LB MAXIMUM EXPECTED MESSENGER TENSION. HEAVY DUTY CONSTRUCTION - 8000 LB TO 12,000 LB MAXIMUM MESSENGER TENSION. FOR HEAVY DUTY CONSTRUCTION, THE MESSENGER SHOULD BE DEAD-ENDED ON THE POLE ABOVE THE TANGENT BRACKET USING A 3/4" EYEBOLT AND HDTC THIMBLE CLEVIS.

2. TYPES, QUANTITIES AND VOLTAGE RATINGS OF MATERIALS, AS WELL AS CLEARANCES FOR VARIOUS VOLTAGE CLASSIFICATIONS ARE TO BE IN ACCORDANCE WITH THE NATIONAL ELECTRIC SAFETY CODE (NESC) AND THE USER'S STANDARD CONSTRUCTION PRACTICES.

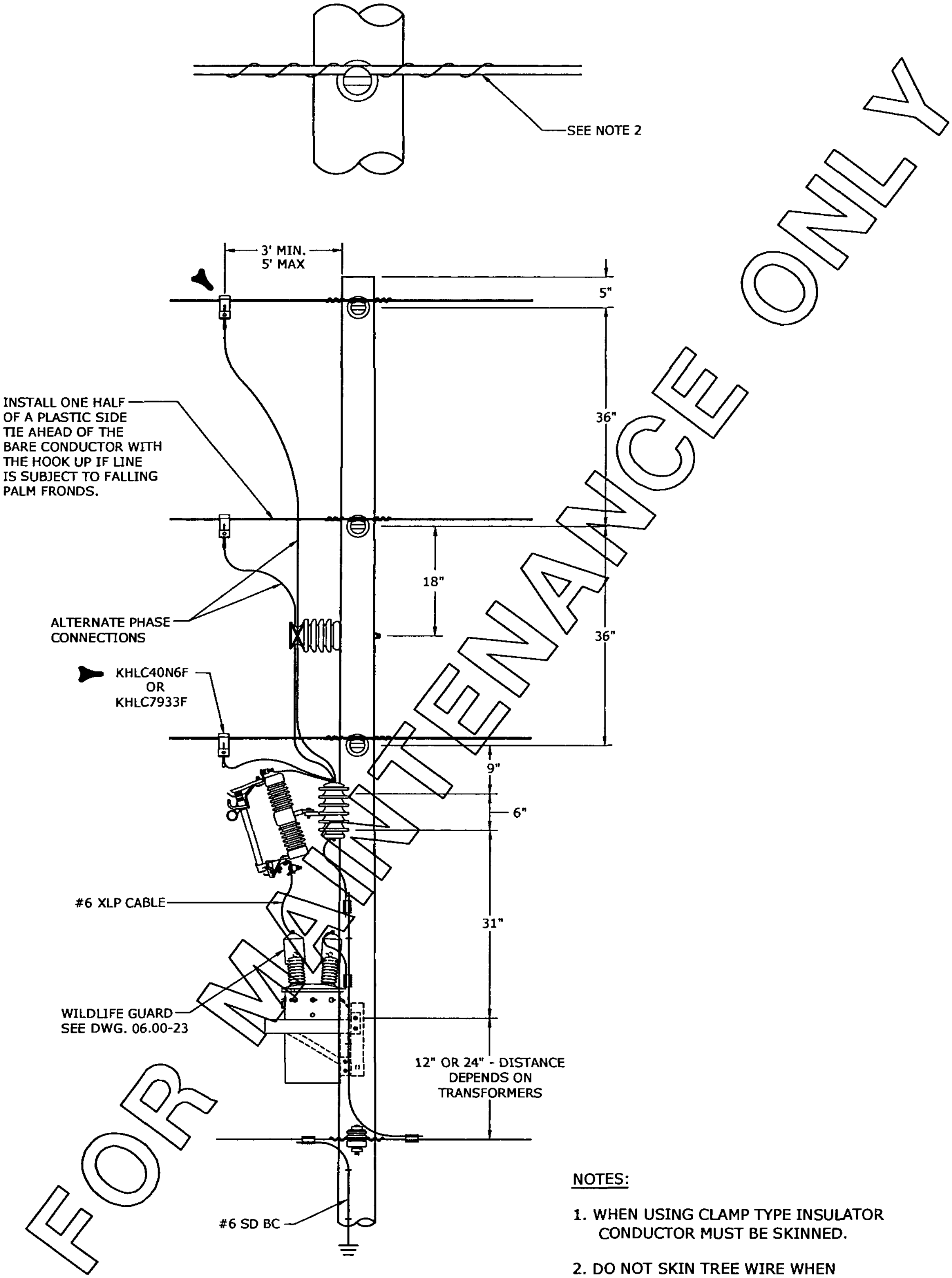
3. SEE DWG. 03.19-32A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	12/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE,
LATERAL TAP USING TANGENT BRACKETS (FMO)

Duke Energy®

FLA DWG. 03.19-32B



FRONT VIEW

NOTES:

1. WHEN USING CLAMP TYPE INSULATOR CONDUCTOR MUST BE SKINNED.
2. DO NOT SKIN TREE WIRE WHEN INSTALLING PLASTIC TIE.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	4/22/10	GUINN	GUINN	ELKINS

TREE WIRE INSTALLATION DETAILS (FMO)

Progress Energy

FLA

DWG. 03.30-02

12.00 COASTAL AREAS

12.01 COASTAL AND CONTAMINATED CONSTRUCTION

12.02 GUYING

12.03 CONNECTIONS

12.04 CUTOUTS AND BRACKETS

12.05 PRIMARY CONSTRUCTION

12.06 TRANSFORMERS

12.07 REGULATORS

SECTION 12

COASTAL AND CONTAMINATED AREA INSTALLATIONS

A COASTAL AREA GENERALLY IS ANY AREA IN CLOSE PROXIMITY TO THE OCEAN OR LARGE SALT WATER BODIES WHERE ADVERSE ATMOSPHERIC/WEATHER CONDITIONS (E.G., SALT SPRAY OR FOG) OVER TIME CAUSE EXCESSIVE MINERAL OR PARTICULATE COATING AND/OR CORROSION TO DISTRIBUTION EQUIPMENT TO THE POINT OF CREATING EXCESSIVE FAILURES, OUTAGES AND/OR BREAKER OPERATIONS. THIS INCLUDES AREAS WHERE THERE MIGHT BE CHEMICALLY ACTIVE SOILS, OR NEAR MANUFACTURING FACILITIES RELEASING PARTICULATE THAT MIGHT CORRODE HARDWARE OR PROMOTE TRACKING.

THE FOLLOWING SPECIFIES SPECIAL ANTI-CORROSIVE AND INSULATION MATERIALS AS WELL AS CONSTRUCTION METHODS DESIGNED TO COUNTER THESE EFFECTS. ALL OTHER CONSTRUCTION PRACTICES AND MATERIALS NOT SPECIFIED IN THIS SECTION SHALL BE NORMAL.

COASTAL AND CONTAMINATED AREA

AREAS SUBJECT TO SEVERE SALT FOG, SEVERE CORROSION, EROSION FROM WIND-BLOWN SANDY SOILS AND HIGH-VELOCITY WINDS. IN GENERAL, THIS AREA IS DEFINED AS ANYTHING WITHIN 1000' OF ANY SALTWATER OR SALTWATER MARSH.

IN ADDITION, THE AREA SURROUNDING MANUFACTURING FACILITIES KNOWN TO RELEASE AIRBORNE PARTICULATE AND IN THE AREA OF CHEMICALLY ACTIVE SOIL. THIS SHOULD BE DONE AT THE DISCRETION OF LOCAL ENGINEERING.

COASTAL AND CONTAMINATED "OVER INSULATED" AREA

AREA WHERE SALT FOG OR EXCESSIVE MINERAL OR PARTICULATE COLLECTING ON INSULATION HAS BEEN THE CAUSE OF POLE FIRES. THESE AREAS ARE LISTED BELOW:

1. ST. PETERSBERG OPERATIONS CENTER GEOGRAPHIC SERVICE BOUNDARY.
2. WALSINGHAM OPERATIONS CENTER GEOGRAPHIC SERVICE BOUNDARY SOUTH OF ULMERTON ROAD.

3				
2				
1				
0	10/26/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

COASTAL AND CONTAMINATED AREAS
CONSTRUCTION

Duke Energy

FLA DWG. 12.00-01

COASTAL AND CONTAMINATED AREA CONSTRUCTION

COASTAL AND CONTAMINATED AREA - HARDWARE

INSULATORS:
35 KV HORIZONTAL LINE POST, CN 080217
DEADEND/ SUSPENSION, 25KV POLYMER, CN 080577
35KV CLAMP TOP CN 080238

CUTOUTS:
25KV CUTOUT, CN 221139

SWITCHES:
25KV SOLID BLADE DISCONNECT, CN 760547

TRANSFORMERS:
STAINLESS STEEL 304L TRANSFORMERS. SEE DWG. 12.06-01 FOR OVERHEAD AND 12.06-03 FOR PAD-MOUNT 304L STAINLESS STEEL TRANSFORMERS.

GUY BONDING:
INSTALL FIBERGLASS INSULATOR ON DOWN GUYS. DO NOT BOND GUY TO NEUTRAL. SEE DWG. 12.05-19.

COASTAL AND CONTAMINATED "OVER INSULATED" AREA HARDWARE

INSULATORS:
35 KV HORIZONTAL LINE POST, CN 080217
DEADEND/ SUSPENSION, 25KV POLYMER, CN 080577
35KV CLAMP TOP CN 080238

CUTOUTS:
25KV CUTOUT,. CN 221139

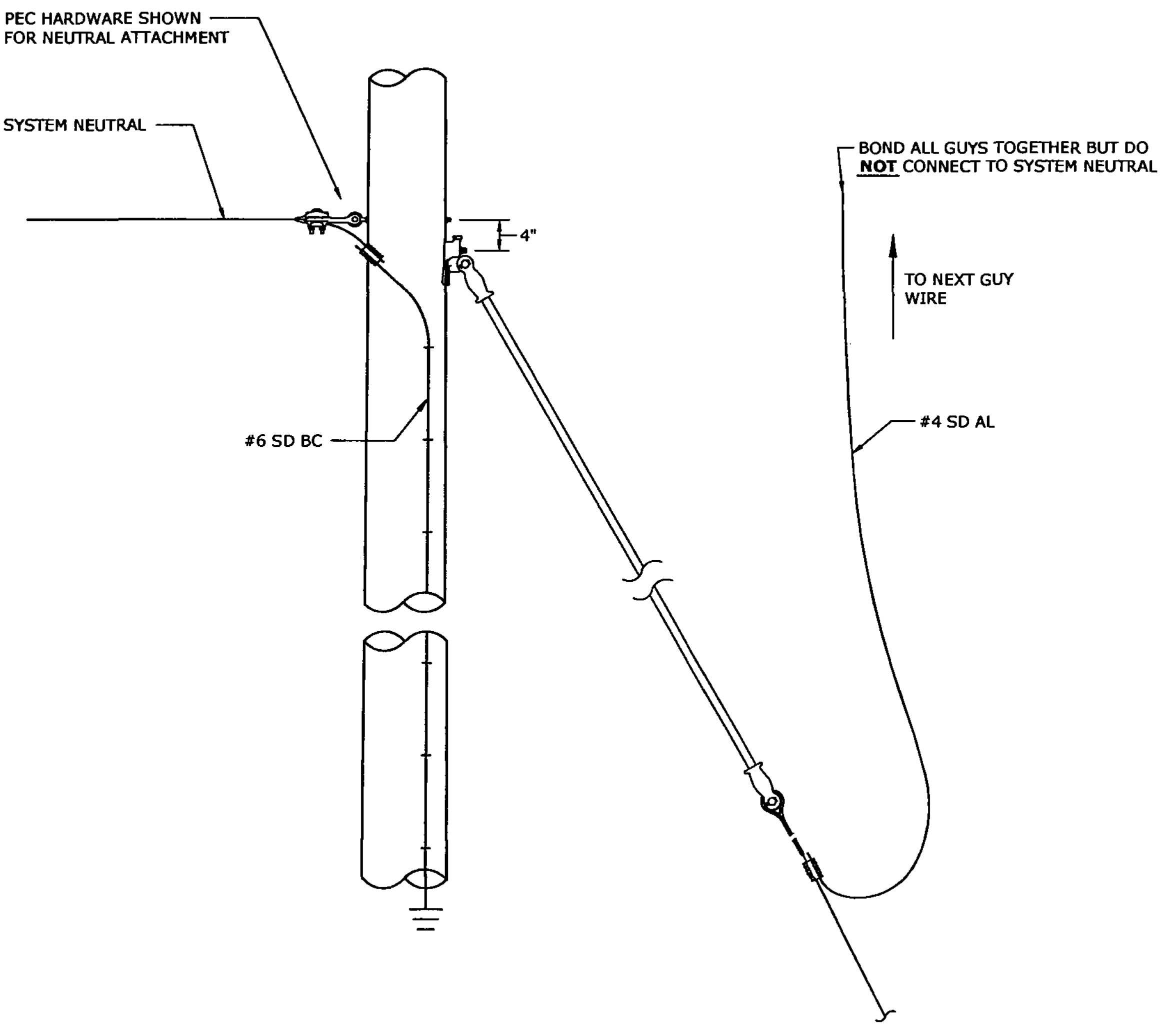
SWITCHES:
25KV SOLID BLADE DISCONNECT, CN 260547

3				
2				
1	6/13/11	SIMMONS	BURLISON	ELKINS
0	10/26/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

COASTAL AND CONTAMINATED AREA CONSTRUCTION

Duke Energy®

FLA DWG. 12.01-02



NOTES:

1. WHERE SOIL IS CHEMICALLY ACTIVE, THE SOIL, ANCHOR AND POLE GROUND CAN ACT AS AN ELECTRIC CELL CAUSING CORROSION AND DETERIORATION OF THE ANCHOR. IN THESE LOCATIONS, THE GUY MUST NOT BE BONDED TO THE SYSTEM NEUTRAL, WHICH IS BONDED TO THE POLE GROUND. A FIBERGLASS INSULATOR SHALL BE INSTALLED IN ALL GUYS THAT ARE NOT BONDED TO THE POLE GROUND. THE FIBERGLASS INSULATOR SHALL BE LONG ENOUGH TO EXTEND 24" PAST THE LOWEST OPEN WIRE, ENERGIZED CONDUCTOR OR EQUIPMENT.

3				
2				
1	5/29/12	DANNA	GUINN	ELKINS
0	10/27/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GUY GROUNDING -

COASTAL AND CONTAMINATED AREAS

Duke Energy

PGN DWG. 12.02-03

CONDUCTOR SPLICES AND CONNECTIONS

ALL CONDUCTOR CONNECTIONS MUST BE PROPERLY PREPARED BEFORE MAKING A CONNECTION REGARDLESS OF HOW NEW THE CONDUCTOR MAY BE. IT IS ESPECIALLY IMPORTANT IN CONTAMINATED AND COASTAL AREAS TO WIRE BRUSH AND APPLY INHIBITOR TO ALL CONNECTIONS.

FOR COPPER TO ALUMINUM CONNECTION, ALWAYS POSITION THE ALUMINUM CONDUCTOR ABOVE THE COPPER. PIN CONNECTORS WILL BE USED TO CONNECT ALUMINUM CONDUCTOR TO TRANSFORMER TERMINALS AND TO COPPER CONDUCTOR (SEE DWG. 12.03-03).

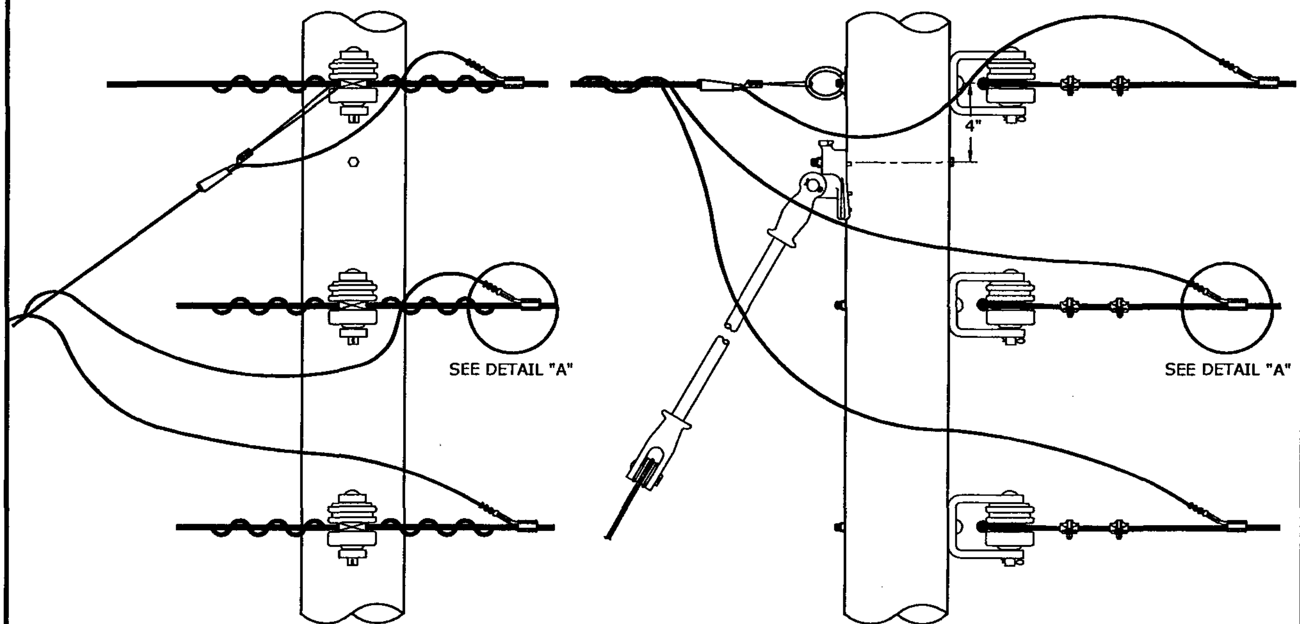
FOR ALUMINUM TO ALUMINUM CONNECTIONS, USE ALUMINUM SQUEEZONS WITH A LIBERAL AMOUNT OF INHIBITOR APPLIED.

3				
2				
1				
0	4/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

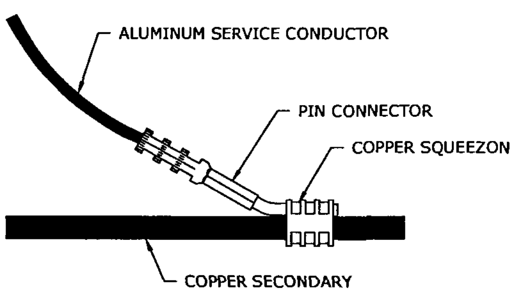
CONDUCTOR SPLICES AND CONNECTIONS
COASTAL AND CONTAMINATED AREAS

Duke Energy

FLA | DWG. 12.03-01



FRONT VIEW   SIDE VIEW



DETAIL "A"

NOTES:

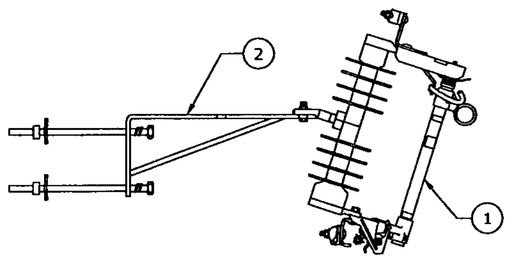
1. USE PIN CONNECTOR TO CONNECT ALUMINUM TRIPLEX DIRECTLY TO COPPER SECONDARY.
2. BEFORE MAKING CONNECTIONS, CLEAN ALL CONDUCTORS THOROUGHLY BY WIRE BRUSHING.
3. ALWAYS POSITION ALUMINUM CONDUCTOR ABOVE COPPER CONDUCTOR TO PREVENT COPPER SALT ACCUMULATION ON THE ALUMINUM CONNECTION.
4. TOOL AND DIE DATA FOR PIN CONNECTOR IS SHOWN ON DWG. 06.03-04.
5. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3				
2				
1				
0	10/27/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

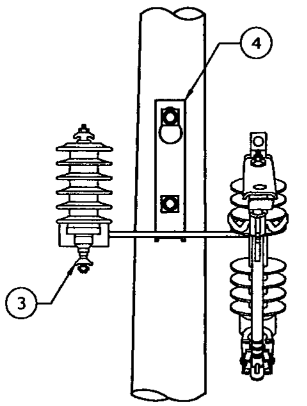
AL TO CU SECONDARY CONNECTIONS
COASTAL AND CONTAMINATED AREAS

Duke Energy

FLA DWG. 12.03-03



COLA BRACKET



CUTOUT AND ARRESTER BRACKET

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	FUSE27CO100F	1	221139	1	FUSE, 27KV, CUTOUT, 100 AMP
	2	BKTCOLA18STLF	1	9220094529	1	BRACKET, CUTOUT, COLA
				152106	2	BOLT, 5/8" X 10"
				013308	2	WASHER, 2-1/4" SQUARE, FLAT
				013264	2	WASHER SPRING, COIL
				10514917	1	STRAP MTG
	3	AREQOH10F	1	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV
	4	BKTCOLADBLSTLF	1	070106	1	BRACKET, CUTOUT AND ARRESTER
				152107	2	BOLT, 5/8" X 12"
				013308	2	WASHER, 2-1/4" SQUARE FLAT
				013264	2	WASHER SPRING, COIL

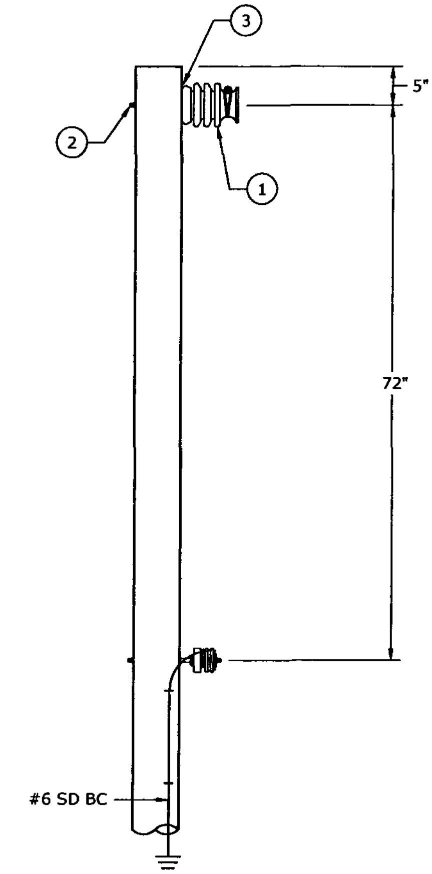
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/27/10	GUINN	GUINN	ELKINS

CUTOUT AND ARRESTER ASSEMBLY -
COASTAL AND CONTAMINATED AREAS

Duke Energy®

FLA

DWG.
12.04-01



0° - 5° ANGLE
12KV

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPTT35F	1	080217	1	INSULATOR, LINE POST, TIE TOP, 35KV
	2	ISSTUDBOLT5810F	1	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"
	3	ISGAINGRID55F	1	074317	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

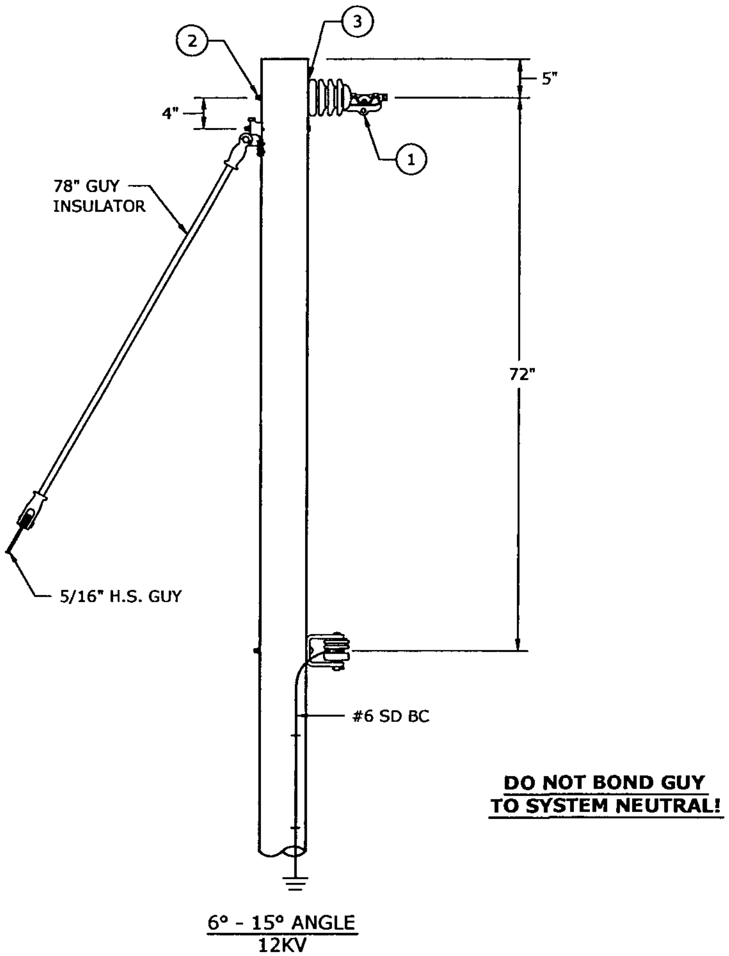
REVISED	DATE	BY	CK'D	APPR.
3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	10/27/10	DANNA	GUINN	ELKINS

SINGLE-PHASE PRIMARY - TANGENT
COASTAL AND CONTAMINATED AREAS

DUKE ENERGY.

FLA

DWG. 12.05-01



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPCLT15F	1	080238	1	INSULATOR, LINE POST, TIE TOP, 35KV
	2	ISSTUDBOLT5810F	1	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"
	3	ISGAINGRID55F	1	074317	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

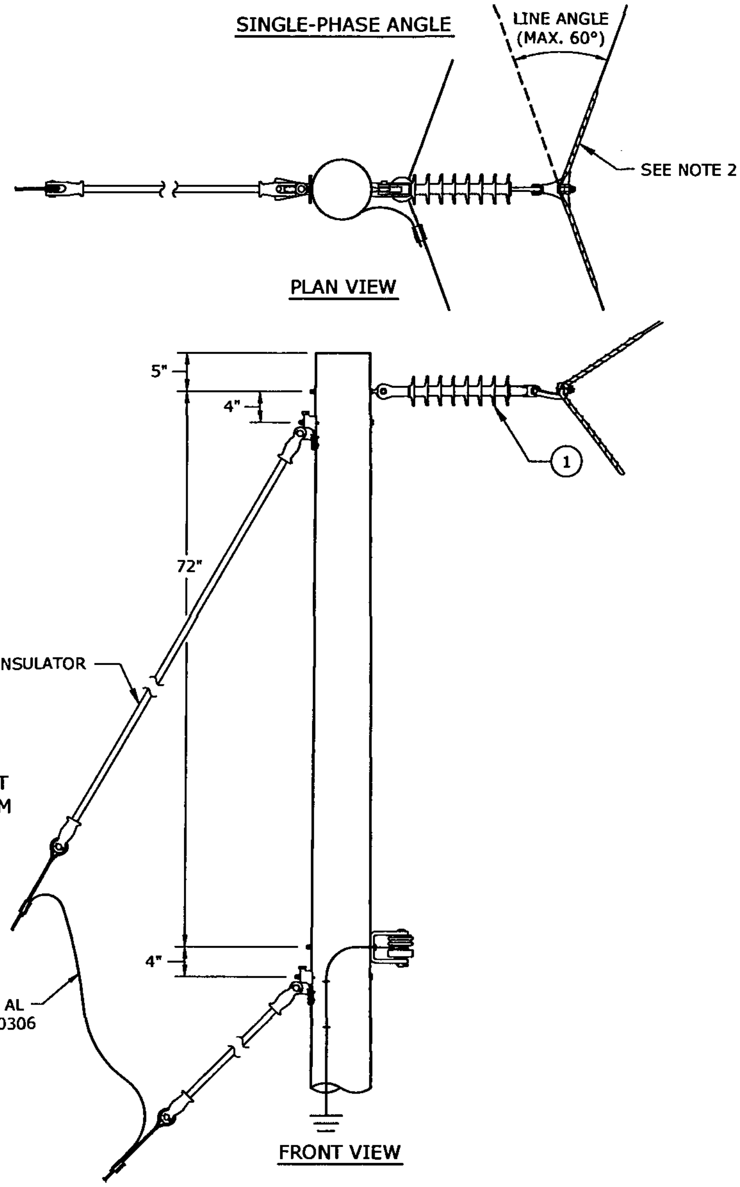
REVISED		BY	CK'D	APPR.
3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	10/27/10	DANNA	GUINN	ELKINS

SINGLE-PHASE PRIMARY - SMALL ANGLES -
COASTAL AND CONTAMINATED AREAS

DUKE ENERGY.

FLA

DWG. 12.05-03



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IDES25PF	1	080577	1	INSULATOR, 25KV POLYMER DEADEND
	2	ISEYEBOLT5810F	1	013346	1	WASHER, CURVED, 3" X 3" X 13/16"
				011708	1	BOLT, OVAL EYE, 5/8" X 10"
	3	SCLMP_F	1	-	1	CLAMP (VARIES WITH WIRE SIZE)
	4	AR_F	1	-	1	ARMOR ROD (VARIES WITH WIRE SIZE)

NOTES:

1. ALL GUYS MUST BE BONDED TO EACH OTHER. DO **NOT** BOND TO THE POLE GROUND.
2. ARMOR RODS REQUIRED FOR ANGLE ASSEMBLIES.

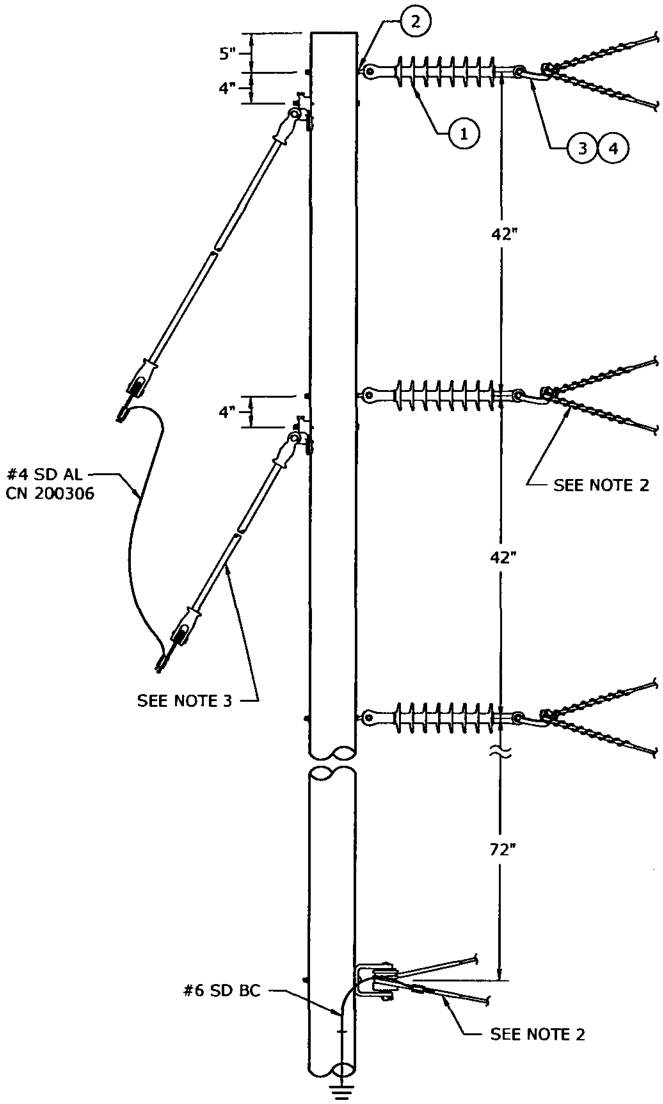
3				
2				
1				
0	10/27/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE PRIMARY -
ANGLES 20 TO 60 DEGREES MAXIMUM
COASTAL AND CONTAMINATED AREAS

Duke Energy

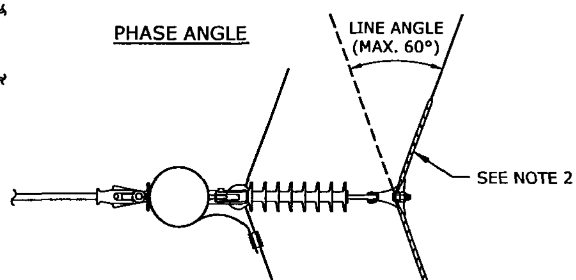
FLA

DWG. 12.05-05



FRONT VIEW
20 - 60 DEGREES

PHASE ANGLE



PLAN VIEW

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IDES25PF	3	080577	1	INSULATOR, 25KV POLYMER DEADEND
	2	ISEYEBOLT5810F	3	013346	1	WASHER, CURVED, 3" X 3" X 13/16"
				011708	1	BOLT, OVAL EYE, 5/8" X 10"
	3	SCLAMP_F	3	-	1	CLAMP (VARIES WITH WIRE SIZE)
	4	AR_F	3	-	1	ARMOR ROD (VARIES WITH WIRE SIZE)

NOTES:

1. USE 2 OR 3 PRIMARY GUYS AS SPECIFIED ON WORK ORDER.
2. ARMOR ROD REQUIRED ON 1/0 AAAC AND 336 AAC. FOR 795 AAC, AN ARMOR ROD OR CUSHION GRIP IS REQUIRED AND IF GREATER THAN 30° DOUBLE DEADEND.
3. SEE DWG. 02.04-18 FOR THE APPROPRIATE APPLICATION OF GUY INSULATORS.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

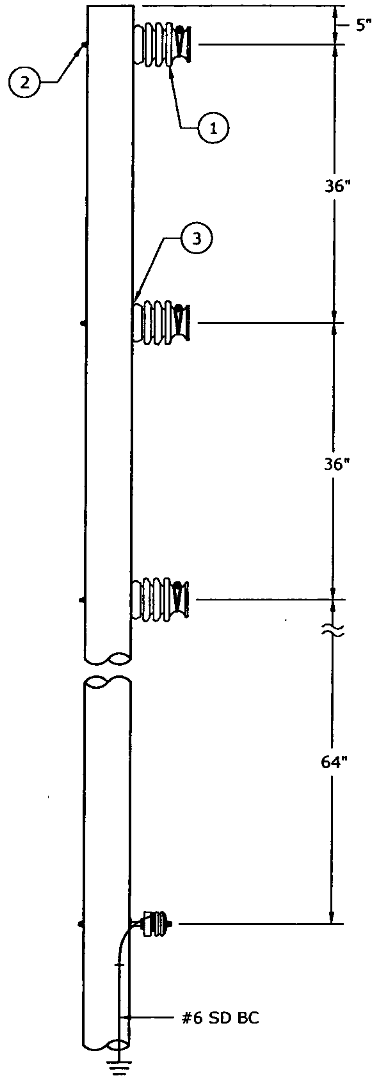
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/27/10	DANNA	GUINN	ELKINS

THREE-PHASE PRIMARY -
ANGLES 20 TO 60 DEGREES MAXIMUM
COASTAL AND CONTAMINATED AREAS

Duke Energy

FLA

DWG. 12.05-07



12KV

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPTT35F	3	080217	1	INSULATOR, LINE POST, TIE TOP, 35KV
	2	ISSTUDBOLT5810F	3	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"
	3	ISGAINGRID55F	3	074317	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

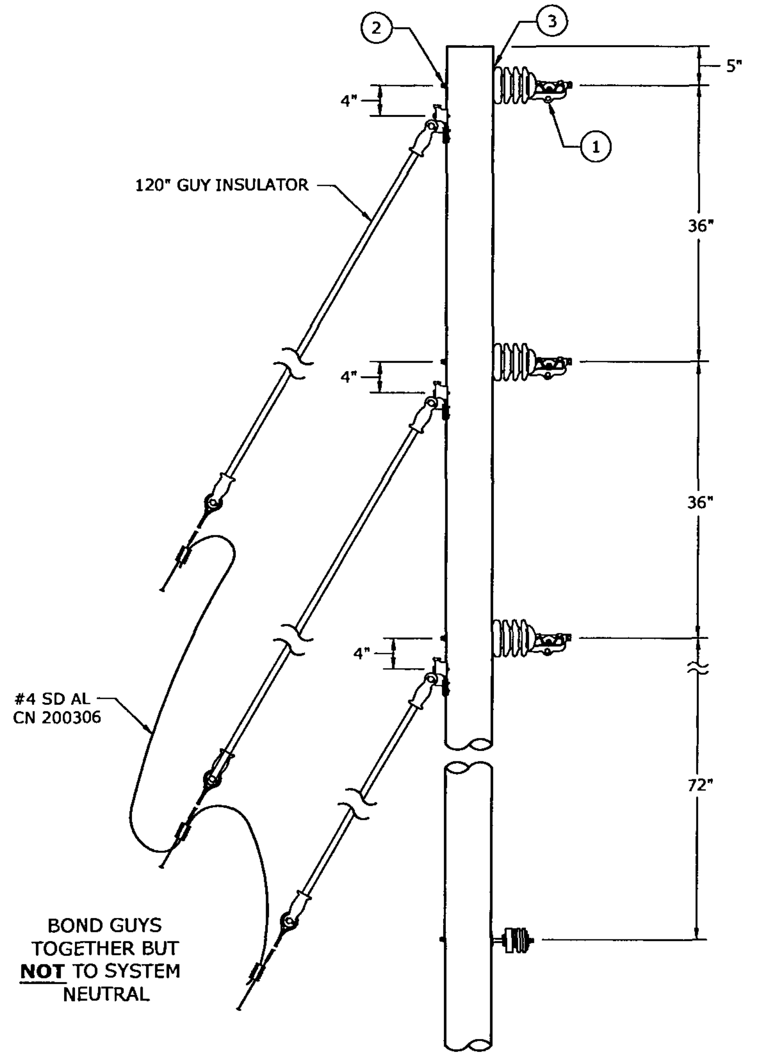
REVISED		BY	CK'D	APPR.
3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	10/27/10	DANNA	GUINN	ELKINS

VERTICAL PRIMARY - TANGENT -
COASTAL AND CONTAMINATED AREAS

DUKE ENERGY.

FLA

DWG. 12.05-15



FRONT VIEW
6-15 DEGREES 12KV

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IHPCLT15F	3	080238	1	INSULATOR, LINE POST, TIE TOP, 35KV
	2	ISSTUDBOLT5810F	3	072366	1	STUD, 5/8" X 10", 3/4" HEAD
				013264	1	WASHER, SPRING COIL, 5/8"
	3	ISGAINGRID55F	3	074317	1	INSULATOR SUPPORT GAINGRID 5-1/2 INCH

NOTES:

1. ARMOR RODS NOT REQUIRED WHEN USING CUSHION GRIPS (795 AAC ONLY).

2. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

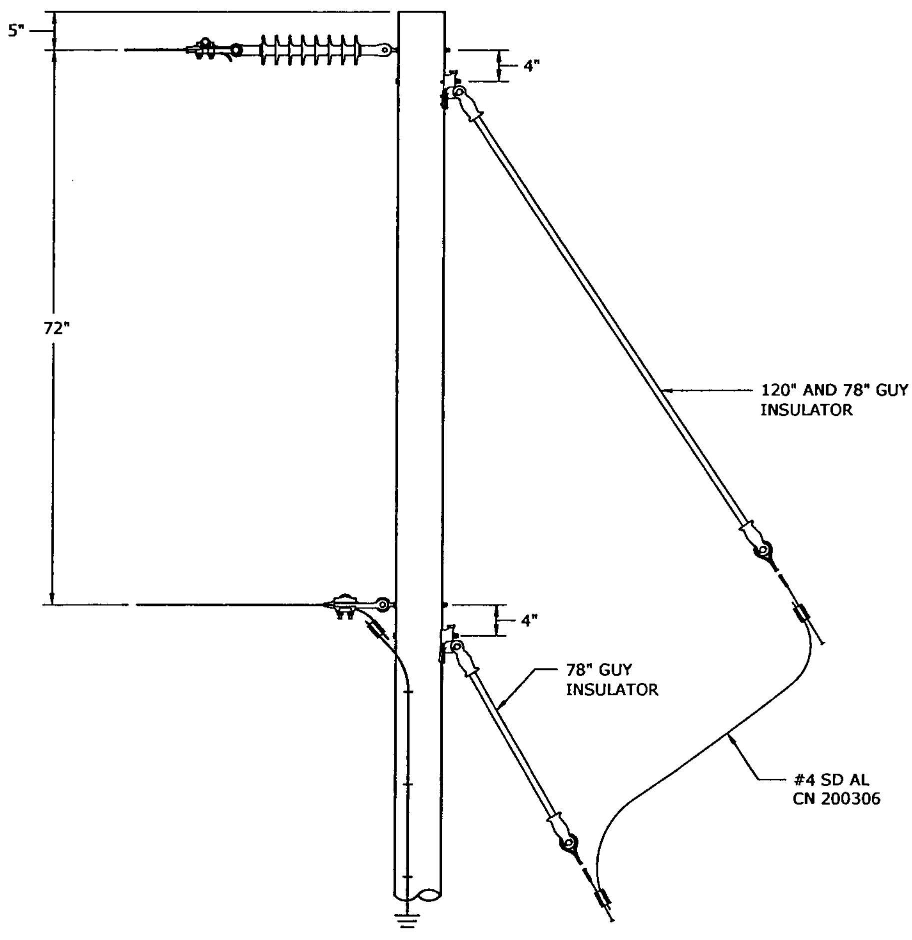
3				
2				
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	10/27/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL PRIMARY - ANGLES TO 15 DEGREES
COASTAL AND CONTAMINATED AREAS

DUKE ENERGY.

FLA

DWG.
12.05-17



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IDES25PF	1	080577	1	INSULATOR, POLYMER, 25KV, DEADEND
	2	ISEYEBOLT5810F	1	011708	1	BOLT, OVAL EYE, 5/8" X 10"
				013346	1	WASHER, 3", SQUARE, 13/16" HOLE
	4	DECLAMP_F	1	-	1	CLAMP, DEADEND (VARIES WITH WIRE SIZE)

NOTES:

1. USE THIS DRAWING FOR 12KV, 23KV, OR 35KV CONSTRUCTION.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 10/27/10	DANNA	GUINN	ELKINS

SINGLE-PHASE DEADEND PRIMARY - COASTAL AND CONTAMINATED AREAS

Duke Energy

FLA DWG. 12.05-19

OVERHEAD 12 KV SYSTEMS			
TYPE TRANSFORMER	SIZE (KVA)	CN	COMP. UNIT
CONVENTIONAL: 7200/12470Y, 120/240, 304L STAINLESS STEEL 2-BUSHING	25	1301180025	TFO25D312CF
CONVENTIONAL: 7200/12470Y, 120/240, 304L STAINLESS STEEL 2-BUSHING, ±2 2.5% TAPS	50	1301180050	TFO50DT312CF
	100	1301180100	TFO100DT312CF
CONVENTIONAL: 12470YGRDY/7200, 120/240, 304L STAINLESS STEEL 1-BUSHING, NO TAPS	3	9220214649	TFO3S312CF

NOTES:

1. 304L STAINLESS STEEL TRANSFORMERS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS.
2. INSTALL GROUNDED SPRING AT BASE OF ALL PRIMARY BUSHINGS TO CONDUCT ANY LEAKAGE CURRENT TO GROUND (CN 14004386). SOME NEWER UNITS WILL ALSO HAVE A SPRING AT THE TOP OF THE BUSHING THAT IS NOT GROUN3ED.

3				
2				
1	9/9/11	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

304L STAINLESS STEEL
POLE-TYPE TRANSFORMERS
FOR COASTAL AREAS

Progress Energy

FLA

DWG. 12.06-01

UNDERGROUND 12 KV SYSTEMS			
TYPE TRANSFORMER	SIZE (KVA)	CN	COMP. UNIT
SINGLE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 240/120 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	25	9220128345	TU25DL3121CF
	50	9220128346	TU50DL3121CF
	75	9220128347	TU75DL3121CF
	100	9220128348	TU100DL3121CF
	167	9220128349	TU167DL3121CF
SINGLE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 480/240 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	50	9220128350	TU50DL3121DF
	167	9220128351	TU167DL3121DF
THREE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 208Y/120 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	75	9220128303	TU75DL312YBF
	150	9220128308	TU150DL312YBF
	300	9220128310	TU300DL312YBF
	500	9220128312	TU500DL312YBF
	750	9220128314	TU750DL312YBF
	1000	9220182167	TU1000DL312YBF
	1500	9220182169	TU1500DL312YBF
THREE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 480Y/277 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	75	9220128316	TU75DL312YFF
	150	9220128318	TU150DL312YFF
	300	9220128320	TU300DL312YFF
	500	9220128323	TU500DL312YFF
	750	9220128325	TU750DL312YFF
	1000	9220128328	TU1000DL312YFF
	1500	9220182171	TU1500DL312YFF
	2500	9220182165	TU2500DL312YFF

NOTES:

1. 304L STAINLESS STEEL TRANSFORMERS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 10/27/10	DANNA	GUINN	ELKINS

304L STAINLESS STEEL
PAD-MOUNTED TRANSFORMERS
FOR COASTAL AREAS

Duke Energy®

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CATALOG NUMBER/CU	RATED VOLTS	VOLTS (KV) SET	KVA RATED	AMPS ±10%	AMPS ±5%	A-65°C ±5%**	MOUNTING	BASE MOUNTING DIMENSIONS*	WEIGHT (LBS)	MAX HEIGHT
9220218056 REG100A72SSF	7.62	7.2	76	100	160	179	POLE/PLATFORM	22" X 22"	1620	-
9220218057 REG21972SSF	7.62	7.2	167	219	350	392	POLE/PLATFORM	24.5" X 24.5"	2770	85"
9220218055 REG32872SSF	7.62	7.2	250	328	525	588	PLATFORM	32" X 25"	3634	88"

* BASE MOUNTING DIMENSIONS VARY BY VENDOR.

** THE A-65°C ±5% RATING IS A CONTINUOUS AMPERE RATING BASED ON THE REGULATION BEING LIMITED TO ±5%. CONSULT WITH DISTRIBUTION STANDARDS FOR MAXIMUM AMPERE RATING WHEN REGULATION IS LIMITED TO SOME OTHER VALUE.

NOTES:

1. ALL OPTIONS INCLUDE REVERSE POWER FLOW, VOLTAGE REDUCTION, VOLTAGE LIMIT AND METERING.
2. 7.62 REGULATORS MAY BE USED ON 7.62 OR 7.2KV TAP. THEY COME SET FROM THE FACTORY FOUR USE ON 7.2KV TAP. WILDWOOD REPAIR SHOP MUST CONVERT THEM FOR USE ON 7.62 SYSTEM.
3. ALL NEW COASTAL REGULATORS ARE CONSTRUCTED OF 304L STAINLESS STEEL EXTERNALLY AND SHOULD HAVE 304LSS STENCILED ON THE TANK UNDERNEATH THE CATALOG NUMBER.
4. STAINLESS STEEL REGULATORS ARE TO BE USED ONLY IN DESIGNATED COASTAL OR HIGHLY CORROSIVE AREAS.
5. ALL COASTAL REGULATORS SHALL HAVE GROUNDING SPRINGS INSTALLED ON BUSHINGS (CN 14004386).

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	2/13/12	SIMMONS	BURLISON	ELKINS

STAINLESS STEEL REGULATORS
FOR COASTAL AREAS

Duke Energy

FLA DWG. 12.07-01

DUKE ENERGY®
FLORIDA

DISTRIBUTION UNDERGROUND CONSTRUCTION MANUAL

20.00 UNDERGROUND GENERAL AND SYMBOLS

20.04 MISCELLANEOUS DRAWINGS

20.10 COMPATIBLE UNIT TABLES

3				
2				
1				
0	8/17/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 20 - UNDERGROUND GENERAL

TABLE OF CONTENTS

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DWG. 20.00-00A

20.10 COMPATIBLE UNIT TABLES (CONT.)

PURPOSE OF SPECIFICATIONS:

THE PURPOSE OF THIS MANUAL IS TO PROMOTE ECONOMICAL AND UNIFORM UNDERGROUND CONSTRUCTION SPECIFICATIONS FOR DISTRIBUTION FACILITIES.

SCOPE:

THE SPECIFICATIONS IN THIS MANUAL ARE THE STANDARDS FOR CONSTRUCTION FOR ALL UNDERGROUND FACILITIES OF THE COMPANY. THESE SPECIFICATIONS SHALL BE FOLLOWED ON ALL SUCH CONSTRUCTION, UNLESS OTHERWISE INSTRUCTED BY ENGINEERING.

EXPLANATION OF THE SPECIFICATIONS OR ADDITIONAL INFORMATION MAY BE OBTAINED THROUGH DISTRIBUTION STANDARDS.

WORK OVERVIEW:

WHEN FIELD CONDITIONS MAKE IT IMPRACTICABLE TO USE STANDARD CONSTRUCTION SPECIFICATIONS OR WHEN THE DETAILS OF THE JOB ARE NOT FULLY COVERED IN THESE SPECIFICATIONS, THE ENGINEER SHALL ISSUE A SKETCH WITH INSTRUCTIONS TO THE FOREMAN SHOWING HOW THE JOB IS TO BE BUILT. SUCH VARIATIONS MUST CONFORM AS NEARLY AS POSSIBLE TO THESE SPECIFICATIONS AND SHALL NOT VIOLATE ANY SAFE WORK PRACTICES, NATIONAL ELECTRICAL SAFETY CODE AND THE FLORIDA PUBLIC COMMISSION ORDERS. IF THERE IS SOME DOUBT AS TO HOW A JOB SHOULD BE BUILT, THE DESIGN ENGINEER SHOULD BE CONTACTED.

GENERAL

UNDERGROUND DISTRIBUTION SHALL BE PROVIDED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS, APPLICABLE COMPANY POLICIES AND APPLICABLE CODES

CLOSE COORDINATION SHOULD BE MAINTAINED WITH LOCAL AUTHORITIES, DEVELOPERS, CONTRACTORS, LOCATE AUTHORITIES AND OTHER UTILITIES, BEFORE AND DURING CONSTRUCTION OF AN UNDERGROUND SYSTEM, IN ORDER TO AVOID CONFLICTS WITH OTHER CONSTRUCTION AND OTHER UNDERGROUND FACILITIES.

ANYONE INVOLVED WITH THE LAYOUT, INSTALLATION, OPERATION, AND MAINTENANCE OF THESE SYSTEMS ARE URGED TO OFFER ANY SUGGESTIONS FOR CHANGES IN THESE SPECIFICATIONS WHICH MIGHT IMPROVE THE INSTALLATION OR OPERATION OF THE SYSTEMS.

LOCATION OF FACILITIES

SERVICE TO CUSTOMERS IN RESIDENTIAL SUBDIVISIONS IS TYPICALLY PROVIDED FROM THE FRONT PROPERTY LINE. ALL EQUIPMENT EXCEPT CABLE RUNS AND LIGHTING FACILITIES SHOULD BE LOCATED OFF THE STREET RIGHT OF WAY AS SHOWN IN THE VARIOUS SPECIFICATION DRAWINGS.

THE LOCATION OF FACILITIES FOR SERVICE TO APARTMENT BUILDINGS, COMMERCIAL PROJECTS, AND INDUSTRIAL PROJECTS SHALL BE DETERMINED BY THE ENGINEER, CONSIDERING THE ARRANGEMENT OF BUILDINGS, STREETS, ALLEYS, WALKWAYS, PARKING AREAS, ETC.

PAD-MOUNTED TRANSFORMERS SHALL BE LOCATED ACCORDING TO DWG. 27.06-05. ALL TRANSFORMER INSTALLATIONS SHALL HAVE SUFFICIENT ROOM FOR GOOD VENTILATION, MAINTENANCE, AND OPERATION. ACCESS ROUTES SHALL BE SUITABLE FOR THE EQUIPMENT USED DURING INSTALLATION, REMOVAL, AND MAINTENANCE.

UNDERGROUND PRIMARY MAY BE INSTALLED CROSS COUNTRY OR ALONG SIDE LOT LINES WHEN THE FOLLOWING CONDITIONS ARE MET:

- CROSS COUNTRY / SIDE LOT LINE CONSTRUCTION MAY BE USED WHEN THE TOTAL COST OF CONSTRUCTION IS REDUCED.
- CROSS COUNTRY / SIDE LOT LINE CONSTRUCTION SHALL BE LOOP FED.
- PROPERTY LINES MATCH WITHIN 5' FOR SIDE LOT LINE CONSTRUCTION.
- OFFSET SIDE LOT LINE CONSTRUCTION 3' FROM PROPERTY LINE.
- CABLE ROUTE MUST BE RELATIVELY LEVEL, 25° MAXIMUM SLOPE.
- A RIGHT OF WAY EASEMENT SHALL BE RECORDED.
- PREFERRED DESIGN IS TO HAVE BOTH TRANSFORMERS (DIP POLE, SWITCHGEAR, JUNCTION BOX, PULL BOX, ETC.) ON COMMON PROPERTY LINE.

RIGHT OF WAY

BEFORE CONSTRUCTION BEGINS, THE LAND OWNER SHALL SIGN A RIGHT OF WAY EASEMENT AND ESTABLISH ALL LOT LINES AND PROPERTY CORNERS. THE EASEMENT SHALL GRANT PROGRESS ENERGY A 10' WIDE PATH FOR THE ACCESS AND INSTALLATION OF PRIMARY, SECONDARY AND SERVICE CONDUCTORS. STREET RIGHTS OF WAY AND UNDERGROUND ROUTES SHALL BE GRADED TO FINAL GRADE AND CLEARED OF ALL OBSTRUCTIONS ABOVE AND BELOW GRADE. THE RIGHT OF WAY SHALL ALSO BE CLEARED OF ALL TREE STUMPS.

PRIMARY CIRCUITS

BOTH ENDS OF AN UNDERGROUND LOOP SHOULD BE:

- SERVED FROM THE SAME SUBSTATION BANK.
- SERVED FROM THE SAME FEEDER.
- IF THESE CONDITIONS ARE NOT MET, EACH TRANSFORMER IN THE LOOP SHALL BE LABELED TO ALERT THE OPERATOR.

FOR NEW CONSTRUCTION, BOTH ENDS OF AN UNDERGROUND LOOP SHOULD BE ON THE SAME PHASE. EACH TRANSFORMER IN THE LOOP SHALL BE LABELED WITH PHASE INFORMATION.

BOTH ENDS OF AN UNDERGROUND LOOP SHOULD NOT TERMINATE AT THE SAME STRUCTURE.

PRIOR TO ENERGIZING NEW OR REPAIRED UNDERGROUND PRIMARY CABLE

APPROPRIATE TEST EQUIPMENT AND CORRESPONDING OPERATING INSTRUCTIONS SHALL BE USED TO TEST THE INTEGRITY AND CONDITION OF CABLE PRIOR TO ENERGIZING.

APPROVED AND APPROPRIATE TEST EQUIPMENT THAT ARE AVAILABLE ARE AS FOLLOWS:

1. VON RADAR TEST SET
2. PHASING VOLT METER/HI-POT SET (AB CHANCE, HASTINGS, SALISBURY)
3. FFR UNIT (HDW, VON)

REFER TO OPERATIONS MANUAL FOR SPECIFIC OPERATING INSTRUCTIONS FOR EACH TYPE OF EQUIPMENT.

TRANSMISSION ENCROACHMENTS

DISTRIBUTION UNDERBUILT ON TRANSMISSION LINES MUST BE APPROVED BY TRANSMISSION THROUGH THE DOCUMENTED PROCESS DESCRIBED IN THE DISTRIBUTION ENGINEERING MANUAL. THIS PROCESS APPLIES ANY TIME NEW DISTRIBUTIN LINES ARE TO BE BUILT ON TRANSMISSION RIGHT OF WAY, AS WELL AS IF ANY CHANGES OR UPGRADES ARE TO BE MADE TO EXISTING ENCROACHMENTS. PLEASE REFER TO THE DISTRIBUTION ENGINEERING MANUAL - TRANSMISSION ENCROACHMENT PROCESS SECTION FOR FURTHER DETAILS.

3				
2				
1	4/24/12	WOJNAROWSKI	BURLISON	ELKINS
0	8/4/10	BURLISON	GUINN	ELKINS
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UNDERGROUND DISTRIBUTION SPECIFICATIONS

Progress Energy

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DWG. 20.00-03

AN OPEN POINT SHALL BE PROVIDED IN A PAD-MOUNTED TRANSFORMER NEAR THE MIDPOINT OF EACH LOOP.

LOOPED PRIMARY CABLE SYSTEMS SHALL NORMALLY BE INSTALLED BY DIRECT BURIAL WITHOUT A SPARE CONDUIT. PRIMARY CABLE SHALL BE SPLICED WHEN A CABLE REEL ENDS. IF A PARTIAL REEL OF CABLE IS LEFT OVER AT THE END OF AN INSTALLATION, THE PARTIAL REEL SHOULD BE USED TO START THE NEXT JOB.

UG CABLE SCRAP GUIDELINES:

ALL UNDERGROUND (UG) CABLE SHOULD BE SCRAPPED ACCORDING TO THE GUIDELINES NOTED BELOW. THIS APPLIES TO COMPANY AND CONTRACTOR CREWS.

FIELD APPLICATIONS:

WHEN INSTALLING UG CABLE, STANDARD CONSTRUCTION PRACTICES SHOULD BE APPLIED AND PRUDENT DECISIONS SHOULD BE MADE TO SCRAP MINIMAL AMOUNTS AT EACH TERMINATION POINT. AT ALL TERMINATION POINTS, THE ACTUAL AMOUNT OF SCRAP SHOULD BE DOCUMENTED ON THE WORK ORDER.

MATERIALS AND SERVICES:

SCRAP AMOUNTS BY CATALOG NUMBER AND AMOUNT ARE TO BE REPORTED ON A REGULAR BASIS BY THE CONTRACTOR TO THE LOCAL MATERIAL AND SERVICES REPRESENTATIVE VIA THE SUPPLIED MATERIAL AND SERVICES SPREADSHEET.

A PARTIAL REEL OF CABLE SHOULD BE SCRAPPED ACCORDING TO THE FOLLOWING GUIDELINES:

- 1/0 AL PRIMARY CABLE-SCRAP LESS THAN 100'
- 500 AL PRIMARY CABLE-SCRAP LESS THAN 175'
- 1000 AL PRIMARY CABLE- SCRAP LESS THAN 175'

500 AL AND 1000 AL PRIMARY CABLE ARE PRE-MEASURED FROM MASTER REELS. SCRAP SHOULD BE AT A MINIMUM. HOWEVER IF CABLE IS LEFT ON REEL, CONTACT MATERIAL AND SERVICES DEPARTMENT FOR PICK-UP.

THESE GUIDELINES ARE RECOMMENDED; HOWEVER, WHEN THESE AMOUNTS CAN BE USED FOR SHORT SPANS, DIP POLE CHANGE-OUTS, PMH/PME RELOCATIONS, OR SPLICING, EFFORTS SHOULD BE MADE TO USE THESE AMOUNTS RATHER THAN SCRAP.

THERE SHOULD BE A MAXIMUM OF ONLY TWO SPLICES USED IN EACH DIRECT-BURIED SPAN DURING A NEW INSTALLATION.

IF PRIMARY CABLE IS BEING INSTALLED IN A CONDUIT OR A DUCT BANK SYSTEM, THE PRIMARY CABLES SHOULD BE SPLICED IN SPLICE PITS, PULLBOXES, OR MANHOLES ACCORDING TO THE INSTRUCTIONS OF THE DESIGNER.

IN RESIDENTIAL SUBDIVISIONS, THE PRIMARY CABLE LOOPS FROM THE MAIN TRENCH TO THE TRANSFORMER LOCATIONS SHOULD BE PLACED IN THE TRENCH SO THAT THE TWO CABLES DO NOT CROSS.

THE PRIMARY NEUTRAL OF THE UNDERGROUND SYSTEM IS FORMED BY CONNECTING THE PRIMARY CONCENTRIC NEUTRALS AT EACH TRANSFORMER LOCATION. THIS PRIMARY CONCENTRIC NEUTRAL SHALL BE CONNECTED TO THE OVERHEAD SYSTEM NEUTRAL AT EACH DIP POLE AND SHALL BE TREATED IN THE SAME MANNER AS THE OVERHEAD SYSTEM NEUTRAL.

SECONDARY CIRCUITS AND SERVICE LATERALS

ALL SECONDARY CABLES SHALL BE TAGGED AT EACH END AS TO WHICH TRANSFORMER OR PEDESTAL IT IS COMING FROM OR TO WHICH PEDESTAL OR CABLE MARKER IT IS GOING TO.

IN RESIDENTIAL OR SUBDIVISIONS, EACH CUSTOMER SHALL BE SERVED BY A SEPARATE SERVICE LATERAL EXTENDING FROM A TRANSFORMER, SECONDARY PEDESTAL. SERVICE SHALL BE LOCATED IN ACCORDANCE WITH DESIGNER'S LAYOUT. THIS IS NECESSARY BECAUSE OF VOLTAGE DROP AND CABLE CAPACITIES. SERVICE LATERALS SHALL BE RUN IN A STRAIGHT LINE WHERE PRACTICAL. IF NOT, THE EXACT RUN SHOULD BE NOTED ON THE MAP OF THE SYSTEM.

SERVICE LATERALS SHALL BE TAGGED AND MARKED AT THE PEDESTAL AND PAD WITH COLOR TIES CORRESPONDING TO THE HOUSE OR LOT TO BE SERVED.

3				
2				
1				
0	8/4/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

UNDERGROUND DISTRIBUTION SPECIFICATIONS - CABLE SCRAP

Duke Energy®

FLA

DWG. 20.00-05

GROUNDING ELECTRODES FOR DISTRIBUTION LINES

THE UNDERGROUND DISTRIBUTION LINE DESIGN STANDARD IN THE CAROLINAS AND FLORIDA IS CONSIDERED TO BE A MULTI-GROUNDED SYSTEM PER THE NESC. THE UNDERGROUND SYSTEM NEUTRAL (THE CONCENTRIC NEUTRAL ON THE #1/0 PRIMARY CABLE, THE LC SHIELD ON THE LARGER BULK FEEDER CABLES, AND THE NEUTRAL CABLE OF 600 VOLT SECONDARY AND SERVICE CABLE) MUST HAVE A MINIMUM OF 4 GROUNDS PER MILE OF CABLE.

IN RESIDENTIAL AND COMMERCIAL DEVELOPMENTS, DUE TO THE NUMBER OF TRANSFORMERS AND SWITCHGEAR INSTALLED, THE NUMBER OF GROUNDS INSTALLED WILL MOST LIKELY EXCEED THE MINIMUM OF 4 PER MILE. IN INDUSTRIAL DEVELOPMENTS AND AREAS WHERE FEEDERS ARE INSTALLED UNDERGROUND, ADDITIONAL GROUND RODS MAY NEED TO BE INSTALLED AT SPLICE LOCATIONS. IF A CONTINUOUS CABLE LENGTH GREATER THAN 1/4 1/4 MILE IS TO BE INSTALLED, THE NUMBER OF GROUND RODS ON EACH END OF THE CABLE RUN MUST BE EVALUATED TO ENSURE THE MINIMUM OF 4 GROUNDS PER MILE IS MET. IF THE MINIMUM NUMBER OF GROUNDS PER MILE CANNOT BE MET IN THE PRELIMINARY PLAN, ADDITIONAL SPLICE LOCATION WITH GROUND RODS MAY NEED TO BE INCORPORATED INTO THE PLAN.

THE NESC CONTAINS AN EXCEPTION TO THE 4 GROUNDS PER MILE FOR UNDERWATER CROSSINGS. HOWEVER, DEEP DRIVEN GROUNDS AND ARRESTER PROTECTION IS RECOMMENDED AT EACH END OF THE UNDERWATER SECTION OF CABLE.

THE INTENT OF THIS NESC RULE IS TO ENSURE THE GROUNDING ELECTRODES ARE DISTRIBUTED AT APPROXIMATELY 1/4 MILE INTERVALS OR SMALLER, ALTHOUGH SOME INTERVALS MAY EXCEED 1/4 MILE. IN ANY MILE INTERVAL OF A GIVEN LINE, A MINIMUM OF 4 GROUNDS SHOULD BE FOUND EVENLY DISTRIBUTED THROUGHOUT THE MILE INTERVAL.

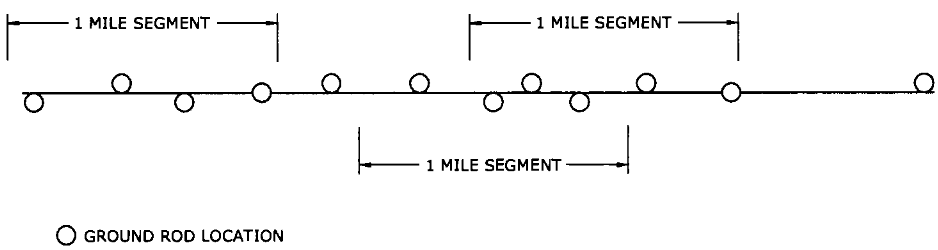


ILLUSTRATION OF 4 GROUND RODS IN EACH RANDOMLY SELECTED MILE OF LINE

3				
2				
1				
0	8/2/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GROUNDING ELECTRODES FOR UNDERGROUND DISTRIBUTION LINES

Duke Energy

PGN DWG. 20.00-06A

EQUIPMENT GROUNDING

THE GROUND RESISTANCE AT AN EQUIPMENT INSTALLATION NEEDS TO BE LOW ENOUGH TO MINIMIZE HAZARDS TO PERSONNEL AND TO PERMIT PROMPT OPERATION OF CIRCUIT PROTECTIVE DEVICES. ON A MULTIGROUNDED SYSTEM, THE RESISTANCE OF THE SYSTEM NEUTRAL IS AFFECTED BY THE RESISTANCE OF THE EQUIPMENT GROUNDS AND ALSO BY THE NUMBER OF GROUNDS INSTALLED ALONG THE LINE. ON A GROUND-WYE SYSTEM, MULTIPLE GROUNDS AT DIFFERENT LOCATIONS ALONG THE SYSTEM ARE MORE IMPORTANT THAN THE RESISTANCE OF ONE PARTICULAR GROUND ROD INSTALLATION.

GROUND RESISTANCE CAN VARY CONSIDERABLY WITH SOIL AND WEATHER CONDITIONS. THE AMOUNT OF MOISTURE IN THE SOIL WILL AFFECT THE RESISTANCE LEVEL AS WELL AS THE TEMPERATURE OR CHEMICAL CONTENT OF THE SOIL. THE USE OF DEEP DRIVEN GROUND ROD INSTALLATIONS WILL MINIMIZE THE VARIATIONS IN RESISTANCE DUE TO WEATHER CONDITIONS AND INCREASE THE PROBABILITY OF PENETRATING A LOW RESISTANCE SOIL LAYER. GIVEN THE ABOVE, WHERE DISTRIBUTION EQUIPMENT WITH ARRESTERS IS INSTALLED (i.e. PAD-MOUNTED TRANSFORMERS, SWITCHGEAR, ETC.), A DEEP DRIVEN GROUND SHALL BE INSTALLED AS FOLLOWS:

ONE DEEP-DRIVEN GROUND CONSISTING OF 4-5' RODS (INSTALLED ONE ON TOP OF THE OTHER TO PROVIDE 1 VERTICAL ELECTRODE 20' IN LENGTH). IF IT BECOMES IMPRACTICAL TO INSTALL 4 DEEP-DRIVEN RODS DUE TO ADVERSE SOIL CONDITIONS (I.E., ROCK), THEN INSTALLATION WILL BE CONSIDERED COMPLETE WITH THE MAXIMUM NUMBER OF RODS THAT THE SOIL WILL PERMIT.

EQUIPMENT WITH **NO** ARRESTERS REQUIRES ONLY 2 - 5' RODS.

WHEN STREET LIGHT INSTALLATIONS REQUIRE A DRIVEN GROUND, 2 - 5' RODS WILL BE INSTALLED AND INTERCONNECTED WITH THE NEUTRAL CONDUCTOR.

EQUIPMENT BONDING

WHERE EQUIPMENT GROUNDING IS REQUIRED, ALL EQUIPMENT TANKS, AND OTHER HARDWARE MUST BE SOLIDLY BONDED TOGETHER AND THEN CONNECTED TO THE SYSTEM NEUTRAL.

- EQUIPMENT PROTECTED BY A FUSE (i.e. OH TRANSFORMERS, OH CAPACITOR BANKS) WILL REQUIRE A #6 SD BC GROUND WIRE, CONNECTED TO THE SYSTEM NEUTRAL. THE GROUND WIRE DOWN THE POLE IS ALSO #6 SD BC, CONNECTED TO THE SYSTEM NEUTRAL AND THE GROUND RODS.
- ALL PAD-MOUNTED TRANSFORMERS AND UNDERGROUND PRIMARY ENCLOSURES, SINGLE AND THREE-PHASE, REQUIRE A #4 SD BC LOOPED GROUND TO MATCH THE NEUTRAL OF #1/0 UG PRIMARY CABLE.
- EQUIPMENT THAT WILL BE SUBJECT TO OPERATING ON THE SUBSTATION BREAKER (i.e. REGULATORS, PAD-MOUNTED SWITCHGEAR, PAD-MOUNTED CAPACITORS, PRIMARY METERING ENCLOSURES, RECLOSERS, ETC.) WILL REQUIRE #2 SD BC GROUND. (THE GROUND WIRE DOWN THE POLE TO THE GROUND RODS IS #6 SD BC.)
- BULK FEEDER (TERMINAL) POLES REQUIRE THE GROUND BRAID STRAPS (PROVIDED IN THE TERMINATOR KIT) BE RUN TO THE SYSTEM NEUTRAL AND CONNECTED. (THE GROUND WIRE DOWN THE POLE TO THE GROUND RODS IS #6 SD BC.)

WHERE EQUIPMENT OR MATERIAL IS NOT GROUNDED, IT MUST BE SEPARATED FROM OTHER GROUNDED EQUIPMENT BY A MINIMUM OF 4". SPECIAL INSTRUCTIONS MAY BE GIVEN THAT REQUIRE ADDITIONAL SEPARATION. THIS WILL MINIMIZE RADIO AND TV INTERFERENCE.

GROUNDING COMPATIBLE UNITS	DESCRIPTION/APPLICATION
➤ GUAR2F	GROUND EQUIPMENT WITHOUT ARRESTERS - 2 - 5' RODS UNDERGROUND ONLY
➤ GUAR4F	GROUND EQUIPMENT WITH ARRESTERS - 4 - 5' RODS UNDERGROUND ONLY
GUPED6F	BONDING GROUND FOR JOINT USE/ PEDESTAL
GUB6F	BONDING GROUND FOR JOINT USE PMT
GUP1E4F	GROUND SINGLE-PHASE PMT - WIRE ONLY
GUP3E4F	GROUND THREE-PHASE PMT - WIRE ONLY
GUPGE2F	GROUND PAD-MOUNTED SWITCHGEAR - WIRE ONLY
GUEMB2F	GROUND PRIMARY METER UNDERGROUND CABINET - WIRE ONLY
GOFWE6F	GROUND EQUIPMENT ADDED TO EXISTING OVERHEAD POLE - WIRE ONLY

3				
2				
1	9/7/12	KATIGBAK	BURLISON	ELKINS
0	8/4/10	BURLISON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GROUND ROD ELECTRODES AND BONDING FOR UNDERGROUND DISTRIBUTION LINES

Duke Energy®

FLA DWG. 20.00-06B

21.01 SINGLE-PHASE PRIMARY RISERS

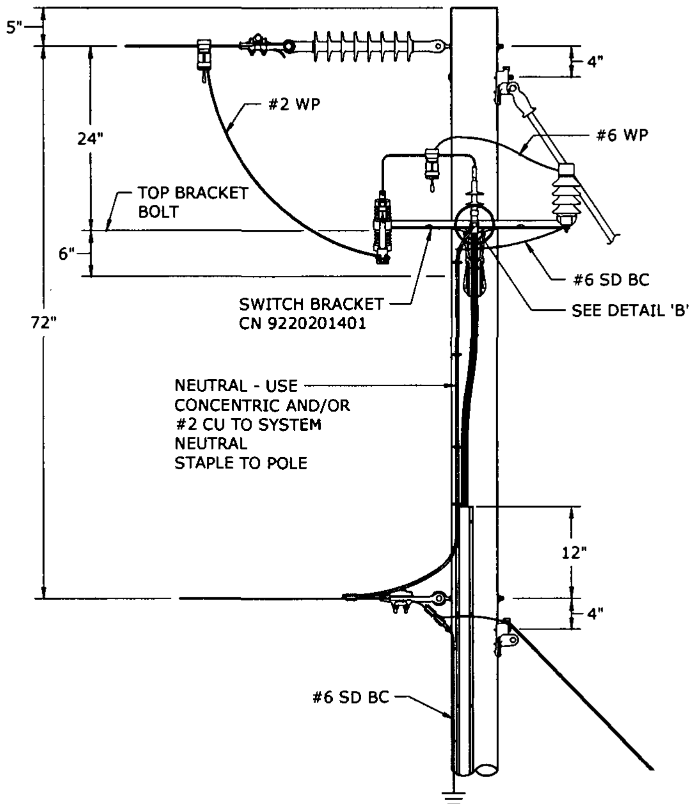
21.05 CABLE GUARD, U-GUARD AND CONDUIT RISERS

21.07 TERMINAL POLES, SMALL CABLE

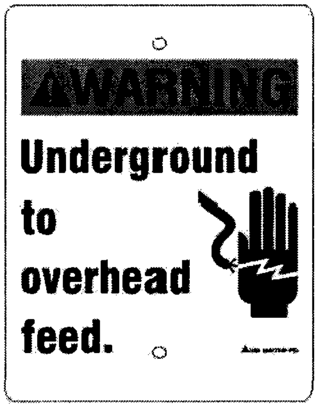
21.08 TERMINAL POLES, LARGE CABLE

21.09 RISERS POLES, SECONDARY

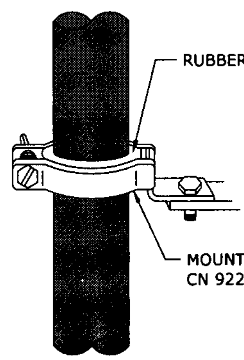
21.10 SUBSTATION FEEDER EXITS



SIDE VIEW



DETAIL 'A' - WARNING SIGN
CN 9220150597
SEE NOTE 2



DETAIL 'B'
CABLE CLAMP

NOTES:

1. MAKE LEAD FROM BOTTOM OF ARRESTER TO CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE.
2. INSTALL WARNING SIGN BELOW SWITCH.
3. FUSE SWITCH PER ENGINEERING INSTRUCTIONS.

3				
2				
1				
0	4/17/12	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE REVERSE RISER - 200 AMP
URD TO OVERHEAD

Progress Energy

FLA

DWG. 21.01-02

U-GUARD SIZE FOR PRIMARY UNDERGROUND CABLE RUNS			
PRIMARY CONCENTRIC NEUTRAL CABLE	U-GUARD SIZE		
	1-CABLE	2-CABLE	3-CABLE
1/0 AL SOL 15KV 175 MILS	2"	3"	3"
500 KCM AL 15KV 175 MILS	-	-	5"
1000 KCM AL 15KV 175 MILS	-	-	5"

U-GUARD SIZE FOR SECONDARY UNDERGROUND CABLE RUNS			
SECONDARY CABLE	U-GUARD SIZE		
	1-CIRCUIT	2-CIRCUIT	3-CIRCUIT
2 #10 CU ST. LT. CABLE	1"	2"	2"
2 #6 AL ST. LT. CABLE	1"	2"	2"
#2 AL UG TPX XLP	1"	2"	-
2/0 AL UG TPX XLP	2"	2"	3"
4/0 AL UG TPX XLP	2"	3"	5"
350 MCM AL UG TPX XLP	2"	3"	5"
4/0 AL UG QPX XLP	3"	5"	5"
500 MCM AL UG TPX	3"	5"	5"
500 MCM AL UG QPX	3"	5"	5"

3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

U-GUARD FILL

Progress Energy

FLA DWG. 21.05-05A

CABLE GRIP SIZE FOR PRIMARY UNDERGROUND CABLE RUNS	
PRIMARY CONCENTRIC NEUTRAL CABLE	CABLE GRIP SIZE PER CONDUCTOR
1/0 AL SOL 15KV 175 MILS	1" X 1-1/4"
500 KCM AL 15KV 175 MILS	2" X 2-1/2"
1000 KCM AL 15KV 175 MILS	3" X 2-1/2"

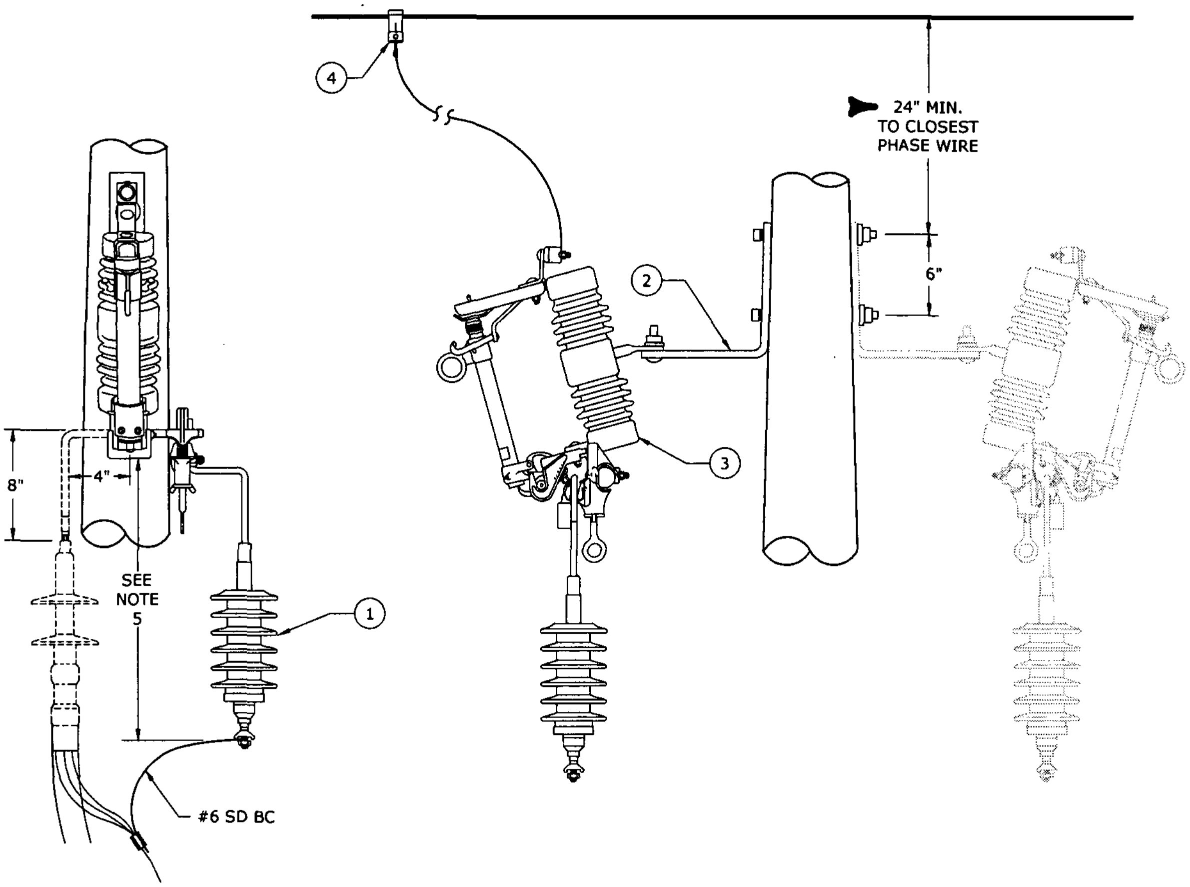
CABLE GRIP SIZE FOR SECONDARY UNDERGROUND CABLE RUNS	
SECONDARY CABLE	RECOMMENDED CABLE GRIP SIZE PER CIRCUIT
2 #10 CU ST. LT. CABLE	1" X 1-1/4"
2 #6 AL ST. LT. CABLE	1" X 1-1/4"
#2 AL UG TPX XLP	1" X 1-1/4"
2/0 AL UG TPX XLP	2" X 2-1/2"
4/0 AL UG TPX XLP	2" X 2-1/2"
350 MCM AL UG TPX XLP	2" X 2-1/2"
4/0 AL UG QPX XLP	2" X 2-1/2"
500 MCM AL UG TPX	3" X 2-1/2"
500 MCM AL UG QPX	3" X 2-1/2"

3				
2				
1				
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CABLE GRIP APPLICATION

Duke Energy

FLA DWG. 21.05-05B



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
CA1T15FM	1	ARUGTP10F	1	153534	1	CONNECTOR, STEM, ARRESTER
				220208	1	ARRESTER, 10KV, LIGHTNING
	2	BKTCOLASNGSTLF	1	013264	1	WASHER, SPRING COIL, 5/8"
				013308	1	WASHER, SQUARE, 2-1/4"
				152106	1	BOLT, MACHINE, 5/8" X 10"
				311263	1	BRACKET, CUTOUT
	3	FUSE15CO100F	1	221112	1	CUTOUT, 15KV, 100A
	4	KHLC40N6F	1	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
	4	KHLC7933F	1	9220184794	1	CLAMP, HOT LINE, ALUM, LARGE, 336-795

NOTES:

1. MOUNT SECOND CUTOUT AND BRACKET ON OPPOSITE SIDE FOR TWO-PHASE TERMINAL POLE.
2. TERMINATOR WITH 18" PIN STEM CONNECTOR ISSUED SEPARATELY.
3. USE #2 WP COPPER JUMPER WIRE FROM CUTOUT TO HOT LINE CLAMP.
4. FORM THE 18" PIN STEM CONNECTOR AS SHOWN BEING CAREFUL NOT TO BEND THE #1/0 SOLID AS IT ENTERS THE WATER SEAL AT CONNECTOR.
5. MAKE THE #6 SOFT DRAWN BARE COPPER LEAD FROM THE BOTTOM OF THE ARRESTER TO THE CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE WHILE MAINTAINING NOT LESS THAN 6" CLEARANCE BETWEEN CUTOUT IN THE OPEN POSITION AND THE CONCENTRIC NEUTRAL.
6. CHECK THAT CUTOUT DOOR WILL FALL CLEAR OF TERMINATOR AND CABLE.
7. ALL TERMINATOR POLE ARRESTERS MUST HAVE VISIBLE ISOLATOR ATTACHED.
8. BOND CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL.

REVISED		BY	CK'D	APPR.
3				
2	11/10/11	BURLISON	BURLISON	ELKINS
1	8/31/11	DANNA	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS

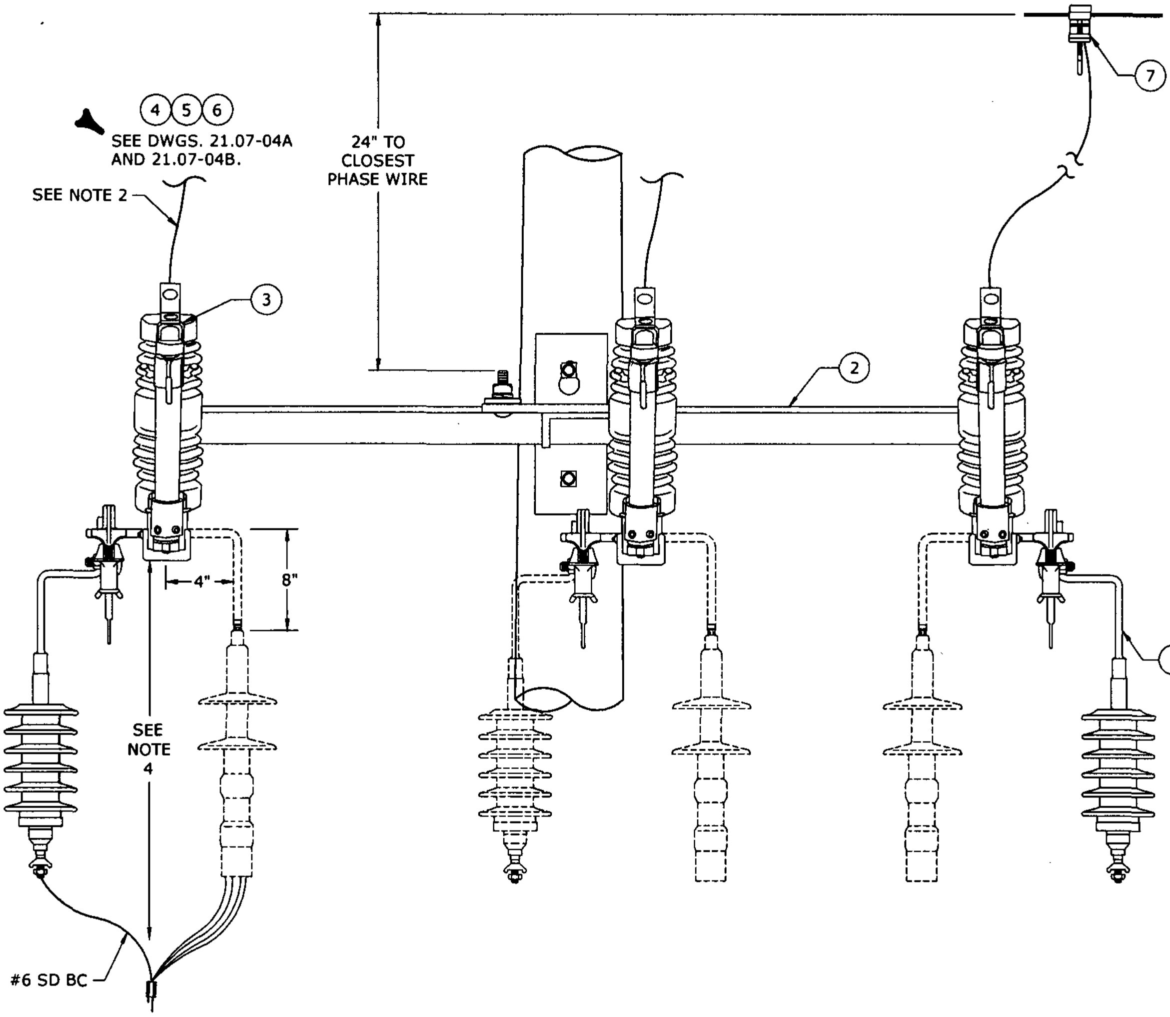
TERMINAL POLE, SINGLE-PHASE AND TWO-PHASE

CUTOUT ASSEMBLY

Progress Energy

FLA

DWG. 21.07-01



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
CA3T15FM	1	ARUGTP10F	3	153534	1	CONNECTOR, STEM ARRESTER
				220208	1	ARRESTER, 19KV LIGHTING
	2	BKTCOLATRISTLF	1	013264	2	WASHER, SPRING COIL, 5/8"
				013308	2	WASHER, SQUARE, 2-1/4"
				152106	2	BOLT, MACHINE, 5/8"X10"
				070104	1	BRACKET, CUTOUT, TRI-MOUNT
	3	FUSE15CO100F	3	221112	1	CUTOUT, 15KV, 100A
	4	IHPTT15F	2	080212	2	INSULATOR, POST, POST,TIE,TOP,15KV
	5	ISSTUDBOLT5812F	2	072367	1	STUD, LINE POST, LP 5/8"X 12"
				013264	1	WASHER, LOCK, SPRING,DOUBLE COIL
	6	HTIEN6CSDF	2	11061009	8	WIRE, TIE, #6, SOLID SD BARE COPPER
	7	KHLC_F	3	-	1	CLAMP, HOTLINE (VARIES W/WIRE SIZE

NOTES:

1. TERMINATOR WITH 18" PIN STEM CONNECTOR ISSUED SEPARATELY.
2. USE #2 WP COPPER JUMPER WIRE FROM CUTOUT TO HOT LINE CLAMP.
3. FORM THE 18" PIN STEM CONNECTOR AS SHOWN BEING CAREFUL NOT TO BEND THE #1/0 SOLID AS IT ENTERS THE WATER SEAL AT CONNECTOR.
4. MAKE THE #6 SOFT DRAWN BARE COPPER LEAD FROM THE BOTTOM OF THE ARRESTER TO THE CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE WHILE MAINTAINING NOT LESS THAN 6" CLEARANCE BETWEEN CUTOUT IN THE OPEN POSITION AND THE CONCENTRIC NEUTRAL.
5. CHECK THAT CUTOUT DOOR WILL FALL CLEAR OF TERMINATOR AND CABLE.
6. ALL TERMINAL POLE ARRESTERS MUST HAVE VISIBLE ISOLATOR ATTACHED.
7. BOND CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL.
8. ROTATE OUTSIDE CUTOUTS FOR CLEARANCE AS NECESSARY.

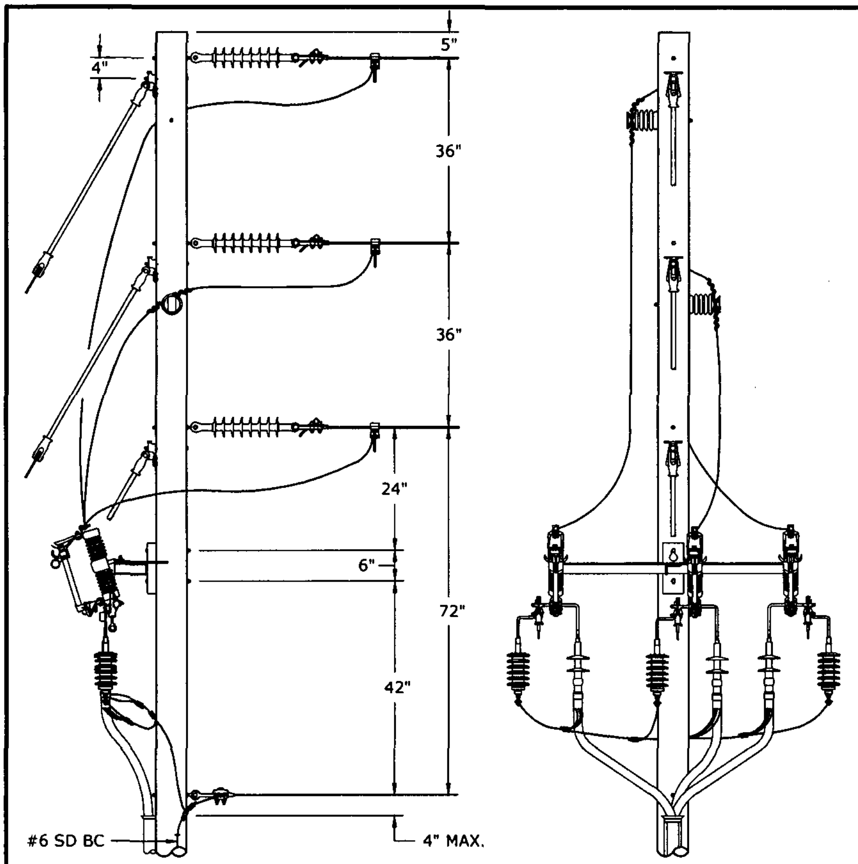
REVISED		BY	CK'D	APPR.
4	4/5/13	DANNA	DANNA	ADCOCK
3	9/21/12	BURLISON	BURLISON	ADCOCK
2	2/13/12	BURLISON	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS

TERMINAL POLE, THREE-PHASE CUTOUT ASSEMBLY

DUKE ENERGY.

FLA

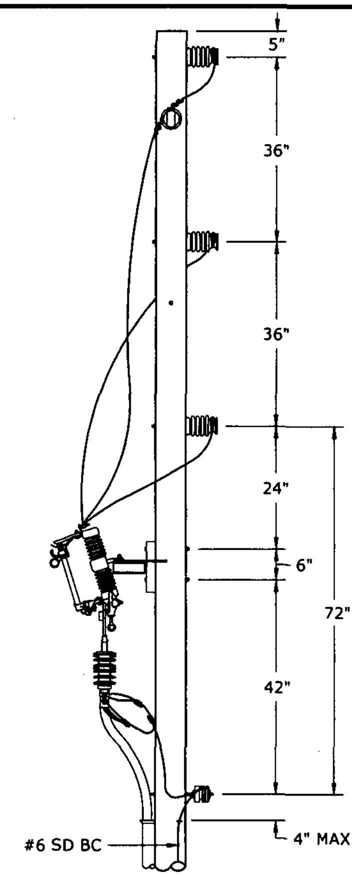
DWG. 21.07-03



FRONT VIEW

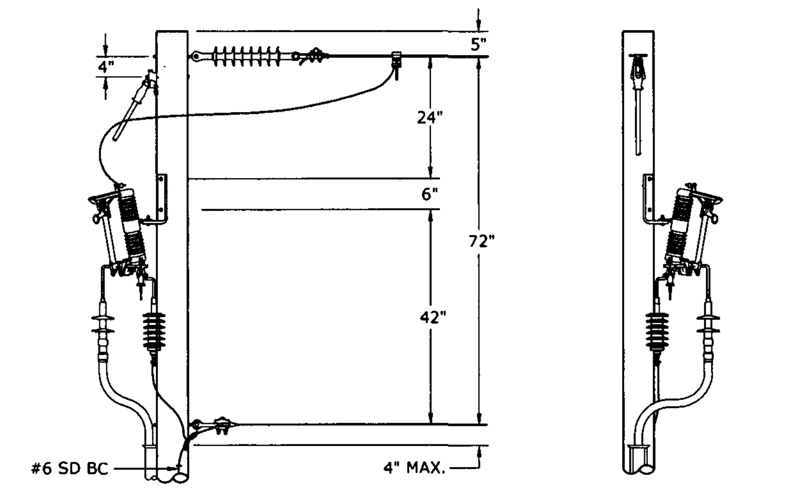
SIDE VIEW

THREE-PHASE DEADEND CONSTRUCTION



FRONT VIEW

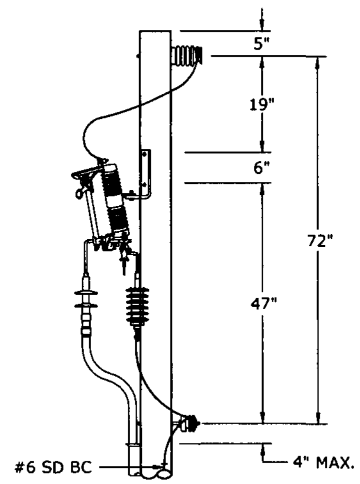
THREE-PHASE TANGENT CONSTRUCTION



FRONT VIEW

SIDE VIEW

SINGLE-PHASE DEADEND CONSTRUCTION



FRONT VIEW

SINGLE-PHASE TANGENT CONSTRUCTION

NOTES:

1. BEND 18" PIN STEM CONNECTOR AND INSTALL IN CUTOUT. SEE DWG. 21.07-01.
2. INSTALL ARRESTER USING HOT LINE CLAMP AND ARRESTER PREBENT STEM CONNECTOR.
3. MAKE THE LEAD FROM THE BOTTOM OF ARRESTER TO THE CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE WHILE MAINTAINING 6" MINIMUM CLEARANCE BETWEEN CUTOUT IN THE OPEN POSITION AND THE CONCENTRIC NEUTRAL.
4. OUTSIDE CUTOUTS MAY BE ROTATED FOR CLEARANCE IF NECESSARY.
5. ALL TERMINAL POLE ARRESTERS MUST HAVE VISIBLE ISOLATOR ATTACHED.
6. BOND CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL.

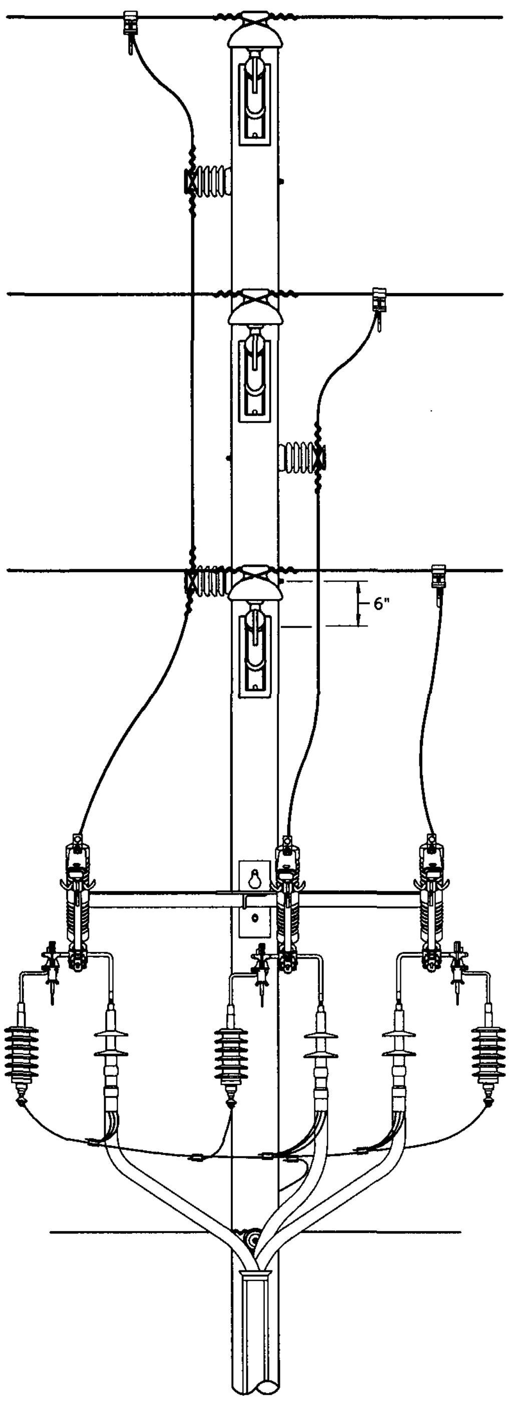
3				
2				
1				
0	4/5/13	DANNA	DANNA	ADCOCK
REVISED	BY	CK'D	APPR.	

VERTICAL CONSTRUCTION, 200 AMP

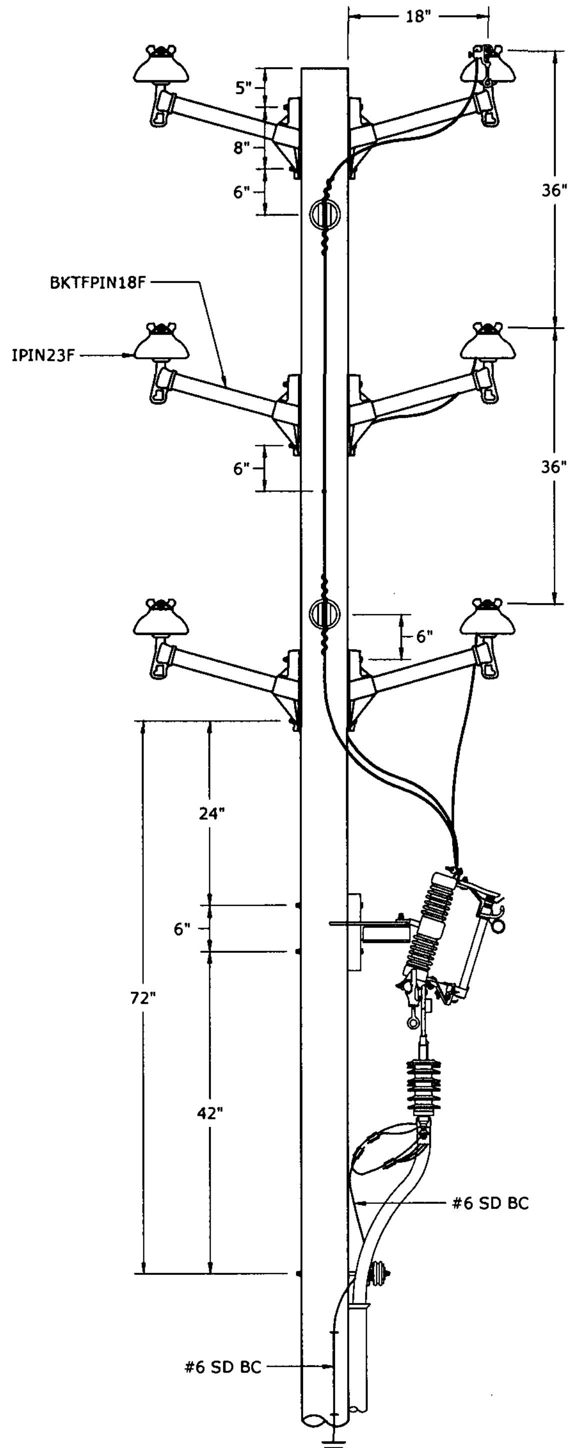
DUKE ENERGY.

FLA

DWG. 21.07-04A



FRONT VIEW



SIDE VIEW
(FROM LEFT SIDE)

NOTES:

1. BEND 18" PIN STEM CONNECTOR AND INSTALL IN CUTOUT. SEE DWG. 21.07-01.
2. INSTALL ARRESTER USING HOT LINE CLAMP AND ARRESTER PREBENT STEM CONNECTOR.
3. MAKE THE LEAD FROM THE BOTTOM OF ARRESTER TO THE CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE WHILE MAINTAINING 6" MINIMUM CLEARANCE BETWEEN CUTOUT IN THE OPEN POSITION AND THE CONCENTRIC NEUTRAL.
4. OUTSIDE CUTOUTS MAY BE ROTATED FOR CLEARANCE IF NECESSARY.
5. ALL TERMINAL POLE ARRESTERS MUST HAVE VISIBLE ISOLATOR ATTACHED.
6. BOND CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL.
7. CAN BE CONSTRUCTED ON DOUBLE CIRCUIT POLES FRAMED WITH STEEL STAND OFF BRACKETS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 4/4/13	DANNA	DANNA	ADCOCK

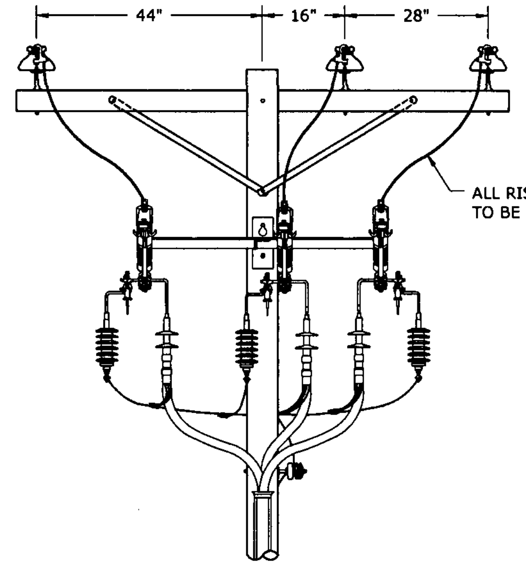
VERTICAL CONSTRUCTION, 200 AMP

DOUBLE CIRCUIT

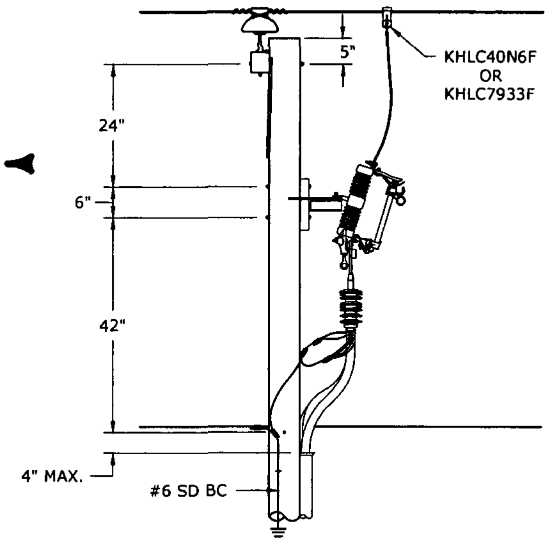
DUKE ENERGY.

FLA

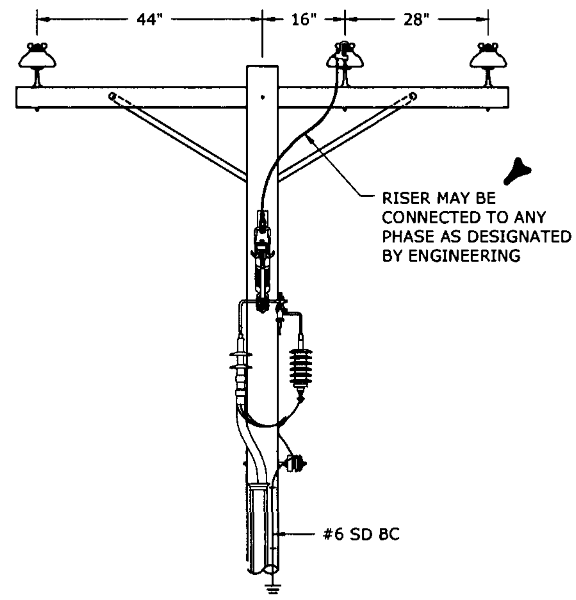
DWG. 21.07-04B



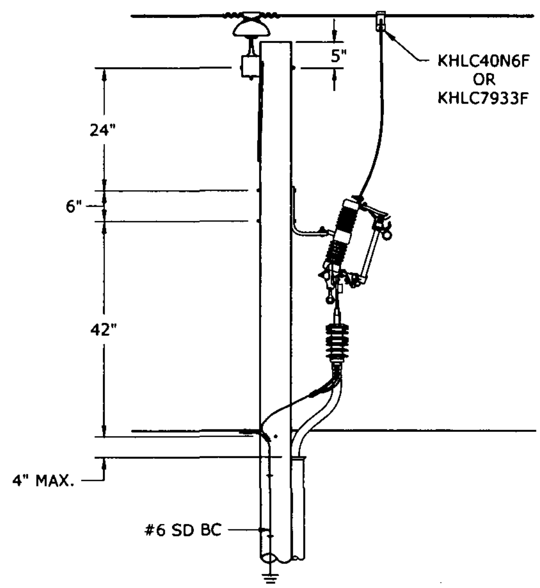
FRONT VIEW



SIDE VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. BEND 18" PIN STEM CONNECTOR AND INSTALL IN CUTOUT. SEE DETAILS ON DWG. 21.07-01.
2. INSTALL ARRESTER USING HOT LINE CLAMP AND ARRESTER PREBENT STEM CONNECTOR.
3. MAKE THE LEAD FROM THE BOTTOM OF ARRESTER TO THE CONCENTRIC NEUTRAL AS SHORT AS POSSIBLE WHILE MAINTAINING 6" MINIMUM CLEARANCE BETWEEN CUTOUT IN THE OPEN POSITION AND THE CONCENTRIC NEUTRAL.
4. OUTSIDE CUTOUTS MAY BE ROTATED FOR CLEARANCE IF NECESSARY.
5. ALL TERMINAL POLE ARRESTERS MUST HAVE VISIBLE ISOLATER ATTACHED.
6. BOND CONCENTRIC NEUTRAL TO SYSTEM NEUTRAL.

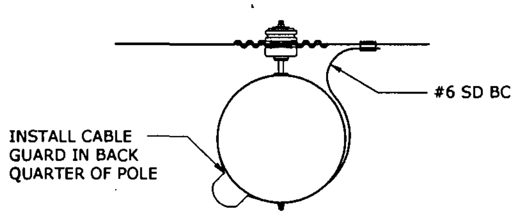
3				
2	12/12/11	BURLISON	BURLISON	ELKINS
1	8/31/11	DANNA	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

HORIZONTAL CONSTRUCTION, 200 AMP

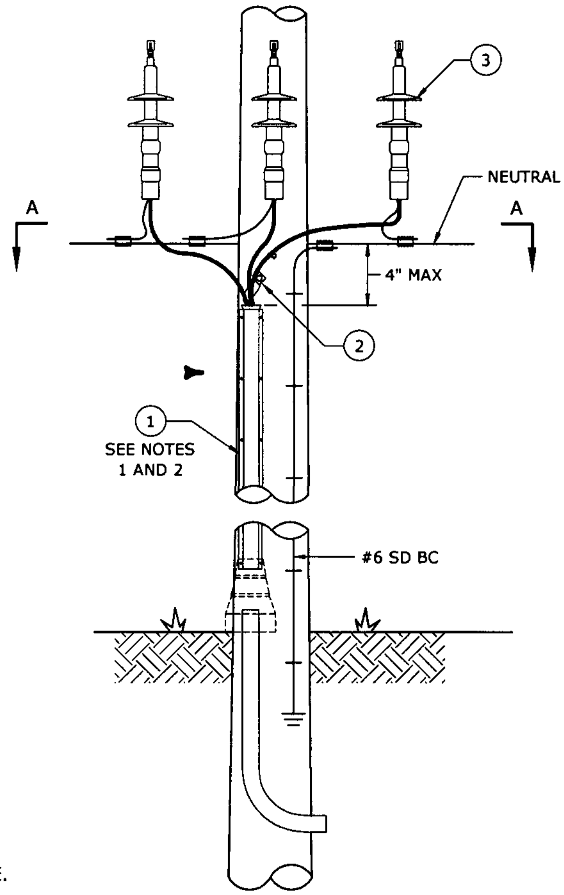
Progress Energy

FLA

DWG. 21.07-05



SECTION A-A



SIDE VIEW

NOTES:

1. IF DIRECT BURIED CABLE, INSTALL CABLE GUARD 12" BELOW GROUND LEVEL.
2. IF CABLE IN CONDUIT, INSTALL CABLE GUARD 4" BELOW CONDUIT.
3. INSTALL LAG SCREW IN EACH HOLE OF MOLDING.
4. FOR OTHER CABLE SIZES, MATERIAL ITEMS SUCH AS CABLE GUARDS, GRIPS, AND CONNECTORS WILL CHANGE. SEE DWGS. 21.05-05A, 21.05-05B, 26.06-10A.
5. ON CONCRETE POLES, INSTALL 3 S.S. BANDS PER 10' SECTION OF CABLE GUARD.
6. WHEN THE CABLE IS INSTALLED IN 4 INCH CONDUIT, USE THE 3" VENTILATOR BOOT (CU CRISVENTBOOT3F, CN 9220239095) TO MAKE THE TRANSITION FROM 4 INCH CONDUIT TO THE 3 INCH U-GUARD.
7. ORIENT U-GUARD WITH BELL ENDS ON BOTTOM. WHEN INSTALLING VENTILATOR BOOT, INSTALL U-GUARD OVER THE FIRST STEP OF THE VENT BOOT.

BILL OF MATERIALS - TERMINAL POLE RISER SINGLE-PHASE #1/0				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
TMP1P10FM	1	CRIS1UGPVC225WF	3	RISER, U-GUARD, 2-1/4"
	2	CABGRP1X125F	1	CABEL GRIP, 1" X 1-1/4"
	3	TRM10AL215KITF	1	TERM, KIT, 1/0, 200 AMP

BILL OF MATERIALS - TERMINAL POLE RISER THREE-PHASE #1/0				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
TMP3P10FM	1	CRIS1UGPVC35WF	3	RISER, U-GUARD, 3-1/2"
	2	CABGRP1X125F	3	CABEL GRIP, 1" X 1-1/4"
	3	TRM10AL215KITF	3	TERM, KIT, 1/0, 200 AMP

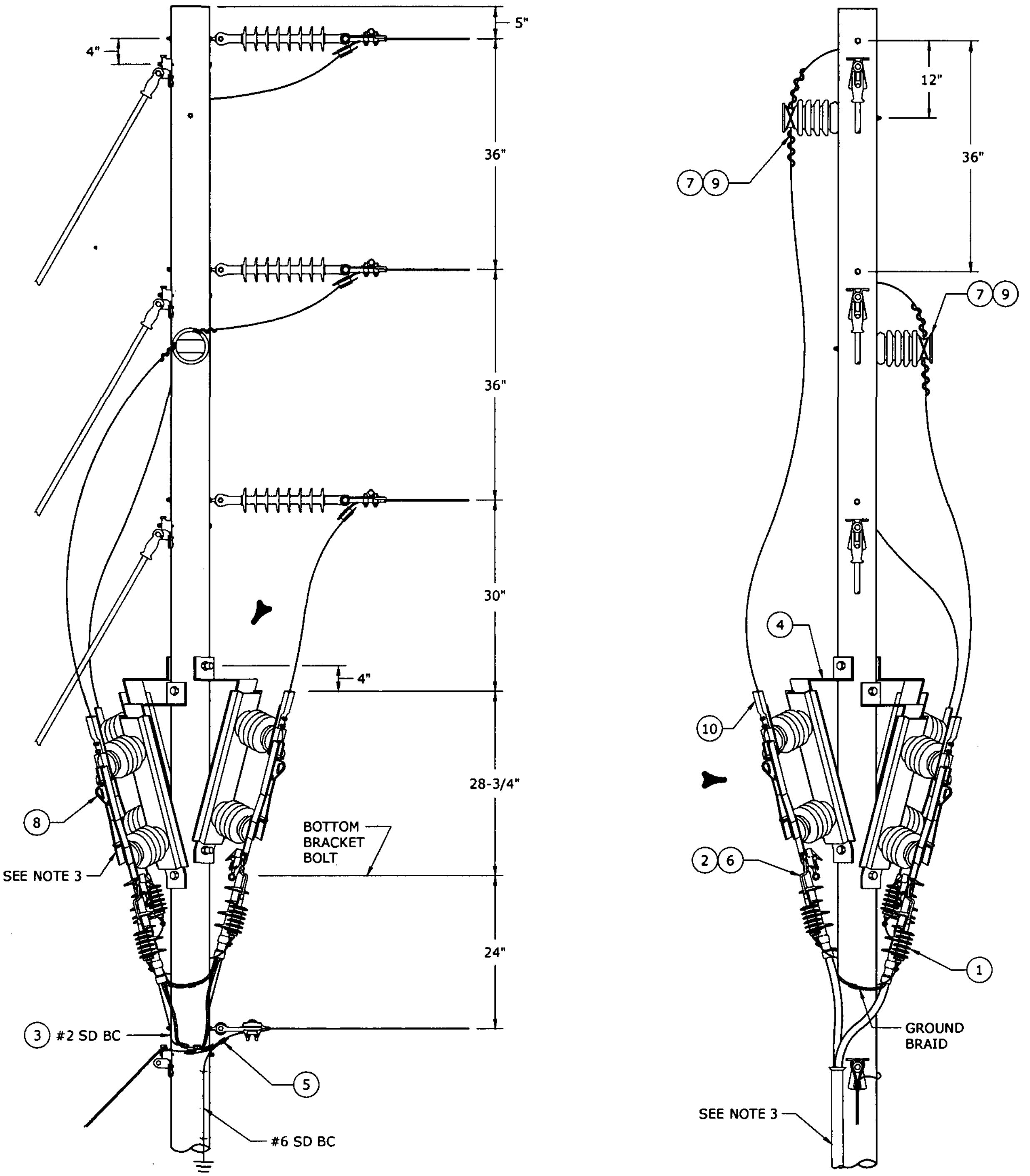
		BY	CK'D	APPR.
3	5/24/12	DANNA	BURLISON	ELKINS
2	11/10/11	ROBESON	BURLISON	ELKINS
1	4/20/11	BURLISON	BURLISON	ELKINS
0	10/26/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

200 AMP TERMINAL POLE, CABLE RISER ASSEMBLY

Progress Energy

FLA

DWG. 21.07-06



SIDE VIEW

FRONT VIEW

NOTES:

1. SEE DWG. 21.08-01B FOR BILL OF MATERIALS AND TERMINATOR CONNECTION DETAIL.

2. USE GROUND BRAIDS FOR NEUTRAL AND CROSS BONDING CONNECTIONS.

3. IT IS ACCEPTABLE TO LOCATE SWITCH AND UGUARD ON OTHER SIDE OF GUYS IF NECESSARY. LOCATING UGUARD AWAY FROM TRAFFIC IS PREFERRED.

3				
2	12/22/11	BURLISON	BURLISON	ELKINS
1	7/13/11	DANNA	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

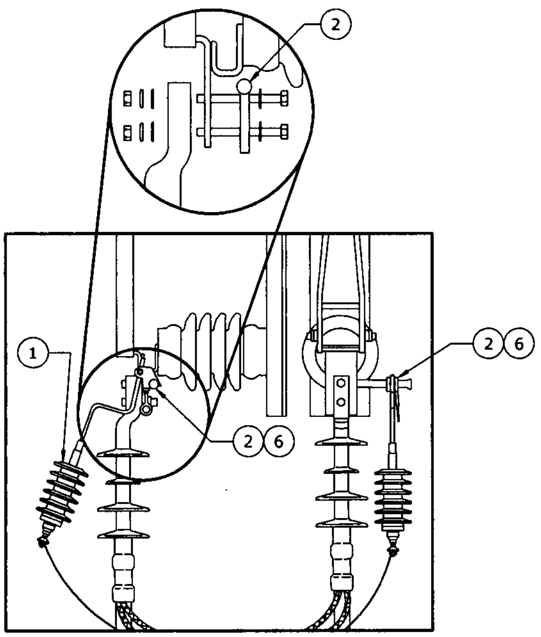
TERMINAL POLE, 600 AMP SWITCH ASSEMBLY

Duke Energy®

FLA

DWG. 21.08-01A

BILL OF MATERIALS				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
S600TPFM	1	ARUGTP10F	3	ARRESTER, 10KV
	2	KLC2H1KUF	3	2-HOLE LUG
	3	GUFTPE2F	1	#2 SD BC
	4	BKTSBDSWSTLF	3	BRACKET, MOUNTING
	5	KH10N2ALF	3	CONNECTOR, COMP, AL
	6	KH10N2F	3	CLAMP, HOT LINE
	7	HTIEN4AACF	2	HAND TIE, #4 AL
	8	SW1S6SBDF	3	SWITCH, DISCONNECT, SOLID BLADE, 15KV, 600A, 1 PH
	9	IHPTT15F	2	INSULATOR, POST, TIE TOP
	10	KLC2H_F	3	COMP LUG, 2-HOLE (VARIES WITH WIRE SIZE)
	11	ISSTUDBOLT5812F	2	STUD BOLT, 5/8" X 12"



NOTES:

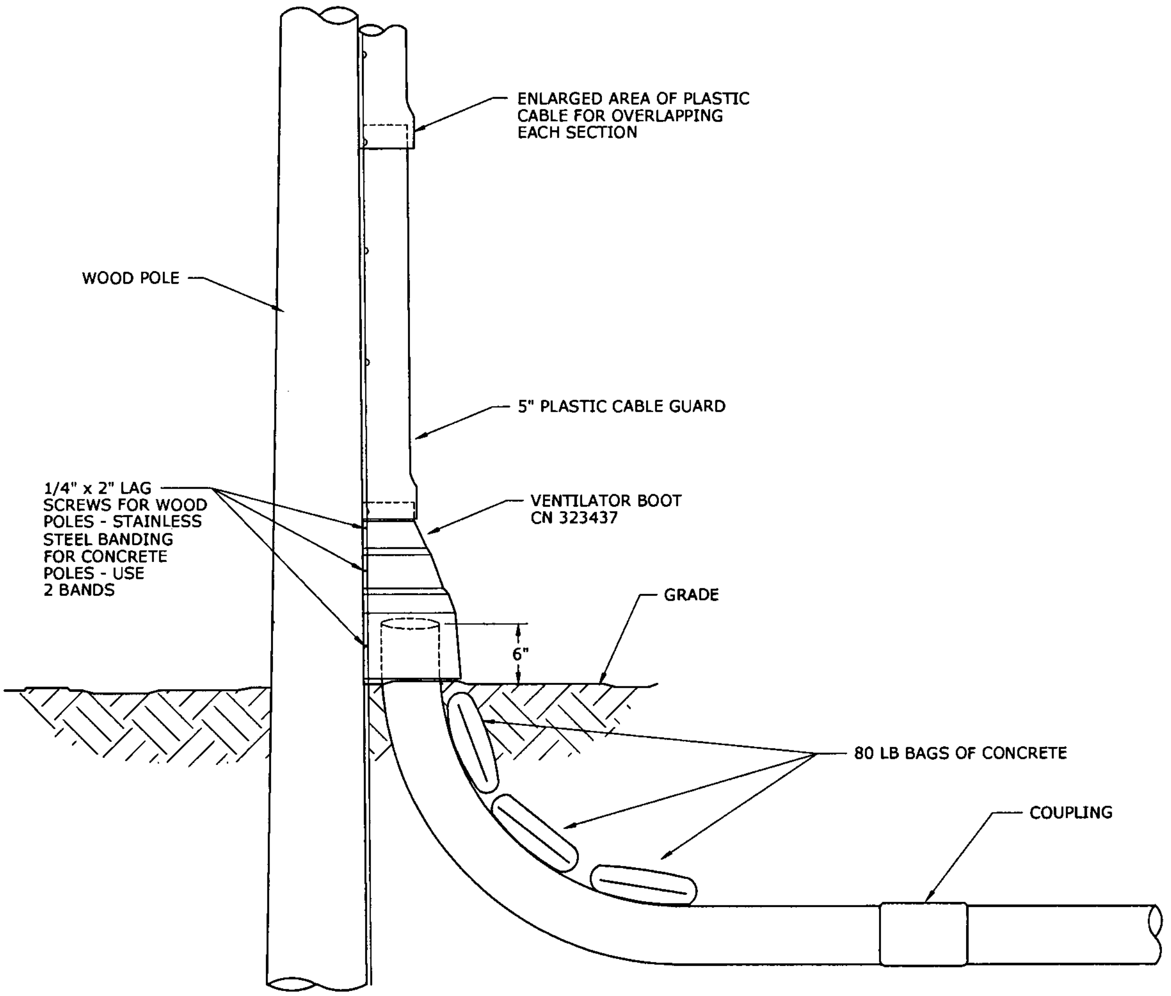
1. SEE DWG. 21.08-01A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	4/20/11	DANNA	BURLISON	ELKINS
0	8/10/10	DANNA	GUINN	ELKINS

TERMINAL POLE, 600 AMP SWITCH ASSEMBLY

Duke Energy

FLA DWG. 21.08-01B



NOTES:

1. INSTALL BACKING PLATE BELOW CONDUIT IF REQUIRED
2. INSTALL VENTILATOR CABLE BOOT FLUSH WITH GRADE.
3. INSTALL CABLE GUARD (ENLARGED END) OVER TOP OF VENTILATOR BOOT

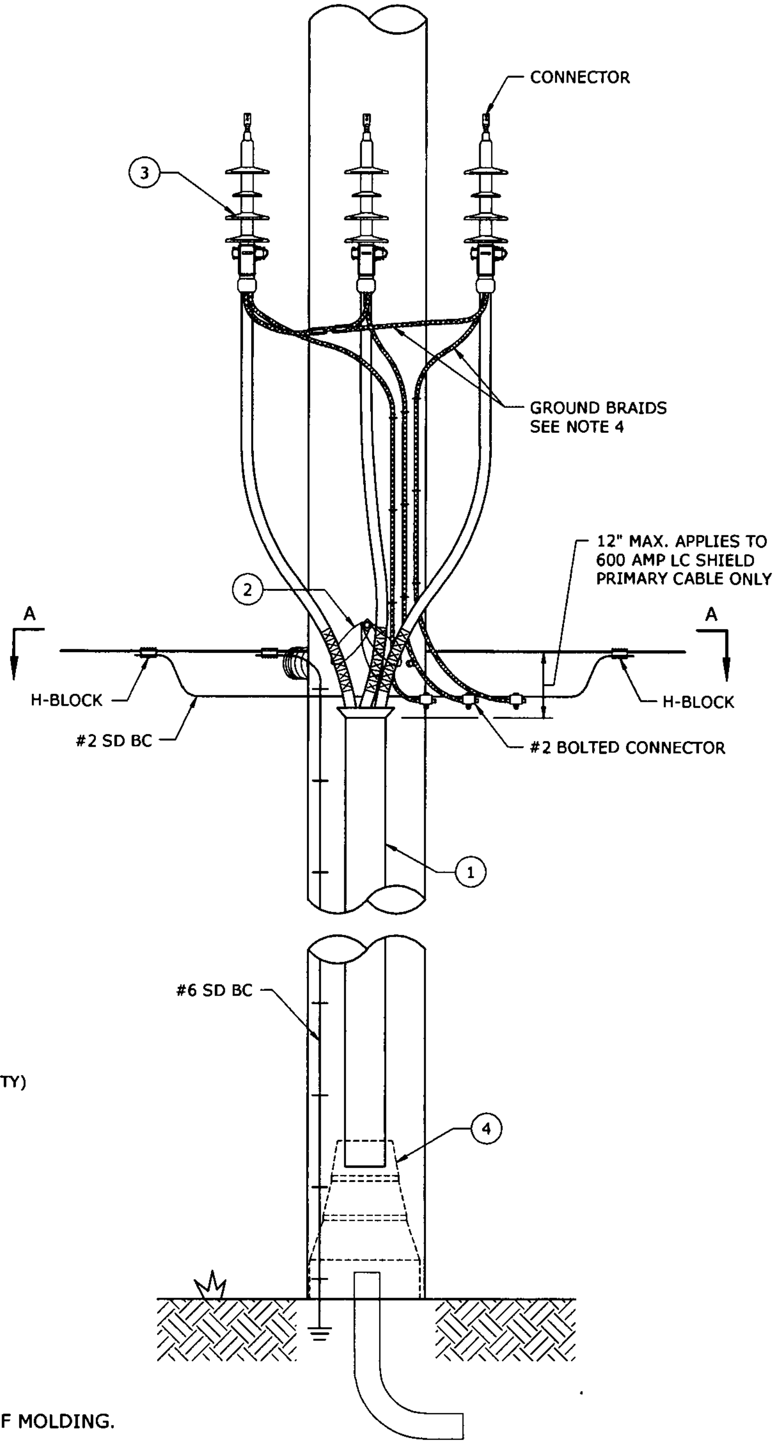
	REVISED	BY	CK'D	APPR.
3				
2				
1				
0	10/26/10	DANNA	GUINN	ELKINS

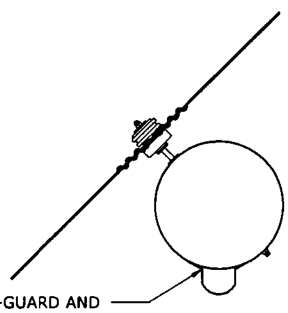
VENTILATOR BOOT INSTALLATION,
ALL 500 AND 1000 KCM PRIMARY RISERS

Duke Energy®

FLA

DWG. 21.08-03





SECTION A-A
(GROUNDING NOT SHOWN FOR CLARITY)

NOTES:

1. INSTALL LAG SCREWS IN EACH HOLE OF MOLDING.
2. SEE DWG. 21.08-08 FOR FAULT INDICATOR DETAILS.
3. SEE DWG. 21.08-07B FOR BILL OF MATERIALS.
4. WHEN INSTALLED PROPERLY, THE LC SHIELD GROUND BRAID HAS TWO LEADS. USE ONE TO DO THE CROSS BOND AND THE OTHER TO CONNECT TO THE NEUTRAL.
5. ON CONCRETE POLES, INSTALL 3 S.S. BANDS PER 10' SECTION OF CABLE GUARD.

3				
2				
1				
0	4/11/11	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

600 AMP TERMINAL POLE, CABLE RISER ASSEMBLY

Duke Energy®

FLA DWG. 21.08-07A

BILL OF MATERIALS - TERMINAL POLE RISER THREE-PHASE 500MCM				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
TMP3P500FM	1	CRIS1UGPVC50WF	3	U-GUARD, 10'-5"
	2	CABGRP2X250F	3	CABLE GRIP, 2 X 2-1/2"
	3	TRM500AL615KITF	3	TERM KIT, 500 KCMIL
	4	CRISVENTBOOTF	1	VENT BOOT

BILL OF MATERIALS - TERMINAL POLE RISER THREE-PHASE 1000MCM				
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	DESCRIPTION
TMP3P1KFM	1	CRIS1UGPVC50WF	3	U-GUARD, 10'-5"
	2	CABGRP3X250F	3	CABLE GRIP, 2 X 2-1/2"
	3	TRM1KAL615KITF	3	TERM KIT, 1000 KCMIL
	4	CRISVENTBOOTF	1	VENT BOOT

NOTES:

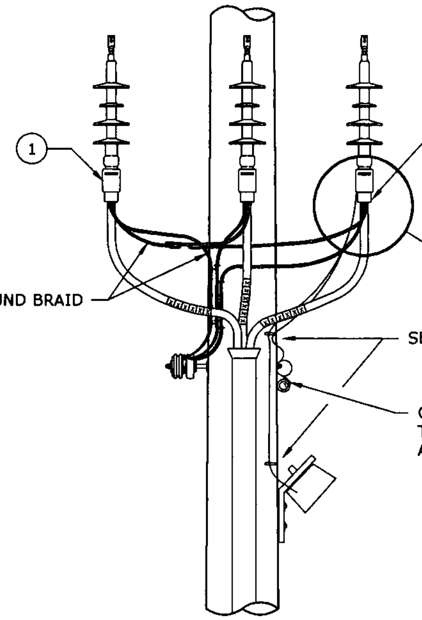
1. SEE DWG. 21.08-07B FOR BILL OF MATERIALS.
2. MATERIAL ITEMS SUCH AS CABLE GUARDS, CONNECTORS, ETC. WILL CHANGE FOR OTHER CABLE SIZES. SEE DWGS. 21.05-05A, 21.05-05B AND 26.06-10A.

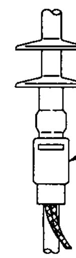
3				
2				
1				
0	4/11/11	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

600 AMP TERMINAL POLE, CABLE RISER ASSEMBLY

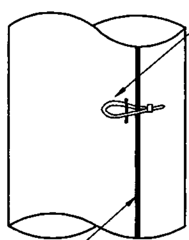
Duke Energy®

FLA DWG. 21.08-07B





DETAIL "A"



DETAIL "B"

BILL OF MATERIALS				
COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
FCIOLD12N3PFF	1	014111	2	SCREW, LAG, 1/4" X 2"
		015271	3	STAPLE, GALVANIZED, 1/4" X 1-1/2"
		070284	1	BRACKET, OH, FAULT, IND, MOUNTING
		323457	1	INDICATOR, FAULT, 3 PH, LG, DIS
		443303	3	TIE, CABLE, PLASTIC MARKER, 'ZIP'

NOTES:

1. CROSS BOND ALL 600A TERMINATORS PER DWG. 21.08-07A.

3				
2				
1				
0	4/11/11	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

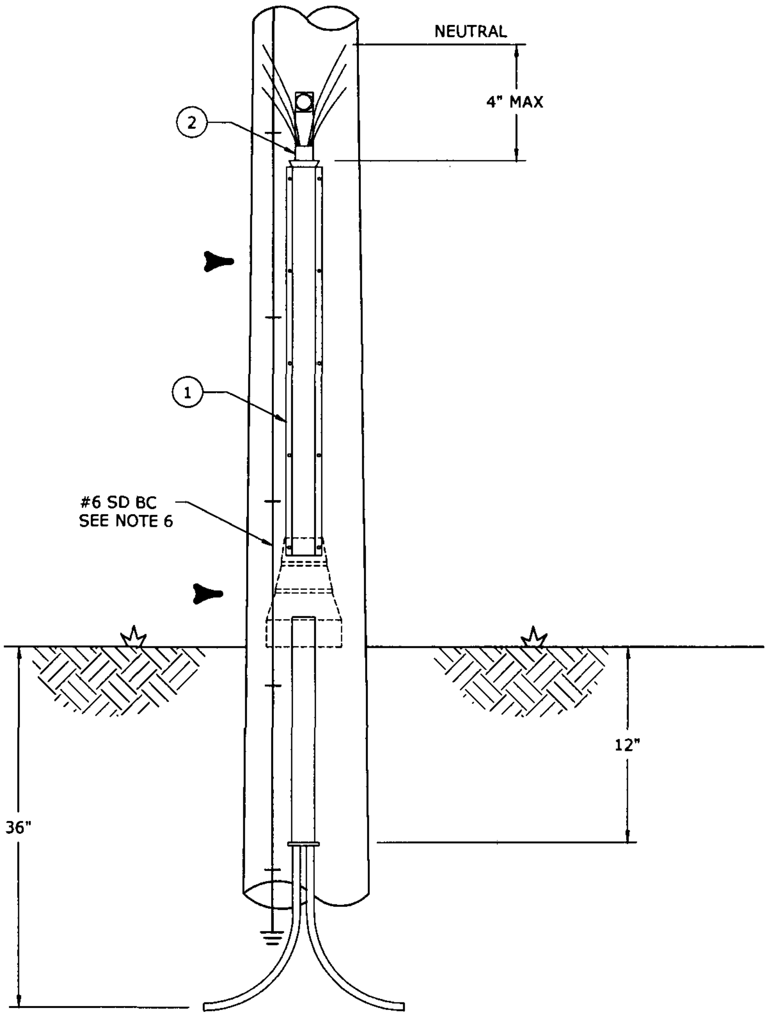
FAULTED CIRCUIT INDICATOR,

600 AMP TERMINAL POLE

Duke Energy

FLA

DWG. 21.08-08



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	CRIS1UGPVC_F	3	014111	15	SCREW, LAG, 1/4" X 2"
				-	1	GUARD, CABLE (VARIES WITH WIRE SIZE)
	2	CABGRP_F	1	-	1	GRIP, CABLE (VARIES WITH WIRE SIZE)

NOTES:

1. INSTALL LAG SCREW IN EVERY HOLE.
2. IF DIRECT BURIED CABLE, INSTALL CABLE GUARD 12" BELOW GROUND LEVEL.
3. IF CABLE IS INSTALLED IN 4" OR 6" CONDUIT, USE APPROPRIATE VENTILATOR BOOT. FOR 5" U-GUARD, USE *CU CRISVENTBOOTF, CN 323437. FOR 3" U-GUARD, USE CU CRISVENTBOOT3F, CN 9220239095.*
4. SEE DWGS. 21.05-05A AND 21.05-05B FOR GUARD AND GRIP SIZES.
5. USE APPROPRIATE H-BLOCK, BOLT-ON OR INSULINK CONNECTORS FOR SECONDARY TO SECONDARY OR SECONDARY TO TRANSFORMER CONNECTIONS. **SECONDARY PEDESTAL CONNECTORS ARE NOT APPROVED FOR THESE APPLICATIONS.**
6. INSTALL GROUND WIRE (IF REQUIRED) ON OUTSIDE OF CABLE GUARD.
7. INSTALL CABLE GUARD ON QUARTER OF POLE.
8. ON CONCRETE POLES, INSTALL 3 S.S. BANDS PER 10' SECTION OF CABLE GUARD.
9. ORIENT U-GUARD WITH BELL ENDS ON BOTTOM. WHEN INSTALLING VENTILATOR BOOT, INSTALL U-GUARD OVER THE FIRST STEP OF THE VENTILATOR BOOT.

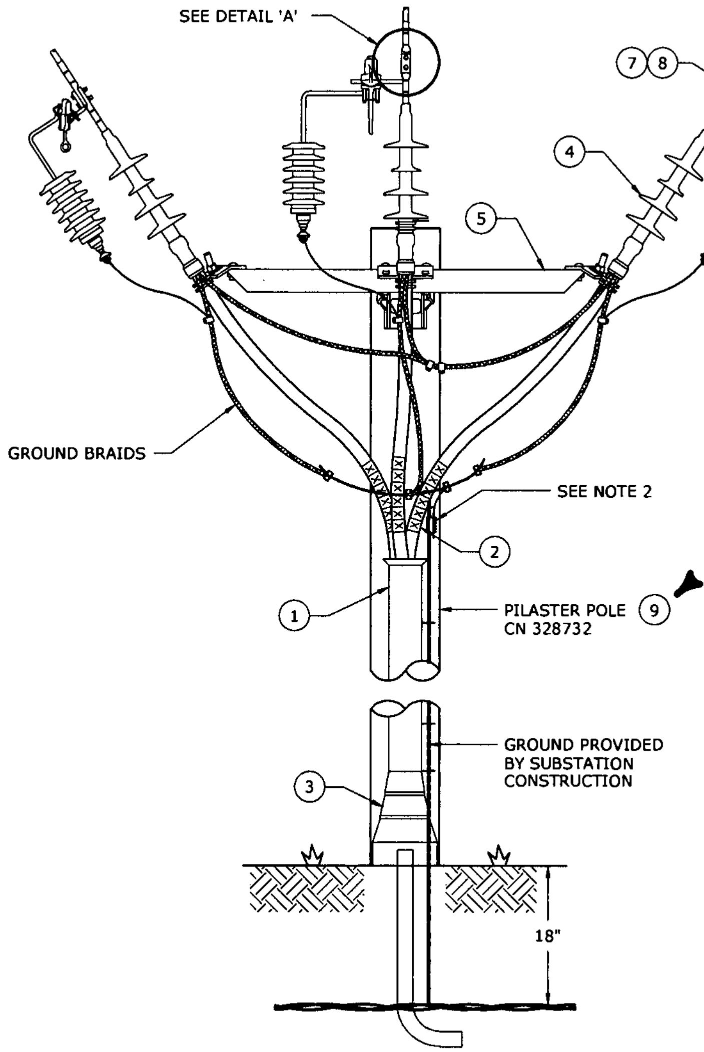
3				
2	5/24/12	DANNA	BURLISON	ELKINS
1	11/10/11	ROBESON	BURLISON	ELKINS
0	10/26/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

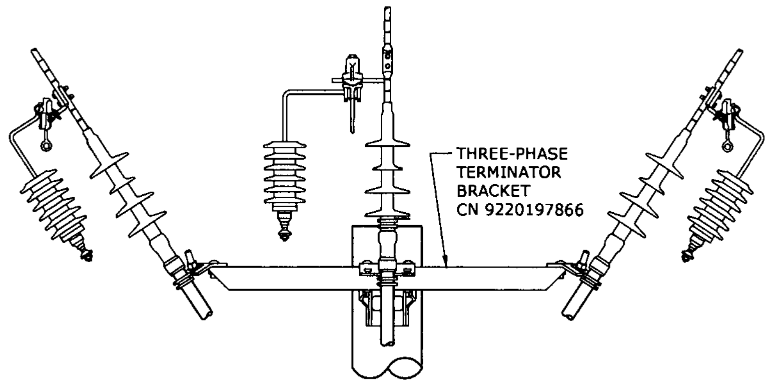
SECONDARY RISER POLE

Progress Energy

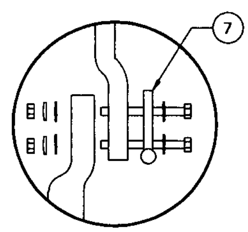
FLA

DWG. 21.09-01





CLUSTER MOUNT BRACKET DETAIL



DETAIL 'A'

NOTES:

1. SEE DWG 21.10-01B FOR BILL OF MATERIALS.
2. GROUND ON POLE PROVIDED BY SUBSTATION CONSTRUCTION.
3. BOND U-GUARD TO POLE. USE 3 BANDS ON EACH 10' U-GUARD SECTION. USE 2 BANDS ON VENTILATOR BOOT.

3				
2				
1	3/8/12	BURLISON	BURLISON	ELKINS
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TERMINAL POLE, SUBSTATION PILASTER

Progress Energy

FLA

DWG. 21.10-01A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
TMP3P1KPFM	1	CRIS1UGPVC50CF	2	-	1	CABLE GUARD, PVC, 5" X 10', CONCRETE/STEEL POLE
	2	CABGRP3X250F	3	-	1	GRIP, SINGLE EYE, 2-1/2" X 3"
	3	CRISVENTBOOTF	1	-	1	GUARD, VENT, CABLE BOOT, 4" - 5"
	4	TRM1KAL615KITF	3	-	1	TERMINATOR, 1000 KCM, 15KV
	5	BKTTMP1000KPF	1	-	1	BKT AND MISC MAT FOR PILASTER POLE TERMINATION
	6	ARUGTP10F	3	-	1	ARRESTER, LIGHTNING, RP, 10KV
	7	KLC2HUF	3	-	1	LUG, 2-HOLE, ARRESTER TYPE
	8	KLC2H79ALF	3	-	1	LUG, 2-HOLE, 795
-	9	PCC18PILASTERF	1	328732	1	PILASTER POLE

NOTES:

1. SEE DWG 21.10-01A FOR DESIGN SPECIFICATIONS.

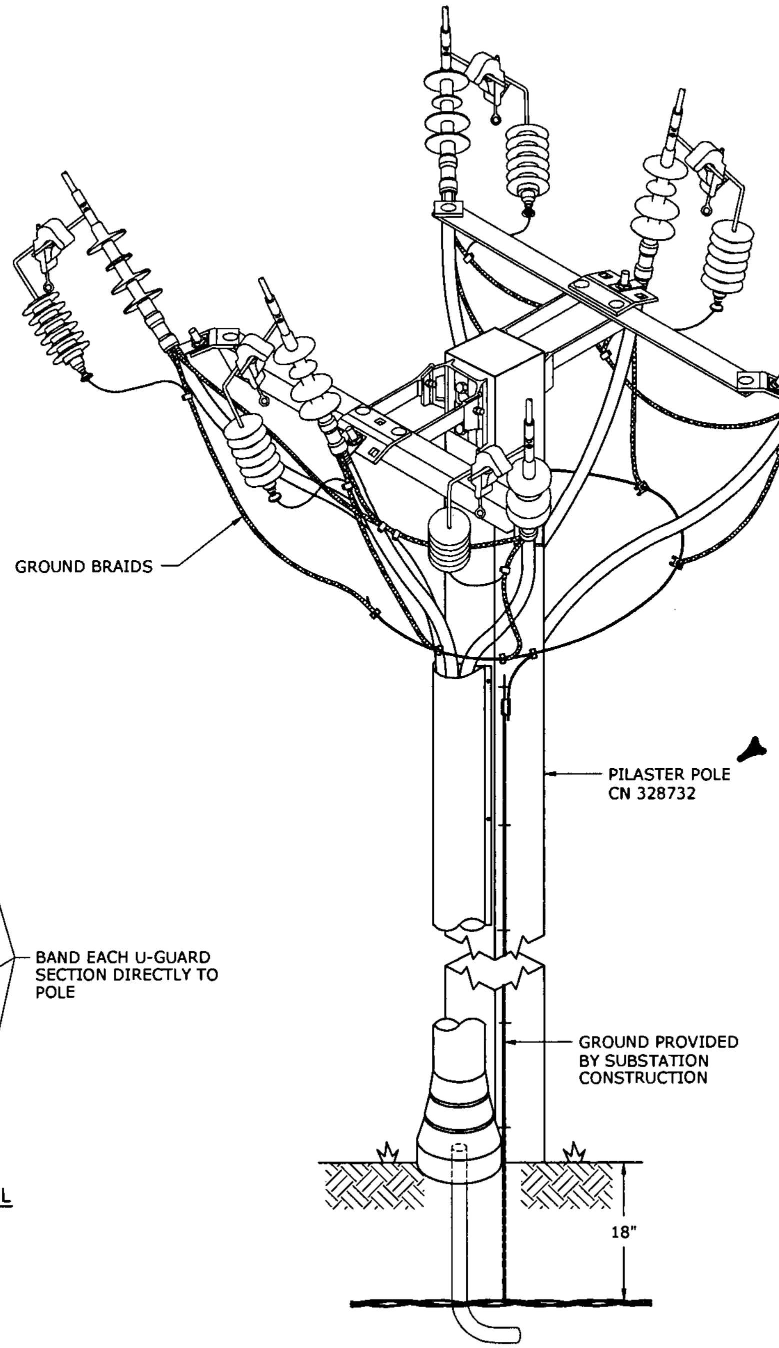
3				
2	10/5/12	BURLISON	BURLISON	ADCOCK
1	3/8/12	BURLISON	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

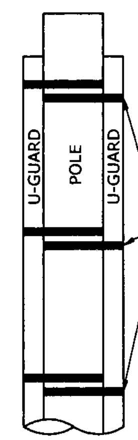
TERMINAL POLE, SUBSTATION PILASTER

Duke Energy®

FLA

DWG. 21.10-01B





BANDING DETAIL

NOTES:

1. SEE DWG. 21.01-01B FOR BILL OF MATERIAL. ORDER QUANTITY OF 2 OF MACRO UNIT.
2. BAND U-GUARD TO POLE. USE 3 BANDS ON 10' U-GUARD SECTION. USE 2 BANDS ON VENTILATOR BOOT.

3				
2				
1	3/8/12	BURLISON	BURLISON	ELKINS
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

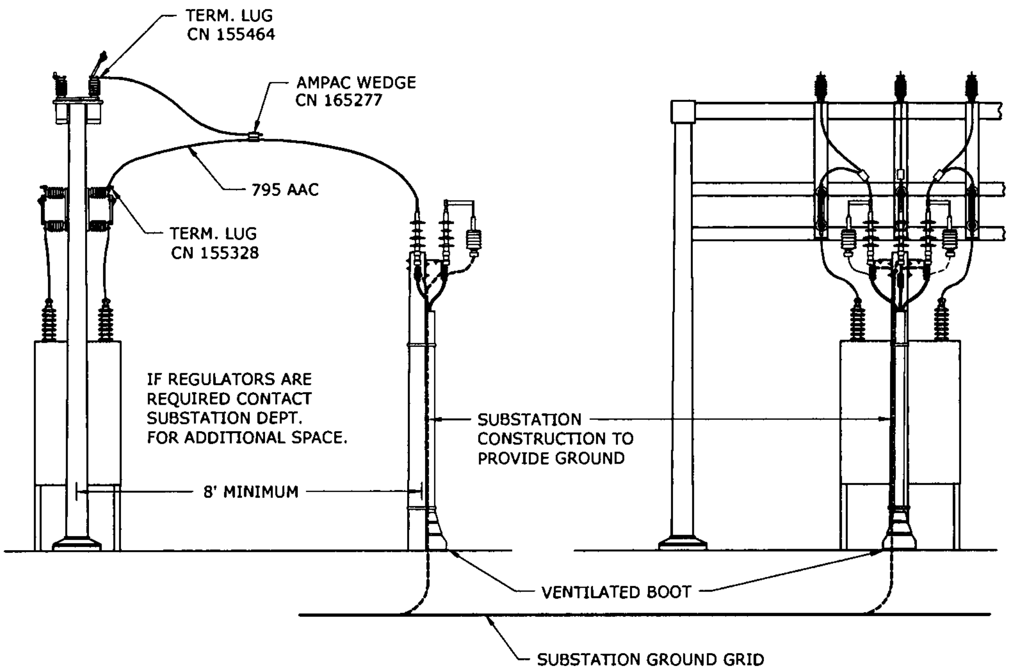
TERMINAL POLE

SUBSTATION PILASTER, DOUBLE CIRCUIT

Progress Energy

FLA

DWG. 21.10-01C



NOTES:

1. DISTRIBUTION CONSTRUCTION WILL INSTALL 795 AAC CONDUCTORS FROM UG TERMINATION TO THE CIRCUIT BREAKER LINE DISCONNECT AND TO THE BYPASS SWITCH. DISTRIBUTION CONSTRUCTION WILL ALSO MAKE CABLE NEUTRAL CONNECTION TO THE GROUND (NEUTRAL) PROVIDED BY SUBSTATION CONSTRUCTION ON THE PILASTER POLE.

2. INSTALL VENTILATED BOOT ON ALL FEEDER TERMINATIONS.

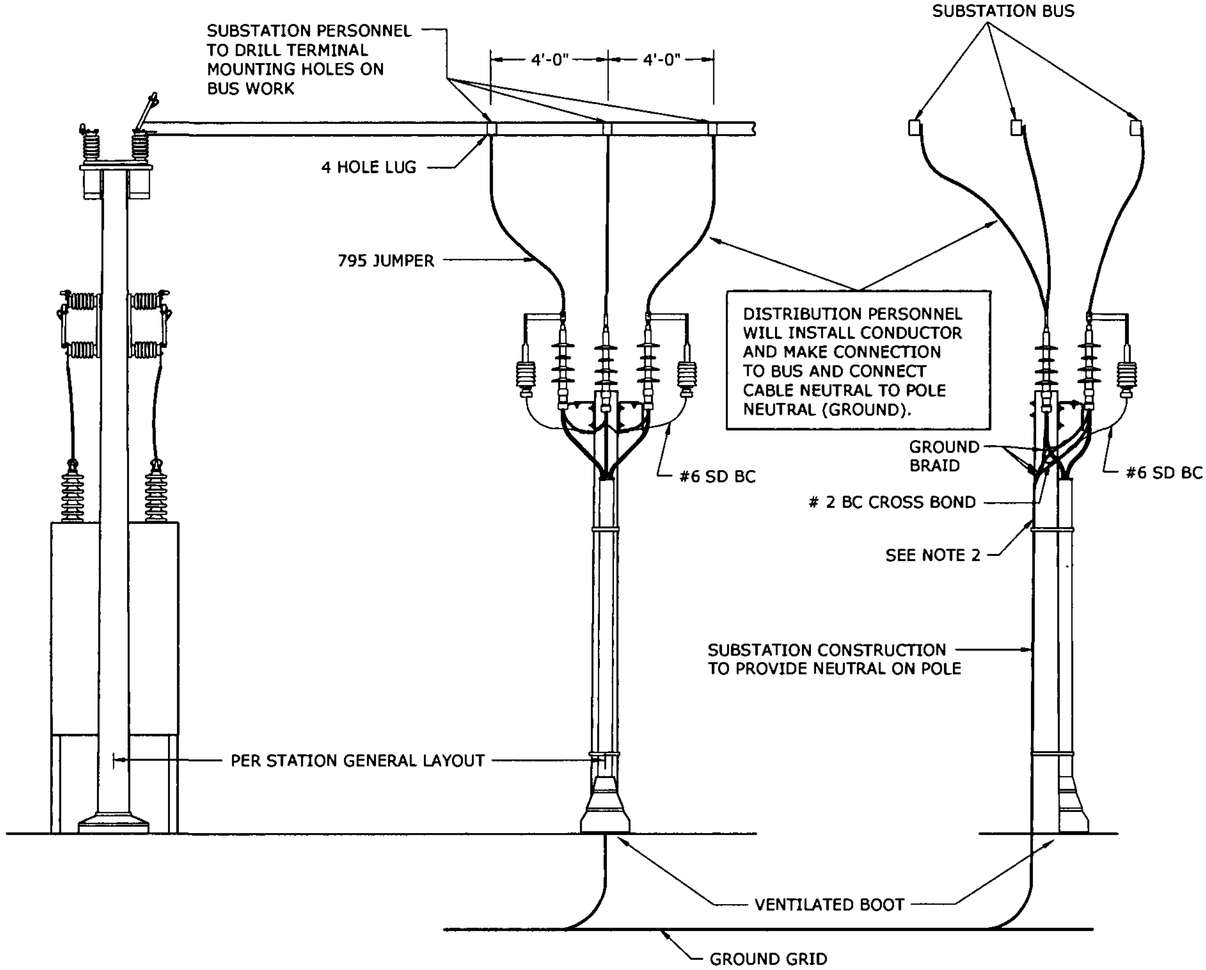
3				
2				
1				
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SUBSTATION CONNECTIONS,
STANDARD TWO-BANK SUBSTATION

Duke Energy®

FLA

DWG. 21.10-02



NOTES:

1. INSTALL VENTILATED BOOT ON ALL FEEDER TERMINATIONS.
2. CONNECT EACH INDIVIDUAL GROUNDING BRAID FROM TERMINATOR TO THE NEUTRAL.

3				
2				
1				
0	10/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SUBSTATION CONNECTIONS,
HIGH DENSITY SUBSTATION

Duke Energy®

FLA

DWG.
21.10-03

3				
2				
1	8/10/11	CECCONI	BURLISON	ELKINS
0	10/1/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 22 - TRENCHING AND CONDUIT

TABLE OF CONTENTS

Duke Energy®

FLA DWG. 22.00-00A

GENERAL

ALL SOIL THAT IS EXCAVATED WILL BE CLASSIFIED AS TYPE C.

A COMPETENT PERSON SHALL BE ON SITE DURING ALL TRENCHING AND EXCAVATING. A COMPETENT PERSON IS DEFINED IN OSHA STANDARDS 1926.650 SUBPART P.

OSHA GUIDELINES

A. SITE EXCAVATION

ALL UNDERGROUND UTILITIES THAT MIGHT INTERFERE WITH THE EXCAVATION MUST BE LOCATED PRIOR TO EXCAVATION. CALL SUNSHINE ONE (1-800-432-4770) FOR UNDERGROUND UTILITY LOCATIONS.

PROTECT EXCAVATION THAT IS ADJACENT TO BUILDINGS, WALLS, SIDEWALKS OR SPOIL PILES TO AVOID STRUCTURAL COLLAPSE OR CAVE-IN.

REMOVE OR DIVERT SURFACE WATER THROUGH THE USE OF WELL POINTS OR PUMPS.

THE EXCAVATION CONDITIONS MUST BE REEVALUATED BY A COMPETENT PERSON AFTER OR DURING EACH WEATHER CHANGE.

THE EXCAVATION SITE MUST BE EVALUATED DAILY BY A COMPETENT PERSON PRIOR TO THE START OF WORK.

GUARD EXCAVATION NEAR MOVING AND VIBRATING TRAFFIC FROM COLLISIONS, FALLS OR CAVE-INS.

IF A HAZARDOUS ATMOSPHERE COULD REASONABLY BE EXPECTED TO EXIST (i.e., PROXIMITY TO LANDFILLS OR STORAGE AREA FOR HAZARDOUS MATERIALS, EXCAVATION GREATER THAN 4', ETC.), THEN THE SITE SHALL BE TESTED BEFORE ANY EMPLOYEES ENTER THE EXCAVATION AND BE RETESTED AS OFTEN AS NECESSARY.

B. EXCAVATION RULES

HARD HATS MUST BE WORN AT ALL TIMES WHILE WORKING IN AN EXCAVATION.

BARRIER PHYSICAL PROTECTION SHALL BE PROVIDED AT ALL UNATTENDED LOCATED EXCAVATIONS. ALL UNATTENDED WELLS, PITS, SHAFTS, ETC., SHALL BE BARRICADED OR COVERED.

WHILE EXCAVATION IS OPEN, UNDERGROUND INSTALLATIONS SHALL BE PROTECTED, SUPPORTED OR REMOVED AS NECESSARY TO SAFE GUARD EMPLOYEES.

A LADDER OR RAMP IS REQUIRED EVERY 25 FEET IN EXCAVATIONS MORE THAN 4 FEET DEEP.

EMPLOYEES SHALL WEAR A HIGH-VISIBILITY TRAFFIC VEST WHEN EXPOSED TO PUBLIC VEHICULAR TRAFFIC.

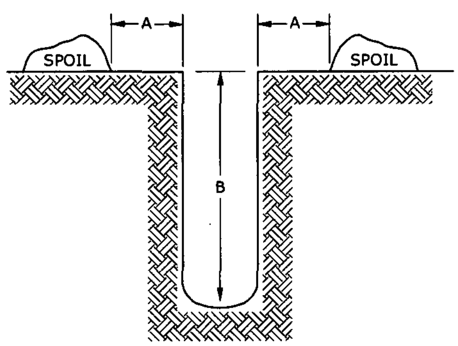
WHERE HAZARDOUS ATMOSPHERIC CONDITIONS EXISTS, EMERGENCY RESCUE EQUIPMENT, SUCH AS BREATHING APPARATUS, A SAFETY HARNESS AND LINE, OR A BASKET STRETCHER SHALL BE READILY AVAILABLE. THIS EQUIPMENT SHALL BE ATTENDED WHEN IN USE.

EMPLOYEES ENTERING MANHOLES SHALL WEAR A HARNESS WITH A LIFE-LINE SECURELY ATTACHED TO IT, SEPARATE FROM A "HAND-LINE," AND IT SHALL BE INDIVIDUALLY ATTENDED AT ALL TIMES.

EMPLOYEES SHALL NOT WORK IN EXCAVATIONS IN WHICH THERE IS ACCUMULATED WATER, OR WATER IS ACCUMULATING, UNLESS ADEQUATE PRECAUTIONS HAVE BEEN TAKEN TO PROTECT EMPLOYEES AGAINST THE HAZARDS POSED BY WATER REMOVAL EQUIPMENT, THE EQUIPMENT AND OPERATIONS SHALL BE MONITORED BY A "COMPETENT PERSON" TO ENSURE PROPER OPERATIONS.

SIDEWALKS, PAVEMENTS AND APARTMENT STRUCTURES SHALL NOT BE UNDERMINED UNLESS SUPPORTED TO PROTECT EMPLOYEES FROM POSSIBLE COLLAPSE OF SUCH STRUCTURES.

SPOIL AND OTHER MATERIALS OR EQUIPMENT SHALL BE PLACED A MINIMUM OF 2 FEET FROM THE EDGE OF AN EXCAVATION. USE OF RETAINING DEVICES TO PREVENT MATERIALS OR EQUIPMENT FROM FALLING OR ROLLING INTO EXCAVATION MAY BE NECESSARY.



TRENCHING CROSS SECTION

WHEN DIMENSION "A" IS 2 FEET OR GREATER AND DIMENSION "B" IS LESS THAN 5 FEET, SHORING WILL USUALLY NOT BE REQUIRED UNLESS THE ON-SITE COMPETENT PERSON DETERMINES THAT EXTENUATING CIRCUMSTANCES REQUIRES SHORING.

3				
2				
1				
0	9/29/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRENCHING AND EXCAVATION

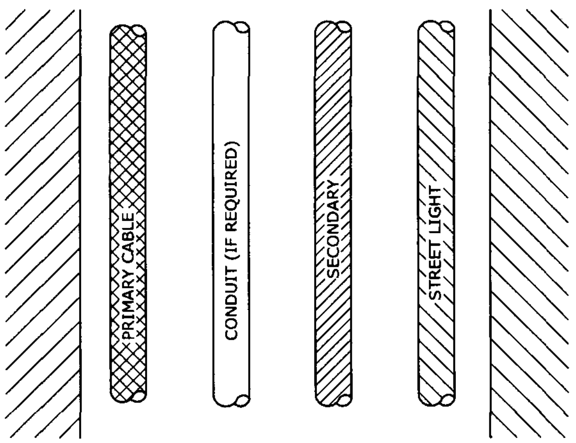
Duke Energy®

FLA DWG. 22.01-00A

TRENCHING AND EXCAVATION GUIDELINES

1. THE BOTTOM OF THE TRENCH SHOULD BE SMOOTH EARTH OR SAND.
2. WHEN INSTALLING DIRECT BURIED CABLE IN ROCK OR ROCKY SOILS, THE CABLE SHOULD BE LAID ON A PROTECTIVE LAYER OF WELL-TAMPED BACKFILL.
3. BACKFILL WITHIN 4 INCHES OF THE CABLE SHOULD BE FREE OF MATERIALS THAT MAY DAMAGE THE CABLE/CONDUIT.
4. BACKFILL SHOULD BE ADEQUATELY COMPACTED.
5. MACHINE COMPACTION SHOULD NOT BE USED WITHIN 6 INCHES OF THE CABLE.
6. ALL PRIMARY AND SECONDARY CABLES MUST HAVE APPROPRIATE IDENTIFICATION TAGS.
7. COLOR WIRE TIES ON SECONDARY CABLES ARE NOT TO BE DUPLICATED AT A TRANSFORMER LOCATION.
8. ALL CABLE ENDS MUST BE CAPPED WITH PROPER SIZE CAP. WRAPPING WITH TAPE DOES NOT PROVIDE ADEQUATE PROTECTION.
9. PVC ENDS MUST BE CAPPED.
10. ALL PVC DEADENDS BURIED WITHOUT ADJACENT CABLE (i.e. ROAD CROSSINGS) ARE TO BE MARKED WITH A POWER MARKER (WHOOPIE CUSHION). IN ADDITION, ALL BELOW GRADE PULL BOXES ARE TO BE MARKED WITH A POWER MARKER.

RECOMMENDED POSITION FOR CABLE AND CONDUIT IN TRENCH



JOINT USE TRENCH

1. NOTIFY SUNSHINE ONE LOCATING SERVICE (1-800-432-4770) PRIOR TO EXCAVATING.
2. COORDINATE WITH GAS TRANSMISSION COMPANIES PRIOR TO EXCAVATING IN VICINITY OF THEIR FACILITIES.
3. PRIMARY AND/OR SECONDARY CABLE AND CONDUIT SYSTEM MUST BE SEPARATED FROM COMMUNICATION CABLES AT LEAST 12 INCHES. NOTE: NO INTENTIONAL SEPARATION IS REQUIRED FROM COMMUNICATION CABLES IF BY MUTUAL CONSENT THE CABLES ARE BEING RANDOMLY LAID.
4. EXTREME CARE SHOULD BE USED WHEN DIGGING AROUND FIBER OPTIC.
5. "VITAL" COMMUNICATION FIBER OPTIC LINE REQUIRES CLOSE COORDINATION WITH COMMUNICATION PROVIDER PRIOR TO EXCAVATION.

RAILROAD CROSSING

1. DIRECTIONAL BORE UNDER RAILROAD TRACKS. NESC REQUIRES MINIMUM OF 60 INCHES BELOW TOP OF RAILS.

3				
2				
1				
0	9/29/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRENCHING AND EXCAVATION

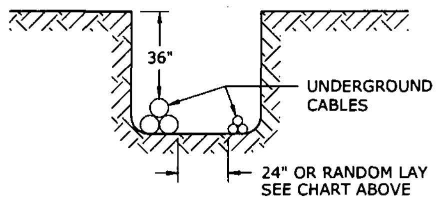
Duke Energy®

FLA DWG. 22.01-00B

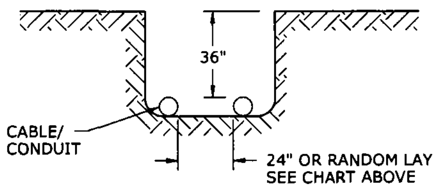
*CLEARANCE FOR PARALLEL CABLE RUNS MINIMUM HORIZONTAL CLEARANCE BETWEEN CABLE(S) OF DIFFERENT LOOPS APPLIES TO DIRECT BURIED CABLE, CONDUIT WITH CABLE INSTALLED AND CABLE INSTALLED VIA DIRECTIONAL BORE METHOD			
DIRECT BURIED CABLES	FEEDER CABLE	PRIMARY CABLE	SECONDARY OR SL CABLE
FEEDER CABLE	24"	24"	24"
PRIMARY CABLE	24"	RANDOM LAY	RANDOM LAY
SECONDARY OR SL CABLE	24"	RANDOM LAY	RANDOM LAY

*FOR FEEDER CABLES ON SAME LOOP OR PRIMARY CABLES ON SAME LOOP, CLEARANCE BETWEEN CABLES SHALL BE 36"

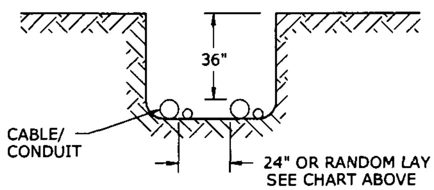
DIRECT BURIED CABLE



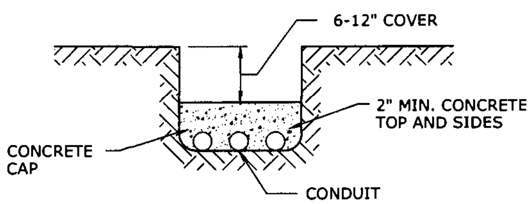
CONDUIT



CABLE WITH SPARE CONDUIT



CONDUIT CONCRETE ENCASED



NOTES:

1. SEPARATION REQUIREMENTS DO NOT APPLY TO CONDUIT SYSTEMS WITH CONCRETE ENCASEMENT AS CONSTRUCTED IN ABOVE ILLUSTRATION.

3				
2				
1				
0	9/29/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CABLE AND CONDUIT DEPTH AND SPACING - NO JOINT USERS

Duke Energy

FLA DWG. 22.01-01

THE USE OF CONDUIT DEPENDS ON APPLICATION AND FIELD CONDITIONS. CONSULT THE FOLLOWING INFORMATION WHEN MAKING A DETERMINATION FOR A PARTICULAR SITUATION. CONSULT DISTRIBUTION STANDARDS FOR QUESTIONS NOT ADDRESSED BELOW.

TRENCH

- PRIMARY CABLE (ALL SIZES) THAT IS INSTALLED VIA THE TRENCHING METHOD WILL BE DIRECT BURIED IN TRENCH
- SERVICE AND SECONDARY CABLE THAT IS INSTALLED VIA THE TRENCHING METHOD WILL BE DIRECT DIRECT BURIED IN TRENCH
- STANDARD CABLE DEPTH IS 36".

DIRECTIONAL BORE

- PRIMARY CABLE (ALL SIZES) THAT IS INSTALLED VIA THE DIRECTIONAL BORE METHOD SHOULD BE DIRECT BURIED WITHIN BORE.
- SERVICE AND SECONDARY CABLE THAT IS INSTALLED VIA THE DIRECTIONAL BORE METHOD SHOULD BE DIRECT BURIED WITHIN BORE.
- STANDARD CABLE DEPTH IS 36".

CONDUIT USAGE

FUTURE MAINTENANCE CONSIDERATIONS MAY MAKE IT NECESSARY TO INSTALL A SPARE CONDUIT. IF FUTURE REPLACEMENT OF CABLE WOULD NOT BE POSSIBLE USING TRENCHING OR DIRECTIONAL BORE METHODS, THEN A SPARE CONDUIT MUST BE INSTALLED. THE FOLLOWING IS A LIST OF FUTURE MAINTENANCE CONSIDERATIONS THAT MUST BE REVIEWED BEFORE THE DECISION IS MADE TO INSTALL A SPARE CONDUIT.

- FUTURE REPLACEMENT WOULD REQUIRE DIRECTIONAL BORING BUT THE DISTANCE OF THE BORE IS LONGER THAN THE MAXIMUM DIRECTIONAL BORE LENGTH. SOME FACTORS THAT DETERMINE MAXIMUM BORE LENGTH ARE 1) MAXIMUM FOOTAGE ON THE CABLE REEL, 2) AS A RULE OF THUMB THE BORE LIMITS ON CURRENT DIRECTIONAL BORE MACHINES USED BY PGN CONTRACTORS IS APPROXIMATELY 500 FT. FOR FUTURE BORES OVER 500 FT CONSULTATION WITH THE CONTRACTOR SHOULD TAKE PLACE. 3) EXCESSIVE CABLE PULLING TENSIONS. CABLE PULLING PROGRAM SHOULD BE USED TO DETERMINE IF MAXIMUM CABLE TENSIONS WILL BE EXCEEDED DURING CABLE PULLBACK.
- FUTURE REPLACEMENT WOULD REQUIRE DIRECTIONAL BORE BUT GREEN SPACE NEAR THE TRANSFORMERS AND OR TERMINATIONS IS LIMITED. THE DIRECTIONAL BORE METHOD REQUIRES BORE PITS TO INSTALL AND RECEIVE THE CABLE OR CONDUIT. THESE AREAS MUST BE AVAILABLE AS GREEN SPACE (NO PAVEMENT) FOR FUTURE INSTALLATION AND RECEIVING PITS (TYPICALLY A 6' X 6' AREA FOR EACH PIT). IN ADDITION, THE BORE PIT AREAS MUST BE ABLE TO ACCOMMODATE THE NECESSARY EQUIPMENT REQUIRED TO COMPLETE THE BORE (I.E.- BORING RIG, TRUCK, AND REEL TRAILER). IF UNCLEAR ABOUT FUTURE ABILITY TO BORE, PLEASE CONSULT WITH THE BORING CONTRACTOR.

SPECIAL CONDITIONS FOR CONDUIT USAGE

CERTAIN CONDITIONS MAKE IT NECESSARY TO INSTALL CABLE IN CONDUIT. THE FOLLOWING ARE EXAMPLES OF APPROVED CONDITIONS.

- PROJECT TIMING
  - CROSSINGS UNDER PAVEMENT WHERE CONDUIT MUST BE INSTALLED PRIOR TO CABLE INSTALLATION DUE TO PROJECT TIMING (EVERY EFFORT SHOULD BE MADE TO INSTALL CABLE IF TIMING AND FIELD CONDITIONS ALLOW).
- CUSTOMER REQUEST
  - PGN IS A "DIRECT BURIED" UTILITY. CUSTOMER REQUESTS FOR CONDUIT INSTALLATION SHOULD BE EVALUATED ON A CASE-BY-CASE BASIS AND WILL REQUIRE MANAGEMENT APPROVAL. THE CUSTOMER IS RESPONSIBLE FOR PAYING ALL ADDITIONAL COSTS ASSOCIATED WITH THE REQUEST (I.E.- CONDUIT, BOXES, SPLICES, PULLING LABOR, ETC.).

3				
2				
1	9/21/12	DANNA	BURLISON	ADCOCK
0	6/15/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

USE OF CONDUIT

Duke Energy

PGN DWG. 22.01-02A

- SPECIFIC REGULATIONS*
    - RAILROAD AND GAS TRANSMISSION CROSSINGS.
    - CROSSING OTHER UTILITIES WHEN CODE CLEARANCES CANNOT BE MET (SEE DWG 22.01-05).
    - REQUIRED BY DOT OR OTHER GOVERNMENTAL AGENCIES.
    - SUBSTATION EXITS TO JUST OUTSIDE OF FENCE.

- FUTURE GROWTH
    - CONDUIT FOR FUTURE PROJECT EXPANSION AND LOAD GROWTH. FOR LONGER TERM FUTURES, AN ECONOMIC ANALYSIS SHOULD BE PERFORMED TO DETERMINE BEST OPTION (I.E. INSTALL CONDUIT NOW VS. BORE IN THE FUTURE).

- SHALLOW INSTALLATIONS *
    - PRIMARY (ALL SIZES)
        - LESS THAN 30" TO 12" - SCH 40 PVC
        - LESS THAN 12" TO 6" - STEEL OR CONCRETE ENCASED PVC
    - SECONDARY (SERVICE AND LIGHTING)
        - LESS THAN 24" TO 12" - SCH 40 PVC
        - LESS THEN 12" TO 6" - STEEL OR CONCRETE ENCASED PVC

- INSTALLATIONS GREATER THAN 48" DEEP
    - PRIMARY AND SECONDARY - ALL SIZES

CERTAIN CONDITIONS MAKE IT NECESSARY TO INSTALL A SPARE CONDUIT. THE FOLLOWING ARE EXAMPLES OF APPROVED CONDITIONS.

- RADIAL PRIMARY FEEDS
    - WHEN CABLE SUPPLYING A SINGLE RADIAL FED TRANSFORMER IS UNDER PAVEMENT OR CONCRETE. CONDUIT CAN BE INSTALLED THE ENTIRE ROUTE FROM THE TERMINATION POINT TO THE TRANSFORMER IF A MAJORITY OF THE ROUTE IS UNDER PAVEMENT OR CONCRETE.
    - TRANSFORMERS ON "SHORT-TERM" RADIAL FEEDS (FUTURE LOOP) SHOULD FOLLOW THE GUIDELINES PREVIOUSLY STATED ABOVE UNDER " **CONDUIT USAGE** ".

*USE THE MOST COST EFFECTIVE DESIGN WHEN TRANSITIONING FROM "CABLE IN CONDUIT" TO "DIRECT BURIED". FOR EXAMPLE, EVALUATE THE COST OF A PULL BOX AND SPLICES VS. THE COST OF INSTALLING THE REMAINDER OF THE SPAN IN CONDUIT.

DUCT BANK

- IN HEAVILY CONGESTED URBAN AREAS, INSTALL CABLE IN DUCT BANK; DEFINED AS HAVING INADEQUATE WIDTH (SEE DWG. 22.01-05) FOR SEPARATION BETWEEN OUR FACILITIES AND FACILITIES OF OTHERS (CABLE, PHONE, GAS, ETC.). CONDUIT WOULD TYPICALLY BE STACKED IN DUCT BANK ARRANGEMENT.

PULL BOXES

PULL BOXES SHOULD BE INSTALLED AS NEEDED TO HOUSE CABLE SPLICES IN CABLE IN CONDUIT INSTALLATIONS. PULL BOXES SHOULD BE INSTALLED WHEN:

- IT HAS BEEN DETERMINED THAT THE MAXIMUM CABLE PULLING LENGTHS FOR CABLES IN CONDUIT HAVE BEEN EXCEEDED.
- A JUNCTION IS REQUIRED PER SPECIFIC DESIGN CONSIDERATIONS.

THE RE-REELING PROCESS

- PURCHASE 1000 OR 500 KCMIL 15 KV CABLE ON LARGE REEL.
- INSTALL CONDUIT.
- MEASURE CONDUIT.
- TRANSFER THE PROPER LENGTH OF ALL THREE PHASES FOR THE PULL TO A SEGMENTED REEL.
- INSTALL THE CABLE IN CONDUIT.

BACKFILL

THE NESC (SECTIONS 32 AND 35) REQUIRES CLEAN BACKFILL NEXT TO CONDUIT OR A DIRECT BURIED CABLE. THE LACK OF CLEAN BACKFILL IS NOT A REASON TO INSTALL CABLE IN CONDUIT.

FROM SUBSECTION 321 A AND B

A. "THE BOTTOM OF THE TRENCH SHOULD BE UNDISTURBED, TAMPED, OR RELATIVELY SMOOTH EARTH. WHERE THE EXCAVATION IS IN ROCK, THE CONDUIT SHOULD BE LAID ON A PROTECTIVE LAYER OF CLEAN TAMPED BACKFILL."

B. "BACKFILL WITHIN 150 MM (6 IN) OF THE CONDUIT SHOULD BE FREE OF SOLID MATERIAL GREATER THAN 100 MM (4 IN) IN MAXIMUM DIMENSION OR WITH SHARP EDGES LIKELY TO DAMAGE IT. THE BALANCE OF BACKFILL SHOULD BE FREE OF SOLID MATERIAL GREATER THAN 200 MM (6 IN) IN MAXIMUM DIMENSION. BACFKILL MATERIAL SHOULD BE ADEQUATELY COMPACTED."

FROM SUBSECTION 352 A

A. "THE BOTTOM OF THE TRENCH RECEIVING DIRECT-BURIED CABLE SHOULD BE RELATIVELY SMOOTH UNDISTURBED EARTH, WELL-TAMPED EARTH OR SAND. WHEN EXCAVATION IS IN ROCK OR ROCKY SOILS, THE CABLE SHOULD BE LAID ON A PROTECTIVE LAYER OF WELL-TAMPED BACKFILL. BACKFILL WITHIN 100 MM (4 IN) OF THE CABLE SHOULD BE FREE OF MATERIALS THAT MAY DAMAGE THE CABLE. BACKFILL SHOULD BE ADEQUATELY COMPACTED. MACHINE COMPACTION SHOULD NOT BE USED WITH 150 MM (6 IN) OF THE CABLE."

3				
2				
1				
0	6/15/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

USE OF CONDUIT

Duke Energy

PGN DWG. 22.01-02C

CONDUIT USE BY TYPE

CURRENTLY, TWO TYPES OF PVC CONDUIT FOR ELECTRIC POWER CONDUCTORS AND CABLES ARE USED: SCHEDULE 40 AND CELLULAR CORE. THESE TWO TYPES ARE TYPICALLY USED BY DIRECT BURIED PVC APPLICATIONS.

CONDUIT IS REQUIRED TO MEET CERTAIN INDUSTRY STANDARDS FOR STRENGTH, DIMENSIONAL COMPATIBILITY, UV RESISTANCE, AND TEMPERATURE.

SCHEDULE 40
- NEMA TC-2
- UL 651

CELLULAR CORE
- ASTM F891
- ASTM F512-89a

CELLULAR CORE CONDUIT HAS A SEPARATE SET OF STANDARDS UNDER WHICH IT IS MANUFACTURED BUT WE REQUIRE THE CONDUIT TO MEET SCHEDULE 40 STRENGTH AND TEMPERATURE REQUIREMENTS. IT IS THEREFORE EQUIVALENT IN APPLICATION TO SCHEDULE 40 AND WILL BE STOCKED IN CERTAIN SIZES UNDER THE SCHEDULE 40 CATALOG NUMBERS.

BOREGUARD SCH. 40 6" PVC CONDUIT IS USED FOR TYPICAL DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE IS NOT REQUIRED BY THE PERMITTING AUTHORITY.

CURRENTLY, TWO TYPES OF HDPE CONDUIT FOR ELECTRIC POWER CONDUCTORS AND CABLES ARE USED: SDR 13.5 AND SDR 11. SIZES AND TYPES ARE LISTED BELOW:

- 7" SDR 13.5, FUSED PIPE. INSIDE DIAMETER 6", CN 9220120565
  WALL THICKNESS 0.528"
  USED FOR DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE IS REQUIRED BY PERMITTING AUTHORITY (DOT)

- 2" SDR 135, COIL PIPE INSIDE DIA. 2.047", CN 370152 USED FOR DIRECTIONAL BORE PROJECTS.

- 4" SDR 135, COIL PIPE INSIDE DIA. 3.793", CN 370156 USED FOR DIRECTIONAL BORE PROJECTS.

- 7" SDR 11, FUSED PIPE. INSIDE DIAMETER 5.74", CN 9220244901
  WALL THICKNESS 0.647"
  USED FOR DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE AND SDR 11 GRADE IS REQUIRED BY PERMITTING AUTHORITY (RR)

3				
2	10/12/12	DANNA	BURLISON	ADCOCK
1	9/21/12	DANNA	BURLISON	ADCOCK
0	9/29/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

USE OF CONDUIT

Duke Energy

FLA DWG. 22.01-02D

I. RECOMMENDED MAXIMUM FILL OF CONDUIT AS % OF CROSS-SECTIONAL AREA			
	NUMBER OF CABLES		
	1	2	3
NEW CONSTRUCTION	53%	31%	40%

II. CONDUIT DIMENSIONS							
	RIGID STEEL		PVC SCHED 40		POLYETHYLENE		
SIZE (IN.)	MIN. INSIDE DIA. (IN.)	CROSS SECT. AREA (SQ. IN.)	MIN. INSIDE DIA. (IN.)	CROSS SECT. AREA (SQ. IN.)	MIN. INSIDE DIA. (IN.)	CROSS SECT. AREA (SQ. IN.)	TYPE
3/4"	-	-	-	-	0.772	0.468	SDR 13.5
1"	1.05	0.86	1.004	0.792	-	-	-
1-1/2"	-	-	1.564	1.921	1.618	2.056	SDR 13.5
2	2.07	3.36	2.021	3.208	2.023	3.214	SDR 13.5
2-1/2"	2.47	4.79	2.414	4.577	2.417	4.588	SDR 13.5
3"	3.07	7.38	3.008	7.106	-	-	-
4"	4.03	12.72	3.961	12.323	3.840	11.581	SDR 13.5
5"	5.05	20.00	4.975	19.439	-	-	-
6"	6.07	28.89	5.986	28.143	-	-	-
7"	-	-	-	-	6.006	28.331	SDR 13.5

III. CONDUIT SIZE FOR PRIMARY						
JACKETED CABLE	PVC OR STEEL			POLYETHYLENE		
	1 CABLE	2 CABLES	3 CABLES	1 CABLE	2 CABLES	3 CABLES
1000 KCMIL AL, 15 KV, 175 MIL	-	-	6"	4"	-	7"
500 KCMIL AL, 15 KV, 175 MIL	-	-	6"	-	-	7"
#4/0 CU, 15 KV, 175 MIL	-	-	4"	-	-	7"
#1/0 AL, 15 KV, 175 MIL	2"	4"	4"	2"	4"	4"
#1/0 AL, 25 KV, 260 MIL	2"	4"	4"	2"	4"	4"

IV. CONDUIT SIZE FOR SECONDARY, SERVICE AND LIGHTING				
CABLE	PVC OR STEEL		POLYETHYLENE	
	1 CIRCUIT	2 CIRCUITS (PARALLEL SERVICES ONLY)	1 CIRCUIT	2 CIRCUITS (PARALLEL SERVICES ONLY)
2 #10 CU LIGHTING CABLE	1-1/2"	-	2"	-
3 #10 CU LIGHTING CABLE	-	-	2"	-
2 #6 AL LIGHTING CABLE	1-1/2"	-	2"	-
3 #6 AL LIGHTING CABLE	-	-	2"	-
#2 TPX	1-1/2"	-	2"	-
#2/0 TPX	2"	-	2"	-
#4/0 TPX	2"	4"	2"	4"
350 TPX	2-1/2"	4"	4"	4"
500 TPX	4"	-	4"	-
750 TPX	4"	-	4"	-
#4/0 QPX	4"	4"	4"	4"
350 QPX	4"	-	4"	-
500 QPX	4"	-	4"	-
750 QPX	4"	-	7"	-

NOTES:

1. WHEN THREE NON-TRIPLEXED (PARALLEL) CABLES ARE PULLED INTO CONDUIT, THE CONDUIT MUST BE LESS THAN OR GREATER THAN THREE TIMES THE DIAMETER OF ONE CABLE BECAUSE THE CENTER CABLE MAY WEDGE BETWEEN THE OTHER TWO AND JAM, ESPECIALLY AROUND BENDS IN THE CONDUIT. CABLE PULLING PROGRAMS WILL PROVIDE INFORMATION ON THE POSSIBILITY OF JAMMING BASED ON THE CONDUIT DIAMETER SELECTED.

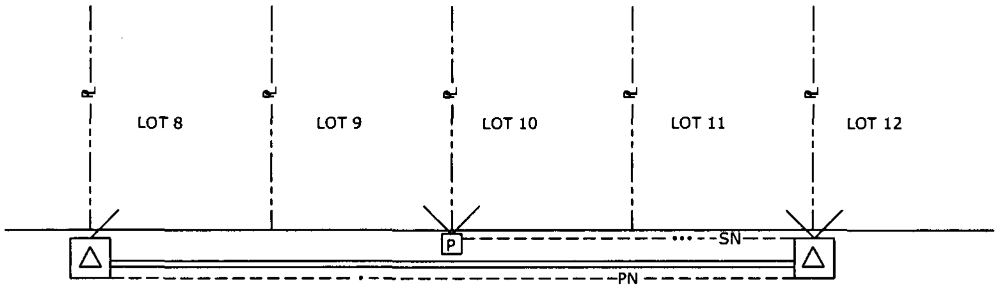
3				
2				
1				
0	9/29/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

RECOMMENDED CONDUIT FILL

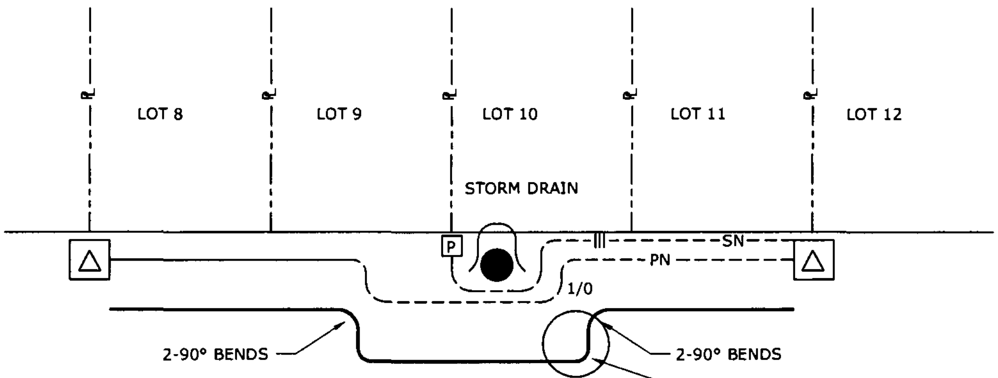
Duke Energy®

FLA

DWG. 22.01-03



WORK ORDER DRAWING



UNACCEPTABLE FIELD CHANGE

NOTES:

1. MAKING FIELD CHANGES FOR ROUTING CONDUIT AROUND PREVIOUSLY UNKNOWN OBSTACLES IS NOT AUTOMATICALLY APPROVED. THE ADDITION OF NON-APPROVED BENDS CAN INCREASE THE DIFFICULTY OF CABLE PULLING AND MAY EVEN MAKE THE PULL IMPOSSIBLE.

2. ANY DEVIATIONS FROM THE ORIGINAL DRAWINGS SHOULD BE ROUTED THROUGH ENGINEERING FOR APPROVAL PRIOR TO INSTALLATION OF FACILITIES.

3					ROUTING CONDUITS AROUND OBSTACLES	Duke Energy®	
2							
1							
0	9/29/10	DANNA	GUINN	ELKINS		FLA	DWG. 22.01-04
REVISED		BY	CK'D	APPR.			

3				
2				
1				
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 33 - FLOODING AND
STORM SURGE REQUIREMENTS
TABLE OF CONTENTS

Duke Energy®

FLA DWG. 33.00-00A

FLOODING AND STORM SURGE REQUIREMENTS FOR FLORIDA

THE FLORIDA PSC HAS MANDATED WHERE PRUDENT AND COST EFFECTIVE, THAT UNDERGROUND FACILITIES ARE DESIGNED TO MITIGATE DAMAGE DUE TO FLOODING AND STORM SURGES.

IT IS ASSET MANAGEMENT'S RESPONSIBILITY TO DETERMINE APPLICABILITY OF FLOODING AND STORM SURGE STANDARDS ON ALL NEW CONSTRUCTION, MAJOR PLANNED WORK, INCLUDING EXPANSIONS, REBUILD OR RELOCATION OF EXISTING FACILITIES AND TARGETED CRITICAL INFRASTRUCTURE FACILITIES AND MAJOR THOROUGHFARES.

PAD-MOUNTED TRANSFORMERS INSTALLED WITHIN 1000' OF ANY SALTWATER, SALTWATER MARSH OR AREAS SUBJECT TO SEVERE SALT FOG, SEVERE CORROSION, EROSION FROM WIND-BLOWN SANDY SOILS OR HIGH VELOCITY WINDS SHOULD BE CONSTRUCTED FROM 304L STAINLESS STEEL EXTERNALLY (NON-STANDARD). SEE DWG. 12.08-12 FOR A LISTING OF THESE TRANSFORMERS.

3				
2				
1				
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

FLOODING AND STORM SURGE REQUIREMENTS FOR FLORIDA

Duke Energy®

FLA

DWG. 33.01-00

FLOODING AND STORM SURGE HARDWARE REQUIREMENTS

- SINGLE-PHASE TRANSFORMER BOX PAD, SEE DWG. 33.03-01.
- SUBMERSIBLE SECONDARY SET SCREW CONNECTORS. FOR SINGLE-PHASE PAD-MOUNTED TRANSFORMERS, SEE DWGS. 33.06-01 AND 33.06-02.
- STAINLESS STEEL PAD-MOUNTED TRANSFORMERS, SEE DWG. 12.08-12. (ONLY IF WITHIN 1000 FT. OF SALTWATER OR SALTWATER MARSH).
- ABOVE GROUND PEDESTALS WITH SINGLE SET SCREW, SUBMERSIBLE CONNECTORS, SEE DWGS. 25.02-02B AND AND 25.04-06.
- SUBMERSIBLE SWITCHGEAR:

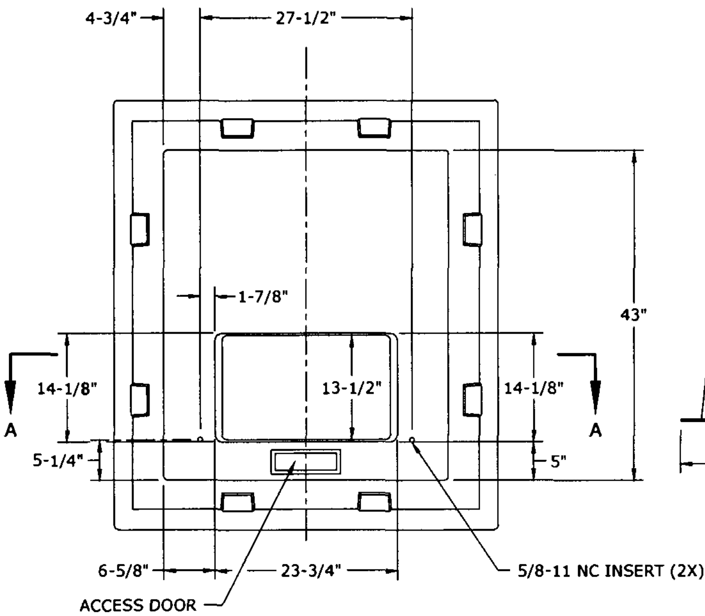
  TRAYER OIL FILLED 600 AMP LOADBREAK, 200 AMP CURRENT LIMITING FUSE. SEE DWGS. 28.06-01 AND AND 28.06-03.

  NOTE: TRAYER FOOTPRINT MATCHES S&C PMH GEAR FOR RETROFIT APPLICATIONS.

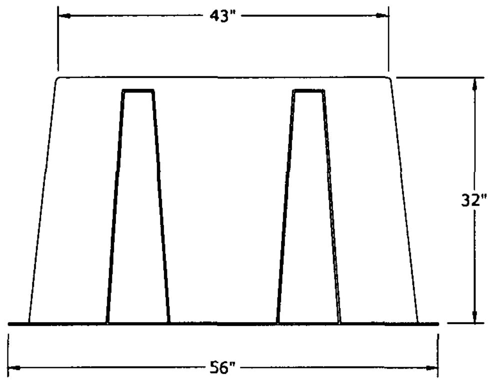
  OR

  VISTA NEXT GENERATION SWITCHGEAR, 600 AMP LOAD BREAK, 200 AMP ARC SPINNER INTERRUPTER SEE DWG. 28.03-07.
- COLD SHRINK FOR 200 AMP LOAD BREAK ELBOW, SEE DWGS. 33.05-05 THROUGH 33.05-11.

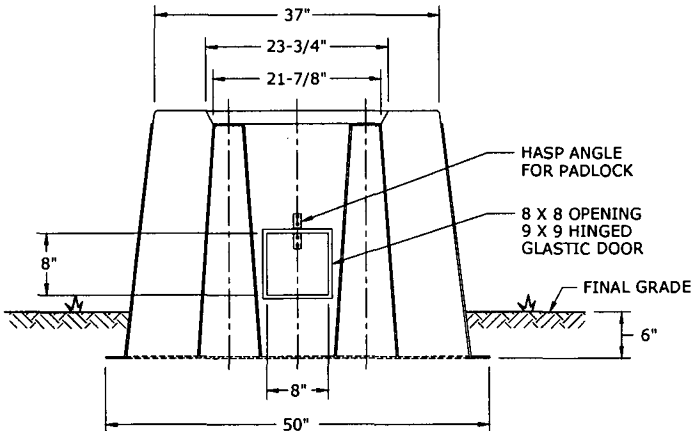
3					FLOODING AND STORM SURGE HARDWARE REQUIREMENTS	Duke Energy
2						
1						
0	8/10/10	DANNA	GUINN	ELKINS		FLA DWG. 33.01-02
REVISED		BY	CK'D	APPR.		



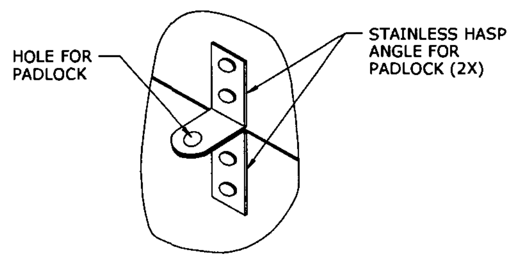
PLAN VIEW



SIDE VIEW



SECTION AA



PADLOCK HASP DETAIL

CU PADTMT37X43FBCF
CN 9220148379

MATERIAL: FIBERGLSS REINFORCED POLYMER
WITH MUNSELL GREEN #7GY3.29/1.5

MAXIMUM EQUIPMENT WEIGHT: 2,000 LBS. (167KVA)

NOTES:

1. FOR USE AS TRANSFORMER MOUNTING BOX IN AREAS WHERE STANDING WATER DUE TO FLOODING AND STORM SURGE WILL BE PRESENT OVER AN EXTENDED PERIOD OF TIME.
2. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE BOX PAD IS INSTALLED.
3. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
4. MAINTAIN CLEARANCES PER DWG. 27.06-05.
5. SOD MAY BE REQUIRED AROUND BOX PAD TO PREVENT SOIL EROSION.

3				
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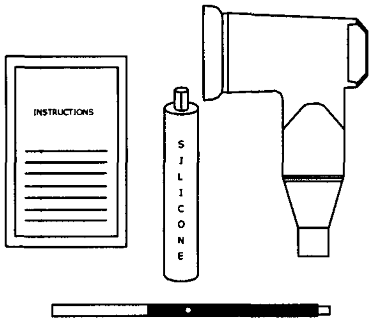
1	6/26/12	DANNA	BURLISON	ELKINS
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE TRANSFORMER
BOX PAD

Progress Energy

FLA

DWG.
33.03-01



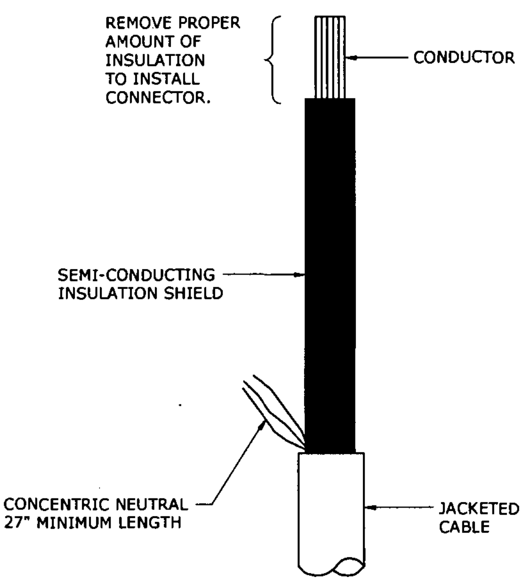
COMPATIBLE UNIT	APPLICATION	QTY.	CN	DESCRIPTION
EB40AL2LB15F	SINGLE-PHASE	1	326237	CONN, TRML ELBOW, 4/0
			326422	ELBOW, 200A, LB, #1/0
EB10AL2LB15F	SINGLE-PHASE	1	326241	CONN, ELBOW 1/0 SOL
			326410	ELBOW, 200A, LB, #1/0
EB2AL2LB15F	SINGLE-PHASE	1	326238	CONN, TRML ELBOW, #2
			326410	ELBOW, 200A, LB, #1/0
-	-	1	326240	1/0 STR COPPERTOP CONNECTORS

*EACH KIT CONTAINS INSTRUCTIONS, ELBOW, MALE CONTACT PROBE, AND SILICONE LUBRICANT.

NOTE: ELBOW (CN 326410) IS TO BE USED FOR 1/0 SOLID, 1/0 STR & #2 STR

THIS PROCEDURE IS FOR DE-ENERGIZED CONDITIONS. USE PROPER SAFETY PROCEDURES AS OUTLINED IN IN THE ACCIDENT PREVENTION MANUAL.

BEFORE WORKING ON CABLE, GROUND IT.



INSTALLATION GUIDELINES

TRAIN CABLE TO FINAL ASSEMBLED POSITION ALLOWING SLACK FOR LOADBREAK OPERATION.

CUT CABLE 18" PAST CENTERLINE OF BUSHING. THIS WILL LEAVE ENOUGH NEUTRAL CONDUCTOR FOR EASY MAKEUP.

REMOVE JACKET AND UNWRAP NEUTRAL WIRES TO A POINT 9" BELOW CENTERLINE OF BUSHING. (FOR UNJACKETED CABLE, SECURE THE NEUTRAL TO THE PRIMARY CABLE WITH AN EXTRA PIECE OF NEUTRAL WIRE. TWIST THE NEUTRAL WIRES TOGETHER INTO A SINGLE CONDUCTOR. DO NOT BIND THE PRIMARY CABLE WHEN TWISTING THE NEUTRALS.

CUT THE CABLE SQUARE AND EVEN AT THE CENTERLINE OF THE BUSHING. REMOVE THE INSULATION SO THAT THE CONNECTOR CAN BE INSTALLED. STRIP LENGTHS CAN VARY BY ELBOW. USE THE DIMENSIONS ON THE INSTRUCTION SHEET THAT CAME WITH THE ELBOW.

PROPER TOOLS MUST BE USED IN CABLE PREPARATION. AVOID THE USE OF KNIVES IN CABLE PREPARATION.

STRIP LENGTH VARIES BY MANUFACTURER. CONSULT KIT INSTRUCTIONS FOR PROPER LENGTH.

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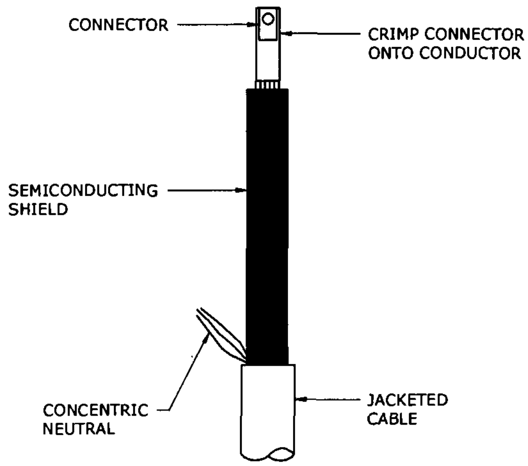
0	8/12/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

200 AMP LOADBREAK ELBOW

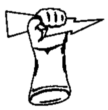
Duke Energy

FLA DWG. 33.05-05

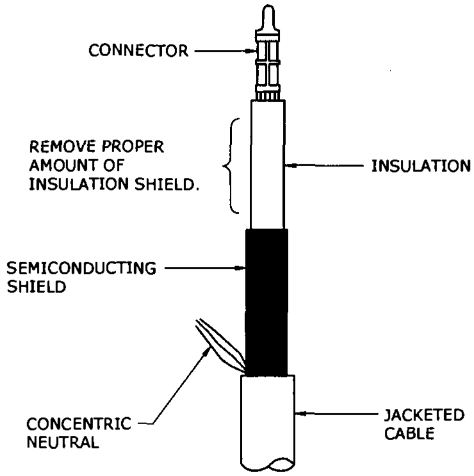
WIRE BRUSH THE CONDUCTOR, AND INSTALL THE CONNECTOR SO THAT THE THREADED HOLE LINES UP WITH THE HOLE IN THE BUSHING. CRIMP THE CONNECTOR. MAKE SURE THE CONNECTOR DOES NOT "BANANA", AND THERE ARE NO SHARP EDGES. FOR 1/0 SOL. WIRE, USE ONLY 5/8" NOSE DIE, CN 415101. **DO NOT** USE BURNDY OH25, CN 415109.



CRIMP THE CONNECTOR PER THE MANUFACTURER'S INSTRUCTIONS. CONSULT CRIMPING TABLE IN KIT INSTRUCTIONS.



PROPER TOOLS MUST BE USED IN CABLE PREPARATION. AVOID THE USE OF KNIVES IN CABLE PREPARATION.



CAREFULLY REMOVE THE PROPER AMOUNT OF INSULATION SHIELD USING A SEMICON STRIPPER. STRIP LENGTHS CAN VARY BY ELBOW. USE THE INSTRUCTION SHEET THAT CAME WITH THE ELBOW. DO NOT NICK OR SCORE INSULATION.

INSULATION LENGTH VARIES BY MANUFACTURER. CONSULT KIT INSTRUCTIONS FOR PROPER LENGTH.

3				
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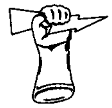
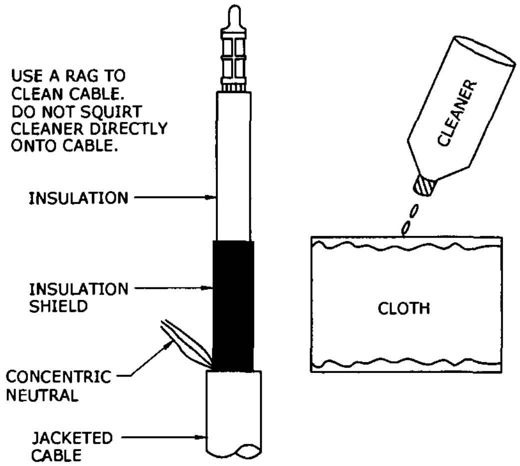
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

200 AMP LOADBREAK ELBOW	Duke Energy	
	FLA	DWG. 33.05-06

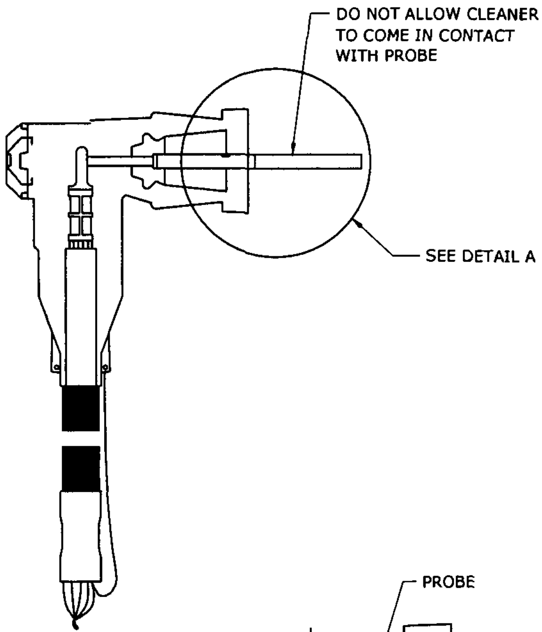


CONSULT THE MSDS BOOK FOR THE PERSONAL PROTECTIVE EQUIPMENT NECESSARY TO USE THE CLEANING SOLVENT.



CLEAN THE CABLE BY WIPING WITH A CLEAN RAG THAT HAS CLEANING SOLVENT ON IT. DO NOT POUR CLEANING SOLVENT DIRECTLY ONTO THE CABLE. IMPORTANT - DO NOT ALLOW CLEANING SOLVENT TO CONTACT THE WHITE END OF THE CONTACT PROBE. IT CAN CAUSE THE MATERIAL TO SWELL AND JAM THE THE ELBOW IN THE BUSHING.

APPLY SILICONE LUBRICANT TO THE CLEAN INSULATION. KEEP THE ELBOW AND CABLE CLEAN. USING A DOWNWARD TWISTING MOTION, SLIDE THE ELBOW ONTO THE CABLE.

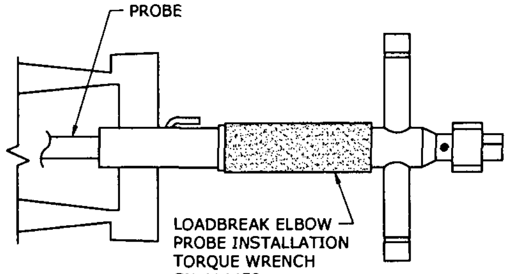


ALIGN THE HOLE IN THE CONNECTOR WITH THE HOLE IN THE ELBOW. INSERT THE CONTACT PROBE INTO THE THREADED HOLE AND TURN BY HAND SEVERAL TURNS. CHECK THAT THE PROBE HAS NOT CROSS-THREADED. TIGHTEN THE PROBE TO PROPER TORQUE USING THE PROBE INSTALLATION TORQUE WRENCH (CN 414453).

NOTE: MANY ELBOW FAILURES HAVE BEEN TRACED TO IMPROPER INSTALLATION OF THE PROBE. PROPER TORQUE IS CRITICAL TO ELBOW LIFE.

DO NOT USE SILICONE TO LUBRICATE THREADS ON CONNECTOR.

USING AN EXTRA PIECE OF NEUTRAL WIRE, ATTACH ONE END TO THE GROUNDING EYE ON THE ELBOW, AND TWIST THE OTHER END WITH THE OTHER NEUTRAL CONDUCTORS. CRIMP OR BOLT THE TWISTED NEUTRAL TO GROUND.

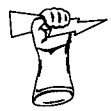


DETAIL A

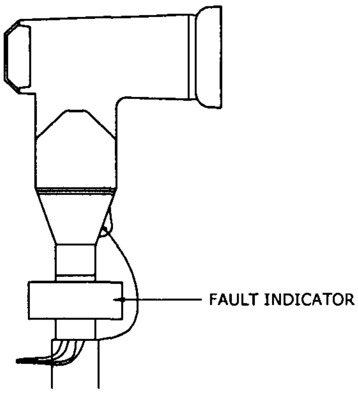
3					200 AMP LOADBREAK ELBOW	Duke Energy®	
2							
1							
0	8/10/10	DANNA	GUINN	ELKINS		FLA	DWG. 33.05-07
REVISED		BY	CK'D	APPR.			

APPLICATION GUIDE

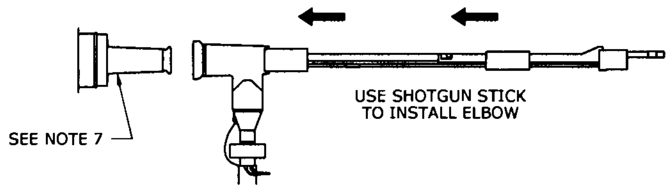
FAULT INDICATOR



PROPER PERSONAL PROTECTIVE EQUIPMENT MUST BE USED WHEN INSTALLING FAULT INDICATOR ON ENERGIZED CABLES.



INSTALL FAULT INDICATOR AS REQUIRED. INDICATOR MUST BE BELOW ELBOW AND ABOVE NEUTRAL BREAKOUT.



LOADMAKE

NOTES:

1. AREA MUST BE CLEAR OF OBSTRUCTIONS THAT WOULD INTERFERE WITH OPERATIONS OF THE ELBOW CONNECTOR.

2. GRASP ELBOW FIRMLY WITH SHOTGUN STICK. POSITION TIP OF PROBE INTO END OF LOADBREAK BUSHING.

3. SLOWLY INSERT ELBOW ONTO BUSHING UNTIL A SLIGHT BUMP IS FELT.

4. MAINTAINING A FIRM GRASP ON THE SHOTGUN STICK, THRUST THE ELBOW THE REST OF THE WAY ONTO THE BUSHING.

5. PUSH AGAIN ON THE ELBOW USING THE SHOTGUN STICK, AND THEN PULL GENTLY TO MAKE SURE THAT IT IS SECURE.

6. APPLY AN EVEN THIN LAYER OF HIGH VISCOSITY SILICONE GREASE TO INSERT BUSHING BEFORE INSTALLING ELBOW. DO NOT USE THIN SILICONE GREASES ON ELBOWS AND BUSHINGS. HIGH VISCOSITY GREASE PROMOTES FUTURE EASE OF REMOVAL.

7. EXTENDED BUSHING INSERT IS TO BE USED ONLY WHERE EXTRA LENGTH IS NEEDED TO CLEAR SECONDARY CONDUCTORS THAT INTERFERE WITH THE PROPER OPERATION OF THE ELBOW.

THE SHOTGUN STICK REQUIRED TO ASSURE PROPER SEATING OF THE ELBOW ONTO THE BUSHING. PUSHING ON BY HAND CANNOT ASSURE ALL GASSES ARE EXPELLED AND ELBOW IS FULLY SEATED. SEE SECTION 6.01 OF THE ACCIDENT PREVENTION MANUAL.

3				
2				
1				
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

200 AMP LOADBREAK ELBOW

Duke Energy®

FLA DWG. 33.05-08

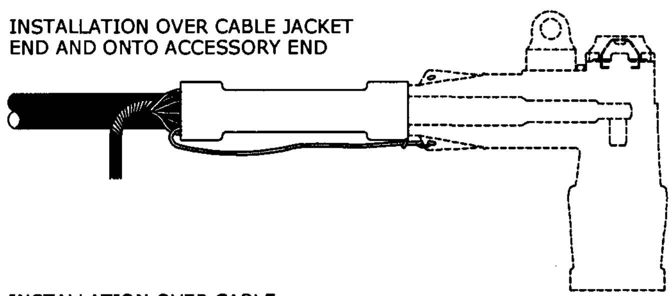
3M
COLD SHRINK
CABLE ACCESSORY SEALING KITS

INSTRUCTION SHEET

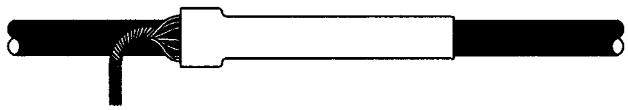
ANSI C119.1
KIT CONTENTS:

1 COLD SHRINK™ SEALING TUBE
3 MASTIC SEALING STRIPS FOR 8452
3 MASTIC SEALING STRIPS FOR 8452L
4 MASTIC SEALING STRIPS FOR 8453
6 MASTIC SEALING STRIPS FOR 8454
1 INSTRUCTION SHEET

INSTALLATION OVER CABLE JACKET
END AND ONTO ACCESSORY END

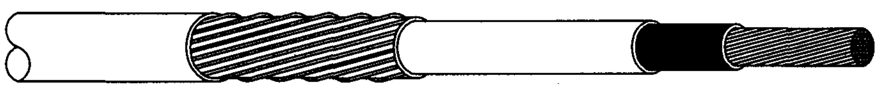


INSTALLATION OVER CABLE
JACKET END ONLY



KIT SELECTION CHART

KIT NUMBER	MINIMUM SEAL DIAMETER	MAXIMUM INSTALLED DIAMETER	CABLE SIZE/KV CLASS		
			15KV	25KV	35KV
8452	0.95 IN. (24 mm)	1.94 IN. (49 mm)	2-4/0	2-2/0	1/0



JACKETED CONCENTRIC NEUTRAL (JCN)

3				
2				
1				
0	8/10/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

200 AMP LOADBREAK ELBOW -
COLD SHRINK

Duke Energy®

FLA

DWG.
33.05-09

CABLE PREPARATION

STEP 1:

REMOVE CABLE JACKET.

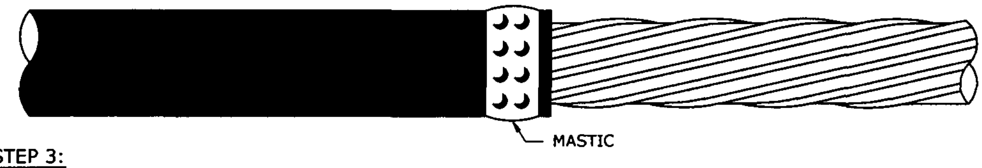
NOTES:

1. WHEN SCALING ACCESSORY END AND CABLE JACKET END, THE DISTANCE THE JACKET IS REMOVED SHOULD BE IN AGREEMENT WITH "ELBOW" MANUFACTURER'S (OR OTHER ACCESSORY) INSTRUCTIONS. THE EXPOSED CABLE SEMI-CON BETWEEN THE CABLE JACKET END AND THE ACCESSORY END SHOULD BE NO MORE THAT 2 INCHES.

2. WHEN SEALING CABLE JACKET END ONLY, REMOVE JACKET FROM CABLE END FOR A DISTANCE TO INSTALLATION OF ACCESSORY PLUS ADDITIONAL DISTANCE AS DESIRED.

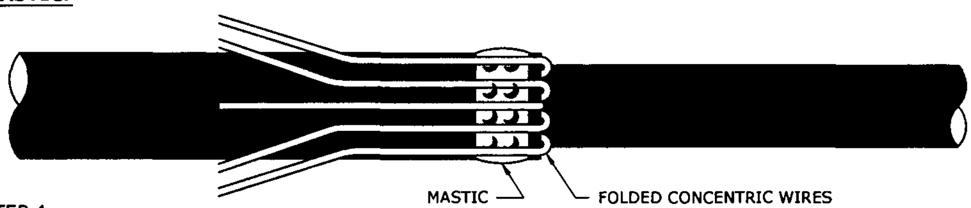
STEP 2:

ON THE CABLE JACKET, 1/2 INCH FORM THE JACKET END, WRAP 1 LAYER OF MASTIC AROUND THE CABLE. **DO NOT STRETCH MASTIC WHEN APPLYING.**



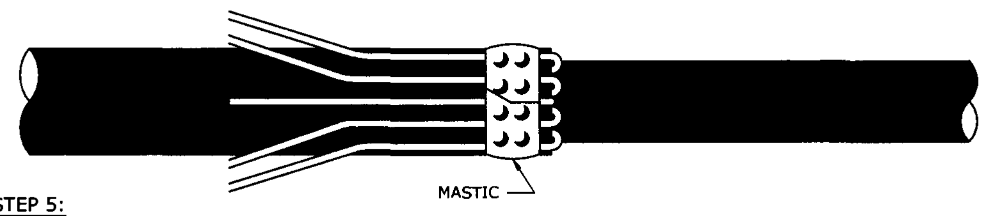
STEP 3:

BEND THE CONCENTRIC WIRES BACK OVER THE CABLE JACKET END AND INDIVIDUALLY PRESS THEM ONTO THE MASTIC. **CONCENTRIC WIRES SHOULD NOT TOUCH EACH OTHER WHEN PRESSED ONTO THE MASTIC.**



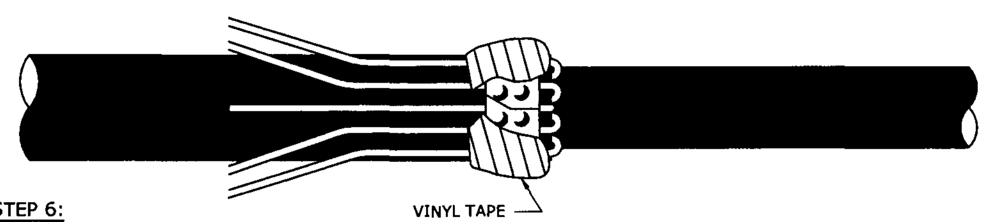
STEP 4:

WRAP A SECOND MASTIC STRIP OVER THE FOLDED WIRES AND PREVIOUSLY APPLIED MASTIC, PRESSING TO FILL VOIDS.



STEP 5:

TIGHTLY OVERWRAP THE MASTIC AND CONCENTRIC WIRES WITH 3/4 INCH WIDE VINYL TAPE FOR A DISTANCE OF APPROXIMATELY 1-1/2 INCHES.



STEP 6:

PREPARE THE CABLE AND INSTALL THE CONNECTOR PER MANUFACTURER'S INSTRUCTIONS PROVIDED WITH THE CABLE ACCESSORY.

STEP 7:

PROCEED TO INSTALLATION PROCEDURE B OR C DEPENDING ON WHAT TYPE OF INSTALLATION IS CHOSEN.

3					200 AMP LOADBREAK ELBOW - COLD SHRINK	Duke Energy
2						
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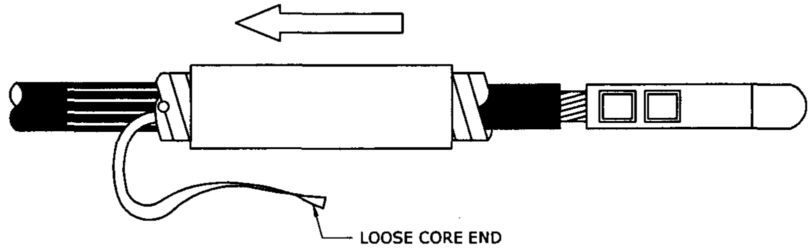
0	8/10/10	DANNA	GUINN	ELKINS		FLA DWG. 33.05-10
REVISED		BY	CK'D	APPR.		

B: INSTALLATION PROCEDURES TO SEAL BOTH ACCESSORY END AND CABLE JACKET END

STEP 1:

SLIDE THE 3M™ COLD SHRINK ™CABLE ACCESSORY SEALING TUBE ONTO THE CABLE. THE TUBE END WITH THE LOOSE CORE END SHOULD GO ON FIRST, AWAY FROM THE CONNECTOR.

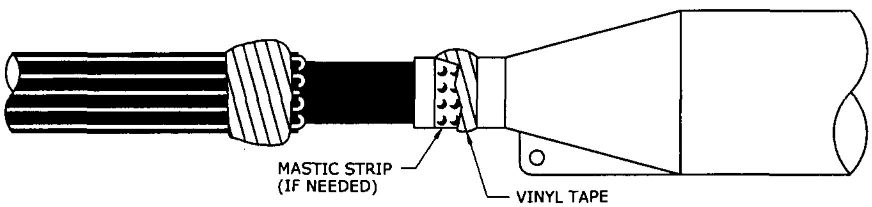


STEP 2:

INSTALL CABLE ACCESSORY PER MANUFACTURER'S INSTRUCTIONS.

STEP 3:

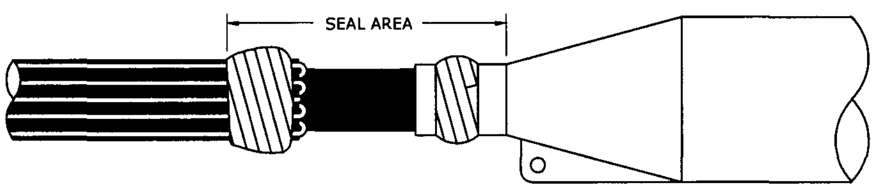
IF SURFACE IRREGULARITIES EXIST IN THE SEAL AREA OF THE INSTALLED ACCESSORY, WRAP A MASTIC STRIP AROUND THE END OF THE INSTALLED ACCESSORY. OVER WRAP MASTIC WITH TWO LAPPED LAYERS OF VINYL TAPE.



STEP 4:

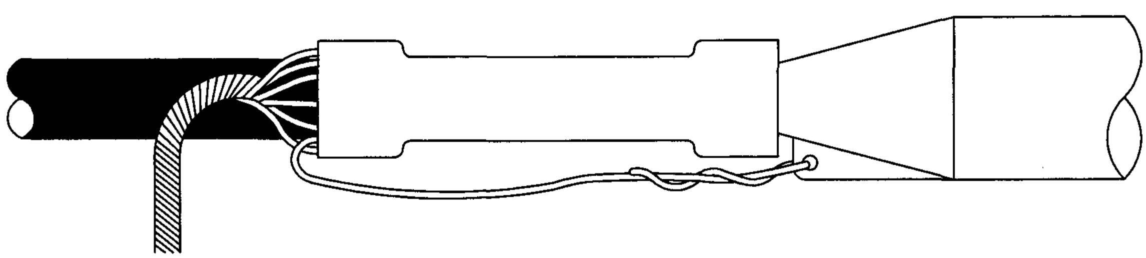
POSITION THE COLD SHRINK TUBE OVER THE SEAL AREA AND REMOVE THE CORE BY UNWINDING THE LOOSE CORE END COUNTER-CLOCKWISE.

AN OCCASIONAL TUG ON THE CORE END WILL AID IN ITS REMOVAL.



STEP 5:

CONNECT CONCENTRIC WIRE TO CABLE ACCESSORY PER ACCESSORY MANUFACTURER'S INSTRUCTIONS.



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REVISED		BY	CK'D	APPR.

200 AMP LOADBREAK ELBOW -

COLD SHRINK

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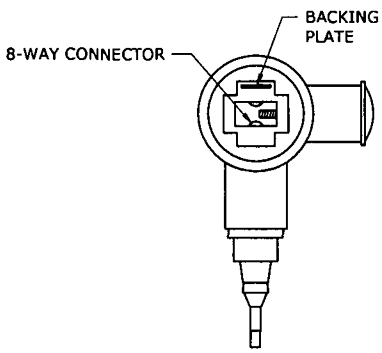
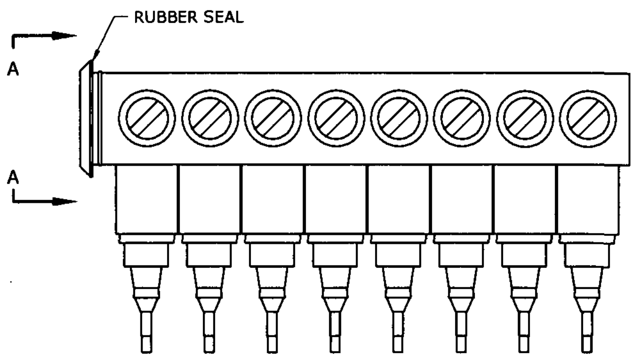
FLA

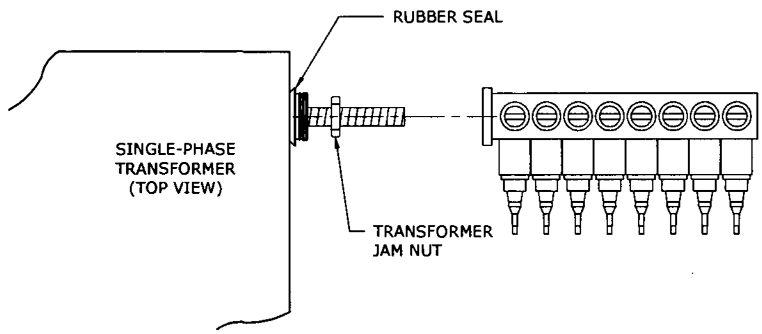
DWG. 33.05-11



SECTION 'A-A'



SUBMERSIBLE SECONDARY SET SCREW CONNECTOR



DETAIL

SUBMERSIBLE CONNECTORS					
COMPATIBLE UNIT	CATALOG NUMBER	RANGE	WAY	AMPACITY	DESCRIPTION
KXS588W35N10F	6740	12 - 350	8	1000	5/8" HOLE, SINGLE SET SCREW
KXS58SM8W35N10F	9220160117	12 - 350	8	1600	1" HOLE, SINGLE SET SCREW

NOTES:

1. SEE DWG 33.06-02 FOR INSTALLATION NOTES.

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REVISED	BY	CK'D	APPR.

SUBMERSIBLE SECONDARY SET SCREW CONNECTORS
SINGLE-PHASE TRANSFORMERS

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FLA

DWG.
33.06-01

NOTES:

1. INSTALL ONLY ONE CABLE PER POSITION.
2. CUT BACK CABLE INSULATION (STRIP GAUGE LOCATED ON BACK OF CONNECTOR). PENCIL, DO NOT RING INSULATION.
3. WIRE BRUSH CONDUCTORS. APPLY INHIBITOR (CN 403108) TO CONDUCTORS.
4. REMOVE CABLE ADAPTER.
5. REMOVE PLASTIC CAP.
6. CUT ADAPTER AT PROPER RING. ADAPTER IS NOT USED FOR LARGEST CABLE THAT WILL FIT IN CONNECTOR.
7. POSITION ADAPTER OVER INSULATED CABLE. (USE SILICONE LUBRICANT ON CABLE AND INSIDE OF ADAPTER.)
8. REMOVE SCREW PLUG CAP AND BACK-OFF SCREW WITH ALLEN WRENCH.
9. PUSH CABLE AND ADAPTER INTO CONNECTOR PORT UNTIL WIRE HITS BACKING PLATE INSIDE CONNECTOR.
10. TIGHTEN SET SCREW WITH 5/16" HEX WRENCH.
11. RE-INSERT SCREW PLUG CAP.
12. INSTALL IDENTIFYING TAG ON EACH SET OF CABLES.
13. ALUMINUM OR COPPER CAN BE USED IN CONNECTORS.
14. ALL SET SCREW PLUG CAPS MUST BE IN PLACE. IF A CAP IS MISSING, OBTAIN CAP FROM ANOTHER SUBMERSIBLE CONNECTOR BY THE SAME MANUFACTURER OR REPLACE THE ENTIRE CONNECTOR. VINYL PLASTIC SEAL AND ELECTRICAL TAPE MAY BE USED TEMPORARILY.
15. WHEN A CABLE IS REMOVED FROM CONNECTOR, A NEW CABLE ADAPTER SHOULD BE INSTALLED IN THE EMPTY POSITION. OBTAIN SAME SIZE ADAPTER FROM CONNECTOR OF THE SAME MANUFACTURER OR REPLACE ENTIRE CONNECTOR. VINYL PLASTIC SEAL AND ELECTRICAL TAPE MAY BE USED TEMPORARILY.

3				
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REVISED		BY	CK'D	APPR.

SINGLE SET SCREW
SUBMERSIBLE CONNECTORS - NOTES
SINGLE-PHASE TRANSFORMERS

Duke Energy

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DWG.
33.06-02

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FLORIDA

DISTRIBUTION ENGINEERING MANUAL

Document title

Distribution Engineering Manual: Overhead Design Guide

Document number

DST-EDGX-00027

Applies to: Energy Delivery Group – Carolinas and Florida

Keywords: distribution; distribution engineering manual

Table of Contents

1. Introduction

Overhead distribution design is an art as much as an engineering skill. The designer is required to balance the needs of the customer in a safe, reliable and economical manner. There are many safety requirements that must be met for both public safety and the safety of the linemen that maintain these lines. There are also many line hardware choices. It is the intent of this design guide that it be used in conjunction with the Progress Energy Distribution Construction Specifications to enable safe and economic designs.

The Distribution Construction Specifications manuals contain a variety of detailed drawings on pole and line construction. Each of these drawings was designed to meet the detailed requirements of the NESC in an economical and reliable manner. These drawings are a toolbox of design choices available to the overhead designer. However, every situation encountered on our systems cannot be shown in detail. It is the goal of this design guide to help the designers understand the basis behind the drawings and enable them to make the best choice for each situation.

The Distribution Standards Unit staff is always available for consultation on any specific situation. A line can be custom designed, if needed. This is sometimes necessary. Custom designs should only be used as a last resort. The standard "off the shelf" designs will always be more economical due to volume material purchases and more reliable due to spare part availability.

2. Line Location

Routing of an overhead distribution line requires careful consideration in order to meet a number of different needs. Often there are a limited number of corridors available. It is important to evaluate each route with respect to their impact on the safe operation and maintenance of the line as well as the economic impact (i.e. cost to build, operate and maintain). When evaluating an available corridor for an overhead distribution line the following points should be considered:

- Economic Impact: A selected corridor should generally aim toward the shortest route to the customer's facility to minimize the cost. When the customer requires that the route be located elsewhere solely for the customer's convenience, the additional cost for the customer-preferred route should be borne by the customer.

- Operation and Maintenance: Access to the poles by line trucks reduces the time for restoration and the cost of future maintenance. For new residential lines, front lot line construction shall be used. Lines shall not be located on rear or side lot lines even if the customer wants to pay the additional cost. Lines outside of a residential development should also be located along road access whenever possible. Road access not only allows for truck access but also reduces tree exposure and trimming on one side of the line.

- Clearances: Both horizontal clearances to fixed objects from line wind swing and the ground clearances required by the NESC are a requirement. In the mountainous areas the terrain will often affect the line route.

- Easements: Written easements for primary lines are a requirement. A corridor 15-feet wide on each side of the line is preferred. Consideration for large conductor lines should also be given to guy lead lengths, which are usually more than 15 feet. A blanket easement should be obtained for the development, if possible.

  • Roadway Considerations: The state DOTs have issued guidelines concerning the location of facilities along state-maintained highways. If poles are to be located on these highway rights-of-way, the planner must be familiar with these requirements. The State of Florida has issued a document titled the Utility Accommodation Manual.

  Click Here for the new 2010 UAM

  The State of North Carolina has a similar guide to be followed.

- Future Improvements: Distribution systems grow and often tap lines are upgraded to become feeders. When selecting a route, consideration should also be given to the use of the route for a feeder in the future.

- Environmental Impacts: Environmental impacts should always be given consideration. Wetlands are sensitive areas. River management zones are also controlled areas. Your Environmental Coordinator can assist with any regulations that must be met in these zones.

- Street Lighting: For lines located along a street, consideration should be given to the possibility of street lighting. This can often affect the pole spacing of the line.

- Railroad Crossings: Railroad crossings require that a special crossing permit be obtained. These permits are coordinated through the Joint Use Section.

- Water Crossings: Permits for lines crossing all navigable waterways are controlled by the Army Corp of Engineers. These permits are also coordinated through the Joint Use Section. For a detailed discussion on the line clearance requirements over navigable waterways, see the Clearances section of this Engineering Manual.

- Federal Lands: Federal forest lands and Native American-owned lands are other special permitting zones. These permits are also coordinated through the Joint Use Section.

- Mines: Active mining areas are subject to control by the Mine Safety & Health Administration. Progress Energy lines should remain outside of any active mining area. See Specification Dwg 01.04-04 for more detail on this.

3. Primary Framing

3.1 Voltages and Insulation Levels

In Florida, the main distribution voltage throughout the service area is 12470GrdY/7200, commonly referred to as 12 kV. There are a few small exceptions to this. The Town of Sebring is 13200GrdY/7620 volts. The Town of Holopaw is 24940GrdY/14400 volts. The University of Florida at Gainesville has a 24940GrdY/14400 volt system.

Except for the few 25 kV areas, Florida wood pole lines are insulated for 12kV levels. There are some insulators and hardware where it was economical to use 25kV insulation due to volume purchases. These are shown on the applicable drawings. A concrete pole should be insulated with 35 kV insulation due to the grounding of the rebar inside the pole. Insulators on steel crossarms should also be insulated with 35 kV insulators.

In the Carolinas, there are two predominant service voltages. The most common voltage (occurring over 85% of the system) is 22860GrdY/13200 volts, commonly referred to as 23 kV. The other system voltage is 12470GrdY/7200. The 12kV areas are scattered about. Some of the larger 12kV areas are in Raleigh inside the inner Beltline, Asheville and Atlantic Beach. There is one substation with a voltage of 34500GrdY/19920. These 34kV feeders are located in the Morehead City area along the road to Cedar Island.

Except for the 34kV feeders, all new Carolinas wood pole lines are insulated for 25kV levels. As in Florida, insulators on concrete poles and steel crossarms should use 35 kV insulators. The 34 kV feeders are insulated for 35 kV levels.

For both service areas the coastal construction is similar. 45 kV silicone insulation is used. This is shown in Section 12 of the Distribution Construction Specifications.

3.2 Construction Standards and Limitations

In Florida, vertical phase-over-phase is the standard construction for three-phase circuits. For the 12 kV areas the vertical single-circuit spacing is 36 inches. Double circuits and 25 kV feeders should be spaced at 42 inches. Due to sag limitations, 795 AAC feeder spans are limited to no more than 250 feet. Horizontal construction using wood eight-foot crossarms is an optional means of construction for conductors 4/0 AAAC and smaller where spans are 400 feet or less.

In the Carolinas, the standard construction for three-phase circuits is delta using fiberglass brackets. Double circuits and vertical construction are spaced at 42 inches. Due to sag limitations for heavily loaded circuits, 477 AAC feeder spans are limited to 280 feet maximum. Horizontal construction using wood eight-foot crossarms is an optional means of construction for conductors 4/0 AAAC and smaller where spans are 400 feet or less.

3.3 Distribution Feeder Definitions

There are different types of feeder circuits that can be designed. Below are the definitions of the types of feeders that are built at Progress Energy.

General Distribution Feeder: A standard feeder that serves a mixture of residential, commercial, and industrial load. The most economical route is usually used for this type of feeder. No attempts are made to limit the feeder loading below our load design limits.

Industrial Feeder: A feeder that serves predominately commercial and/or industrial load. The feeder is deliberately limited to this load mixture in order to maintain above average feeder reliability. If location dictates, a few residential customers could also happen to be on this feeder. Since cold load pickup is not a consideration, an Industrial Feeder can be loaded more heavily than a General Distribution Feeder.

Express Feeder: A feeder that is routed past existing customers (i.e.,expressed) to an area to serve a selected group of customers. The feeder is deliberately routed and limited to these customers in order to maintain above-average feeder reliability. Progress Energy has the option of adding other customers to an express feeder and turning it into a general distribution feeder or an industrial feeder, if we so desire.

Dedicated Feeder: A feeder that bypasses existing customers and is routed (i.e., dedicated) to serve only one customer. If the feeder is reserved for one customer by contractual agreement, the customer must pay a monthly facilities charge and Progress Energy does not have the option of adding other customers to this feeder.

4.0 NESC (National Electrical Safety Code)

4.1 General

For both service areas we are required by the Utilities Commission to construct lines according to the current edition of the National Electrical Safety Code. The latest edition is dated 2012. The code is now on a five-year revision cycle, with the next book due out in 2017. Prior to 2002 the NESC was on a three-year revision cycle. The dates are important because when the code is revised to incorporate new rules, existing lines are "grandfathered" as long as they are safe. To determine if a line has been constructed according to code, one must first determine the year it was constructed. For instance, 1977 and 1981 were years where significant updating was done to the NESC. So lines constructed before those years are legally only required to meet the pre-1977 codes.

It is essential to know that the NESC is a safety standard, not a design standard. Over the years it has commonly become the minimum design basis for utilities. The NESC is sometimes prescriptive (tells you exactly what to do), but for the most part the rules are performance-based (tells you the result to be achieved rather than the design parameters). They are also the minimum rules we must meet. It is extremely time-consuming to design the spacing, clearances and strengths of each structure from scratch. The Distribution Construction Specifications are developed to meet or exceed the NESC minimums. Utilizing the Distribution Construction Specification drawings will save the designers much effort, and also avoid spacing errors.

4.2 Description of NESC Sections

Below is a very brief listing of the contents of the more important sections of the NESC that are followed in our designs.

Sec 9 – Grounding Methods for Electric Supply and Communication Facilities
- Provides methods of grounding
- Substation fences required to be grounded to limit touch voltages
- Multi-grounded neutral systems required to have at least four grounds in each mile.

Part 1 - Rules for the Installation and Maintenance of Electric Supply Stations and Equipment

Sec 10 thru 18
- Substations fences of 7 feet or more in height
- Guarding of live parts by height

Part 2 – Safety Rules for the Installation and Maintenance of Overhead Electric Supply and Communication Lines

Sec 21 – General Requirements
- Line and equipment inspections, with records kept

Sec 22 – Relations between Various Classes of Lines and Equipment

- Supply conductors at a higher level than communication conductors
- Conductors of higher voltage above those of lower voltage
- Communication circuits in supply space installed and maintained only by authorized and qualified personnel

Sec 23 – Clearances

- Clearances measured from surface to surface
- Spacing measured from center to center
- Clearances of supporting structures from other objects (poles four feet minimum from a fire hydrant, poles six inches minimum behind curbs)
- Vertical clearances of conductors above ground, roadway, rail or water surfaces (measured under conditions which produce the greatest sag)
- Clearance between conductors carried on different supporting structures (use of conductor movement envelope)
- Clearance of conductors from buildings, bridges, swimming pools and other installations (use of horizontal clearance with wind displacement)
- Clearance for conductors carried on the same supporting structure
- Working space and climbing space
- Vertical clearance between communication and supply facilities on the same structure. The general rule is to maintain a 40-inch clearance zone on the pole between supply conductors and communication conductors.

Sec 24 – Grades of Construction

- Grade B (highest grade) required for railroad crossings and limited access highways
- Grade C (next highest grade) construction requirements (minimum grade used by Progress Energy)
- Grade N (lowest grade) construction requirements. This grade is not used by Progress Energy

Sec 25 – Loading for Grades B and C

- Heavy, medium and light loading districts defined. The Carolinas are in the Medium Loading district, which has a wind loading of 4 lbs/ft (about 40 mph). This wind loading is acting on a conductor covered with ¼ inch of ice. The equipment or structure the wind acts on need not be covered in ice. Florida is in the Light Loading district, which has a wind loading of 9 lbs/ft (about 60 mph). There is no ice loading.
- Extreme wind loading rules defined. Any pole more than 60 feet above ground is subject to the extreme wind loading rules.
- Vertical and transverse loads on line supports defined.
- Overload factors defined. Overload factors are different for each grade of construction and the type of item or hardware.

Sec 26 – Strength Requirements

- Application of strength factors. For certain hardware you can only use it to a portion of its rated strength. Strength factors are usually 1 or less.

Sec 27 – Line Insulation

- Specific strength requirements for various types of hardware are given. Insulators are limited to 50% of their rated ultimate strength in compression and tension and 40% in cantilever.
- Guy insulator use requirements are given.

Part 3 – Safety Rules for the Installation and Maintenance of Underground Electric Supply and Communication Lines

Sec 32 – Underground Conduit Systems

- Separation from other utilities
- Manhole dimensions and strength requirements

Sec 35 – Direct Buried Cable

- Identification symbols
- Burial depth
- Separation from other utilities

Sec 38 – Equipment

- Distance from fire hydrants (3 feet)
- ANSI safety signs

4.3 Grade C Construction

Grade C construction is the normal construction grade most commonly used on our system. It is used on lines that are located on private rights-of-way or public rights-of-way. For Grade C construction the overload factor for wind loading on a tangent wood pole structure is 2. Unless stated otherwise, the construction drawings in the Distribution Specifications Manuals will meet the requirements for Grade C.

In situations where a Grade C line crosses over another circuit, the NESC requires that slightly higher overload factors be used. This is referred to as a Grade C crossing structure. For wind loading on a tangent wood pole structure the overload factor is 2.67. Since these situations are rare, the Progress Energy specification drawings do not touch on this subject. The construction should be designed to the Grade B construction requirements below. This will meet the Grade C crossing requirements.

4.4 Grade B Construction

Grade B construction is encountered frequently on our system. Grade B construction is required for railroad crossings and limited access highways. A limited-access highway is defined in the NESC as follows:

Limited Access Highways: As used herein, limited access highways are fully controlled by a governmental authority for purposes of improving traffic flow and safety. Fully-controlled highways have no grade crossings and have carefully designed access connections.

There is no intent in the NESC for ordinary highways and roadways to have Grade B construction.

Grade B construction is required to be more heavy duty than regular Grade C construction. The intent is to take additional steps and have additional safety factors that might prevent an energized conductor from being dropped across a limited access highway. The additional Grade B construction requirements are:

- Higher overload factors are required for poles, hardware, guys and anchors. This will usually necessitate both shorter spans and larger class poles. For wind loading on a tangent wood pole structure the overload factor is 4.
- Longitudinal strength requirements for the structures are in place to prevent conductors falling across the roadway. If the Grade C line behind the Grade B crossing breaks, the intent is that Grade B structure is capable of handling the unbalanced conductor pull. Back guying can be in place to provide this strength.
- Single pin construction is not allowed. Double pin construction is allowed, but it must be capable of holding the unbalanced conductor pulls. For this reason the Progress Energy Grade B specifications will show only dead ended or clamped construction.

5. Grounding

The Progress Energy distribution systems are multi-grounded wye systems. For a multi-grounded wye system the NESC requires that there be four grounds in each mile of overhead primary line. It also requires that each transformer location be grounded. The customer grounds or wrapped butt pole grounds are not counted towards the requirements. There is no specific NESC requirement for the resistance of each driven ground electrode on a multi-grounded system.

The standard Progress Energy ground rod is a 5/8 inch by five-foot, copper-clad steel rod. The largest factor in getting a good ground connection is the electrical conductance of the soil. This is determined by the type of soil and the moisture content. Failure to reach moisture (the water table) will result in higher resistance levels. For the type of soils in the Progress Energy service areas, coupling ground rods together to form deep-driven grounds is necessary if a low resistance ground is to be obtained. Installing a second ground rod six feet distance from the first rod is not nearly as effective as coupling the rods vertically together for a deep-driven ground rod.

On distribution lines that are under built below transmission lines, the same grounding system should be utilized whenever possible. In lines where there are two separate grounded neutrals, the two grounds should be bonded together to avoid any difference of potential.

The grounding specifications in the Carolinas and Florida are the same, 4 5-foot ground rods are required for grounding primary facilities, with few exceptions.

6. Services

6.1 General

Services and secondary conductors should be sized to meet the following three criteria:

- Load current. They should be sized to meet the anticipated peak demand load current plus any allowance for anticipated load growth. The summer and winter ampacities of each service conductor is shown in Section 5 of the Distribution Construction Specifications Manual.

- Voltage drop. They should be sized to meet the maximum voltage drop allowed for residential and commercial services.

- Flicker. They should be sized to meet the flicker allowed for the largest motor, air conditioner compressor or other devices located at the premises. Also there are regulatory flicker requirements that the flicker caused by a customer will not cause objectionable flicker to other customer's service.

  Once the wire size has been selected, the service conductors have a maximum unguyed span limit. This is shown on Specification Dwg 4.00-01. These limits are based on the deflection of a standard two-inch overhead steel mast being limited to 350 lbs. of tension.

6.2 Voltage Drop Requirements

The voltage drop requirement will usually be the governing factor for residential services due to the standard residential service length. The amount of allowed voltage drop is defined by the utility commissions in our service areas. The defined limits are as follows:

Residential or lighting customers: +/- 5% from nominal voltage of 120 volts (126 volts max, 114 volts min)

Industrial/commercial customers – Florida: +/- 7 1/2% from nominal voltage of 120 volts (129 volts max, 111 volts min)

Industrial/commercial customers – Carolinas: +/- 10% from nominal voltage of 120 volts (132 volts max, 108 volts min)

The voltage drop limits include the drop in the transformer and the drop in the secondary and service. The voltage drop in the transformers depends upon the transformer impedance. The transformer impedance limits are:

10 to 75 kva units	3.0% max, 1.5% min
100 to 167 kva units	3.0% max, 2.0% min

Since the actual transformer impedance is not known at the time of design, the practice has been to assume the residential transformers have a 2.0% impedance....i.e......2.0% of the voltage drop will occur in the transformer and the remaining 3.0% (3.6 volts) will occur in the service.

6.3 <u>Voltage Drop Examples</u>

Example – Residential Dwelling Voltage Drop

Residential dwelling has an estimated 20 KW demand at 120/240 volts single phase. Distance of planned sec/service is 150 ft. You are planning on running a #1/0 TPX service. What is the anticipated voltage drop?

Answer:

Assume .95 pf. For #1/0 TPX, from Specification Dwg 5.00-04, the voltage drop factor per hundred ft is .0878.
KW x Distance (in hundreds of feet) x constant = Voltage Drop
20 KW x 1.5 (hundred ft) x .0878 = 2.63 volts drop
2.63 volts < 3.6 volt design limit

Example – Office Building Service

A small office building has an estimated demand of 70 KWD at 208Y/120 volts three phase. Distance from transformer bank to POD is 80 ft. What is the minimum size OH service required? Do we need a lift pole?

Answer:

Assume .85 pf. KVA = KWD/pf = 70 kW/.85 = 82.4 KVA

First, find minimum size service cables needed due to ampacity.
3 Ph KVA = [Square root 3] times Volts (ph to ph) times Amps
Amps = 3 Ph KVA/ [Square root 3] times Volts = 82.4 KVA/[1.732 X .208] = 229 amps
From either Florida Dwg 5.00-11 or Carolinas Dwg 5.00-03, need #4/0 QPX.

Second, check voltage drop.
For #4/0 QPX, from Specification Dwg 5.00-04, the voltage drop factor per hundred ft is .0188. .0188 [vd per 100 ft] times 70 KW times 0.8 [hundred ft] times 2/3 (to get on 120 volt base) = 0.70 volts drop
0.70 volts < 3.6 volt design limit

Do we need a lift pole?
Distance is 80 feet.
See Dwg 4.00-01.
Limit of #4.0 QPX unguyed is 60 feet. Therefore, a lift pole is needed.

6.4 Flicker

The requirements for voltage flicker limits vary between our service areas.

CAROLINAS: While there is no regulatory limit for the amount of flicker a customer's device may cause in their own service, from a practical standpoint there should be a design limit for residential services. Without a design limit for residential services the standard air conditioner or heat pump's normal operation would cause objectionable flicker for the average customer. The design practice has been to limit residential flicker to no more than 5% in the service.

FLORIDA: In Florida, sudden changes in voltage (flicker) that occur more frequently than two times per hour are limited to 5%. Voltage changes that occur more frequently than once per minute are limited to 2 ½%.

A more detailed discussion of voltage flicker requirements is located in DST-EDGX-00033 Voltage Flicker of this Engineering Manual.

6.5 Large Overhead Services

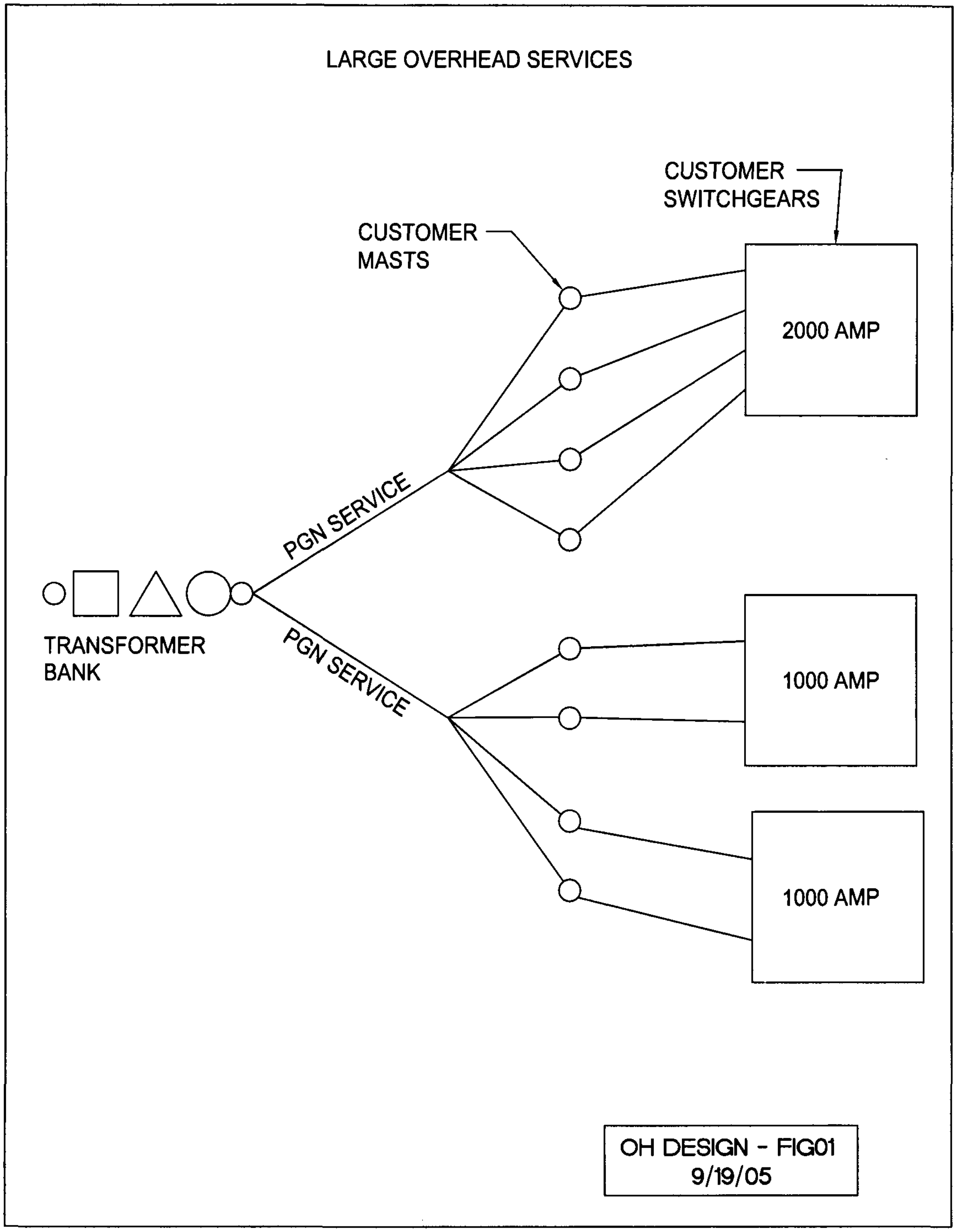
One situation encountered in overhead systems is an overhead service to a high amperage point of delivery. When the customer starts wiring out more than four or six conductors per phase and our service drops need to be several conductors per phase to handle the amperage, connecting up this many wires can be a challenge. It is difficult to parallel this many conductors per phase. The key is to divide and conquer.

For load requirements where multiple-service disconnects are to be installed, the National Electric Code permits a maximum of six disconnects to be installed. Most electricians will take advantage of this code rule. It is more economical to use the individual disconnects than to use a main breaker and the same number of individual disconnects. A point of delivery like this could have up to six mastheads and six or more conductors per phase. Cable trays with large amounts of conductors could also be used.

In Florida where more than one service riser is involved, our service policies require that it is the responsibility of the customer to connect the conductors from each riser together. In the Carolinas it is the responsibility of the utilities to connect the service drop conductors to the service riser conductors. Large overhead service connections are more of a problem in the Carolinas than they are in Florida.

The key is to connect up all of the conductors without needlessly paralleling all of the conductors. The designer should work with the electrical contractor to have each set of conductors indentified for each disconnect. The load for each disconnect should also be identified. The designer could then group sets of disconnects to be served by a set of conductors in our service drop. See Fig 01 below.

There are other NEC rules that allow customers to have more than one disconnect. When the customer's load requirements are in excess of 2000 amps, the NEC permits the customer to have a second point of delivery. This second point of delivery could be adjacent to the first point of delivery or located at another location.



7.0 Poles

7.1 Pole Sizing – Class

Determining the required strength and therefore the pole class can be a complicated matter. The height of the pole must be determined first (See Pole Sizing – Height section). The basic steps need the longitudinal, transverse and vertical loadings for each structure.

The class of an unguyed tangent pole is dependent upon the following factors:

- The breaking moment at the base of the pole caused by wind loading (see Fig. 4).

  This includes the wind loading on the conductors, the pole and the equipment. The NESC states that the direction of wind loading in the critical direction must be considered. For instance, a wind blowing at an angle to a line has a lesser impact than a wind blowing exactly perpendicular to the line. You would need to include all conductors, such as primary, neutrals, secondary, joint-use cables and TPX service cable taking off of the pole.

- The downward buckling moment created by attached equipment (see the bottom of Fig. 4).

  Whether this force is in the same direction as the wind force depends on the side of the pole where the equipment is mounted. The critical direction of loading is the direction the wind is shown. If the transformer was mounted on the field side of the pole, then its weight would be in the same loading direction as the wind and contribute to the pole blowing over. If the transformer was mounted on the road side of the pole, then it's weight would offset some of the pull of the triplexed services.

- The side pulls of any services.

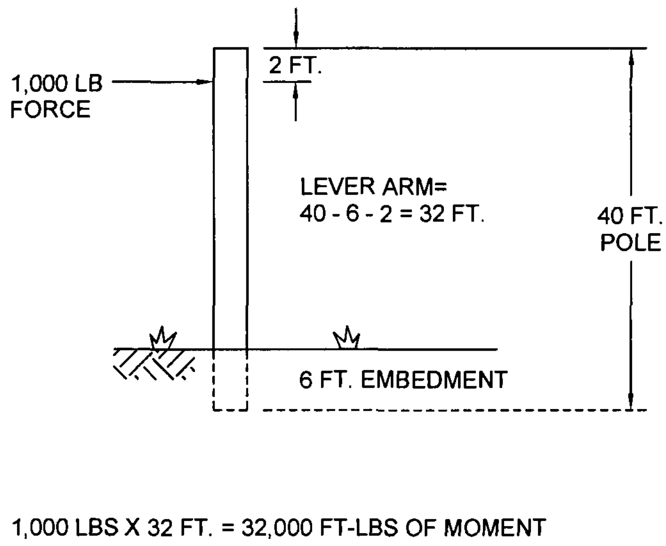
  Again, only the force component that is in the critical direction of pole loading would contribute to the pole blowing over.

  For overhead conductors and line equipment the wind forces can be divided into their load vector components. Multiply these components by the overload factors and shape factors (if applicable) to get the required design forces and then multiply these forces by the height they act on the pole above ground line to determine their bending moments. Sum these moments together with the wind moment on the pole (multiplied by its overload factor) to determine the total bending moment on the pole and then select the smallest class pole's maximum bending moment (see Fig 03) to resist this bending moment. Bending moment is measured in foot-pounds. The force in feet is multiplied by the lever arm, or the distance in feet, to arrive at the bending moment in ft-lbs. See Fig 2 for an example of how to calculate bending moment.

The class of a guyed pole is dependent upon different factors. The NESC requires a guyed structure to use the pole acting as a column or strut only, and all the horizontal forces must be resisted by the guy assembly. So only the downward buckling forces in the pole contribute to its class. The following factors contribute to the pole class determination:

- The vertical, downward axial loading in the pole caused by the guy lead. (See Fig 05). This is usually the major force. The horizontal force of wind and tension on the conductors is offset by the horizontal force component of the guy wire. So only the vertical component would contribute to the pole, which is acting as a strut, towards buckling.
- The weight of the equipment mounted on the pole is a factor. The actual weight in pounds is carried straight down the pole. In addition, the equipment is usually mounted to the side of the pole. This is known as eccentric loading and contributes a bending moment to the pole. This bending moment will cause the pole to carry less downward forces and buckle sooner.
- The vertical downward force in the pole caused by the weight of all conductors to include the joint use facilities and the ice weight (for Carolinas only) must be considered.
- Any downward force on the conductors caused by the adjacent span poles being lower than the structure being analyzed.

Once all of the downward forces and bending moments are known, the buckling stresses in the pole are determined by Mueller's Equations. Showing an example calculation is beyond the scope of this manual. The "Pole Foreman" program was used to determine the transformer bank loadings shown on Dwg 2.02-03. Other than the weight of large transformer banks and other heavy equipment, the pole class required for a normal deadend pole should be the same as that for a tangent pole of the same span lengths. When guy leads are of normal length, it is only on tall deadend poles where the buckling would be the controlling factor.



The resisting-bending moment for each height and class of pole comes from ANSI 05.1. It is based on the maximum wood fiber stress that can be tolerated. This is a function of the applied forces and the geometry of the tapered wood pole. This standard is the basis for both dimensional data and strength data. See Figure 3 for the allowable bending moments on wood poles. The PGN dimensional wood pole data is shown on Dwg 02.02-08. From a stocking standpoint not every available pole size and class can be stocked. For each pole height a selected standard class is stocked. The stocked pole heights and classes are shown on Dwg 02.02-02 & 03.

Listed below are some various factors from the NESC used to calculate the bending moment forces on a pole.

Wind Loading:
Florida 9 lbs/sq ft force (60 mph)
Carolinas 4 lbs/sq ft force (40 mph), with conductor areas increased by ¼ inch radial ice

Ice Loading:
Florida No ice
Carolinas ¼ inch radial ice on conductors

Overload Factors	
Class C – Normal construction	2
Class C – Crossing over other circuits	2.75
Class B – Railroad crossings and controlled access highways	4

Shape Factors for Wind Loading	
Cylindrical components – poles, transformers	1.0
Flat surfaces – cap banks, reclosers	1.6

AUTHORIZED COPY

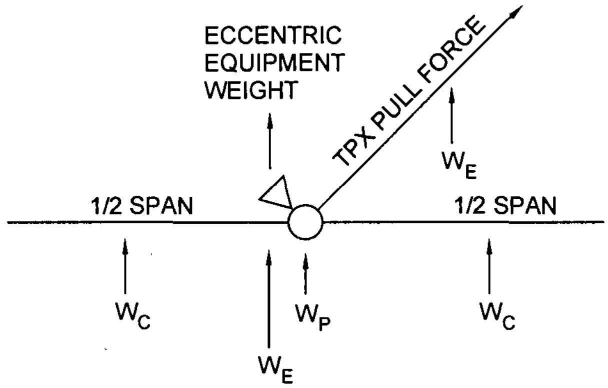
POLE BENDING MOMENTS - SOUTHERN YELLOW PINE						
POLE SIZE	CLASS	POLE DEPTH (FT)	CIR AT GROUND LINE (IN)	ANSI MAXIMUM MOMENT (FT-LBS)	WIND ON POLES	
					CAROLINAS	FLORIDA
30	4	5.0	29.85	56,173	739	1,787
30	6	5.0	25.33	34,234	656	1,475
35	3	5.5	34.19	84,410	1,234	2,777
35	4	5.5	31.68	67,151	1,134	2,551
35	5	5.5	29.17	54,421	1,033	2,326
40	2	5.5	38.70	122,413	1,867	4,201
40	3	5.5	36.19	100,106	1,730	3,893
40	4	5.5	33.68	80,688	1,593	3,584
40	5	5.5	31.18	64,021	1,456	3,276
45	1	6.0	43.00	167,919	2,608	5,870
45	2	6.0	40.50	140,300	2,434	5,477
45	3	6.0	37.50	111,375	2,245	5,053
45	4	6.0	35.00	90,552	2,071	4,660
45	5	6.0	32.50	72,501	1,896	4,267
50	1	6.5	44.80	189,901	3,305	7,439
50	2	6.5	41.81	154,360	3,072	6,913
50	3	6.5	38.82	123,555	2,838	6,386
50	4	6.5	36.32	101,189	2,620	5,897
55	1	7.0	46.10	206,917	4,078	9,177
55	2	7.0	43.12	167,329	3,793	8,537
55	3	7.0	40.14	136,592	3,509	7,897
55	4	7.0	37.65	112,717	3,245	7,302
60	1	7.5	47.42	225,205	4,942	11,123
60	2	7.5	44.44	185,360	4,602	10,357
60	3	7.5	41.47	150,625	4,262	9,593

POLE BENDING MOMENTS - PRESTRESSED CONCRETE POLES						
POLE SIZE	CLASS	POLE DEPTH (FT)	CIR AT GROUND LINE (IN)	ANSI MAXIMUM MOMENT (FT-LBS)	WIND ON POLES	
					CAROLINAS	FLORIDA
30	I	5.0	-	27,000	-	2,354
35	I	5.5	-	32,400	-	3,601
50	II	6.5	-	151,700	-	14,275
35	III	5.5	-	70,200	-	4,610
40	III	5.5	-	83,200	-	6,704
45	III	6.0	-	94,900	-	9,034
35	IV	5.5	-	121,500	-	5,416

OH DESIGN - FIG03
9/19/05

What are the factors involved in sizing the class of a wood tangent pole? Let's look at each contributing factor to understand where it comes from and its effect. (See Figure 04 for a diagram of these forces.)

TANGENT POLE STRENGTH CONSIDERATIONS



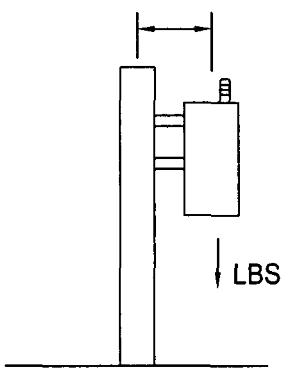
W_C = WIND FORCE ON CONDUCTORS = SPAN LENGTH X FORCE PER FOOT (W_F)

W_F = WIND FORCE / COND. FT = WIND FORCE (LB/FT) X $\frac{\text{CONDUCTOR DIAMETER (IN)}}{12}$

W_P = WIND FORCE ON POLE

W_E = WIND FORCE ON EQUIPMENT

W_S = SIDEPULL FORCE OF OVERHEAD SERVICES



DISTANCE FROM POLE FACE TO CENTER OF GRAVITY OF EQUIPMENT

ECCENTRIC EQUIPMENT WEIGHT (FT-LBS) =
DISTANCE (FEET) X WEIGHT (LBS)

OH DESIGN - FIG04
9/19/05

Wind on conductors: The wind blowing on the conductors in the span is one of the largest contributors to the bending moment on the pole. All conductors, including communication conductors, contribute and must be taken into account. The NESC states the direction of critical loading shall be considered. The critical direction for a tangent pole is perpendicular to the line. The wind force blowing on each conductor times the conductors mounting height is calculated individually and then summed. This is often the main factor in determining the maximum span allowed for various conductor sizes.

The formula for calculating the wind force per foot of conductor is Wc=Wind Force (lbs/sq ft) [conductor diameter (in)/12]. For example, consider a 795 AAC conductor in Florida with a 250 foot span. The diameter of this conductor is 1.026 inches. Fc = (9 lbs/sq ft)[1.026/12] = .7695 lb/ft. The 250 ft span times .7695 lb/ft is a force of 192 lbs per conductor on the pole. 192 lbs at a height of 32 feet is 6,144 ft-lbs from this one conductor. As another example, consider a 477 Sac conductor in Carolina with a 280 foot span. The diameter of this conductor is .793 inches and the ¼ inch of radial ice added yield an overall diameter of 1.293 inches. Wc = (4 lbs/sq ft)[1.293/12] = .431 lb/ft. The 280 ft span times .431 lb/ft is a force of 121 lbs per conductor on the pole. 121 lbs at a height of 32 feet is 3,872 ft-lbs from this one conductor. Similarly, the force on the other two-phase conductors and the neutral would also need to be calculated. Wind overload factors are then applied to these moments. The overload factor depends on the grade of construction and the type of pole. For Grade B construction (used for interstate highways and railroad crossings) it is 4. For normal Grade C construction it is 2.

Wind on poles and equipment: The wind blowing on the pole and any pole equipment must be considered. The NESC specifies that calculations for cylindrical objects use a shape factor of 1.0 and flat objects use a shape factor of 1.6. Figure 3 has a listing of the moment due to wind on poles.

Equipment weight: The heavy equipment such as transformers and regulators are usually bolted to the side of the pole. Since this load is eccentric it contributes to the bending moment of the pole. Its lever arm would be the distance between the center of gravity of the equipment and the center of the pole. This can be a considerable factor. For instance, a 50 kva transformer weighs about 870 lbs and is about 28 inches around. This gives it a lever arm of around 1 ½ ft. This is a bending moment of 870 lbs times 1.5 ft, which is 1,305 ft-lbs. That's not so bad. But consider a 167 kva single-phase regulator. Weighing 2,770 lbs with about a 3-ft lever arm, this would add 8,310 ft-lbs of bending moment to the pole, plus the factor of wind on the regulator. As a result of these large bending moments, it is common practice to sideguy installations with large regulators to reduce pole leaning.

Service and tap sidepulls: The TPX services pulling off of the pole will add bending moment. The angle of the pull is a factor. The moment due to a service is the service tension (lbs) [sin of pull angle] [height of attachment]. The pull angle is the angle between the main line and the direction of the pull. So for two 100 ft TPX services pulling off at 45 degrees to two houses, the bending moment added by the pull is 2 wires times [142 lbs tension (Florida values from Specification Dwg 05-03-01)] times [sin 45 degrees] times [20 ft attachment height], which is 4,016 ft-lbs.

In addition to looking at the above factors for the bending moment, another item to consider in sizing poles is the vertical loading. The vertical loading is caused by the weight of the conductors and equipment weight. Also, the guy tensions can add considerable axial loading to a pole. The usual result of too much axial pole loading is buckling.

There are several shortcuts to avoiding these tedious hand calculations. Specification Dwg. 02.02-03 contains a pole-sizing table which shows our standard poles and some common situations where they are used. This table will generally help you to size the bulk of your poles. Also, there is a software available called Pole Foreman that has templates of our common conductor configurations already loaded. This does an exacting job of calculating vertical and horizontal pole loading for your exact situation. (See the Pole Foreman section below).

7.2 <u>Pole-Sizing-Height – Non-Joint Use Poles</u>

The recommended approach to selecting the proper pole is to determine the height needed first, and then determine the class pole needed.

The height of the pole needed is determined from a combination of the ground clearance required by the NESC for the lowest conductor/cable on the pole plus the NESC clearances between the various conductors/cables on the pole.

Step 1- Determine the sag of the lowest conductor/cable on the pole. If there are no joint use conductors/cables on the pole, the sag of lowest supply conductor must meet minimum NESC ground clearances for the conditions under the line. See Specification Drawing 09.02-01 for appropriate ground clearances. These ground clearances are determined under the following conductor temperature and loading conditions, whichever gives the greatest final sag (NESC Rule 232)

- 120 degree F, no wind displacement
- The maximum temperature for which the line is designed to operate (185 degree F for Florida, 120 degrees F for the Carolinas.)
- 32 degrees F, no wind displacement, radial thickness of ice (1/4 inch for the Carolinas, none for Florida)

For our example, we will use a #4/0 AAAC neutral in a 300-foot span that crosses a Carolina DOT-maintained road. Carolina 25 kV construction will be used.

Before we check out the span for the above conditions, we need to first understand the basics of ruling spans. (See the Conductor Sag and Tension section of this Engineering Manual for a complete in-depth discussion of this topic.) Ruling span is an equivalent span length based on the total spans and the average tension of the conductor in a series of spans being pulled up and sagged in one operation. It is a theoretical span whose sag and tension characteristics, when applied to the whole section, will result in the minimum tension difference between the individual spans once they are tied off. The formula to calculate the ruling span is:

$$RULING\ SPAN = \sqrt{\frac{S_1^3 + S_2^3 + S_3^3 + \cdots S_n^3}{S_1 + S_2 + S_3 + \cdots S_n}}$$

Here is an Excel spread sheet that can perform the ruling span calculation.

Ruling Span Calculation Sheet

When looking up the sags for a particular conductor in the sag tables, we need to be in the section called Conductor Loading Conditions for Design. We then go to the section of the sag table that contains the closest ruling span. Within that ruling span section, find the sag for the span length of concern. If you find that the actual ruling span you have is between the ruling spans listed in the charts, you can interpolate between the two span values. Since you are doing safety calculations and the actual amount of initial sag done by the installing crews could be in doubt, another method is to use the larger sag value for your design calculations.

Now let's go back to our example. Assume we have ruling spans such that the 280-foot ruling span chart section is close. For the first condition listed above, checking the final sag tables in Carolinas Dwg 05.01-18, the 120 degree, no wind displacement final sag for a 300-foot span is 66 inches.

For the second condition, since the neutral will not be operated above 120 degrees F, there is no need to check this sag.

For the third condition, the 32 degrees F, no wind displacement, ¼ inch ice sag is 40 inches.

The condition resulting in the greatest sag is the 120 degrees F, no wind displacement which gives the 66 inches of sag.

Step 2: Determine the required ground clearance distance. Assume, for instance, that it is a DOT-maintained highway. From Specification Dwg 09.02-01, 15.5 foot of clearance over roads subject to truck traffic is required by the NESC for the neutral. However, in North Carolina, 18 feet of clearance is required over DOT-maintained roads. In Florida, 24 feet is required over limited access roads and 18 foot over all others. Therefore, we add 66 inches (5.5 feet) to the 18-foot minimum clearance to determine the mounting height of our neutral on the pole which would be 23.5 feet.

If there were any grade differences between the base of the poles and the ground area being spanned, it should be taken into account in this step. For instance, if the bases of the poles were three feet below a raised roadway, then three additional feet should be added to the required neutral height.

Step 3- Determine what the primary conductor configuration is for the top of the pole. In our example we will be constructing a three-phase 25 kV line (Carolina construction). See Specification Drawing 03.12-02. The total supply space requirement shown on this drawing for 25 kV construction is 155 inches, or 12.92 feet. Adding this to the Step 2 height will require an above-ground height of 36.4 feet (23.5 feet plus 12.92 feet).

Step 4- The normal requirement of pole depth setting is 10 % of pole length plus 2 feet. The actual pole setting depths depend on soil conditions and are shown on Specification Dwg 02.02-14. In the above example, if we selected a 45-foot pole, the setting depth would be 0.10 X 45 foot plus 2 feet = 6.5 feet. If we subtract this from 45 feet (45-6.5) it will leave us with 38.5 foot height above ground level, 2.1 feet more than our calculated need.

7.3 Pole Sizing-Height –Joint Use Poles

There are several considerations to be taken into account for joint use poles. First, let's look at some of the basic NESC rules involving vertical separation of joint use cables from our supply space conductors.

The NESC requires a "Communications Worker Safety Zone" of 40 inches on the pole between the highest communications cable and the lowest supply conductor/cable on the pole.

If additional joint-use companies will be attaching to the pole, we would need to add 12 inches for each additional one.

There are also some additional sag-related clearance rules to be considered involving the mid-span separations between the different conductors. The sag of the joint use cables will rarely be exactly equal to the sag of the supply conductors, so sag differences must be considered. NESC Rule 235-C2 requires the conductors and cables to have their vertical clearance adjusted at the supporting structure so that the clearance at any point in the span for voltages less that 50 kV between conductors is not less than 75% of that required at the supports. There are some exceptions. A neutral conductor bonded to the communication as required by the code may have a span clearance of 12 inches provided the clearance at the supporting poles of 30 inches is maintained. Since it is not the standard practice in either Florida or the Carolinas to enforce and monitor the NESC bonding requirements, this exception is rarely able to be used.

Let's now look at some joint use examples and determine how much additional pole height must be added to the pole to accommodate the joint use.

Example – Joint Use

You have obtained the sag requirements for the joint use cables from the joint use company. Their design final sag requirements are 6 inches more than the design final sag requirements of our supply neutral. The bonding exception requirements for NESC Rule 235-C2 will not be met.

Answer:

In this case we need to allow for the Communications Worker Safety Zone on the pole and also take into account the increased sag requirements. The following should be added to the height calculations for a non-joint use pole:

- 40 inches (3.33 feet) for the Communications Worker Safety Zone
- 12 inches (1 foot) for each additional joint use company
- 6 inches (0.5 feet) for the difference between the joint-use cable sag and our supply-conductor neutral sag.

In the prior non-joint use pole example, what would be the neutral attachment height for one joint use cable? We would need to add the additional joint use space to the 23.5 foot distance we determined in Step 2 above. This would be the 23.5 feet plus 3.33 feet plus .5 feet for a total of 27.33 feet.

Example – Joint Use

You have obtained the sag requirements for the joint use cables from the joint use company. Their design final sag requirements are two feet total, which is less than the design final sag requirements of our supply neutral. Our neutral sag requirements are 66 inches (5.5 feet). The bonding exception requirements for NESC Rule 235-C2 will not be met. How high would the neutral need to be for maintaining an 18-foot road clearance?

Answer:

First, determine the clearance at mid-span between the lowest supply conductor and the highest joint use cable. The NESC will allow the clearance between conductors/cables in mid-span to be 75 percent of the clearance required at the pole. If the sag of the supply conductor/cable is greater than 75 percent of the clearance requirement at the pole, the mounting height of the supply conductor/cable will have to be raised to meet the minimum clearance in mid span. Start with our neutral sag, 66 inches, and subtract the joint use cable sag of 24 inches to get 42 inches of sag difference. We need 75% of 40 inches, or 30 inches as a minimum as a mid span clearance. The total mid span clearance mounting requirement is therefore 42 inches plus 30 inches, for a total of 72 inches. We will need to raise our neutral attachment height from 40 inches to 72 inches, which is an additional 32 inches. So the pole spacing between our neutral and the joint use cable attachment should be 72 inches to meet the mid span requirement.

The following should be added to the height calculations for a non-joint use pole:

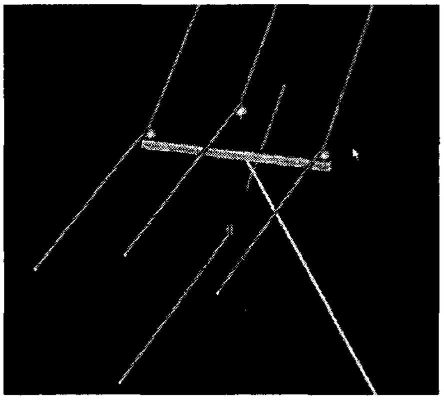
- 40 inches (3.33 feet) for the Communications Worker Safety Zone
- 32 inches (2.66 feet) for the additional sag-related clearances
- 12 inches (1 foot) for each additional joint use company

Let's do the math for this from the mid-span viewpoint again first. From a mid-span viewpoint, the distance totals would be the 18 feet ground clearance to the joint use cable plus the 30 inch (2.5 feet) mid-span clearance plus the 66 inches (5.5 feet) of neutral sag for a total of 26 feet.

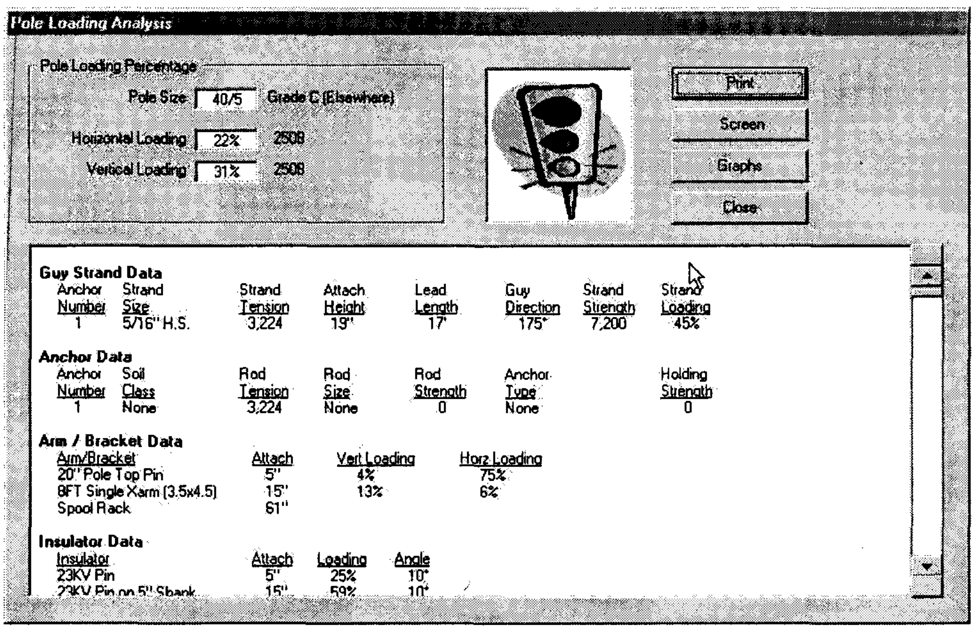
We can also check the math from the pole viewpoint if we desire. From the pole viewpoint, the required mounting height for the joint use cable attachment is 18-feet of ground clearance for the joint use cable plus two feet of joint use sag for a mounting height of 20 feet. To this we add the 72 inches (6 feet) spacing between the supply and joint use cable for a total of 26 feet to the neutral attachment mounting height.

7.4 Pole Foreman

The recommended computer program used to determine pole class is called Pole Foreman. This program is a module put out by Powerline Technology, Inc. Distribution Standards supports this program and also a related program for wire sag called Sagline. These modules have templates and files populated with Progress Energy data. This data includes our conductors, line hardware and its related strength ratings, guying ratings and our primary construction configurations.



Pole Foreman is able to show you a solid model of the structure being analyzed. This view enables the designer to verify they are modeling the correct structure configuration. The program can also model transformer banks on the pole. It contains joint use cable data for analysis of lines with multiple joint use cables. Pole Foreman is a single structure program. Only one pole structure at a time is modeled. It is easy to change from Grade C to Grade B code rules or to change from the regular medium/light loading rules to the extreme wind rules.



The printout of the analysis gives a clear stop/go indication on whether or not the structure meets the NESC requirements. Both horizontal and vertical loading are calculated. The detail on all hardware strengths and loadings is also available.

This program is sold by individual software licenses. This method is currently more economical than a corporate site license. An individual site license is about $1500 purchase price with an annual maintenance fee of 14%. The maintenance fee covers changes in Progress Energy templates, NESC rule changes and program feature upgrades. Contact Distribution Standards if you are interested in purchasing a copy.

8. Anchors & Guying

Guyed structures are used at line angles, dead ends, locations where there is a significant conductor change and situations where the pole by itself is not capable of supporting the horizontal loads. The guy assembly must be designed to withstand all forces acting in the direction of the guy assembly. Each force acting on the structure must be broken down into its vector components in the direction of the guy assembly. It is critical to line safety and reliability that guyed structures be properly designed. Failure of a guyed structure in a storm is more time consuming to replace than a tangent structure, and can also lead to failure of adjacent tangent structures.

8.1 Dead End Structure Guys

Let's look first at the simple case of a dead-ended primary conductor to understand how these forces are acting on the guy assembly. See Figure 5. Since the critical direction of wind loading would be perpendicular to the line and the guy, the wind force blowing on the conductors is not a factor. The significant force involved with a dead-end structure is the tension in the conductors.

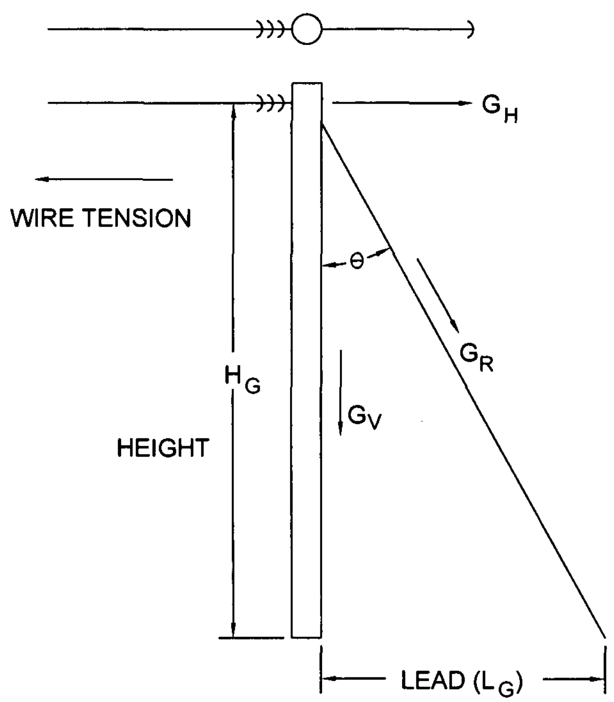
The maximum loading tensions with appropriate NESC overload factors must be used for the conductor tensions.

As shown in Figure 5, the horizontal force in the guy assembly is equal to the wire tension forces. This assumes the height of the conductor attachments and the height of the guy attachments are essentially equal. Even with a one-to-one attachment height to guy lead ratio, the guy wire tensions are much higher than the conductor tensions. For a one-to-one lead ratio the guy tension is 1.4 times the conductor tension. As the guy lead is shortened the guy wire tension increases. Short guy leads could not only cause the guy wire to be over-tensioned, but the guy attachment hardware itself could be used beyond its rating. In addition, the vertical bearing of the hardware on the pole would become excessive and could split the top of the pole.

The downward force of the guy wire generates a downward vertical force (or axial load) through the pole. This vertical force is equal to the conductor tension multiplied by the guy height/guy lead ratio. As the guy lead is shortened and the guy wire tension increases, the downward force in the pole also increases. The axial pole loading will not normally be a problem. Another component of axial pole loading is the weight of ice on the conductors and the equipment weight. By far the most important factor in causing high axial pole loading is the use of a short or reduced length guy lead.

A guyed pole acts like a column to sustain the downward axial loads. When the axial load becomes large enough, the pole acting as a column becomes unstable and lateral deflections will cause the pole to buckle. The critical area of pole buckling will usually be the section of the pole that is one third the distance from the point of guy attachment to the ground line. Poles that are observed to be bending in this location should either have the guy lead extended or be increased in class.

In areas with poor soil (marsh, soft fill dirt) the downward axial force will sometimes be more pressure than the soil can bear. In this case, a bearing plate can be used on the bottom of the pole as shown on Specification Dwg 02.02-14. Another solution is to use bog shoes as shown on Specification Dwg 02.02-16.



G_H = GUY HORIZONTAL FORCE = WIRE TENSION FORCE

$$\text{SIN}\,\theta = \frac{L_G}{\sqrt{H_G^2 + L_G^2}} \qquad \text{COS}\,\theta = \frac{H_G}{\sqrt{H_G^2 + L_G^2}}$$

G_R = GUY RESISTIVE FORCE

$$G_R = \frac{G_H}{\text{SIN}\,\theta} \quad \underline{\text{OR}} \quad G_H\left[\frac{\sqrt{H_G^2 + L_G^2}}{L_G}\right]$$

G_V = GUY VERTICAL FORCE

$$G_V = G_R\left[\frac{H_G}{\sqrt{H_G^2 + L_G^2}}\right] = G_H\left[\frac{H_G}{L_G}\right]$$

OH DESIGN - FIG05
9/19/05

8.2 Angle or Bisector Guys

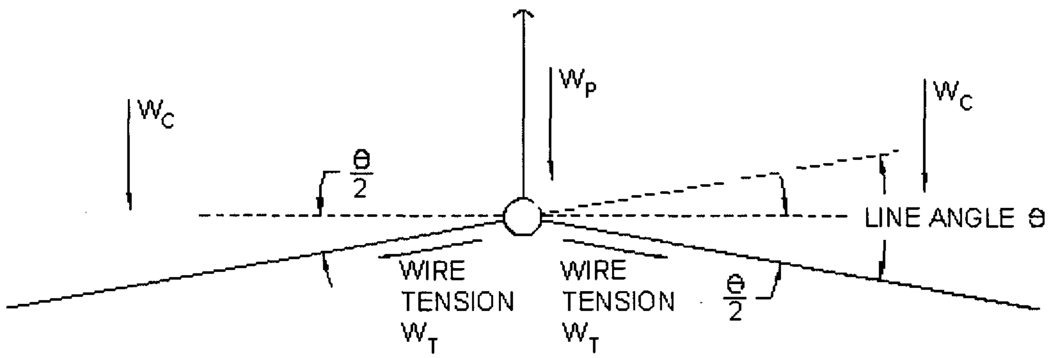
An angle or bisector guyed structure is treated differently by the NESC. A tangent pole has the transverse wind loading on the conductors and pole resisted by the bending moment of the pole. A guyed structure is required to use the pole acting as a column or strut only, and all the forces must be resisted by the guy assembly. So the guy assembly must resist the tension in the conductors, the wind loading on the conductors and the wind loading on the pole and any equipment on the pole. These forces are shown in Figure 6.

It is very important to mention that care should be taken to stake the guy location in the exact center of the line angle. Any off-center position of the angle guy will allow the pole to bear some of the horizontal forces rather than the entire horizontal forces being borne by the guy strand. The result is even a small distance off-center can be dramatic. For example, one long-span, single-phase line with a 60-degree angle was looked at by Pole Foreman. With the guy lead placed at only 10 degree from center, the pole went from passing code requirements to being over 150% overstressed.

The wind loading is determined by which NESC loading district you are in. The Carolinas are in the Medium Loading district, which has a wind loading of 4 lbs/ft (about 40 mph). This wind loading is acting on a conductor covered with ¼ inch of ice. The equipment or structure the wind acts on need not be covered in ice. Florida is in the Light Loading district, which has a wind loading of 9 lbs/ft (about 60 mph). There is no ice loading.

Above turning angles greater than 60 degrees, the line conductors should be double deadened and each line section treated as individual dead end structures. Here again, note the criticality of avoiding short guy leads, since each dead-end guy is adding axial loading to the pole.

There are guying charts developed in the specification manual which have had all these calculations done for various angles and span lengths. These are Specification Dwgs 02-04-32 thru 48. Let's look at them for a moment. The preferred guy lead lengths are indicated. Look at any chart in the span guy area. Look at the difference between the dead end tension and the 60-degree tension for any conductor. Without any wind loading, the 60 degree angle tension would equal the deadend tension (Sin 60/2=0.5, times two conductors = 1). The difference in the deadend tension and the 60-degree angle tension is the contribution of the wind loading on the conductors and the pole.



W_T = WIRE TENSION FORCE = 2 X TENSION PER CONDUCTOR X SIN $\frac{\theta}{2}$

W_C = WIND FORCE ON CONDUCTORS = SPAN LENGTH X FORCE PER FT (W_F) X COS $\frac{\theta}{2}$

W_F = WIND FORCE/COND FT = WIND FORCE (LB/FT) X $\frac{\text{CONDUCTOR DIAMETER (IN)}}{12}$

W_P = WIND FORCE ON POLE

G_H = GUY HORIZONTAL FORCE = $W_T + W_C + W_P$

CAROLINAS: MEDIUM LOADING - HORIZONTAL WIND FORCE = 4 LB/FT (≃40 MPH)
FLORIDA: LIGHT LOADING - HORIZONTAL WIND FORCE = 9 LB/FT (≃60 MPH)

OH DESIGN - FIG06
9/19/05

8.3 Procedure for Sizing the Guys

Step 1: From your field layout determine your conductor size and configuration, grade of construction, span lengths, line angle and guy lead to height ratios. For angle guys with unequal span lengths, one half of the span lengths on either side of the pole should be added together to get the span length.

Step 2: Find the correct guying tables in Section 2 of the specification manual. Use Specification Dwgs 02.04-32, 34 and 36 for Grade C short, medium, and long spans, respectively. Use Specification Dwgs 02.04-44, 46 and 48 for Grade B short, medium and long spans, respectively. As the drawings are listed under the same numbers for both Florida and the Carolinas, the numbers are different due to the different loading zones. The Carolinas are in the medium-loading zone, while Florida is in the light-loading zone.

Step 3: Find the wire size on the top row. Go down to the correct guy lead to height ratio section. For your line angle, this is the tension in the guy wire for a single conductor. (FYI: These are the actual guy wire tensions. No overload factor has yet been applied to these loads.)

Step 4: From your conductor configuration, determine how many conductors the guy wire will be supporting. This is usually one conductor, one and ½ conductors (for cases where two guys back up three primary conductors) or two conductors (for one guy backing up two conductors on a steel arm). Multiply the tension in the single conductor by the number of conductors the guy is supporting. This is the required guy wire tension capacity.

Step 5: Go to the Specification Dwg 02.04-10 and select a guy wire size that is above the required guy wire tension capacity. (FYI: Overload and strength factors have been applied to the guy strand rating values to meet the NESC requirements.)

8.4 Example – Guy Sizing

Case One: Grade C construction, 3#1/0 AAAC primary conductors with #1/0 AAAC neutral, 250 foot span, 45 ft pole, conductor configuration vertical turning a 45-degree line angle utilizing angle assemblies, guy lead available is 20 feet.

Allowing for embedment depth, the guy lead to height ratio is 1: 1.95. The 1:2 ratio sections will therefore be used. The 50-degree angle will be used.
Carolinas area: From Specification Dwg 02.04-34, the guy wire tension for a #1/0 single conductor is 3,898lbs.
Florida area: From Specification Dwg 02.05-34, the guy wire tension for a #1/0 single conductor is 4,312 lbs.
Conductor/guy configuration that will be utilized is two guys backing up three primary conductors and one guy backing up the neutral conductor.

Primary guy tensions – Carolinas: 3,898 lbs times 1.5 equals 5,847 lbs.
Neutral guy tension – Carolinas: 3,898 lbs
Primary guy tensions – Florida: 4,312 lbs times 1.5 equals 6,468 lbs.
Neutral guy tension – Florida: 4,312 lbs

From Specification Dwg 02.04-10, a 5/16 HS guy wire for Grade C construction is rated 7,200 lbs. This easily meets the required primary and neutral guy tensions.

8.5 High Wind Coastal Areas - Storm Guying

In our service areas there are some distribution lines that are exposed to much higher winds than a normal distribution line. These lines are directly along a beach road or in an exposed coastal marsh area of eastern NC. While these lines are not subject to the extreme wind rules when they are less than 60 feet in height, it is important to design them for their environment. Obviously, one design method you can use to add strength to the line is to avoid the maximum span lengths. Keeping span lengths reasonable and shorter than normal will enable the line to better resist high winds without leaning or breaking poles.

Even with reasonable span lengths, these distribution lines are subject to be rocked by the high winds. The rocking action of the gusty winds, combined with water-saturated soils, will cause the poles to lean. Under some conditions, winds can rock the lines and cause the poles to literally walk out of their holes. After hurricanes, many beach lines have been found to be leaning or the poles lying on the ground un-broken. Adding storm guys will avoid this.

Storm guys are usually added on every fourth structure for best effect. Adding the minimum size guy wires and anchors can have a huge, favorable impact. Two guys are added at neutral level on each side of the poles. These guys provide resistance to the poles from leaning, and also provide downward force to keep the poles from walking out of their holes.

8.6 Anchors

The selection and design of anchors for guyed structures are the least precise elements in the design or an overhead distribution line. First, soil conditions vary greatly. The best a designer can do is to make an educated guess at the soil types. Also, the manufacturers' data and ratings are based on controlled test conditions and anchors being installed with proper torque exactly as specified. As a result of these items, a large factor of safety should be used in determining the anchor ratings and the anchor selection. It is relatively economical to over design the anchoring system rather than risk failure.

There are two factors Distribution Standards has looked at in determining the anchor ratings. First is the mechanical strength of the anchor assembly. This rating must allow for the fact that over time some corrosion and loss of material will occur. The other rating is the resistance of the anchor assembly to pull out in a particular class of soil. The resulting ratings that are listed in the specification manual have also had the required NESC overload factors applied.

For the designer the anchor selection is relatively simple. Using Specification Dwgs 02.06-02, the anchor rating should be matched up with the guy wire tensions it will be supporting.

8.7 Guy Insulator Clearances

NESC Rule 279 (2) b has a performance requirement related to the use of guy insulators.

(1) All insulators shall be located at a position that maintains the bottom of the insulator not less than 8 ft above the ground if the guy is broken below the insulator.
(2) Insulators shall be so placed that, in case any guy contacts, or is contacted by, an energized conductor or part, the voltage will not be transferred to other facilities on the structure(s).
(3) Insulators shall be so placed that in case any guy sags down upon another, the insulators will not become ineffective.

These are pretty stringent installation requirements, all designed to maintain public safety from a broken or loose guy wire. These requirements are in the Progress Energy construction specifications and are shown on Specification Dwg 02.04-18.

It is important that the designer understand the guy insulator rules and know how to apply them. The Distribution Standards web site has a detailed presentation on guy insulator clearances and usage.

9.0 Overhead Conductor Data

9.1 Electrical Properties

Let's look at some of the basic electrical properties of conductors. This will give us a basis for understanding how the voltage drop factors are determined.

DC Resistance: The DC resistance of a conductor is a function of its cross sectional area, length and volume resistivity. This can be expressed as

$$R = Pv\ [L/A]$$

where R = conductor resistance (ohms per unit length)
Pv = volume resistivity of conductor material
L = conductor unit length
A = conductor cross sectional area

The resistance of a material is a function of temperature. The resistance will go up as the temperature rises. The common temperature used for measuring this is 20 deg C. To determine the DC resistance at other temperatures, the known resistance must be corrected using the temperature coefficient of resistance for the conductor metal. Over a moderate temperature range such as 0 deg C to 120 deg C the change in resistance is linear.

AC Resistance: A conductor offers a greater resistance to the flow of alternating current than it does to direct current. Factors that are responsible for this are skin effect, proximity effect and hysteresis and eddy current losses. Let's look at these factors.

Skin effect is always present in a conductor carrying AC current. AC current tends to flow near the outside of a conductor, yielding a higher current density on the outer layers and increasing the effective resistance. For a concentric-lay stranded aluminum conductor such as we use, studies indicate that the skin effect is identical to that of a solid cylindrical conductor having the same DC resistance. The magnitude of this increase is usually expressed as an AC/DC ratio. These ratios would be determined from conductor tables.

Proximity effect is present when two conductors carrying AC current are spaced relatively close to one another. Their mutual inductance affects the current distribution in each wire. This results in greater current density on the near sides of the conductors when the current in the conductors is flowing in opposite directions and at the far sides of the conductors when the current is flowing in the same direction. Similar to skin effect, this leads to an increase in resistance. Bare overhead conductors are usually installed with sufficient spacing such that proximity effects may be neglected. However, it is a factor in tri-plexed cables.

Hysteresis and eddy current effects in conductors add to the effective AC resistance. These losses are a function of current and increase with the level of current. These losses are important in conductors utilizing steel cores at high current levels, such as our ACSR conductors. In concentric-lay stranded conductors the practice is to alternate the direction of lay in the different layers. This allows for one strand layer to cancel out the axial magnetic effects of the next layer.

Inductance and Inductive Properties: The inductance (L) of an electrical circuit is defined as the ratio of the voltage drop along the conductor (V) to the rate of change of the current (i). It is expressed as

$$V = L\,[di/dt]$$

The general method of calculating inductance expresses the distance between conductors in terms of geometric mean distance (GMD) and the conductor radius in terms of geometric mean radius (GMR). Inductive reactance for cables is generally given in terms of ohms per 1000 ft.

9.2 <u>Voltage Drop Constants</u>

Using the electrical properties of AC resistance and inductive reactance from the manufacturer's tables, a voltage drop constant can be calculated for our Progress Energy overhead service cables. These voltage drop constants are expressed in terms of per kva per 100 feet of circuit on a 120 volt base in our construction specifications. The formula for calculating the voltage drop constant is

$$\text{Voltage Drop Constant} = I[R\ \cos(\varnothing) + X\ \sin(\varnothing)]$$

where I = current for one kva of load in amps
R = AC resistance in ohms
X = inductive reactance in ohms per
Ø = power factor phase angle

Let's see how we can calculate the voltage drop constant for a typical overhead conductor. As an example, let's use 1/0 aluminum triplex, which is a common conductor in the Carolinas. What we want to calculate is the voltage drop per kva per 100 ft on a 120 volt base. Let's use a .95 power factor.

From the manufacturer's data we can get the resistance and reactance (See Figure 8).

AC resistance @ 75 Deg C is .200 ohms per 1000 ft
Reactance is .029 ohms per 1000 ft

Find the current I for one kw

I = ([1000 VA]/240 V)/.95 = 4.386 amps

Find the AC resistance R for 100 ft of TPX

R = [.200/10] 2 = .040 ohms   Note: Times 2 for two wire loop in circuit

Find inductive reactance X for 100 ft

X = [.029/10] 2 = .0058 ohms

Find the phase angle Ø

Inverse COS (.95) = 18.2 degrees
COS (18.2) = .95
SIN (18.2) = .312

Find Voltage Drop Constant

Voltage Drop constant = 4.386 [.040 (.95) + .0058 (.3122)] = .1746 volts per kva per 100 ft

This is on a 240 volt base. Divide by 2 to get 120 volt base.

.1746/2 = <u>.0873 volts per kva per 100 ft</u>

9.3 Progress Energy Tables

Overhead conductor data is found in both the Distribution Overhead Construction Specifications Manual and the Engineering Manual. Data which is used in the day-to-day job by both engineers and service coordinators is found in the construction specifications. Other more engineering oriented data is in the Engineering Manual. The main overhead conductor data tables are located as follows:

- Voltage Drop Factors: These are found in the construction specifications. These tables contain the voltage drop factors for overhead multiplexed cables and can be found in Specification Dwg 05.00-04 and 05.00-05.

- Multiplex Cable Ampacities: These are found in the construction specifications. These tables contain ampacity, weights, and some physical data. The Carolinas table is Specification Dwg 05.00-03 and the Florida table is Specification Dwg 5.00-11.

- Bare Conductor Ampacities: These are found in the construction specifications. These tables contain ampacity, weights, and some physical data. The Carolinas tables are Specification Dwgs 05.00-01 & 02 and the Florida table is Specification Dwg 5.00-10.

- AC Resistance & Reactance: This data is found in the Engineering Manual below in Figures 7 thru 10.

BARE PRIMARY CONDUCTORS - PHYSICAL AND MECHANICAL PROPERTIES

SIZE - NAME	STRAND.	COPPER EQUIV.	DIA. (INCHES)	CROSS SECTION AREA (SQ. IN.)	MCM (ALUM.)	WT. PER MILE (LBS.)	VERTICAL LOADS WEIGHT LOAD (LBS./LIN. FT.)				HORIZONTAL LOADS WIND LOAD (LBS./LIN. FT.)					RATED BREAKING STRENGTH
							BARE	1/4" ICE	1/2" ICE	1" ICE	40 MPH (4 PSF)	80 MPH (16 PSF)	90 MPH (21 PSF)	100 MPH (26 PSF)	110 MPH (31 PSF)	
#4 - SWANATE	7/1	6	.257	.0411	62.50	354	.0670	.22	.54	1.63	.25	.34	.45	.56	.66	2,360
#2 - SPARROW	6/1	4	.316	.0608	66.37	482	.0913	.27	.60	1.73	.27	.42	.55	.68	.82	2,850
1/0 - RAVEN	6/1	2	.398	.0968	105.53	767	.1453	.35	.69	1.88	.30	.53	.70	.86	1.03	4,380
4/0 - PENGUIN	6/1	2/0	.563	.1939	211.61	1537	.2911	.54	.95	2.23	.35	.75	.99	1.22	1.45	8,350
336.4 - MERLIN	18/1	4/0	.684	.2789	336.40	1929	.3652	.66	1.10	2.46	.41	.91	1.20	1.48	1.77	8,680
556.5 - PARAKEET	24/7		.914	.4938	556.50	3786	.7169	1.08	1.60	3.10	.47	1.22	1.60	1.98	2.36	19,800
795 - TERN	45/7		1.063	.6674	795.00	4731	.8958	1.30	1.87	3.46	.52	1.42	1.86	2.30	2.75	22,100
477 SAC - COSMOS	45/7	300	.792	.493	477.00	2364	.4475	.77	1.25	2.68	.43	1.06	1.39	1.72	2.05	8360

BARE PRIMARY CONDUCTORS - ELECTRICAL PROPERTIES

SIZE - NAME	RESISTANCE (OHMS)				REACTANCE (OHMS)										RATED AMPACITY
	25°C		50°C		10"		15"		30"		54"		60"		
	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	(AMPERES)
#4 - SWANATE	2.226	.422	2.48	.470	.689	.131	.738	.140	.823	.156	.894	.169	.907	.172	140
#2 - SPARROW	1.390	.263	1.610	.305	.623	.118	.672	.127	.757	.143	.828	.157	.841	.159	185
1/0 - RAVEN	.924	.175	1.030	.195	.588	.111	.637	.121	.721	.137	.793	.150	.805	.153	240
4/0 - PENGUIN	.493	.093	.545	.103	.553	.105	.602	.114	.686	.130	.758	.144	.770	.146	365
336.4 - MERLIN	.273	.052	.300	.057	.440	.083	.489	.093	.573	.109	.645	.122	.657	.125	515
556.5 - PARAKEET	.163	.031	.179	.034	.401	.075	.450	.085	.534	.101	.606	.114	.618	.117	720
795 - TERN	.116	.022	.128	.024	.384	.073	.433	.078	.517	.098	.589	.112	.601	.114	890
477 SAC - COSMOS	.194	.037	.213	.040	.426	.081	.475	.090	.559	.106	.630	.119	.643	.122	640

OH DESIGN - FIG07
1/12/12

CAROLINAS BARE CONDUCTORS

OVERHEAD MULTIPLEX CONDUCTORS - PHYSICAL AND MECHANICAL PROPERTIES

SIZE - NAME	PHASE		NEUTRAL		DIA. OF CIRCUM-SCRIBED CIRCLE (INCHES)	AREA OF CIRCUM-SCRIBED CIRCLE (SQ. INCHES)	VERTICAL LOADS WEIGHT LOAD (LBS./LIN. FT.)				HORIZONTAL LOADS WIND LOAD (LBS./LIN. FT.)				
	SIZE, AWG AND STRANDING	INSULATION THICKNESS MILS	SIZE, AWG AND STRANDING	RATED BREAKING STRENGTH			NO ICE	1/4" ICE	1/2" ICE	1" ICE	40 MPH (4 PSF)	80 MPH (16 PSF)	90 MPH (21 PSF)	100 MPH (26 PSF)	110 MPH (31 PSF)
#4 ALUM. TRIPLEX CRAB	4-7	45	30580 - 7	1110	.63	.3117	.153	.427	.856	2.181	.377	1.507	1.978	2.448	2.919
#2 ALUM. TRIPLEX SOLASTER	2-7	45	48690 - 7	1760	.75	.4418	.232	.543	1.010	2.409	.417	1.667	2.188	2.708	3.229
1/0 ALUM. TRIPLEX SANDCRAB	1/0-7	60	77470 - 7	2800	.95	.7088	.373	.746	1.275	2.799	.483	1.933	2.538	3.142	3.746
1/0 ALUM. QUADRUPLEX VIATKA	1/0-7	60	77470 - 7	2800	1.11	.9677	.542	.965	1.543	3.167	.537	2.147	2.818	3.488	4.159
4/0 ALUM. TRIPLEX LEPAS	4/0-19	60	246900-7	8560	1.32	1.368	.754	1.242	1.886	3.640	.607	2.427	3.185	3.943	4.702
4/0 ALUM. QUADRUPLEX WALKING	4/0-19	60	246900-7	8560	1.49	1.744	1.015	1.556	2.253	4.113	.663	2.653	3.483	4.312	5.141
350 ALUM. TRIPLEX	350000-37	95	246900-7	8560	1.76	2.44	1.187	1.812	2.593	4.620	.753	3.013	3.955	4.897	5.838
350 ALUM. QUADRUPLEX	350000-37	95	246900-7	8560	2.15	3.63	1.635	2.381	3.283	5.554	.883	3.533	4.638	5.742	6.846

OVERHEAD MULTIPLEX CONDUCTORS - ELECTRICAL PROPERTIES

SIZE - NAME	RESISTANCE (OHMS)								REACTANCE (OHMS)		RATED AMPACITY
	25°C		50°C		75°C		90°C				
	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	PER MILE	PER 1000 FT.	(AMPERES)
#4 ALUM. TRIPLEX CRAB	2.23	.423	2.46	.465	2.67	.506	2.81	.532	.158	.030	118
#2 ALUM. TRIPLEX SOLASTER	1.40	.266	1.54	.292	1.68	.318	1.76	.334	.153	.029	159
1/0 ALUM. TRIPLEX SANDCRAB	.88	.167	.97	.184	1.06	.200	1.11	.210	.153	.029	211
1/0 ALUM. QUADRUPLEX VIATKA	.88	.167	.97	.184	1.06	.200	1.11	.210	.153	.029	187
4/0 ALUM. TRIPLEX LEPAS	.44	.083	.49	.092	.53	.100	.55	.105	.143	.027	329
4/0 ALUM. QUADRUPLEX WALKING	.44	.083	.49	.092	.53	.100	.55	.105	.143	.027	290
350 ALUM. TRIPLEX	.28	.053	.31	.059	.33	.063	.35	.066	.143	.027	420
350 ALUM. QUADRUPLEX	.28	.053	.31	.059	.33	.063	.35	.066	.143	.027	400

OH DESIGN – FIG08
1/12/12

CAROLINAS OVERHEAD CABLES

FLORIDA OVERHEAD SERVICE & SECONDARY CABLES
PHYSICAL & ELECTRICAL PROPERTIES

SIZE - NAME	NO. OF STRANDS	INSULATION THICKNESS (MILS)	BARE OD (INCHES)	INSUL OD (INCHES)	AC RESISTANCE - OHMS PER 1000 FT			INDUCTIVE REACTANCE OHMS/1000 FT
					25°C	75°C	90°C	
SERVICE CABLES								
#6 DUPLEX VISLA	7	45	0.178	0.277	0.6726	0.8057	0.8457	0.032
#2 TRIPLEX SOLASTER	7	45	0.283	0.382	0.2656	0.3182	0.334	0.029
#1/0 TRIPLEX SANDCRAB	7	60	0.357	0.489	0.1671	0.2002	0.2101	0.029
AERIAL CONDUCTORS - SECONDARY								
#4 DUPLEX WHIPPET	7	45	0.225	0.324	0.4227	0.5064	0.5315	0.030
#1/0 DUPLEX NO CODE WORD	7	60	0.357	0.489	0.1671	0.2002	0.2101	0.029
#1/0 TRIPLEX AUBURN	7	60	0.357	0.489	0.1671	0.2002	0.2101	0.029
#4/0 TRIPLEX NO CODE WORD	19	60	0.512	0.644	0.0835	0.1001	0.1051	0.027
#1/0 QUADRUPLEX GALLEY	7	60	0.357	0.489	0.1671	0.2002	0.2101	0.029
#4/0 QUADRUPLEX NO CODE WORD	19	60	0.512	0.644	0.0835	0.1001	0.1051	0.027

DATA IS FROM GENERAL CABLE (BICC) DATED MAY 2005

OH DESIGN - FIG09
1/12/12

	CATALOG NUMBER	TYPE OF INSULATION	*AMPACITY PER CONDUCTOR	WEIGHT IN POUNDS PER FOOT	OUTSIDE DIAMETER INCHES	BREAKING STRENGTH IN POUNDS
600 VOLT COPPER CABLE						
6 DUPLEX		HDP	65	.210	0.32	1,105
6 TRIPLEX		HDP	100	.310	0.63	1,105
2 TRIPLEX		HDP	135	.630	0.84	2,705
6 QUADRUPLEX		HDP	85	.440	0.80	1,105
2 QUADRUPLEX		HDP	120	1.000	1.09	2,705
6 SOLID 1/C		TBWP	100	.112	0.287	763
4 SOLID 1/C		TBWP	130	.164	0.329	1,213
2 STRANDED 1/C	193501	XLP	192	.342	0.870	2,622
1/0 STRANDED 1/C		TBWP	235	.424	0.524	3,066
2/0 STRANDED 1/C		TBWP	275	.522	0.570	3,866
4/0 STRANDED 1/C	193504	XLP	400	.587	1.110	6,149
250 KCM STRANDED 1/C		TBWP	410	.985	0.762	7,265
350 KCM STRANDED 1/C		XLP	510	1.345	0.866	10,170
500 KCM STRANDED 1/C	193507	XLP	700	2.071	1.390	14,530
600 VOLT ALUMINUM SERVICE CABLE (SC)						
6 DUPLEX	180404	XLP	55	0.063	0.43	528
4 TRIPLEX		XLP	100	1.156	0.71	826
2 TRIPLEX	181408	XLP	135	0.228	0.73	1,266
2 QUADRUPLEX	182408	XLP	160	0.310	1.02	1,267
1/0 TRIPLEX	181410	XLP	250	0.366	1.00	1,864
1/0 QUADRUPLEX	182411	XLP	225	0.533	1.19	1,990
4/0 TRIPLEX	181412	XLP	400	0.697	1.30	4,020
336.4 QUADRUPLEX	182422	XLP	465	1.630	1.80	5,940
600 VOLT ALUMINUM AERIAL SECONDARY CABLE (ASC)						
4 2 CONDUCTOR	201103	XLP	90	0.099	0.54	1,745
1/0 2 CONDUCTOR	201101	XLP	271	0.265	0.85	4,380
1/0 3 CONDUCTOR	201106	XLP	250	0.408	1.00	4,415
1/0 4 CONDUCTOR	201109	XLP	225	0.533	1.19	4,415
4/0, 4/0, 1/0	201107	XLP	400	0.626	1.39	4,415
4/0, 4/0, 4/0, 1/0	201111	XLP	355	0.968	1.74	4,415

*AMPACITY BASED ON AMBIENT TEMPERATURE OF 40°C AND CONDUCTOR TEMPERATURE RISE OF 35°C OVERALL CONDUCTOR TEMPERATURE OF 75°C EXCEPT FOR CABLES WITH XLP INSULATION WHICH HAS A TEMPERATURE RISE OF 50°C AND OVERALL CONDUCTOR TEMPERATURE OF 90°C.

INSULATION:
HDP = HI-DENSITY POLYETHYLENE
PVC = POLY-VINYL CHLORIDE
RINJ & HTS ARE THERMALLY EQUIVALENT TO CROSS LINK POLYETHYLENE
XLP = CROSS LINK POLYETHYLENE
TBWP = TRIPLE BRAID WEATHERPROOF

NOTE: MAXIMUM CONDUCTOR CURRENT WILL ALSO BE LIMITED BY THE UP STREAM PROTECTIVE DEVICE.
PRIMARY LOAD PICKUP JUMPER - SEE "PRIMARY LOAD PICKUP JUMPER", GENERAL, SECTION OH-1.

FLORIDA OH CABLE DATA PRE-YEAR 2000

OH DESIGN - FIG10
1/12/12

10.0 Joint Use

General

Any communications company (attacher) wishing to 1) attach to Progress Energy (PE) poles or 2) overlash to existing facilities whether owned by proposing attacher or another attacher on PE poles must first have a contractual agreement in place with PE. After the contractual agreement is finalized, the proposed attacher must make application to PE. These requirements shall apply to anyone wanting to attach to or occupy PE facilities, including all cable operators or telecommunications carriers, and any affiliates of PE. All new attachments requests must come through the System Joint Use Administrator.

Permitting

Pole utilization requires a permit for installation of new attachments, removal of existing attachments, upgrade to larger cables, lashing of new cables to existing messengers, rebuilds of cable systems, large scale relocations for road widening, etc. and installation of service drops on lift poles. Service drops may be permitted monthly "after the fact".

A permit is required in order to maintain accurate attachment inventories and to obtain technical data necessary to review the adequacy of existing distribution and/or transmission system facilities.

Each pole in the application shall be checked to meet NESC clearance and pole class requirements. If NESC standards are not met, the pole shall be changed to the appropriate pole class and/or height or a mid-span pole may be required to accommodate existing facilities plus the proposed additional facilities. All costs associated with this work shall be paid in advance by the proposed attacher. It is the responsibility of the attacher to obtain all necessary easements for their facilities.

Once the NESC analysis is completed, the attacher will receive an approved permit if no make-ready is required for the attachment. If the attacher's application requires make-ready, the attacher will receive an invoice for make-ready costs which includes engineering and construction costs along with an administrative fee.

Tagging

Each attacher shall install identifying tags on its cables and equipment at a minimum interval of every five (5) poles for the purpose of identification. Attachers shall install tags at the time attacher's facilities are installed. Existing attachers should also install identifying tags on their equipment.

Clearances

All permit requests for new attachments will be assigned an attachment height. 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.

At the time of installation, all communications facilities shall be located a minimum of 40" below PE power facilities (secondaries or neutral) per NESC rules 235C and 238.

At the time of installation, all communications facilities passing above or below ungrounded street light brackets shall be 20" away from such brackets per NESC rule 238C and 20" away from top of the streetlight luminaire. All communications facilities passing above or below grounded street light brackets shall be 4" away from such brackets and 4" away from top of the streetlight luminaire. All communication facilities must maintain a minimum clearance of 12" below the insulated conductor drip loops of the lights per NESC rule 238D.

Where floodlights or area lights are on PE permanent poles, the clearances at the time of installation shall be 20" below or above the light brackets per NESC rule 238C.

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, maintaining 12" separation at midspan. During construction or deconstruction, third party attachers shall not directly or indirectly influence the sag and tension of PE wire or cause a pole to lean, thus jeopardizing the structural integrity and reliability of its distribution systems.

Attachers are not permitted to dead-end on a primary URD riser pole.

Poles shall not be boxed in and communication cable shall not be installed on both sides of a pole. Communication cable must be installed on the same side as the secondary or neutral. Communication crossarms, extension brackets or buckarms shall not be installed or used for third party attachments.

These clearances shall apply to installations by an attacher or by PE. Any work performed by PE or by the attacher after the initial installation of facilities shall preserve required clearances of all parties on the pole. PE shall also inform the attacher if PE becomes aware that the attacher's facilities are not in compliance with applicable clearance requirements. The attacher will have sixty (60) days to bring its facilities within compliance or PE may deem the attacher in violation of PE Standards.

Guys & Anchors

Attachers are responsible for their own down guys and anchors and are not permitted to utilize PE anchors.

Other

No permanent climbing aids are allowed on PE poles.

All power supply installations must have appropriate disconnect devices. New strand-mounted power supplies will be billed on a metered account basis. All new power supplies and new metering equipment shall be mounted only on attacher-owned facilities.

Air dryers, nitrogen bottles, cabinets, load coils, etc. shall not be attached to PE poles.

All vertical runs installed by attacher shall be placed in conduit and attached to pole using U-guards and other protective covering. Vertical runs must be on a 45-degree angle from the communication company's attachment and never on the face of the pole.

Horizontal attachments to PE poles must be made by use of a three-bolt suspension clamp with a center through bolt. A two-inch minimum vertical spacing must be maintained between through bolt holes. Attachers 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.

Generally, attachments and/or service drops shall not extend more than 4" from the closest surface of the pole, unless prior approval is obtained from the local PE Engineering department. Amplifiers and terminals shall be a minimum of 12" from the closest surface of the pole.

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

Attachers must remove all of their out-of-service facilities from PE poles at the time of new attachment or overlash.

Once a PE pole is replaced and its facilities transferred, attachers have 60 days from notification to transfer their facilities to the new pole. PE utilizes NJUNS (National Joint Utilities Notification System) to notify all attachers of pole replacements and requires all third-party attachers to utilize the system.

All communication messengers shall be bonded to electrical ground wherever a vertical ground wire exists.

Attacher's request to install communication facilities on a PE transmission pole requires the approval of PE's Transmission Department. A complete structural analysis will be required and all costs associated with the analysis will be paid by the proposing attacher. PE will only consider requests for attachment to transmission poles that were specifically designed to accommodate underbuilt distribution and communication facilities.

Wireless

Wireless attachment applications will be handled on a per case basis. The minimum information required by PE includes: pole number, address/location, plat of proposed work, photo of proposed pole, radio frequency information, aerial construction details (dimension, weight connectivity), direction of antennae, and wireless component specifications. Contact the Joint Use Supervisor at (407) 942-9415.

Only one wireless device (receiver, transmitter, or combination unit) will be allowed per pole. Multiple wireless attachers are not permitted on a single pole. Amplifiers and equipment other than wireless devices will not be allowed on poles. All other locations will be reviewed based on field conditions and approved by PE. Wireless devices will not be permitted on poles designed for the exclusive use of street lighting.

All wireless attachers must obtain all necessary easements for their facilities.

NOTE: PEF does not allow wireless attachments on streetlight brackets.

Procedures

Additional procedures for joint use in the Carolinas and Florida may be obtained from the Joint Use Department by calling the number listed below under Joint Use Contacts.

Examples of Existing Procedures

- JU Telephone Make Ready Field Procedures Document
- Stub Pole Removal Document
- Banner Agreement Flowchart
- Banner Agreement Document
- Joint Use Attachment Request for New Agreement
- Permitting for New Attachments
- Priority Pole Replacements – Field Procedure

Joint Use Contacts

Pole attachment requests are to be submitted to the following addresses:

In the Carolinas:
Progress Energy Carolinas, Inc.
Joint Use
100 E. Davie St., TPP 14
Raleigh, NC 27601
(919) 546-6239

In Florida:
Progress Energy Florida, Inc.
Joint Use
3300 Exchange Place, NP4D
Lake Mary, FL 32746
(407) 942-9425

PE's Joint Use Supervisor, at (407) 942-9415, should be contacted for questions and clarification of the joint use policy.

11.0 Environmental Issues

There are many state and federal environmental regulations that affect our distribution system activities. Environmental responsibility is a core value of Progress Energy. As a distribution system designer, we need to be aware of the environmental areas of concern. Anytime we encounter one of these areas, we can turn to our regional Environmental Coordinator to assist us with compliance.

There are Carolinas and Florida environmental websites we can use for information.

The first site is maintained by the Progress Energy Florida Environmental Section. The link on the left sidebar titled, "Environmental Programs" contains information on each program.

Similarly the Carolinas environmental information is on a site maintained by the Energy Delivery Business Unit.

Below is a listing of the environmental areas that our distribution activities could involve.

Oil Spills

Both state and federal regulations require the reporting of oil spills. All oil spills, regardless of volume, should be reported to your Environmental Coordinator to ensure proper reporting and cleanup.

SPCC (Spill Prevention Control and Countermeasures) Plans

Federal regulations require that an SPCC plan be prepared for any site that stores more than 1320 gallons of oil, in aggregate or in a single container. Our large transformer installations would qualify for these plans if certain other requirements are also met. See the Transformers section of the Engineering Manual for more information on this subject.

Endangered and Threatened Species

We need to be aware of species that would fall under the Endangered Species Act. Two species that are found in our service areas are the red cockaded woodpecker and the bald eagle. Conducting any activity that disturbs their areas, habitats or nests is prohibited. In addition, bald eagles have wingspans large enough to be affected by our overhead power lines. Any overhead power line located near a bald eagle nesting area or feeding ground could possibly need some special construction and/or increased phase spacing in order not to interfere with their activities.

Also, there are rare plant areas that would fall under the Endangered Species Act. Line designers should be aware of the rare plant sites in their area. The Carolinas Environmental Coordinators and Region Foresters have a county-by-county listing of identified rare plant sites.

Migratory Bird Nests

There are laws against the disturbance of migratory bird nests. Federal and state permits are required to relocate any active nest. Osprey nests are often found in our PEC and PEF service areas. These nests involve special consideration.

Sedimentation/Erosion

There are state and federal regulations involving any land-disturbing activities that would cause sediment runoff. Runoff from any land disturbing activities cannot be allowed to leave the site (Right-of-Way) or enter a stream or wetland area. In general, land disturbing activities of one acre or more may require permits and a State approved sedimentation control plan.

Wetland, Rivers and Coastal Areas

Wetlands and coastal areas are special habitats. As such, any disturbing of the soil and vegetation in these areas is generally prohibited unless certain conditions are met or a permit is obtained. In North Carolina, the Neuse and Tar-Pamlico River basins are also areas where our work activities may be subject to special regulations. The Neuse River rules are documented in the Overhead and Underground Construction Specifications Manuals.

PCBs

Transformers on the distribution system may contain PCBS if they are not marked as Non-PCB transformers. Rebuilding, replacement or relocation projects may result in the identification of transformers that require proper handling and/or disposal in accordance with Federal Regulations.

12.0 Special Construction

12.1 General

There are many situations encountered where the Distribution Construction Specifications do not provide guidance. Some of these situations are long spans, tall waterway crossings, joint-use lines with many attachers, transmission underbuilds, large conductors, etc. Designers should contact Distribution Standards for assistance in these cases. Distribution Standards will provide guidance on designs for these unusual cases.

12.2 Substation Overhead Feeder Exits

Substation bay structures are not guyed structures and cannot stand the tensions of the normal span lengths of our distribution conductors. It is a necessary practice in both service areas to limit the conductor tension coming into the substation bay for overhead feeder exits. In most cases this means the ruling span length for the bay attachment must be kept to a short length. For Florida, the substation tensions and sags are shown on Specification Dwg 05.01-20. For the Carolinas, the span and tension information is shown on Specification Dwgs 03.28-04 & 06.

12.3 Overhead Neutral Construction

Feeders with overhead neutral construction are rare, but more prevalent in the Carolinas than in Florida. There are specification drawings for this type of construction shown in the Carolinas Distribution Construction Specifications Manual in subsection 03.24. This type of construction is generally confined to express feeders. The engineering reason for this type of construction is to guard against damage done by direct lightning strikes to the conductors and poles. Since the ground wire down lead takes up one side of the pole, it is difficult to use this type of construction for normal feeders and install items such as underground dips, transformer banks, capacitor banks, etc. It is also difficult to install lightning arresters, which are still needed to prevent against lightning induced over voltages.

For this type of construction, it is important that the ground down lead be fully insulated through the primary space. It is also critical to line performance that each pole ground be a low resistance ground. Failure to follow these precautions will usually result in a line design that is less reliable than the standard feeder construction.

12.4 Avian Protection

Progress Energy constructs and operates distribution facilities to serve customers in North Carolina, South Carolina and Florida. These facilities are constructed along rivers, lakes, and coastlines that are natural habitats for eagles, ospreys, and other raptors. Aquaculture farms are being developed in many rural areas, which may attract large birds of prey. In addition, raptors sometimes utilize distribution poles and equipment for nesting and as a perch when hunting. The wing span of these large raptors can contact energized conductors and equipment when landing or leaving the perch, resulting in potential outages and electrocution of the bird. Also, raptor nests constructed on distribution facilities can have similar results.

Specifications contained in this section have been developed for constructing and maintaining distribution facilities in areas of known populations of large raptors with the objective of minimizing outages and raptor electrocutions. Some of the more common construction types have been addressed. Contact the Distribution Standards Unit for unique situations.

12.5 Transmission Encroachments

Distribution underbuilt on Transmission lines must be approved by Transmission through the documented process described in the Distribution Engineering Manual. This process applies any time new distribution lines are to be built on Transmission right of way, as well as if any changes or upgrades are to be made to existing encroachments. Please refer to the Distribution Engineering Manual – Transmission Encroachment Process section, DST-EDGX-00065, for further details.

Document title

Distribution Engineering Manual: Underground Design Guide

Document number

DST-EDGX-00028

Applies to: Energy Delivery Group – Carolinas and Florida

Keywords: distribution; distribution engineering manual

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1.0 Introduction

The layout of a distribution system for a specific area is the responsibility of the design personnel assigned to the project. The purpose of this section is to provide a set of fundamental principles of design and construction which can be used to arrive at an optimized design for a project.

The design of the underground primary system must be economical to install and provide reliable service. It must be safe, be easily maintained, and have positive impact on aesthetics. The design process involves a balance of these parameters.

It is not intended that this guide be considered as complete or final but rather as an evolving resource. This guide is constantly subject to modification and revision as regulatory, technological and economic conditions change. Each user is encouraged to make suggestions for change whenever it is felt to add value and benefit to the guideline.

2.0 Mapping

The mapping of an underground electrical distribution system is an extremely important activity. An accurate map provides a visual inventory of facilities installed and essential operating information, such as the location of open points. An accurate map is essential for safe operation of the underground system. One of the major differences between Overhead and Underground Distribution is that the source of feed for the various cables and apparatus cannot visibly be traced in the underground system. With so much of underground facilities installed "out of sight", accurate mapping and marking of distribution equipment becomes more critical than it is for overhead facilities which can be easily and visibly field checked. In underground, only the points of termination, padmount transformers, switchgear, switching enclosures, secondary pedestals, etc., are visible after installation. Thus, a complete identification method must be used for underground projects. It must be simple, permanent, and easily identifiable in order to know the source and termination point of the conductors and be able to identify these positions on the underground system map.

All underground facilities are permanently recorded in Progress Energy's Geographical Information Systems (GIS). The GIS system is the permanent record for as-built facilities. The GIS data is critical operational information and used by the Distribution Control Centers and by operational personnel. It is essential that changes made in the field are communicated to the DCC so the GIS maps can be updated. GIS maps may be used for construction maps as well but field changes are sometimes made to construction maps so as-built changes are necessary to ensure the maps are accurate for switching operations.

The cable at all termination points (i.e. transformers) shall be tagged with a combination of numbers, letters, or colors so each cable can be identified at the other end of the cable run.

Terminal poles, pads, transformers, pedestals, switchgear, and other apparatus are assigned a location ID. All cable ends must be tagged before being installed in a duct in a conduit system and before the trenches are back filled for a direct buried system. The Distribution Construction Specifications cover the proper tagging and numbering methods of underground facilities.

In Florida and some Carolinas operation centers, underground primary cables are designated as A, B, and C. These correspond to overhead phases of the same designation. Where so labeled these cables are identical to A, B, and C phases at the substation bus.

In most Carolinas operations centers, the letters X, Y and Z are used to identify underground phases. Normal convention for lettering phases is to use X phase for a single phase, Y phase with the second branch circuit, and Z phase with the third branch circuit. Note: X is not necessarily equal to A, in fact there is a 2/3 chance that it is not. One advantage to this method is that if the overhead phases are changed the underground system does not have to be re-tagged and the maps updated.

In the Carolinas, before location ID's were introduced, in addition to the letters X, Y and Z to indicate phasing, numbers were used to denote the different points of terminations. In most cases, these points of termination were consecutively numbered and continued through the entire loop until the circuit was terminated at each riser pole (i.e., riser pole to transformer 1X, on to 2X, etc., up to the other riser pole). The numbering continues counting through the opening point since the opening point is subject to change from time to time.

3.0 Location

Underground cables should be installed in a utility easement immediately adjacent to the road right of way. If the area just off road right of way is unsuitable for placing underground cables the cable may be installed on the road right of way. However, placing facilities on road right of way places the company at risk for a future relocation cost if there is road work to be done so this should be avoided, especially for bulk feeder cables.

Regardless of location of the facilities, an easement shall be obtained before installation to ensure we have the right to install and maintain the facilities where they are located. If a future road project requires the facilities be relocated we should be reimbursed for the work if we have an easement for being there.

Underground primary and/or secondary may be installed cross country or along side lot lines when it significantly reduces construction cost. Joining two long adjacent cul-de-sacs together by installing cable along a side lot line is an example of where this type of cable placement is acceptable. While it is not always necessary, depending on the situation a spare conduit may be installed along a side lot line.

Underground equipment (transformers, switchgear, etc.) shall be installed off the road right of way. Typically, these above-ground facilities will be installed immediately adjacent to the road right of way, or behind a sidewalk in some developments.

Poles, switchgear, transformers, pull boxes, junction enclosures, and vaults should be located such that truck access is available during and especially after construction. A lawn or other landscaped area is not considered access for vehicles.

Road Crossings - Typically, road crossings should be designed at a property line to facilitate locating the road crossing. Road cuts should be minimized.

Locating our above-ground facilities inside a 100-year flood plane is discouraged, but sometimes unavoidable. When our facilities are located inside a 100-year flood plane, special materials and installation methods may be required. If severe erosion does not occur during a flood, the above-ground facilities will normally survive the flood and be usable after floodwaters recede. Refer to the Coastal and Contaminated section of the Distribution Construction Specifications for special materials, including submersible equipment, raised pads, etc.

The preferred design for serving marinas or boat slips is to use ganged-meter bases located on land. Our facilities will not typically be extended out onto docks.

Refer to NESC Section 32, Underground Conduit Systems, 320 Location and NESC Section 35, Direct Buried Cable, 351, Location and Routing

4.0 Equipment and Environment Protection

The expected thermal, chemical, mechanical and environmental conditions at the location shall be considered in the design of all electrical equipment.

Oil-filled electrical equipment shall be protected by one or more of the following methods to minimize fire hazards. The method to be applied shall be according to the degree of fire hazard and the amount of oil contained in the equipment. Recognized methods are: space separation, fire-resistant barriers and absorption beds.

Environmentally sensitive areas, most notably having to do with water, such as retention ponds, lakes, rivers, well fields, etc. should be given every consideration when placing oil-filled equipment, either overhead or underground.

All oil-filled electrical equipment exposed to paved areas and/or vehicular traffic shall be protected by protective barriers (i.e. bollards). For new construction, the bollards shall be provided and installed by the customer. It would be preferable to negotiate a location for the equipment where it is not exposed to traffic. This is often not possible when padmount transformers are located behind buildings, next to loading docks and surrounded by paved areas. So it is critical to negotiate with the customer to ensure bollards are installed to protect padmount transformers. It is in the customer's best interest to avoid an outage, and in Progress Energy's best interest to avoid equipment damage and a possible oil spill.

There are many state and federal environmental regulations that affect our distribution system activities. Environmental responsibility is a core value of Progress Energy. Distribution system designers need to be aware of the environmental areas of concern. Should we encounter one of these areas, we can turn to our regional Environmental Coordinator to assist us with compliance.

Below is a listing of the environmental areas that our distribution activities could involve"

4.1 Sedimentation/Erosion

There are state and federal regulations involving any land-disturbing activities which would cause sediment runoff. Runoff from any land-disturbing activities, regardless of size of the project, cannot be allowed to leave the site (Right-of-Way) or enter a stream or wetland area. In general, land-disturbing activities of one acre or more may require permits and a State-approved sedimentation control plan. An acre is 43,560 square feet so it would take a substantial linear distance of trenching for these regulations to apply. For example, if we assume a 5-foot wide disturbance area for trenching it would take 8,712 feet of trenching to equate to an acre of disturbed area. The designer should be cognizant of this requirement and consult with the Region Environmental Specialist to determine if permits will be required.

4.2 Wetland, Rivers and Coastal Areas

Wetlands and coastal areas are special habitats. As such, any disturbing of the soil and vegetation in these areas is generally prohibited unless certain conditions are met or a permit is obtained. Crossing a stream or wetlands with an underground line must be performed in accordance with a permit from the U.S. Army Corps of Engineers. Notification to the Corps may or may not be required, based on the circumstances. Notification and subsequent approval likely will be required in the mountain counties and the coastal area counties if construction is performed with trenching. In navigable waters, a Section 10 crossing permit may also be required. Certain underground navigable stream crossings may also require a fee paid to the State of NC for use of the land under the stream.

In North Carolina, the Neuse and Tar-Pamlico River basins are also areas where our work activities may be subject to special regulations. The Neuse River rules are documented in the Overhead and Underground Construction Specifications Manuals.

4.3 Oil Spills

Both state and federal regulations require the reporting of oil spills. All oil spills, regardless of volume, shall be reported to your Environmental Coordinator to ensure proper reporting and cleanup.

4.4 SPCC (Spill Prevention Control and Countermeasures) Plans

Federal regulations require that an SPCC plan be prepared for any site that stores more than 1320 gallons of oil, in aggregate or in a single container. Our largest padmount transformer (3750) does not have 1320 gallons of oil so no one transformer installation will require an SPCC plan. However, if a number of padmount transformers are in close proximity, a plan may be required. The Environmental Coordinator or Distribution Standards engineer may be consulted to determine if a plan is necessary. If a plan is required, the plan requirements must be completed, including spill containment facilities where necessary, before the transformers are brought on site. See also the Transformers section of the Engineering Manual for more information on this subject.

4.5 Endangered and Threatened Species

We need to be aware of species that would fall under the Endangered Species Act. Two species that are found in our service areas are the red-cockaded woodpecker and the bald eagle. Conducting any activity that disturbs their areas, habitats or nests is prohibited. In addition, bald eagles have wingspans large enough to be affected by our overhead power lines. Any overhead power line located near a bald eagle nesting or feeding area could possibly require some special construction and/or increased phase spacing in order to not interfere with their activities. See Overhead Construction Specifications for avian protection designs.

Also, there are rare plant areas that would fall under the Endangered Species Act. Line designers should be aware of the rare plant sites in their area. The Environmental Coordinators and Region Foresters have a county-by-county listing of identified rare plant sites.

4.6 Migratory Bird Nests

There are laws against the disturbance of migratory bird nests. Federal and state permits are required to relocate any active nest. Osprey nests are often found in our PEC and PEF service areas. These nests involve special consideration. Coordinate efforts with the Region Environmental Coordinator.

4.7 PCBs

Transformers on the distribution system may contain PCBs if they are not marked as Non-PCB transformers. Rebuilding, replacement or relocation projects may result in the identification of transformers that require proper handling and/or disposal in accordance with Federal Regulations. Any new transformer is required to be PCB-free and be marked as such so PCBs should not be an issue for new projects.

5.0 Application of the NESC in underground designs

Listed below are a number of NESC rules applicable to underground distribution systems. See the latest edition of the NESC (2007 as of this revision) for more details. Our Distribution Construction Specifications take all of these NESC rules into consideration.

5.1 Locating Underground Primary and Secondary Lines

Applicable NESC Rules:

NESC Section 32 Underground Conduit Systems
320. Location

NESC Section 35 Direct-Buried Cable
351. Location and Routing

These two NESC rules give information on items that must be considered while locating and routing underground distribution primary and secondary lines and services. These rules give specific information regarding natural hazards, highways and streets, bridges and tunnels, crossing railroad tracks, and submarine crossings. These rules also provide requirements for separation from other underground installations (among these are other supply and communications conduit systems, sanitary and storm sewers, water, fuel, and steam lines), as well as swimming pools, buildings and other structures.

5.2 Grounding of Underground Distribution Equipment

Applicable NESC Rules:

NESC Section 31 General Requirements
314. Grounding of Circuits and Equipment

NESC Section 34 Cable in Underground Structures
342. Grounding and Bonding

NESC Section 37 Supply Cable Terminations
374. Grounding

NESC Section 38 Equipment
384. Grounding

NESC Section 9 Grounding Methods

Section 9 provides information on grounding "methods" (how to ground) to be used in underground systems. The other listed rules give the "requirements" (what to ground) of underground system components to be grounded, such as neutrals, transformer tanks, etc.

5.3 Cable

Applicable NESC Rules:

NESC Section 33 Supply Cable

This section specifies material requirements for cable used in underground distribution systems. These rules cover requirements for sheaths and jackets, shielding, and cable accessories and joints. These rules are generally of no concern to designers, as the necessary requirements are covered in the material specification and procurement process in the Corporate Office.

5.4 Direct-Buried Cable Systems

Applicable NESC Rules:

NESC Section 35 Direct-Buried Cable
353. Installation
354. Random Separation - Additional Requirements

In addition to requirements on cable location and routing referred to earlier, the NESC also contains requirements regarding the installation of direct-buried cable; that is cable buried in the ground and not installed in a duct. The NESC provides rules here on trenching, plowing-in cable, boring (under streets, roads, etc.), quality of backfill, and depth of burial.

The NESC also provides requirements for direct-buried cables that are randomly separated - that is, cables of different systems (e.g., electrical, telephone, CATV) that are installed in the same trench with no deliberate separation between them. However, random separation can only be done when all parties agree, and electrical and gas can never be randomly separated.

5.5 Conduit Systems

Applicable NESC Rules:
NESC Section 32 Underground Conduit Systems

321. Excavation and Backfill
322. Ducts and Joints
323. Manholes, Handholes, and Vaults

Rules and considerations relating strictly to conduit systems are covered in NESC Section 32. The above listed rules contain requirements regarding trenching, quality of backfill, materials (ducts, joints, etc.), and duct installation.

It is notable that the NESC considers a conduit system to be a system of individual ducts. A duct installed between two padmount transformers would not be a conduit system per NESC and the rules for direct burial would apply. The notes below are from Section 32, and are the first notes under the header for Section 32.

"*NOTE 1*: While it is often the practice to use *duct* and *conduit* interchangeably, *duct*, as used herein, is a single, enclosed raceway for conductors or cable; *conduit* is a structure containing one or more ducts; and *conduit system* is the combination of conduit, conduits, manholes, handholes, and/or vaults joined to form an integrated whole."

"*Note 2*: For cables installed in a single duct not part of a conduit system, the rules of Section 35 apply."

5.6 Manholes and Vaults

Applicable NESC Rules:
NESC Section 38 Equipment
382. Location in Underground Structures
383. Installation

Requirements for the design of manholes, handholes, and vaults are covered in the above section. Requirements are included on strength, dimensions, access, covers, ladders, drainage, ventilation, mechanical protection, and identification.

Vaults are often a special design item, designed for a specific application and location, and in those cases, close attention must be paid to the requirements of this section.

5.7 Risers
Applicable NESC Rules:

NESC Section 23 Clearances
239D Guarding and Protection Near Ground

NESC Section 36 Risers
360 General
361 Installation
362 Pole Risers - Additional Requirements
363 Pad-Mounted Installations

In cases where underground distribution systems are tied to overhead distribution systems, a riser will be needed. The above listed rules relate to their design and installation.

5.8 Underground Equipment Considerations

Applicable NESC Rules:

NESC Section 38 Equipment
382. Location in Underground Structures
383. Installation
384. Grounding
385. Identification

The above listed rules relate to equipment (buses, transformers, switches, pumps, outlets, etc.) installed with or in distribution underground systems and structures (manholes, vaults, etc.). Application of these rules is covered throughout the Underground Construction Specifications.

5.9 Underground Secondary and Services

The NESC rules that apply to underground distribution primary lines also apply to underground distribution secondary and services, with very few exceptions. The secondary and services are at a lower voltage class, recognized by the NESC as being less than 600 volts to ground.

6.0 Grounding Of Underground Distribution Circuits

Neutrals, Grounds, Equipment Grounds, and Bonding

The Progress Energy distribution system is a multi-grounded wye system. For a multi-grounded wye system the NESC requires that there be four grounds per mile in each mile of underground primary line. The requirement expands to eight grounds per mile when primary cable is direct buried in random lay with other joint users. It also requires that each transformer location be grounded. The customer grounds are not counted towards the requirements. There is no specific NESC requirement for the resistance of each driven ground electrode on a multi-grounded system. A multi-grounded wye system depends on having many grounds to provide a well-grounded system vs. having fewer grounds with a specific ground resistance.

Normally, there are easily four grounds per mile because every riser pole, padmount transformer, and switchgear has a ground. However, in some unusual cases we may go some distance between grounds and require additional grounds to be installed that are not at an equipment location. These grounds could be installed at a splice in a pullbox, or at a direct buried splice. Four ground rod installations shall be provided in each mile of underground circuit. An exception is made in the NESC for underwater crossings where it is not practical to ground underwater. In these cases a ground shall be provided on each end of the underwater crossing, if the crossing is greater than one quarter mile in length.

The primary neutral of an underground distribution system is formed by connecting the primary concentric or shield neutrals of each section of cable at any point of termination. The primary neutrals shall be connected to the overhead system neutral at each riser pole and shall be treated in the same manner as the overhead neutral.

Good grounding is one of the most important factors in the successful operation of any distribution system. In general, each time an underground primary cable surfaces above ground, the neutral at that cable is to be grounded to a ground rod(s), or a ground grid (if one exists, such as in a substation).

In all pad-mounted installations, a loop ground is to be installed for the purpose of bonding to the pad-mounted equipment. This is recommended mainly to ensure good bonding in case a connection is broken or becomes corroded.

Section 314B of the NESC requires all metal less than 8' above ground to be effectively grounded. Progress Energy specifications meet this requirement by using a separately driven ground rod at these locations and bonding to our system neutral. However, at existing metal pedestal locations, bonding to the metal stake and to the service neutral will provide an effective ground. Also, at existing metal U-guard locations, bonding to the pole ground will provide the same results.

NESC 350F indicates 'Bonding should be provided between all above-ground metallic power and communication apparatus (pedestals, terminals, apparatus cases, transformer cases, etc.) that are separated by a distance of 6' or less in order to eliminate the possibility for "touch potential", i.e. a difference in voltage between the two metallic objects.' Six feet is designated since that is as far as a person can reach, to be able to touch both at the same time. We provide a ground terminal on the exterior of padmount transformers so CATV and telephone companies can make a bond between their metallic pedestal and our padmount, if located closer than 6 feet.

7.0 Underground Cable Theory

7.1 Primary Cable

In the 1960's, polyethylene underground cable was introduced to the utility industry and was praised as the innovation that would result in all electric distribution lines being installed underground. The cable was inexpensive, had a high dielectric strength, was thought not to require trained professionals to terminate and splice the cable, and could be installed by inexperienced crews. The praise about this cable was short-lived because the cable began to fail within a relatively short period of time (and in some cases as short as three years after installation); however, by this time the general public had been sold on the idea of underground power lines and many counties and municipalities had ordinances requiring subdivided property to have electric facilities installed underground.

Industry research quickly began to isolate the premature failure of this cable. The researchers soon found that the electric field stress within the insulation acted upon small voids (air bubbles) and contaminants that were found in the insulating dielectric material of the cable. The electric field stress would overcome the dielectric strength of the air in the void or contaminant material and thus cause a discharge of free electrons across the voids or contaminated area producing ozone. The discharge would continually bombard the insulation around the void or contaminant which eventually caused an effect that became known as "treeing". This process would ultimately cause the insulation level to break down and the cable to fail.

The direction of the electron activity within the insulation, described in the preceding paragraph, is in the same direction as the electric field which is perpendicular to the cable's conductor. Over time, this activity results in small carbonized channels that appear in the insulating material along the direction of the electric field. These channels will appear in both an outward and inward direction from the void or contaminant, again perpendicular to the conductor. As the electric field stress continues the electron bombardment, these carbon channels continue to "grow" and lengthen, opening up multiple channels much like the limbs of a tree beginning to branch out. This branching out soon became known as "treeing". There are two types of treeing that occur. One is known as "bowtie" treeing and the other is known as "vented' treeing.

When treeing is observed under a microscope around a void or contaminant, the shape of the treeing appears much like a "bowtie", with channels spreading out from the point of the void or contaminant. The "vented" treeing occurs from either the conductor shield outward or the insulating shield inward and when viewed under a microscope, appears to have channels that actually open to the insulation shield or the conductor shield as though the tree was venting to the shield. Moisture was found to be one of the causes of vented treeing (sometimes referred to as "water trees") while the remainder were caused by a variety of things such as voids and contaminants at the interfaces between the shields and insulation, poor adhesion of the shields to the insulation, sharp protrusions from the shield into the insulation and skips of the shields during manufacturing.

The manufacturers of electric cable quickly began research on processes to improve the integrity of the shields and insulation. As a result, they developed a chemical treatment process that would improve the stability of the insulation at higher operating temperatures. This process created "bonds" between the carbon chains of the insulating materials and shields and became known as "Cross-Linked Polyethylene (XLPE). During this research, it was discovered the XLPE did not "tree" as much or at the same pace as the older normal polyethylene insulating material (High Molecular Weight Polyethylene - HMWPE). What was found was that the Cross-Linking process tied up many of the "free electrons" within the insulating material, resulting in less electron activity that contributed to "tree growth" in the insulation. Therefore, today we have a polyethylene cable that is expected to provide a cable life greater than 40 years. The distinguishing advantages of this XLPE cable over the older HMWPE cable (that had such a poor operating history) are as follows:

- Solid or strand-filled conductor to keep out moisture
- Super smooth/super clean conductor shield to eliminate contaminants and protrusions into the insulation.
- Improved insulation shields for a smoother interface between the shield and insulation.
- Super Tough overall jacket material to protect the cable and provide an additional moisture shield.
- Use of #1/0 vs. #2 Al cable to reduce the electrical stress near the conductor shield.

In addition, cable manufacturers have developed special chemical treatments to XLPE insulation to make the XLPE insulation even more resistant to the development and growth of trees. This cable is TRXLPE, or Tree Retardant Cross-Linked Polyethylene. This is the type of cable Progress Energy purchases.

In the early years the concentric neutral was exposed to the earth. This provided for improved grounding; however, certain types of soil tend to degrade the concentric neutral resulting in an open neutral. The cables purchased today by Progress Energy have a durable external jacket and are therefore waterproof.

7.2 Electrical Stress

Electrical stress is the most common cause of underground cable failures outside of cable dig-ins. Progress Energy's experience has shown that a large percentage of electrical stress failure comes from poor and improper cable preparation and/or a lack of care in making the splice or installing the termination.

Electrical stress is simply the strength of the electric field along an energized conductor. Controlling the magnitude and disbursement of this stress is the art of preventing failure of the cable whether it is across a splice, a terminator, or simply mid-span in continuous cable.

Any underground cable which is an insulated electric conductor, has a capacitance. When a changing voltage is applied to a capacitor, a charging current will flow through that capacitor. In the case of our primary cable, the primary conductor is essentially one plate of a capacitor and the insulation shield is the other plate with the insulation between the two plates being the dielectric. If the insulation shield is damaged or missing, the electric field will be concentrated in the insulation and whatever lies between the insulation and a grounded surface (the concentric neutral wires). If a thin layer of air lies between the surface of the insulation and a grounded surface, the air gap is subject to the stress of the electric field. When the electric field strength exceeds the dielectric strength of the air, a discharge to the grounded surface will occur, resulting in the formation of ozone. Ozone is very destructive to the insulating material and a complete breakdown of the cable insulation will occur.

In the 70's, we received some underground cable that began to fail prematurely (some as early as three years after installation) which was later found to be impregnated with impurities and air gaps in the insulation layer of the cable. These impurities and air gaps caused irregularities in the control of the electric field which caused the insulation to eventually break down as described in the above paragraph. Cable manufacturers and technology have since come a long way through several generations of improving the quality of cable insulation and means of making the cable, which have significantly improved the expected cable life to around 40 years. Even with our bad experience with the impure cable bought in the early 70's, other cables purchased outside of those few years have proven to have a long life.

In addition to maintaining a continuous shield over the insulation, it is equally important that the shield be properly terminated where the cable is spliced or terminated. When a cable is terminated, the grounded shield must be removed a certain distance back to prevent a voltage breakdown along the surface of the insulation (referred to as the strip back dimension). Where the shield ends, the electrical field is suddenly released and the "lines of electrical stress" will concentrate in the area causing a breakdown of the insulation at that point if something is not provided to spread out these lines of electrical stress.

The device used to disperse the lines of stress is a simple one made out of a material similar to the insulation shield and is called a "stress relief cone". It is formed in the shape of a cone that is "flared" outward from the cable. The flared outward shape of the device acts to vary the relative capacitance and insulation thickness, thereby spreading out the lines of voltage stress much like an optical lens refracts light. All splicing and terminating devices contain some type of stress relief material. This stress cone is easily recognized in the old "pennant" termination assembly. In a splice or elbow, the stress relief device cannot be seen because it is molded into the housing of the splice or elbow. In the 3-M type terminator, the stress relief is provided by the "black" material inside the terminator.

When handling, splicing, and terminating primary cable, it is important that the manufacturer's and/or Company instructions be followed so that each component part of the primary cable system will provide the length and quality of service that it was designed to provide.

7.3 Primary Terminations

Improper primary terminations are common causes of underground failures. Improper terminations cause extreme electrical stress on the cable. This electrical stress ultimately destroys the cable insulation, generally causing a phase-to-ground fault. The Distribution Standards Unit has a program available to explain in detail the importance of proper terminations and how all accessories work with each other. This program, "Underground Primary Distribution Cable and Accessories" can be scheduled through the Craft/Technical Training Unit.

When considering how to train and terminate underground cable, the designer should plan for minimum bending radius of no more than 12 times the outside diameter of the cable (usually given in inches). This applies for any points of termination or in any bend in trenches, as well.

On riser poles, the cable should be terminated with outdoor terminations. In padmount transformers, switchgear, vaults, and transclosures, the cable should be terminated with elbows. These installations are commonly called "dead front". Elbows for bulk feeder (350, 500, 750, and 1000) are dead break. Dead-break elbows shall only be operated with no load and no voltage. These elbows (T-bodies) may be referred to as 600 amp class but the ampacity of the conductor is often less. Elbows for our smaller primary, typically #1/0, are load break. Load-break elbows may be referred to as 200 amp class, but the ampacity of the cable may be less, particularly if installed in conduit, or under a riser.

Some older installations may be "live front", having live terminations similar to riser poles. When maintenance is planned for live front installations, consideration should be given to converting to dead front. Other older installations may have dead-break 200-amp elbows. When equipment with dead-break 200-amp elbows is replaced, use load-break bushing inserts, and replace the elbows with load break elbows. When cable terminated with 200-amp dead-break elbows is replaced, load-break elbows will be installed on the new cable and dead-break bushing inserts replaced with load break. Live-front transformers shall be replaced.

8.0 Underground Conductor Application Data

It is the intent of this section to provide technical data which can be used to support installation decisions. The conductor data shown in this section consists of tables showing physical and electrical properties of the medium voltage (primary) and 600 volt (secondary, service) underground cables used in distribution construction. Also included is a table which contains constants used in voltage drop calculations. Some of the data in this section is duplicated in our Distribution Construction Specifications.

8.1 Physical Properties

Properties such as diameter and insulation thickness are taken directly from manufacturer's literature. The components of our cable are described in group specifications GS-2 (primary) and GS-31 (secondary and service).

Secondary and Service – We use both multiplex and single conductors with a rugged external cover which are suitable for direct burial, in duct, and outdoor locations exposed to weather and sunlight. The cable is capable of operating continuously in either wet or dry locations at a conductor temperature of 90°C normally and 130°C for emergency operations. The cable is impervious to water.

Primary Cables - We use primary cable which is suitable for direct burial, duct, and outdoor locations exposed to weather and sunlight. The cable is capable of operating continuously in either wet or dry locations at a conductor temperature of 90°C normally and 130°C for emergency operations. The cable is impervious to water.

8.2 Electrical Properties

Conductor properties such as resistance and reactance are taken directly from manufacturer's literature. The conductor ampacity ratings shown in Section 23 (Conductors UG) of the Distribution Construction Specifications are calculated for Progress Energy specific applications and conductor types.

The basis for the ampacity calculations vary for buried and in air conductors. All conductors assume a 90° C maximum conductor temperature. For buried conductors, the burial depth for cable and conduit is 36 inches, ambient earth temperature is 15° C, effective thermal resistivity of earth is 110 C-cm/W and a 75% load factor is used. For conductors in air, an ambient air temperature of 10° C is used for winter and 35° C for summer. Primary conductors have an emergency rating which is based on a load factor of 100%, conductor temperature of 130° C, with a lifetime maximum cumulative hours for emergency loading of 1500 hours.

1,500 hours is 62.5 days of emergency loading and peak loading does not generally last very long. So cables can be loaded to the emergency rating periodically without damage for emergency conditions. Cables should not be loaded above the emergency rating for any period of time. Loading the cable above the emergency rating will shorten the life of the cable and may lead to a failure. The failure may not occur immediately, but sometime in the future when the failure may be listed as a cause unknown, but the cable was damaged earlier.

A primary duct bank is an assembly of ducts 2, 3, 4, 5 or 6, commonly stacked and encased in concrete. Duct bank construction is very expensive and should only be used in extreme cases where adequate trench widths can not be obtained thus requiring vertical stacking of ducts. This may be the case in some urban redevelopment areas, but generally for new construction, duct bank should not be required. For example, where we can install a wide trench, 6-6 inch ducts can be laid in a 40-inch wide trench. Also, the NESC allows for shallower depths where supplemental protection is provided so we could stack 6-6 inch ducts in a 24-inch wide trench.

Primary cable duct bank ampacities are also shown in Section 23 of the Distribution Construction Specifications. These duct bank ampacities which were initially expressed as cable ampacities in (amperes) were converted to bank capacities expressed in (MVA). A 10% reduction of the single-circuit ampacity is used as the multi-circuit duct maximum circuit ampacity. For 2, 3, 4, and 5 circuit banks, 12KV and 23KV, the bank capacities are listed as 98%, 96%, 94%, and 92% respectively, of the original values. These reductions provide an adequate margin of safety for reliability when using duct bank MVA-capacity ratings.

Resistance values are expressed in ohms per 1000 feet at 90^{o} C. Inductive reactance values are expressed in Ohms per 1000 feet. For triplex conductors, reactance values are calculated, based on conductors twisted together and directly buried. Single conductor reactance values are calculated based on a direct buried, symmetrical, flat, conductor configuration. For this configuration, the spacing between centers of conductors is multiplied by 1.26 when calculating the reactance value. Reactance values do vary slightly between single conductors and triplex conductors because of the effect that conductor spacing has on reactance.

8.3 Voltage Drop

Voltage calculations are required to design a distribution system that assures certain standards. In designing a distribution system, every effort should be made to supply a voltage that is compatible with the requirements of the customer's utilization equipment. The voltage drop on secondary facilities to serve a customer should be designed to be within 5%. This should include the voltage drop in the transformer and the service. Voltage calculations will ensure the proper sizing of a conductor for the given electrical load and will prevent excessive flicker on a customer's service. The voltage drop constants shown in Section 23 of the Distribution Construction Specifications are used in voltage drop calculations.

The following example shows the method used to calculate the voltage drop for #4/0 aluminum triplex at .95 power factor.

From PGN 23.03-01 the voltage drop per kW per 100 feet of circuit on 120-volt base for 4/0 triplex at 0.95 power factor is 0..0455.

Now calculate the voltage drop for the following conditions.

LOAD = 20 KW single-phase (.95 PF)

DISTANCE - 234 FT.

WIRE SIZE - #4/0 UG Aluminum Triplex

VOLTAGE - 120/240 V

VOLTAGE DROP CONSTANT = .0433 OHMS

Formula for calculating voltage drop is:

NOTE: Distance should be the total length of the conductor, including risers.

VOLTAGE DROP = (KWD/PF) x (DISTANCE/100FT.) x (VOLTAGE DROP CONSTANT)

VOLTAGE DROP = (20KW) x (234FT. /100FT.) x (.0455) = 2.13 VOLTS.

8.4 Cable Pulling

Section 22 in the Distribution Construction Specifications describes cable-pulling procedures and techniques. It also identifies equipment required and maximum allowable cable-pulling tensions for pulling our primary cables in conduit. These tensions establish the safe limits for preventing the cable from being stressed or damaged in the pulling process. The original basis for the tensions was the EPRI cable-pulling program. These values, however, have been conservatively adjusted as shown in Section 22 of the Distribution Spec manual. If a pull cannot be made without exceeding the maximum established tensions, the engineer should be consulted.

We currently use a software product from DSTAR (Distribution Systems Testing, Application and Research) called Cable-Pulling Assistant (CPA) for determining cable pulling requirements. The program is available on the Distribution Standards web site and is kept up-to-date by Standards.

8.5 Ferroresonance

Ferroresonance is probably one of the most misunderstood electrical conditions that can occur in the electric utility business and can be very misleading to operations personnel trying to operate and maintain the underground system. Although this electrical phenomenon has been recognized and studied since 1925, there still remains ambiguity and confusion about it today.

The Distribution Standards Unit offers a detailed training seminar on ferroresonance that is available to any group at any location on the system. The intent of this subsection is to provide a general description of ferroresonance without a lot of the mathematical and theoretical illustrations that are present in reality.

Although complicated, resonance is defined as "the enhancement of the response of an electric or mechanical system to a periodic driving force when the driving frequency is equal to a periodic natural undamped frequency of the system". In an electrical circuit, consisting of resistance (R), inductance (L), and capacitance (C) connected in series, resonance occurs at the point where the inductive reactance equals the capacitive reactance. When resonance occurs, stored energy is exchanged between the inductive and capacitive components resulting in the voltage drop across each component being equal and opposite in polarity such that they cancel each other. At this point, the current in the circuit is limited only by the resistance (R) in the circuit which is usually quite low, resulting in extremely high current flow. This current flow develops voltages across the capacitive components and inductive components that are much greater in magnitude than the source voltage, which can cause damage to each of the components in the circuit.

The prefix "ferro" is derived from the word ferrous meaning 'iron', which represents the core material of the transformer. An electric transformer is nothing more than an inductor and represents the inductive component in the above-mentioned resonant circuit. Underground primary cable, composed of an energized inner primary conductor, an outer grounded-neutral conductor, and an insulating material in between, is nothing more than a capacitor and represents the capacitive components of the above circuit. Thus when resonance or ferroresonance occurs in underground systems, the inductive reactance of the transformer matches the capacitive reactance of the underground primary cable at established frequencies such that the source voltage feeds only the resistive components of the cable and transformer. The resistive components tend to look like a short circuit because of the relatively low resistance of the cable and transformer and thus results in a high current flow. The high current in turn causes high voltages to be developed across the capacitive component (the cable) and across the inductive component (the transformer) which can easily shorten the life of either or both the cable or transformer. Even the customer's electrical facilities connected on the secondary side of the transformer are subjected to over voltage during the brief resonant time period.

The point where ferroresonance occurs is difficult to calculate because of the characteristics of the transformer and in particular the iron core and the coil of the transformer. The inductive reactance of the circuit, when initially energized, will vary because the coils of the iron core transformer vary in inductance as a function of the current flow in the transformer winding and because the frequency will vary at any given instance, thus making it possible to have multiple sets of resonant conditions occurring at any point in time. The frequency of the current when the inductive reactance equals the capacitive reactance is referred to as the resonant frequency. Although the source current frequency is a steady 60 Hz, the nonlinear characteristics of the iron core in the transformer produces oscillations that vary with each cycle of current. Since the oscillations are constantly changing, predicting when the resonant frequency may occur is difficult, if not impossible.

Because ferroresonance is so difficult to determine and the point-of-resonance varies, utilities typically try to devise design and operating guidelines to avoid those conditions where ferroresonance is known, in theory and application, to occur. In electric distribution systems, it is theoretically possible for ferroresonant over voltages to occur anywhere on the overhead or underground system during certain single-phase switching operations. In actuality, it rarely, if ever occurs on the overhead system because the capacitive component is generally not of significance to contribute to resonance. However, for underground systems where the cable has more of a capacitive reactance, the opportunity for resonance is greatly enhanced. The most proactive design to remove the opportunity for ferroresonance to occur is by avoiding single-phase switching operations. This can be accomplished by using three-phase switches at every switching point; however, this is neither practical nor economical, and thus utilities have devised other procedures which remove the parameters for ferroresonance to occur. These are:

- Avoid underground floating-wye primary connections (wye-delta banks). This cannot always be avoided because of customer demands. Although the electric industry has made great strides in the area of 208Y/120 and 480Y/277-volt electrical equipment development, the 240/120-volt delta, 3-phase 4-wire service remains a predominate choice of some customers, especially in re-development areas. For some customers 3-wire 480 volt is also needed.

- Leave customer's load connected during switching operations. The customer's load in parallel with the magnetizing impedance of the transformer can favorably increase the inductive reactance of the transformer, avoiding a matching of inductive and capacitive reactance component. In the past, the fact that some of the customer's load remained connected to the bank most likely prevented the ferroresonant over voltages from developing when the individual phases were energized.

- Avoid energizing medium lengths of underground primary and transformers at the same time. Although it has been shown in actual field test that the length of the primary underground cable is critical to the circuit parameters for ferroresonance to occur, it remains impractical for a designer to calculate the range of circuit lengths that may be critical. Generally long lengths of underground cable and very short lengths are not critical.

- Minimize single-phase energizing at the riser poles for transformer banks connected floating wye or delta on the high side. This may be accomplished with an overhead, pad mount, or vault-type, gang-operated switch.

- Temporarily ground a floating-wye connection. For smaller, three-phase transformer banks the recommendation is to temporarily ground the floating-wye connection until all three phases are energized. This is the most economical alternative. This same recommendation is made for three phase, floating wye - delta vaults. In vault design, a yellow grounding elbow and feed-thru bushing is recommended for the purposes of providing the temporary ground. This is addressed in Section 29 of the Distribution Construction Manual.

- Use internal three-phase loadbreak (open-close) oil switch when provided in delta-connected transformers. In transformers so equipped, use the internal three-phase oil switch located in the primary compartment. This in effect allows the underground cable (or the capacitive component) to be energized first, then the inductive component energized last, thus avoiding the possibility of resonance occurring.

- When energizing a single, three-phase padmount, park the elbows in the padmount, energize all three cables first and then energize the transformer, one elbow at a time. Install elbow arresters after the transformer is energized on all three phases.

In designing underground systems, the designer should always be aware that ferroresonance is a design consideration anytime a three-phase transformer bank is connected delta or floating wye on the primary side of the bank. The designer should be aware of the conditions where ferroresonance can occur and use one of the above alternatives to remove that condition.

9.0 Methods of Installation

9.1 Primary Circuits

Underground Primary cable is generally installed in a 36" deep trench. Bulk feeder primary cable is generally installed in a 36 or 48-inch trench depending on whether there are other facilities to be installed in the same trench. See Distribution Constructions Specifications for details.

A. Underground primary may be radial (stub) or looped. Single transformers shall be radial fed. Multiple transformers (two or more) shall be loop fed. The cost for a loop feed for multiple transformers shall be part of the construction cost in the Carolinas, but will require a contribution in aid of construction in Florida. The cost for a loop feed for a single transformer shall be done via a contribution in aid of construction as abnormal construction cost.

   A customer served by a single radial fed padmount may request an additional circuit to make a loop feed. A contribution in aid in construction is required to pay for the additional circuitry. Under very special circumstances a single radial fed padmount transformer may be fed with a loop feed. This requires management approval of the circumstances.

   Some of the following types of customers that are typical of those who may request a loop feed, and are willing to pay a contribution in aid of construction for the additional construction cost, include the following:

   i. Emergency shelters
   ii. Fire Departments
   iii. Fire pumps
   iv. Fire Alarms
   v. Hospitals
   vi. Police

vii. Civil defense
viii. Public airports
ix. Military installations
x. Homes for the aged
xi. Municipal sewage pumping stations
xii. Municipal water pumping stations
xiii. 911 Centers

B. Both ends of an underground loop should not terminate on the same pole or in the same switchgear. This eliminates the need for an outage when maintaining poles and switchgear.

C. When dipping into a neighborhood, the developer shall provide locations for two poles so the dips will not be on the same pole.

D. Both ends of an underground fused loop should terminate on the same feeder. This may not always be possible, but is desirable.

E. It is desirable to not have an overhead switch between fused termination poles serving a loop. This reduces the potential for fused loops between feeders.

F. It is desirable to have both ends of an underground fused loop be in close proximity to each other. This reduces restoration time and reduces the potential for fused loops between feeders.

G. Avoid routing primary so that it doubles back in the same trench. The two trenches will normally be installed on opposite sides of the road.

H. Underground #1/0 primary loops should be normally open at the load center of the loop. For single transformers with loop-fed primary, the opening point will be at the transformer.

I. Residential developments often include service to commercial pumps. When the pumps require three-phase 240 volt service, or 480 volt service, a two transformer, open wye – open delta bank can be provided. While it is possible to use the lighting transformer of a 240/120 volt bank to provide service to single-phase residential customers the motor starting could result in a voltage flicker issue that would adversely affect the residential customers. Electric motors typically have a starting current 5-6 times normal running current so the larger the motor the more likely a flicker issue could exist for the residential customer. In general, this situation should be avoided unless voltage flicker is analyzed carefully. See the Voltage Flicker chapter of the Engineering Manual (DST-EDGX-0033) for more information.

J. Open wye – open delta transformer bank installations should be installed with the lighting transformer on the leading phase. A phase leads B phase; B leads C; C leads A. The designer should indicate the phase for each transformer. Installing in this manner provides less voltage unbalance which is important for three-phase motor operation. Voltage unbalance increases heating on three-phase motors. The NEMA MG-1 Standard provides information on motor de-rating required when an unbalance exists. There is always some unbalance on the distribution system but an open delta bank will add 1% or more to the primary feeder unbalance. A motor that is not fully loaded can withstand the voltage unbalance without consequence. A motor that is fully loaded will be excessively heated if the unbalance is high. This is true regardless of the size of the three-phase motor. In general, the size of three-phase motors served by open wye – open delta transformer banks should be limited to 50 HP. Larger motors can be served under certain circumstances. Contact Distribution Standards for guidance on larger motors.

K. Both phases serving an open wye – open delta transformer bank should originate at the same terminal pole or switchgear.

L. Do not design an open wye – open delta bank as an opening point between two separate phases in a single-phase residential cable loop.

M. Underground primary should be protected from over current. When specifying the protective device, the designer should take care to coordinate the protective device first with the closest source side protective device and next with the largest transformer in the circuit on the load side.

   a. Bulk feeder.
      i. Feeder breaker
      ii. Recloser
      iii. Vacuum Fault Interrupter
   b. Underground #1/0 primary.
      i. Fuses at terminal poles.
         1. Since underground faults tend to be permanent in nature, it is recommended that K-speed fusing be used to protect #1/0 primary. K-speed fuses are faster blowing fuses than KS fuses or 103's. Because of their faster speed in clearing faults, there is less damage to cable and terminations, as well as fewer operations of the substation feeder circuit breaker (FCB) or the closest source side protective device.

ii. ii. Fuses in switchgear.

1. For the same reason mentioned above, E-speed fuses are used in underground switchgear. E-speed fuses are slower than K-speed fuses but not as slow as KS fuses, so it is possible to do some series fusing with E-speed fuses.

N. Underground facilities must be protected from lightning-induced over-voltage.

a. Terminal poles shall have riser pole arresters.

b. Normal open points in an underground loop (junction box, switchgear, or transformer) shall have elbow arresters on each side of the open point. See Specifications Drawing 27.03-02A for arrester ratings.

c. Ends of radial feeds shall have elbow arresters.

d. Some older live-front (PMH) switchgear has mounting rails for base-mount arresters with no isolator.

i. Where this rail is available, install base-mount arresters on each side of normal opening points.

ii. Where this rail is not provided

1. Install elbow arresters on each phase in the first transformers from the PMH.
2. Install elbow arresters in adjacent dead-front (PME) switchgear, if available.

e. Dead front switchgear shall have arresters installed on the cable at the open point and one additional 600 amp way in the same switchgear. This will be a total of 6 arresters. No arresters are required in a gear that does not have any normal open points.

In the past, mechanical fault indicators were used to facilitate fault location in a primary, loop-feed system. These fault indicators were located on the primary cable at every single and three-phase padmount transformer, in switching enclosures, and at switchgear. A tool has been developed that uses radar technology to assist the line technician in locating a cable fault. Use of this tool expedites the location of cable faults and essentially makes mechanical fault indicators obsolete for single phase applications.. Therefore, the use of mechanical fault indicators is no longer standard except in the few areas where the tool is not available.

The tool works well for single-phase circuits, but for three-phase circuits with padmount transformers that are wye-wye connected five-legged core transformers the tool will not work so mechanical fault indicators will still be required on some three-phase padmount transformers. The three phase transformers will need to be switched out of the circuit to use the fault-finding tool. When a single, three-phase padmount is installed in a radial circuit a fault indicator is not needed.

Primary should be spliced when a cable reel ends to reduce scrap material. When a partial reel of cable is left over at the end of an installation, the partial reel should be used to start the next job.

9.2 Secondary Circuits and Service Laterals

A. General

Underground secondary is often installed in joint 36" trench along with the primary cable. Secondary and service laterals are required to have a 24" minimum cover. Secondary conductors are defined as those which parallel primary, or cables installed between a pad-mounted transformer and a secondary pedestal, or cable marker. A service lateral is the conductor that is installed from a pad-mounted transformer, secondary pedestal or cable marker directly to a customer's Point of Delivery (generally a meter base or CT cabinet).

In single-family residential subdivisions, each customer is to be served by a separate service lateral extending from a transformer or secondary pedestal. In multiple family dwellings, one service lateral may serve a ganged meter base of two or more meters.

B. Load Current, Voltage Drop, Flicker

Secondary and Service conductors should be sized to meet the following three criteria:

- Load Current – preferable to design for 80% loading to allow for growth
- Voltage Drop – 5% total drop in transformer and service (for residential)
- Flicker – 5% voltage flicker due to starting of motor loads

- Load current. Secondary and services should be sized to meet the anticipated peak demand load current plus allowance for anticipated load growth. The ampacity of each secondary and service conductor is shown in the Underground Conductor Data section of this design guide and also in Section 23 of the Distribution Construction Specifications Manual.

- Voltage drop. Secondary and services should be sized to meet the maximum voltage drop allowed for residential and commercial services. The voltage drop requirement will usually be the governing factor for residential services due to the standard residential service length. The amount of allowed voltage drop is defined by the commissions in our service areas. The defined limits are as follows:

Residential or lighting customers: +/- 5% of nominal voltage (126 volts max, 114 volts min on 120 volt base)

Commercial and industrial customers – Florida: +/- 7 1/2% of nominal voltage (129 volts max, 111 volts min on 120- volt base)

Commercial and industrial customers – Carolinas: +/- 10% of nominal voltage (132 volts max, 108 volts min on 120-volt base)

The voltage drop limits include the drop in the transformer and the drop in the secondary and service. The voltage drop in the transformer depends upon the transformer impedance and the power factor of the load. The higher the power factor is, the less voltage drop on the transformer. For residential load with high power factor the voltage drop on the transformer is lower than with lower power factor commercial/industrial load. The transformer impedance limits provided to our manufacturers in our group specifications are:

Single phase	
25 to 75 kva units	3.0% max, 1.5% min, 2.25% typical
100 to 167 kva units	3.0% max, 2.0% min, 2.5% typical
250 kva units	5.75% max, 3.0% min, 3.75% typical
Three phase	
75 to 500 kva units	5.0% max, 2.5% min, 3.0% typical
750 to 3750 kva units	6.18% max, 5.32% min, 5.75% typical

Since the actual transformer impedance is not known at the time of design, the practice for residential design has been to assume 2.0% of the voltage drop will occur in the transformer and the remaining 3.0% (3.6 volts) will occur in the service.

- Flicker - Secondary and services should be sized to meet the flicker allowed for the largest motor, air conditioner compressor, or other devices located at the premises. Also, there are regulatory flicker requirements that the flicker caused by a customer will not cause objectionable flicker to other customer's service. The requirements for voltage flicker limits vary between our service areas.

- Electric tankless water heaters create a condition that is similar to flicker. Tankless water heaters usually include an electronic control, but they should be considered resistive for all practical purposes. Unlike a motor, there is no "starting" current that reduces after the motor starts, but they do draw a much higher current than a standard water heater; therefore, a larger voltage drop is incurred in secondary and services, and transformers. Where tankless water heaters will be used, the impact on voltage drop must be considered. More information on tankless water heaters is provided in the Appendix of the Engineering Manual.

CAROLINAS: While there is no regulatory limit for the amount of flicker a customer's device may cause in their own service, from a practical standpoint there should be a design limit for residential services. Without a design limit for residential services, the standard air conditioner or heat pump's normal operation would cause objectionable flicker for the average customer. The current design practice is to limit residential flicker to no more than 5% (6 volts).

FLORIDA: In Florida sudden changes in voltage (flicker) that occur more frequently than two times per hour are limited to 5% (6 volts). This is regulated by the Public Utilities Commission.

Carolinas and Florida therefore use the same flicker limit, 5%, for residential service.

A more detailed discussion of voltage flicker requirements is located in the Voltage Flicker chapter of the Engineering Manual. (DST-EDGX-00033)

C. Secondary Pedestals

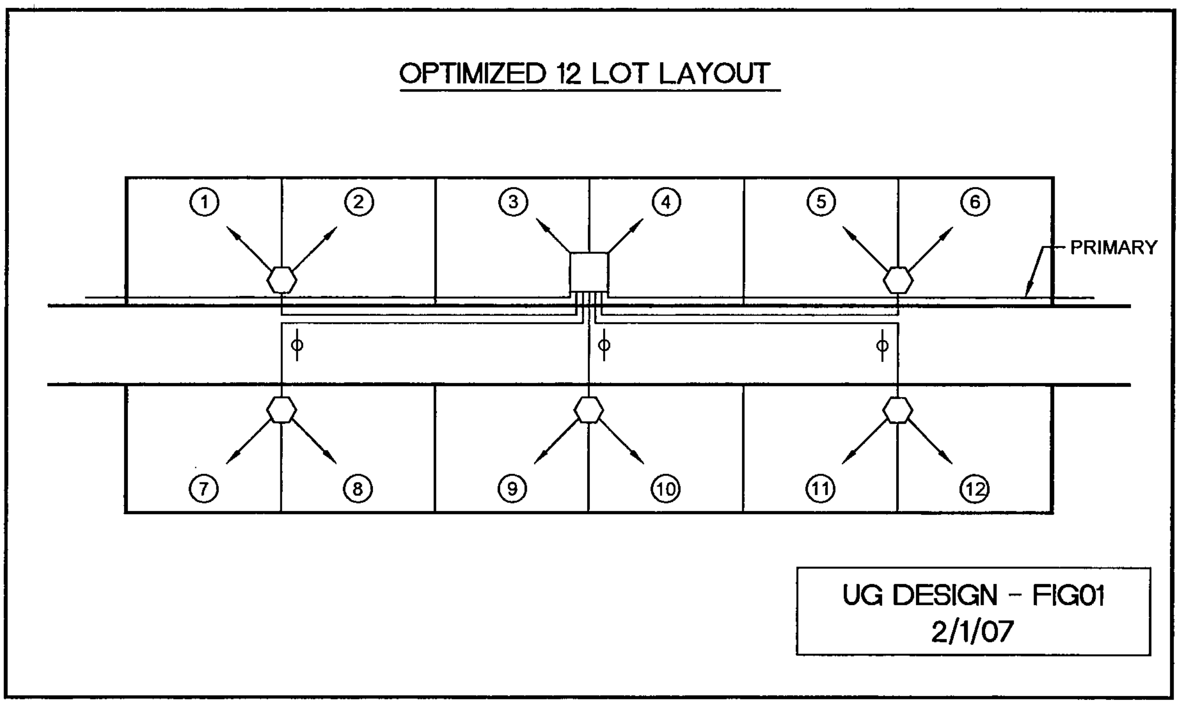
The maximum number of secondary connections to a padmount transformer is limited by the number of positions on the secondary spade connectors. Eight connections is the normal maximum due to eight-hole, secondary spade connectors. Only one conductor may be installed per position.

Secondary pedestals are utilized to reduce cost by optimizing loading on transformers and secondary cables. A secondary pedestal may be used when there are two services to be served from the same lot corner, or one service and a street light. This is often more economical than placing two cable markers with two separate secondary runs at a lot corner and making two permanent service connections at a later date. The load will dictate whether separate services need to be run or whether both can be served by a common secondary pedestal.

Transformer costs have increased substantially in recent years and the use of secondary pedestals will often result in a cost-optimized design. The cost per kVA of the transformer is lower as the size of the transformer is increased. Since eight connections in a padmount is the maximum we can often extend this to serve 10 or 12 homes by strategic use of secondary pedestals. The use of secondary pedestals can also reduce secondary cable usage which also optimizes the cost of the design. Secondary pedestals should also be used to serve an individual service and a street light when this will reduce a long run of cable to serve just a light.

One pedestal may be served by another pedestal when the total cost of the installation is reduced. This is referred to as "daisy-chaining" pedestals. It is limited in application because voltage drop and flicker requirements must be met and it is not usually possible to meet these requirements with daisy-chained pedestals. It is only possible when the housing load is small. Voltage drop and flicker requirements will self-limit the number of pedestals that can be daisy-chained.

The most economical design is typically one where we serve an equal number of lots on each side of the road from a single transformer and maximize the number of homes served from a transformer. How many homes we can serve is dependent on the average load for each home and the size width of the lots.



In an overhead area a secondary pedestal should be located near the property line between two homes to serve both homes from one underground riser. This is often more cost effective than using two separate service runs in separate trenches with two underground risers. It is also more economical, and preferred, to install a pedestal at the base of a pole, if two services are to be installed, than having 2 service risers.

When serving only one home from an overhead transformer and riser, it is not cost effective to install a pedestal at the base of the pole. The service shall be run directly from the transformer to the home.

10.0 Conduit Guidelines

Progress Energy buys a rugged primary cable which is made for direct burial so our construction standard is to direct bury. There are applications where conduit should be considered. Use of conduit depends on application and field conditions. Consult Distribution Construction Specifications drawing 22.01-02A and 22.01-02B when making a determination for a particular situation. Conduit-sizing recommendations are included in this section.

TRANSFORMERS

Loading data for new installations and change outs is contained in the Transformer chapter of the Engineering Manual (DST-EDGX-00029).

RISERS

Poles where we transition between overhead and underground facilities are commonly called dip poles, riser poles, or terminal poles. Vertical runs of cable on the pole are protected with cable guard or conduit. Cable guard is also called U-guard. Cable guard may be used for risers on straight poles. There should be no gaps between the guard and the pole within 8' of the ground. Small gaps, less than ½ the cable diameter, are permitted above 8'. Small knots may be cut from wood poles to permit close installation. Where a gap within 8' of the ground line or a large gap, greater than or equal to ½ the cable diameter would occur with cable guard, a conduit riser should be used. A ventilator shall be installed to provide air convection cooling for bulk feeders and for secondary and services larger than 350.

Secondary, service, and lighting cable shall not be installed under the same cable guard or in the same conduit riser as primary cable. Typically, there isn't room on a pole for more than two risers. Where there is insufficient room on a pole for the number of risers needed, there are various options. For secondary, service, and lighting consider installing one set of conductors on the pole and using a secondary pedestal to transition to multiple conductors. Another alternative is to install risers offset from the pole.

UNDERGROUND FEEDERS/SWITCHGEAR

Underground feeder loops are designed differently than underground fused loops. Underground feeder loops are large conductors (typically 350, 500, 750 or 1000 kcmil) with 600-amp terminal pole switches. The underground loop may have the same feeder source for both ends but in some cases the underground feeder is capable of tying two feeders together. Because it has this capacity, it is common practice to design the underground with two sources. For overhead feeder sources, this can be two separate overhead feeders with a 600-amp switch in the feeder between the two terminal poles. This design improves reliability because if one source fails, the entire underground feeder loop can be switched to the other source. Unlike the fused loop which is only designed to pick up the fused-loop load, an underground feeder loop can pick up additional feeder load. The terminal pole switch provides an isolating point. Padmounted switchgear can be various electrical configurations. Configurations are shown in Section 27 of our *Distribution Construction Specifications.*

Padmount switchgear is installed on underground feeder loops. The switchgear provides fused taps or electronic fault interrupters for terminating #1/0 loops in areas without overhead lines. The switchgear also provides sectionalizing points in the underground feeder. If a fault occurs in the underground feeder cable, the fault can be isolated by opening the switches in the pad mount switchgear at each end of the faulted cable. The switchgear units can be kept energized after isolating the faulted cable. If fused loops terminate at the pad mount switchgear, they remain energized. If a pad mount switch fails, the fused loops and feeder loop terminated in it can be switched out while maintaining service to all customers. This flexibility only exists if fused loops do not start and end at the same switchgear. However, since a padmount switchgear is a high cost item, its use should be limited. Attempts should first be made to utilize fused loops from overhead circuits.

LIGHTING

See DST-EGDX-00041 - Area and Street Lighting

11.0 Residential Design

Although designing subdivision layouts is very individualized, there are some conventions that are more logical to do first. The recommended method for designing a subdivision is as follows:

Determine the total load in the development – Start with the loads and square footage of the homes in the development along with their mix of electric and non-electric loads. Also consider any non-residential load that may be served from within the development.

Service sizing – Determine the secondary and service wire sizes and distances where the voltages can be maintained at normal levels. When estimating the service distance on a layout, the designer should assume a distance of 1/2 the depth of the lot, unless the actual footage is known. Residential services in a subdivision should be sized for all electric homes since it is unknown at the time the subdivision is designed which homes will be all-electric and which homes will have gas. It is more practical, in residential design, to size the service for all electric than to have to replace a service at a later date. The design service size and the design load should be indicated on the layout. The secondary system should be designed so that 350 TPX services are not required.

Transformer sizing and layout – Once the secondary and service sizes and distances are known, the designer can determine the maximum number of lots that can be served per pad mount transformer. Refer to DST-EGDX-00029 to properly size the transformers. Although the standard number of triplex cables that can be connected in a pad mount transformer is eight, more than eight lots can be served from a padmount by using underground triplex secondary cable to secondary pedestals with individual services pulled from the pedestals to the individual houses. Underground Conductor Application Data gives the instructions for determining the size and distance along with the transformer loading charts, the designer can then place the secondary, service, and transformer on the drawings to maximize the number of lots served by a padmount.

Secondary and Services layout – Service laterals are to be laid out in as straight a line as possible from the cable marker, pedestal, or transformer to the meter on the house. The normal point of delivery is defined in CSI-EDGC-00006, "Individual Service Connections (Carolinas)" and "Requirements for Electric Service (Florida)". Often there will be a few lots adjacent to each other in the development to be served from a nearby overhead line and transformer. It is often most economical to install secondary to a secondary pedestal between the lots and each home would then be served with an individual service from the secondary pedestal vs. two separate services.

Primary Design – With secondary, services, pedestals, and transformers plotted on the layout, the designer can complete the layout and primary design. The routing of the primary cable through a residential underground area will be determined by the locations of the transformers and the layout of the roads. The designer should be careful to utilize a minimum length of cable consistent with the economical use of the trench opened for secondary circuits. When it is necessary to install both sides of a primary loop along one street, install the two sides of the primary loop on separate sides of the street to prevent one dig-in damaging both sides of the loop. When it is practical to run cable along side property lines, underground primary may be installed along side lot lines. An example would be two large cul-de-sacs where it is most economical to connect the two cul-de-sacs with a cable run down side lot lines between the two cul-de-sacs.

In residential subdivisions at a loop-feed padmount transformer, where the primary is installed on public right of way, the primary cable should loop from the main trench to the transformer and placed in the trench so the two cables do not cross each other. All cables should be tagged and marked as outlined in the Distribution Construction Specifications.

When to add a 2^{nd} or 3^{rd}-phase wire in a development – In laying out the primary cable routing in a development, the designer should take into consideration the connected loads to ensure that the underground tap fuse will not become overloaded. Sometimes it is necessary because of the loads to add a 2^{nd} or 3^{rd} primary phase in a development. The reasons that generally cause multiple phases in a development are:

1. Underground tap fuse serving a loop would exceed 75% of the maximum fuse rating. This assumes a cold load pickup of twice steady state diversified load following a feeder outage.
2. Overloading of the underground cable itself. Fusing normally limits the load on #1/0 cable vs the rating of the cable itself.
3. Three-phase power required in the development for a water pump, sewage lift pump, clubhouse, etc. Open-delta transformer connections can normally be used for three-phase motor load so only two phases would be required to serve an open-delta transformer bank.

Sizing riser pole fuses – Underground #1/0 distribution circuits should be fused. When sizing riser pole fuses, the fuse must coordinate with the closest protective device on the source side feeding the riser as well as carry the load it feeds on the load side. DST-EDGX-00040-"Protective Coordination" should be consulted for the coordination of various fuses and protective devices. With the assumption made that the fuse will coordinate upstream, the following will focus on sizing the fuse for both the normal load, emergency load, and cold load it serves. Typically, a fuse can carry 150% of the fuse rating continuously. For example, a 100-amp fuse can carry 150 amps continuously. Based on this, riser pole fuses may be loaded to 75% of the fuse rating which allows for 150% loading for cold load pickup following an extended feeder outage or for carrying the other end of a loop, should the cable fail. The designer should use the connected load kVA (# of units X kVA per unit X diversity factor) for each phase to determine the load on the fuse. In selecting the fuse, the designer should also check for proper coordination with the source side protective device. Note that the connected kVA of transformers is not what is used for fusing calculations. We design load transformers to 160% of their nameplate in winter and 130% in summer so it is more important to look at actual load in the subdivision than connected kVA of transformer capacity.

The diversity factor to apply to the load depends on the number of lots served but in general applying a 50% diversity factor is a good approach to designing the underground system. If there are 200 homes in a subdivision, the load will be 50% or less at peak than 200 times the peak load of each unit. When there has been a feeder failure at peak for an extended period the diversity will be lost and the fuse must carry twice as much as before the outage. Using only 75% of the fuse rating and taking into consideration that a fuse can carry 150% of it's rating continuously, the fuse will be able to carry the load until diversity is regained.

Steps in determining riser pole fuses and # of primary circuits.

1. From the layout, total the connected load (# of units x kVA per unit X diversity factor) on the looped circuit.
2. Determine the maximum fuse that will coordinate with the closest upstream (source) protective device.
3. Determine the minimum fuse that will clear the largest pad-mount transformer in the primary circuit.
4. Size the riser pole fuse to serve the total diversified load of any complete loop ensuring that it will coordinate with the upstream device and the transformer. Keep in mind that the fuse can carry 150% of its rating continuously. If the largest fuse that will coordinate is too small for the development load, consider the following:
    a. Change out upstream protective device to allow larger riser pole fuses.
    b. Spread load in the development across multiple riser pole fuses.
    c. Add a second or third phase on the distribution system to the development (if not already present).
    d. Re-conductor the distribution line feeding the development so as to allow riser pole fuses that will coordinate with upstream devices, serve the development load, and clear the largest padmount transformer. Example: Reconductor #4 AL with #1/0 AL.
5. Design the primary circuit loops so as not to exceed 75% of the fuse rating. This may require a 2nd and 3rd-phase loop to be considered for the development.

6. Establish an opening point in the loop about mid way and ensure that the loop on the riser pole fuse to the opening point does not exceed 75% of the fuse rating. If the fuse loading to the opening point exceeds 75%, consider changing the opening point or increasing the fuse size.
7. When the circuits have been determined, establish an opening point mid way of the designed loop.

Example:
There will be 200 lots in the subdivision, 15 kVA per lot. 200 x 15 x 0.5 = 1500 KVA of total load. Since the load will be served by two half-loops from two separate fuses the load per fuse will be 750 kVA.

For a 12 kV feeder, 750 / 7.2 = 104 amps. A 100-amp fuse is the largest recommended fuse for a riser pole and since 104 amps is greater than 75% of a 100-amp fuse rating this subdivision will require two phases, 4 total fuses. Then we could use 80-amp fuses since 52 amps per fuse is less than 75% of an 80-amp fuse.

For a 23 kV feeder, 750 / 13.2 = 57 amps so this subdivision could be served with only one phase. The two fuses could be 80-amp fuses since 57 amps per fuse is less than 75% of an 80-amp fuse.

By loading the fuse to 75% of it's rating, we will have capacity for cold load should we lockout a feeder during a peak time and it is out long enough to lose our load diversity. We will also have capacity for one riser pole fuse to serve the entire loop in the event of a cable failure near the other riser pole.

Subdivisions built in partial phases – When a subdivision is built in phases, a preliminary primary layout of the entire subdivision must be made to determine the best overall layout for the subdivision taking into consideration the location of possible connections to existing or new overhead lines. The particular phase being built should be designed to conform to the overall layout. When a distribution system is installed in phases, install only a portion of the loop until the development is completed. It is not necessary to have each development phase looped, if it involves excessive expenditures. If the development phase does not end at a transformer, conduit should be installed just past the lots being developed so that the primary may be extended without trenching across developed lots.

12.0 Single-Phase Fault Current

Single-phase fault current levels for residential installations have some special design considerations. Residential panel circuit breakers are normally rated for 10-kA fault current. The designer needs to be aware when the 10 kA levels at a residential breaker location could be exceeded. When these levels are exceeded, the designer should notify the customer's electrician so they can get higher-rated breakers.

Progress Energy's self contained meters (200 amp and 320 amp) are rated for 12-kA fault current so it is a must to get fault current below this value, even if above 10 kA, unless there is a breaker on the source or load side of the meter rated for a higher fault current. The next highest rating for circuit breakers after 10 kA breakers is 22 kA. If there is a 22 kA breaker on the source or load side of a meter this is acceptable.

When designing a residential project, it is best from a safety standpoint to avoid >10-kA level designs when possible. The larger the padmount transformer size, the higher the level of fault current. However, the impedance of the secondary cable will rapidly drop the fault current level. It is generally possible, for little or no additional cost, to layout transformer/secondary cable combinations that are under the 10-kA fault current level. The chart below shows the transformer/cable combinations that will be below the 10-kA fault current level.

MINIMUM TRANSFORMER and CABLE LENGTHS TO BE BELOW 10-KA FAULT CURRENT LEVELS

Transformer Size	350 TPX	#4/0 TPX	#2/0 TPX
50 kVA	> 40 ft	Any length	Any length
75 kVA	> 50 ft	> 40 ft	> 25 ft
100 kVA	> 85 ft	> 60 ft	> 45 ft
167 kVA	> 120 ft	> 85 ft	> 55 ft
250 KVA	> 140 ft	> 95 ft	> 65 ft

<u>NEC Requirements:</u>

The NEC permits series rating of circuit breakers. For example, in a panel, the NEC permits a 10 kA rated circuit breaker even when the available fault current exceeds 10 kA but only under the following conditions:

1. It is protected on the line side by a breaker that is rated for the maximum fault current.

2. The series combination has been tested and demonstrated to safely open a short-circuit current higher than 10,000 ampere on the load side of the downstream breaker.

The first condition is normally possible to ascertain from the developer's plans.

The largest problem PGN has encountered is with large condo-townhouse-apartment projects where it seems logical to place a large padmount transformer between two buildings with short services to large ganged meter bases. The fault current will almost always be over 10 kA in these cases (see table above).

However, the plans for most of these buildings will include a large main breaker, 800, 1000, or 1200 amps, rated at 42 kA or more. And individual breakers are installed on the load side of the breaker and are often rated 22 kA. The electrical service designers have apparently run into this subject before and are prepared for it. When we have a main breaker rated for a fault current in excess of 10 kA, and/or a load side breaker rated for 10 KA or more, we need not be concerned about the fault current delivered to the meter.

All gang meter installations that have more than 6 meters are required by NEC to have a main breaker, so if we ensure the main breaker is rated for more than 10 kA, and it likely will be, we are covered for high fault current situations and we can place large padmounts with short services with no concerns.

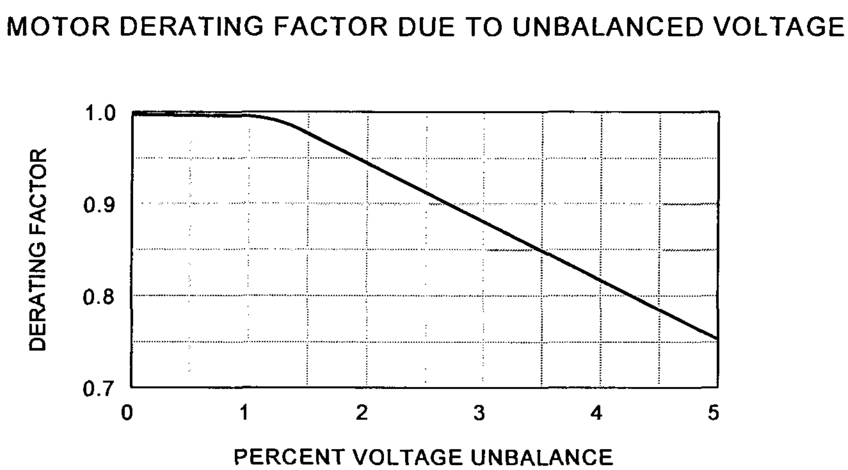
If the plans do not include the rating of the main breaker we should ask the developer to provide ratings, or provide the fault current information on the layout and get the developer to formerly acknowledge the layout and keep a record of this acknowledgement on file. We normally get the developer to sign the layout, acknowledging the facility locations. If the fault current is included where it exceeds 10 kA this should be adequate record that fault current information has been provided.

One exception: Gang meter bases of six or less meters do not require a main breaker, so if one of these is served with a short service from a large padmount and fault current is over 10 kA we should either modify the design to provide less than 10 kA to the meter, or ensure the developer acknowledges the fault current formerly and keep a record of this acknowledgement on file.

13.0 Non-Residential design

A common underground primary design for serving non-residential customers is a primary underground loop from an overhead line, routed to padmount transformers near the customer's POD or property line. The normal opening point should be located near the center of the loop. This is similar to a residential development but normally three-phase whereas, a residential development would be 1, 2 or 3 phases, depending on the number of lots.

In many residential developments a three-phase pump is required to be served. The most economical service will be to serve the non-residential load from the same phase conductors that serve the residential load. This may be done with an open-delta installation using two single-phase padmount transformers. There will be some voltage imbalance when using an open-delta bank so the customer must be advised in order to properly size the pump motors. A larger size motor may be required to compensate for the voltage imbalance.



13.1 Sizing the service

Unlike residential services in which the POD is located in the meter base on the customer's house, non-residential POD's are typically in a meter trough or at the secondary terminals of the transformers. The latter places the responsibility and the cost of secondary wiring with the customer, and the designer should plan for the appropriate number of conductors being connected. Where there are multiple customers who are individually metered, the company does supply the secondary service to a POD located somewhere other than the secondary terminals, such as a meter trough on the customer's wall. In this case, the designer must size the service to serve these customer loads within acceptable voltage drop levels.

13.2 Sizing and locating transformers

Refer to DST-EGDX-0029 for sizing transformers. Transformers should be located near the center of the load they serve. The placement and location of padmount transformers shall meet the requirements in Section 27, Padmount Transformers, in the Distribution Construction Manual. The locations shall be easily accessible by a line truck and not subject to traffic. If the customer can not provide a location that is not subject to traffic then the customer shall be required to provide bollards around the transformer to protect. Bollards are typically concrete posts, painted yellow for high visibility and placed around the transformer in locations to prevent damage from traffic. They shall not be placed in front of the transformer in a way that would interfere with opening the doors for normal operations.

13.3 Designing the primary system

When the POD's are established, the KVA demand loads are finalized, and the required transformers located in the layout, the designer can begin laying out the primary system feeding the POD's. In most cases, #1/0 Al underground cable is the standard cable for general power distribution to non-residential loads. Occasionally, a project load or customer will be large enough to require bulk feeder cable but this should be very rare.

13.4 Secondary Handholes and Pedestals

Secondary handholes and pedestals are used to provide a compartment with space inside to allow the connections of secondary wires to multiple service wires which generally serve multiple customers from the handhole or pedestal location.

Pedestals – In residential and light non-residential applications, the designer should consider using pedestals when more than eight services or multiplex cables are planned to be served from a single-phase padmount transformer.

Handholes - In contrast to pedestals, handholes are to be used for multiple secondary and lighting circuits in shopping centers, apartments, condominiums and downtown urban areas. Handholes may be more expensive than pedestals but are more suitable where subject to high traffic or pedestrian areas. Handholes are more commonly fed from underground vaults or enclosures and are used to extend secondary voltages for general distribution up a city block, in a shopping mall or in a strip shopping center. Connections made in handholes are to be submersible as shown in the Distribution Construction Specifications. Generally, all cables should enter the handhole from one end.

13.5 Padmount Switchgear

Padmount switchgear consists of a variation of terminals, switches, fuses, and fault interrupters contained in a metal enclosure mounted on a pad. The equivalent devices used in overhead design are gang-operated load break switches, 600-amp disconnects and fused cutouts. Our standard padmount switchgear is the PME. The PME is a dead front design in which cables are terminated using either 600 amp or 200 amp elbows. The switch in a PME is rated for 400 amps load break at 23 kV and 600 amps at 12 kV.

Padmount switchgear is used in several types of underground applications.

Sectionalizing three-phase feeders.

Fusing of single or three-phase taps off feeders

Fusing of single or three-phase taps off three phase #1/0 circuits

13.6 Primary Junction Enclosure

A primary junction enclosure is a switch box that contains one or more load-break, three-way or four-way bushing inserts for installation of 200-amp load-break elbows. There are no fuses and no switches.

A single-phase enclosure shall be used for a single-phase application only. Two separate phases shall not terminate in a single-phase enclosure. A three-phase enclosure shall be used for two or three phases. A single-phase enclosure shall not be used for multiple phases.

A single-phase enclosure will have two parking stands for parking 200-amp elbows and either one load-break, three-way or one load-break four-way. With a three-way, one single-phase circuit can feed in and out of the enclosure and there would be one un-fused tap. With a four-way, one single-phase circuit can feed in and out of the enclosure and there would be two un-fused taps.

A three-phase enclosure will have nine parking stands for parking 200-amp elbows and either three load-break three-ways or three load-break four-ways. With a three-way, one three-phase circuit can feed in and out of the enclosure and there would be one three-phase un-fused tap. With a four-way, one three-phase circuit can feed in and out of the enclosure and there would be two un-fused taps. A three-phase junction could also be used with a two-phase circuit.

A three-phase junction with three four-ways is similar to a PME9 except there are no fuses and no switches, just a feed in, a feed out, and two taps.

The application of single and three-phase enclosures is limited, since switching is done by operating load break elbows instead of switches and there are no fuses. However, it may prove economical to install enclosures in certain applications.

For example, a shopping center may be served by a three-phase, 1/0 loop around back of the shopping center and where a new business (restaurant) opens in the center of the parking lot. The most economical means to serve the new business may be to tap into the existing 1/0 loop with an enclosure and radial feed to the new business.
Another application is very common. The last lot in the first phase of a development is some distance from the last padmount transformer installed. When the next phase opens, it will be necessary to extend the primary from the last padmount. We could install conduit from the last padmount to the end of the developed first phase and pull primary cable later. But, if the distance is long it will be more economical if we install primary cable into an enclosure and terminate the cable. When the second phase begins development, we would remove and salvage the enclosure, splice the cable, and continue on into the second phase of development. There is an economical break-point at approximately 170 feet. For distances less than 170 feet, it would be more economical to install conduit for future use. Above 170 feet, it is more economical to install the primary cable into a temporary junction enclosure. By installing and terminating the cable into a junction enclosure energized, any dig-ins will be identified by an outage. No primary cable shall be installed and left de-energized, with intention of energizing at a future date. If the cable is left de-energized and becomes damaged, we would not know about it until the cable is needed and then it would likely need to be replaced. Primary cable shall never be left stubbed up into a cable marker.

13.7 Ductbank

Ductbank is a conduit system comprising multiple ducts, stacked in a trench and generally encased in concrete. For example, a 6x6 ductback would be 6-6 inch conduits. Ductbank construction is generally used in urban areas where there is insufficient width to install multiple circuits in a wide trench. Ductbank construction is expensive and should be used only when available real estate is limited.

13.8 Pullbox

Pullboxes are used where a cable pull-in conduit would exceed maximum cable-pulling tensions. A small pullbox can accommodate one set of three-phase, small, primary conductors (1/0 or 4/0). A large pullbox is required for one set of three-phase, large, primary conductors (350 through 1000 kCMIL).

Only one circuit should be installed in each pullbox for the following reasons:

1) To avoid a splice failure on one circuit, thus damaging the second circuit.
2) To eliminate any hazard for employees working on one circuit in a pullbox while the other circuit is energized.

14.0 Planned Urban Development (PUD) Design

Planned Urban Developments, better known as PUDs, generally consist of large blocks of land that are subdivided and zoned for residential and commercial development. PUDs are typically a self-sufficient community. The residential blocks of land will consist of single family dwellings, and multiple family clusters consisting of townhouses, condos, and apartments. The non-residential blocks of land include commercial property. The commercial blocks consist of shopping facilities, offices, restaurants, churches, parks, libraries, schools, and public protection facilities (fire, police, and sanitation).

Designing electric distribution facilities for PUDs is much like planning for a small town where a complete infrastructure is required.

Estimating Load Blocks – The designer will generally determine the electrical load of the entire PUD by developing load blocks for the various zoned properties. The load blocks will normally be placed on the development map in large blocks without actual layouts being known or designed.

Overhead distribution is our normal mode of service, and as such, overhead facilities should be planned where possible and where covenants or ordinances allow. If overhead bulk feeders can be used in the developments with the general distribution circuits installed underground, then this should be done. Many times, the city or county ordinances will required everything to be installed underground. When this is the case, underground distribution bulk feeders may need to be incorporated in the PUDs electrical design.

When local, city, or county ordinances require that the bulk feeder be placed underground as well as the general distribution circuits, the bulk feeder should be planned with switchgear installed and located to provide fused compartments for originating the general distribution circuits. The most common switchgear used in a PUD is a PME9. It has two 600-amp compartments with a 600-amp load break switch (600 at 12 kV, 400 at 23 kV) on each circuit, and it has two fused compartments with three fuses in each compartment. So the bulk feeder would run through the switch and the fused compartments would create 1/0 loops to other switchgear.

1/0 cable is rated for 215 amps when direct buried, 175 amps in PVC conduit, and 150 amps when under U-Guard in summer and 180 amps when under U-Guard in winter. These are cable ratings, but the concentric neutral is a reduced-size neutral and only rated 115 amps. So for serving single-phase loads the reduced neutral size must be considered. This is a good reason to limit the terminal pole fuse to 100 amps. The return current for single-phase load will largely return on the concentric neutral. Another reason is that our cutouts are rated 100 amps. We have 200-amp cutouts available but would generally only use them for non-residential applications with a larger than 100-amp fuse. For serving non-residential, three-phase load, the size of the concentric neutral is less of an issue since the load should be fairly balanced and therefore with very little current return on the concentric neutral.

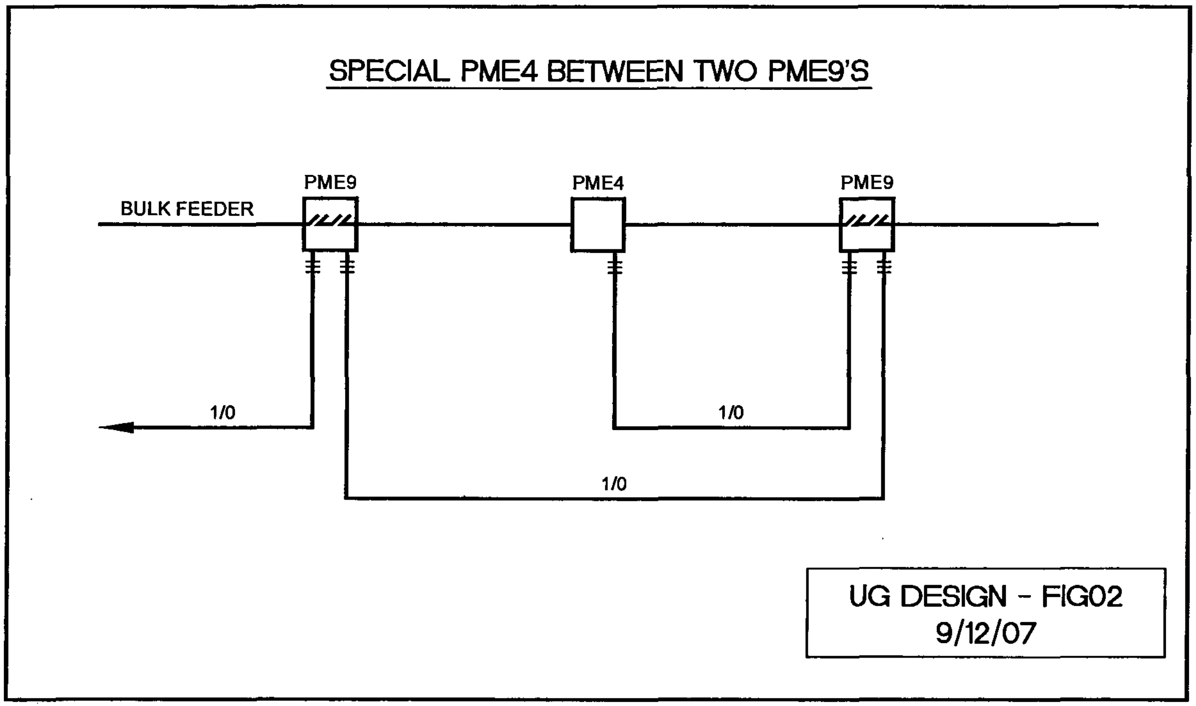
If we size the fuse to 75% of the fuse size and use a 100-amp maximum fuse then a 3-phase 1/0 loop is good for 3.2 MW at 12 kV and 5.9 MW at 23 kV. The layout of the subdivision may be such that multiple 1/0 loops can be used. Multiple 1/0 loops would be more economical than a feeder cable system with associated switchgear. Multiple 1/0 loops would be good for 6.4 or 11.8 MW at 12 or 23 kV respectively.

We have a number of sizes of bulk feeder cable. 500 and 1000 kcmil are used in Florida. These are 15 kV-rated cables. 350 and 750 kcmil are used in Carolinas. These are 25 kV-rated cables and can be used on 12 kV or 23 kV feeders in the Carolinas. The direct buried ratings are listed in the table below along with the load capability in MVA.

Primary Conductor Size	Ampacity Direct Buried	Load at 12 kV (MVA)	Load at 23 kV (MVA)
350	410	8.9	16.2
500	520	11.2	*
750	625	13.5	24.8
1000	725	15.7	*
***** 500 and 1000 are 15 kV rated cables**			

The load listed for 350 and 500 are near, or exceeding the maximum that would normally be served from an overhead feeder so it should be unusual to require 750 or 1000 in a residential development.

We also have a special PME 4 that can be used between 2 – PME9's or between a dip pole and a PME9. It has 600-amp terminations and one 200 amp fuse compartment with two fuses. But it has no 600-amp switches so it must be used between 2 devices where switching can be done. The cost of this switchgear is about half of a PME9.



Overall, the general distribution circuits should be planned to fully load the 1/0 aluminum primary cable with loops originating at one switchgear and eventually terminating at another switchgear. Designing a loop to both originate and terminate in the same switchgear can negate the benefit of the looped circuit in the case of a failure in the switchgear, and should be avoided.

When determining the placement of switchgear, keep several issues in mind:

- Keep the loading on each 1/0 general circuit at or below 75% of the fuse rating. It is best not to plan on using the largest fuse available to allow some flexibility for the unknown, should the actual loads be greater than the estimated block loads. As mentioned earlier, a 100-amp fuse should typically be the largest used for single-phase load.
- Strategically place the switchgear to minimize the use of pull boxes.
- Design circuits to maximize use of PME9s and use each of the four compartments.
- Plan for use of existing facilities that may be nearby the development.

Several things impact the design of the bulk feeder:

- Will the bulk feeder in the PUD be a main feeder (meaning overhead feeder on both ends of the PUD with general distribution load feeding through the PUD)?

- Is the bulk feeder needed to serve the load within the PUD due to loads?
- Many times, the load within a PUD plus the surrounding area load will require the installation of several bulk feeders. The PUD load will often require a capacity increase in a nearby Transmission/Distribution (T/D) Substation or the installation of a new T/D Substation. When a PUD is being designed, the region planner must be consulted so the surrounding infrastructure can be planned and constructed.

15.0 Fault Indicators

Fault indicators are used in underground distribution systems to facilitate the sectionalizing of underground primary cable when electrical faults occur. Fault indicators serve no purpose in protecting equipment, but assist with identification of the faulted span. This facilitates the restoration of service. There are several different kinds of fault indicators available, each with their own application and purpose.

Fault indicators are either manual reset or automatic reset. Manual reset indicators must be reset after operation by a line technician. Manual reset fault indicators require that the equipment in which the indicators are installed be opened to both visually check for indication, and to reset the indicator. The reset is accomplished by pushing on a toggle switch on the indicator.

Automatic reset indicators reset themselves. There are several types of automatic reset fault indicators. Current reset fault indicators reset after normal load current flows following an outage, typically 3-8 amps. Time reset indicators reset after a period of time following an outage, typically four hours. Voltage reset indicators reset when voltage is sensed following an outage. There are two types of voltage reset indicators. One is reset when secondary voltage is restored so these can only be used on padmount transformers where secondary voltage is available. The other type resets based on sensing the electrostatic voltage on the primary cable. These are more typically used on primary cable, especially in switchgear where there is no secondary voltage available.

Automatic reset indicators will be comprised of three parts, the sensor that is located on the primary cable, the indicator that is placed on the exterior wall of the equipment in which it is installed, and a cable to attach the indicator to the sensor. A hole is either pre-drilled in the equipment or one is drilled at the time of the installation so the visible indicator is visible on the outside of the equipment without opening, and since the indicator will automatically reset there is no need for a line technician to open the equipment.

The ability to "drive-by" the auto reset fault indicator is a distinct advantage over manual reset fault indicators during troubleshooting in that it is quicker to find the location of the fault since a "drive-by" is much quicker than stopping at every equipment, opening it, checking the indicator display, resetting the indicator and then closing the equipment.

On underground systems, temporary faults are rare. Faults are typically permanent, resulting in a fuse blowing or a feeder lockout. On overhead systems, faults can be "temporary" and it is more difficult to select a fault indicator that will provide the needed function for both permanent and temporary faults. On underground systems, we are usually looking for a permanent fault that operated a protective device, and not a temporary fault, so fault-indicator selection is a little simpler than for overhead systems.

Circuit Parameters to consider when applying fault indicators

Progress Energy distribution circuits have voltages from 12 KV to 35 KV, with the majority of our system falling in the 12 KV and 23 KV classes. Loads on the feeder circuits typically fall in the maximum range of 600 amps with 350 amps being the normal peak feeder loading. The maximum three-phase symmetrical short circuit current at the bus of the substation for these systems falls in the range of 8,000 to 10,000 amps. A typical single-phase underground circuit rarely exceeds 75 amps in normal load current.

As stated above, the maximum short circuit current (bolted fault) at the bus of substations is in the range of 8,000-10,000 amps. This would be the maximum fault current that is available. Another fault condition that may occur on the distribution system is the high impedance fault condition. A high impedance fault condition may occur when an energized conductor makes contact with a tree limb or earth. A bolted fault is one where an energized conductor is in contact with the neutral of the system.

Low impedance faults or bolted faults can be very high in magnitude (10,000 amps near the substation) or very low (300 amps on the end of a long circuit). Faults able to be detected by normal protective devices are low impedance faults. Studies have shown that these detectable faults have fault impedance of close to 0 ohms with the maximum being no more than 2 ohms. This implies the calculated value of fault current assuming a "bolted fault" is essentially the same as the actual fault current level at the given calculated point on the feeder. Studies show that the maximum 2-ohm fault impedance has a considerable affect on lowering the fault current close in to the substation but has little affect on the fault some distance away. What can be concluded is that fault impedance does not significantly affect fault indicator performance since low level faults are not greatly altered.

High impedance faults are faults that are low in value, generally less than 100 amps. The low current values are due to high impedance. This implies that high impedance faults do not contact the neutral and do not arc to the neutral. As such, they are not detectable by conventional means and are not to be considered when selecting fault indicators.

Reclosing and inrush

Temporary faults cause breaker operations, resulting in a magnetizing inrush when the circuit is re-energized (reclosed). The magnetizing inrush currents are produced primarily by the connected transformer kVA on the system. The inrush currents are high where there is a large amount of transformer kVA being energized. Since the inrush current is short in duration, fuses and time delay protection is not normally affected. Experience has shown that the inrush on typical tap lines is below the trip level of most fault indicators. However, this is not the case on the main arteries of the feeder line.

Cold load pickup after an extended outage on a feeder or tap line can cause mis-operation of protective devices. The cold load pickup is normally caused from the following three sources:

- Inrush - lasting a few cycles
- Motor starting - lasting a few seconds
- Loss of diversity - lasting many minutes

If a lateral fuse operates during cold load pickup conditions, it could be from overload due to the loss of diversity. If relays operate, it is most likely the quick trip and caused from the steep inrush current at the breaker. For fault indicators, the inrush current and /or the load current due to loss of diversity could cause a false trip.

Application

Manual reset fault indicators are affected by cold load pickup and magnetizing inrush. The manual reset fault indicator is more applicable to lightly loaded tap lines where these conditions are much less in magnitude. The majority of the use of manual reset fault indicators is on underground circuits where faults are generally permanent faults. Manual reset fault indicators are essentially magnets, they require no power source to operate properly and thus they require no periodic maintenance.

Automatic reset fault indicators are not magnets and require a battery to operate properly. The battery is not replaceable on underground fault indicators; therefore, the fault indicators must be replaced every 10-15 years when the battery wears out. Given that the automatic fault indicator battery will expire in 10-15 years these should not be used on new cable except in bulk feeder applications. Using in switchgear will expedite restoration of service for bulk feeder outages and the maintenance replacements will be more manageable.

For normal fused 1/0 circuits the use of manual fault indicators has been standard in the past; however, in August 2007 Progress Energy began utilizing fault-finding radar equipment that other utilities have found expedites service restoration without the need for fault indicators. So the use of manual and automatic fault indicators on the underground system is being reduced substantially.

For new construction, beginning in August 2007 fault indicators will be installed as follows:

Single-phase transformers – fault indicators are not required except in a few designated areas in the Carolinas where there is very little underground being installed and where the fault-finding tool will not be available for locating faults. These areas are identified in the 'Distribution Underground Specifications'.

Three-phase transformers – manual fault indicators shall be installed on the load side cables when the transformer is within a loop system or on a radial system containing more than one transformer. Fault indicators are not required on a single, radial-fed, three-phase transformer.

Switchgear – automatic reset fault indicators shall be installed on all primary cables in each switched compartment of a pad mounted switchgear.

Primary junction enclosures – manual fault indicators shall be installed on load side cables.

16.0 Transclosures and Vaults

Vaults and transformer enclosures (transclosures) are used to house distribution transformers, related switch gear, and fusing equipment when standard padmounted installations are not practical. This section will explain when to use vaults or transclosures and the division of responsibilities between Progress Energy and the customer, along with related code requirements. It will also list reference drawings and specifications, as needed, to meet installation and maintenance requirements.

16.1 Transclosures

A transclosure is a metal enclosure in which overhead-type transformers are installed, thus they are **transformer enclosures,** or transclosures for abbreviation. They can be used for other types of equipment as well. Reference PEC and PEF 'Requirements for Electric Service' for situations where transclosure installations are applicable. Examples include the following:

- Three-transformer delta services
  - Note that a 3-wire, floating-wye service can be provided from a padmount transformer for 480-volt service in lieu of a 3-wire delta service
- Three-transformer four-wire delta (240/120 volt three-phase service).
- Non-standard secondary voltages for underground (600 volt, 4160/2400, etc.)
- Primary metering
- Ball field lighting - single phase with large loads (480/240)
- Fusing and Switching

16.2 Transformers, Cables and Clearances

Transformers used within transclosures are typically overhead-type transformers. They should be retrofitted at the transformer shop with primary bushing wells so the underground primary cable can be connected with primary elbows for a dead-front installation. Engineering should coordinate with the customer to limit the number of service cables the customer runs to 8 circuits. The louvers in the transclosures will provide adequate convection cooling of the transformer bank when clearances are maintained around the transclosure.

When equipment is mounted in the transclosure that requires use of hot sticks, adequate safe clearance around the transclosure must be provided to allow for the operation of the equipment. In general leave the same working clearance that would be required for the front of a three-phase padmount transformer. Ten feet is required in front of a padmount transformer for switching purposes.

Aluminum, fiberglass, or stainless steel transclosures can be acquired for use in contaminated areas, along with stainless steel transformers. These transclosures are special design and special order. Contact Distribution Standards.

16.3 Vaults

Minimum Dimensions and Initial Planning

Vaults located on the outside of the building (below ground or above ground) will be regulated by the rules of the NESC. Vaults located within a building will be regulated by the rules of the NEC. Some vaults are located recessed in the side of the building and the vault doors are flush with the building wall. New vaults should only be located within a building as a last resort. Padmount transformers are significantly less expensive than vault-type transformers and should be the first choice for providing underground service to a building. However, a vault is common construction for high rise buildings. Vaults are always customer provided and the size and location shall be negotiated during the planning for electrical service to a new building.

For vaults associated with the secondary network system in St. Petersburg and Clearwater see Section 42 of the Engineering Manual.

This is a guide showing the minimum-size vault that the customer should build. This should only be used as a guide and all vault sizes and requirements shall be jointly agreed upon between the building architects and the Progress Energy engineer while the building is in the planning stage. Minimum height dimensions are measured from the floor to the bottom of any overhead support beams in the top.

	Height	Width	Depth
100-500 kVA w/o switch w/o fuses	10'	15'	10'
100-500 kVA w/ switch w/ fuses	10'	15'	15'
750-1500 kVA w/o switch w/o fuses	12'	10'	20'
750-1500 kVA w/ switch w/ fuses	12'	15'	20'
1500 kVA single bank w/ switch w/ fuses	12'	20'	20'
2500 kVA	15'	30'	20'

There is no way to make firm minimum dimension requirements for all vaults on an equipment-to-be-installed basis. There are too many variables such as Progress Energy primary and customer service entrance conduit locations, truck and personal access and room at the building site.

To expedite the job in an orderly and timely manner, it is necessary to work with the architect during the design phase of the building. Once the load is given to engineering, a list of equipment needed to serve the customer should be made including transformer size and type, fusing and switching requirements and an idea of the present and future need for conduit entrances in the vault.

A good way to do the initial vault layout and to find specific dimension requirements is to draw and cut out scale plan views of the equipment and arrange it in different configurations. Once this is done a meeting with the architect should take place to discuss specific divisions of responsibilities and establish a construction timetable. Space for a large vault in downtown areas can be limited and you will put yourself at an advantage when you show up at your initial meeting with the building architect with a basic layout for space requirements. Under no condition should necessary NESC working clearances and safe personnel access be compromised.

Before vault construction begins, a sketched plan view and view of all vault walls should be agreed to by both the Progress Energy engineer and the builder or architect. This sketch should show the following:

- Inside dimensions
- Personnel access (door location and dimensions for above-ground vault or removable grate opening and ladder location for subsurface vault - clear inside dimension)
- Equipment access (doors, removable grate or cover panels)
- Grating (amount of required clear opening for cooling)
- Sleeves in floor corners for ground rods
- Sump location and grating dimensions
- Conduit sleeve locations in walls dimensioned to the vault top and nearest adjacent wall corner location
- Customer conduit entrance and the number of and size of circuits the customer will bring into the vault
- Conduit size and location to allow metering circuits from the vault to the meter enclosure
- Show the location outside the vault for the meter enclosure.

16.4 <u>Customer Responsibility – Outside-the-Building Vault</u>

The customer shall build the transformer vault. Progress Energy requirements will be provided by the engineer working the job in a timely manner to allow the building architect proper lead time. The vault will meet any local codes, NESC requirements, insurance requirements, ordinances, and the following requirements:

- Location - Vaults will be located outside the building. (One wall of vault may be a common outside building wall.) Truck and crane access routes to the vault must be obvious or marked so damage will not occur to buried tanks, cables or piping of any kind. The access route must remain open at all times. Progress Energy will not be responsible for decorative shrubbery or trees planted in the access route or around the perimeter of the vault that interfere with construction or maintenance of the vault.

- Walls - Walls to be solid masonry in subsurface vaults, and capable of supporting any equipment the engineer specifies to be mounted with lead shields and anchor bolts. Walls to be capable of withstanding a radial force equal to or greater than the strength of pulling eyes. Progress Energy can supply to the customer sets of eye bolts (eyebolt, nut, and square washer) with a minimum tensile strength of 12,400 lbs. to be installed by the customer 12" above the floor at locations specified by Progress Energy. The customer will supply the back steel plates or wall-mounting hardware to secure the eyebolt in place.
- The vault floor to the bottom of ceiling support beams' minimum is 10' for small vaults and 12' for medium and 15' for large vaults.
- For subsurface vaults, conduit sleeves or conduit panels are to be provided and installed by the customer to allow the installation of 6" conduits for cable at locations specified by Progress Energy. Conduit entrance panels with knockouts are preferred or, unused sleeves will be plugged.
- Floors - Floor to be concrete or 6 inches of crushed stone (stone only if the vault top is completely removable) in surface vaults and must be concrete in subsurface vaults, of sufficient strength to support equipment weight. Progress Energy will provide maximum transformer weight and the approximate footprint of the transformer. Surface vaults must have natural drainage to eliminate standing water.
- Concrete floors will have 1" diameter holes in each corner of the vault floor to be centered 8" from each wall at the corner. This is for the installation of ground rods.
- For above-ground vaults primary cable conduit entrances through the floor must be installed by the customer per the Progress Energy engineer's specification.

Drainage - Subsurface vaults must have a sump in a location not to interfere with the equipment placement as specified by the engineer. The sump must be covered with grating sufficient to support personnel with a hole only large enough for control cable in and discharge water pipe out. Progress Energy will supply a sump pump and necessary plumbing and circuit to power the pump. The sump and pump should be sized to keep water levels below the exposed secondary and or metering CT's and PT's during expected high water conditions. Care must be taken in the placement of subsurface vaults to not allow them to become natural catch basins for storm runoff.

Grates - The customer will be required to design grating and air intakes to meet the minimum square inch clear openings (total grate panel area less the area of the panel occupied by the grating steel) for equipment cooling adequate to dispose of the transformer full-load losses without creating temperature rise which is in excess of the transformer rating. For subsurface vaults Progress Energy requires a minimum top grating as specified in the NEC 450-45 (c) of 3 square inches of clear opening per kVA of transformer capacity. If this requirement cannot be met, mechanical forced air cooling should be used as a last resort and must include a fan failure alarm circuit. Above ground vaults ventilation shall meet the same requirements as mentioned above. For above-ground vaults, grated and screened tamper-proof air vents a minimum of 6" x 12" should be placed at least every 10 feet around the outside walls of the vault. This area is part of the total three square inches per kVA area required.

Above-ground vaults accessible to only authorized personnel must have pedestrian-rated covers consisting of removable solid panels with enough grating to provide ventilation. Each panel must have provisions for removal by line trucks and should not weigh more than 2500 lbs. each.

Subsurface vaults will have covers consisting of removable solid panels with enough grating to provide ventilation of all grating panels. If possible the grating should be installed on both ends of the vault top with the solid sections in the middle. This helps create a natural chimney effect. Each panel must have provisions for removal by line trucks and should not weigh more than 2500 lbs. each.

The top will be designed to support any anticipated loading. NESC 323 states that if vault tops are subject to vehicular loading, rule 1 applies. Vehicular load includes line trucks, cranes or equipment transport trucks that must traverse the vault top. When the vault top is not subject to vehicular loading, rule 2 applies. Removable panels should be installed over the transformer and other large equipment when possible to allow equipment to be moved with a line truck or crane without having to use dollies, eyebolts and come-a-longs.

The location of any mid-vault support columns should be approved by the Progress Energy engineer to be worked into the equipment layout.

Any special lifting devices or special rigging necessary to remove panels other than standard winch hooks, cables and clevises will be provided by the customer and will be stored in the vault near the personnel entrance.

Accessibility - Doors shall be provided for all above-ground vaults. They shall be metal with a hasp to accept a Progress Energy padlock, and must not open into the vault. An alternate locking mechanism would be a cylinder lock specially keyed to accept the standard Progress Energy padlock key. A means shall be provided for securing the door in the open position. If the door is used only for personnel access, the minimum dimension shall be 36" wide x 78" high. If the door has to serve as the equipment entrance, the minimum clear dimension will be specified by the Progress Energy engineer.

For subsurface vaults, personnel access from the top will be from one of the following:

1. A minimum 36" diameter manhole cover.
2. Removable grate or solid panel section to have a minimum clear opening of 24" wide x 30" deep. A rectangular access door will be hinged to avoid dropping the door through the opening. Any opening accessible to the general public must be equipped with a hasp to accept a Progress Energy padlock. An alternate locking mechanism would be a cylinder lock specially keyed to accept the standard Progress Energy padlock, or per NESC 323D, be of sufficient weight and require special tools be used to open the vault cover. This would include cast manhole covers or cast rectangular doors that require the use of manhole hooks to open.

If there is not sufficient room on the side of the access opening to allow the mounting of remote switch operating handles, the Progress Energy engineer can specify a second opening to allow for the mounting of switch remote control operating handles and/or remote vault monitoring test points.

A fixed ladder will be provided by Progress Energy to meet the specifications below. Ladders are custom ordered for proper length. When ordering, the engineer must specify the length required.

- The ladder must be made of corrosion-resistant aluminum alloy.
- The ladder should be mounted at a 10 to 1 slope. (See Progress Energy Specification Drawing 29.01-03).
- The ladder must have a portable top section that can be installed by service personnel to provide a hand hold before descending into the vault. This can be a retractable center pole attached to the ladder or a separate removable top section. A Progress Energy engineer will provide drawings or suggestions.

<u>Lighting</u> - Vault lighting is to be supplied and installed by the customer in accordance with OSHA requirements. Fixtures and switches will have external grounding studs to permit bonding with adjacent grounded equipment or grounding to the vault ground system.

<u>Metering</u> - The meter enclosure is to be located outside the vault on a wall suitable to provide protection to the enclosure and allow the access to meter reading personnel. The small door on the metering enclosure should be between 4' and 5'6" off the ground.

A 1-1/2" I.D. schedule 40 PVC conduit system with a pull wire is to be supplied and installed by the customer from the CT location in the vault or switchgear to the meter enclosure outside the vault. If the distance from the CT's to the meter enclosure is greater than 50', contact Distribution Standards for circuit parameters to avoid over-burdening of the CT's. If the conduit system will be in conflict with the installation of equipment by Progress Energy, the customer will install the conduit from the meter enclosure into the vault and leave enough 1-1/2" conduit and supports in the vault for the Progress Energy crew to complete the conduit system. The conduit system location and length will be agreed upon by Progress Energy and the customer.

If the CT's are installed over the transformer secondary bushings but a suitable location in the vault cannot be found for the meter PT's, locate the PTs in a meter cabinet next to the meter enclosure.

It is acceptable to install metering CT's and PT's in the customer's main switchgear if agreed upon by the metering supervisor and the switchgear is equipped with the appropriate mounting hardware.

Sometimes it will be necessary to serve secondary or additional small metered services from a transformer feeding the main large service in a vault. If these small loads cannot be connected to the transformer secondary bushings and leave room for the CT, the transformer can be unloaded into a bus that will allow the small services to be tapped up before the main large service load current passes through the CT's to the customer's service entrance cables.

<u>Point of Delivery and Customer Service Entrance Cables</u> - The point-of-delivery will be where the customer's conductors meet the Progress Energy transformer secondary terminations. This may be different than the point of metering (CT and PT location). Progress Energy will supply terminations and terminate the cable to the secondary spades of the transformer or Progress Energy buss. The customer should be encouraged to limit the number of circuits brought to any one point of delivery in a vault to 12-16 conductors per phase. This can be achieved by increasing customer conductor size. If the Progress Energy engineer needs to split the secondary into two points of delivery for large loads, the customer will be responsible for splitting the feed to his mains and running two sets of service entrance cables.

If the customer's service entrance cables need to be supported from the point of entry into the vault to the point of delivery, the customer will supply and install a Progress Energy approved raceway, cable tray, or rack in the vault. This is where early planning of transformer placement relative to service cable entrances into the vault will help.

All service entrance cables will be marked by the customer as follows:

- Two wraps of phasing tape for each conductor, one near the conduit entrance into the vault and one near the end of the conductor.
- The circuits should be marked showing common feeds to disconnects or other customer switchgear.

All service entrance cables may be cut to fit to the transformer spades to provide a neat appearance.

Grounding - For a grounded 4-wire service the customer service entrance conductor neutral will be attached to the Progress Energy secondary neutral and connected to the vault grounding grid.

For an ungrounded 3-wire service the customer can run a single bare copper equipment grounding conductor from his switchgear into the vault to be attached to the vault grounding grid.

16.5 Customer Responsibility - Inside the Building Vault NEC Article 450

Progress Energy will specify the dimensions, floor type, allowable grade, minimum turning radius, and any special provisions to be made of access corridors from the outside of the building to the inside of the vault within the building (NEC 450-43 b). The sills or curbs referenced in this section must be removable so they will not have to be crossed with the transformers. Progress Energy will provide maximum transformer weights and footprint.

All personnel access ways shall be located such that the operator may exit the vault without having to approach the equipment. Doors should open to the outside of the vault and have provisions to be latched open, and have a hasp to accept a Progress Energy padlock. An alternate locking mechanism would be a cylinder lock specially keyed to accept the standard Progress Energy padlock key.

The customer will provide conduit encased in a minimum of 2" of concrete from the outside of the building to the vault for the installation of primary cables as specified by Progress Energy. This conduit encased in concrete is an NEC requirement.

Ventilation shall be adequate to dispose of the transformer full-load losses without creating temperature rise which is in excess of the transformer rating. NEC 450-45 covers ventilation requirements.

Vault lighting is to be supplied and installed by the customer in accordance with OSHA requirements.

If the vault is built over earthen ground the floor should be installed with 1" diameter sleeves in each corner to allow ground rod installation for a standard 2/0 ground loop.

If there is a room located below the vault floor or if for some other reason ground rods cannot be installed, a part of the buildings main structural steel shall be made available within the vault for the connection of the vault grounding grid. This steel shall have an earth ground.

All plans involving the vault and conduit system are to be approved by the Progress Energy engineer prior to construction.

PROGRESS ENERGY RESPONSIBILITY - Reference PART 3. NESC
Clearances For Working Space – Progress Energy Accident Prevention Manual, Progress Energy Safety Manual, NESC Section 37 rule 373.

It is the responsibility of the engineer to prepare a vault drawing for construction that will allow the vault equipment to be located to allow minimum working clearances for maintenance and operation without violating any Progress Energy safety rules. This should be reviewed with a Distribution Field Supervisor or other appropriate operations personnel prior to construction.

The standard is to use only dead-front high-voltage terminations (greater than 600 volts) on vault equipment. Rule 373 does not specify a minimum voltage, so exposed secondary connectors or transformer terminations must also be guarded or isolated to reduce the risk of accidental contact.

16.6 Fusing and Switching

Transformers located inside buildings shall be fused with a full-range current-limiting fuse located either in the vault (submersible type), outside in a power fuse holder (X-Limiter in SMD20 power fuse holder), or from a padmounted switchgear (X-Limiter).

Three-Phase Transformer Bank - The transformer banks in transclosures are usually connected delta - delta or floating wye - delta using conventional transformers. With underground primary source cable, these banks may be susceptible to the development of ferroresonant overvoltages if the bank is energized one phase at a time. The high voltages produced during this condition can damage equipment. This is true with both transclosures and vaults.

Delta - Delta banks sourced by an underground circuit should have a ganged, three-phase switch to energize and de-energize the bank. This can be done by using a gang-operated PME or VAC PAC. Fusing for the bank can be on the dip pole or at the transclosure location using a PME.

Floating Wye - Delta banks sourced by an underground circuit should be energized by a gang-operated switch or by *temporarily* grounding the floating neutral while the bank is being energized from a single-phase source such as fused cutouts or single-phase disconnects. *Temporary* grounding should be done by bringing the floating neutral to the front of the transclosure.

EQUIPMENT

Switches - (see vacuum switch drawings in vault section of the spec book)
All delta transformer banks should be energized and de-energized from a gang-operated 3-phase switch (pole, pad mount, transformer, or vault).

Floating-wye banks (See 'Construction Specifications' - Section 29.) should have the neutral accessible for temporary grounding from outside the vault. This eliminates the need for a ganged three-phase switch. When it is not possible to temporarily ground the floating neutral of a floating wye bank, a gang operated 3-phase switch should be used. Three-phase gang switching may be done at a surface-mounted switch feeding a sub-surface vault.

Switching in vaults should be done with gang-operated, dead-front vacuum switches. When possible, the switch should be wall mounted approximately 4' off the floor. This allows service personnel to stand in front of the switch and operate load-break elbows and use elbow capacitive test points and phasing equipment as needed. The switch should be arranged to permit operation of all switched positions from outside the vault with a stick, or, call for remote operator cables with the control handles mounted at the vault entrance. Switches may have 600 amp apparatus bushings to allow direct connection of 600-amp dead break elbows, or they may be ordered with 200 amp bushing wells for direct connection of 200 amp elbows. If necessary, 600-200 amp bushing adapters may be used to connect 200 amp elbows to 600 amp apparatus bushings. A record of the installation date of the switch and gas pressure should be kept.

Care should be taken to choose vacuum switch locations that allow cable support near the switch to eliminate excessive cantilever forces on the apparatus bushings.

Each position of the switch is to be clearly labeled. If remote operators are used, each position should be clearly labeled and an up-to-date circuit switching map provided to dispatchers and all pertinent service personnel.

Fault Indicators - for trouble shooting by service personnel, should be specified by the engineer and mounted (when possible) to be seen from the vault entrance without entering the vault. If remote operator cables are used on the switch, the fault detector readouts can be mounted with the remote operator handles at the vault entrance next to the corresponding remote handle.

Fuses - Preferred fusing inside vaults and transclosures is solid dielectric, full-range current-limiting submersible fuses. Vaults and transclosures may be protected by fuses located on dip poles or in padmount switchgear. In above-ground enclosures fuse cabinets with power fuses or solid dielectric full-range current-limiting fuses may be used. In some existing installations, SF6 fuses are used. These fuses are no longer manufactured. In other existing installations, fuse cabinets with power fuses in series with fuse cabinets with current limiting fuses were used. These may be maintained as needed. Contact Distribution Standards for repair part ordering information.

General - Vault transformer protection will be done with single-phase cutouts, overhead power fuses, underground power fuses (PME), submersible, solid-dielectric, full-range, current-limiting fuses, or electronic fault interrupters. In special cases, current-limiting fuses may be used in series with power fuses or electronic fault interrupters. Vaults are often located in downtown areas near substations with high available fault current. All the fuses listed above can interrupt the maximum system available fault current directly off the feeder circuit breaker.

Split Bus - For transformers on a 12-kV feeder, the maximum is 2500 kVA fused with a 125 amp full-range, current-limiting fuse. For transformers on a 23-kV feeder, the maximum is 2500 kVA fused with a 100-amp, full-range, current-limiting fuse. If loads larger than 2500 kVA are to be served from a vault, it will be up to the engineer to specify a split bus primary and secondary system that includes two transformers fused separately on the primary side of the transformers. Each transformer is to serve separate switchgear frames or main disconnects on the secondary side. <u>DO NOT fuse two transformers separately on the primary side and connect them together on the secondary side.</u> It will be up to the engineer to negotiate with the customer the optimum load split on the customer's service entrance equipment. Because this will be done for Progress Energy convenience, the customer will not be charged for totalized metering.

Single-phase Conventional Transformers - will be equipped with bushing wells and banked in vaults with no internal fusing.

Three-Phase Vault-Type Transformers - have internal expulsion fuses that operate only for a primary coil failure within the tank. These fuses have limited arc-interrupting capability and do not offer any secondary protection. The internal expulsion fuses clear when the upstream primary fuse clears the fault arc. An internal, open-expulsion fuse prevents the failed transformer coil from being re-energized.

Recommended Fuse Installation (independent of switching requirements):

- Use dip-pole fusing when possible.
- Use PME-fused taps when possible for underground projects
- Submersible fuses in damp, potentially-flooded vaults or in contaminated areas

Single-Phasing Protection - if requested by the customer, will require a facilities charge. The system will rely on single-phase fusing with voltage sensing of a single phase condition and a gang three-phase trip to lockout. Contact Distribution Standards for assistance.

Transformers - Due to possible long lead times for acquisition of vault transformers, don't delay making requisition to the transformer shop. All transformers installed in surface or sub-surface vaults will be equipped for 200-amp underground elbows. For surface or subsurface vaults, delta - grounded wye or grounded wye - grounded wye loads requiring a (500 kVA to 1000kVA 208Y120) or (500 kVA to 2500 kVA 480Y277) transformer, a 3-phase vault-type transformer should be used. For 240/120 volt delta secondary, use conventional transformers with bushing wells in the top. For sub-surface installation subject to flooding, or in contaminated areas, use stainless steel conventional transformers. All conventional transformers should be set on wood timbers or metal stands (DO NOT set on concrete floor or concrete piers). Transformers in vaults located inside or under buildings should be filled with a less flammable dielectric (FR3, BIOTEMP or other equivalent fluid). Note that mineral oil is not a less flammable (high fire point) dielectric fluid.

Vault-type transformers: Contact Distribution Standard for impedances, dimensions and weights.
1) Three 200-amp bushing wells on the left, front side
2) Fully-insulated Ho bushing to allow for a 3-wire service
3) Dual voltage switch (24.9 or 14.4 with taps)
4) Tap changer
5) Staggered LV spades (except straight across on the 500 kVA)
6) Internal expulsion fuses (see fusing section above)

Conventional transformers:

1) When stainless steel transformers are needed (subsurface vaults subject to flooding or contaminated areas) they must be ordered and should be specified with bushing wells.

2) Not all conventional transformers can be retrofitted with bushing wells. Send a request for bushing well equipped transformers to the transformer shop. They will either locate existing transformers for retrofit or order new ones.

3) Conventional transformers located inside or underneath buildings should be filled with a less flammable dielectric (FR3, BIOTEMP or other equivalent fluid).

Grounding - Standard vault grounding consists of a bare copper loop around the perimeter of the vault connected to the sectional, driven-ground rods. The ground loop is attached to the wall. Route ground loop around doorways and other access areas as needed.

All equipment, except transformers and vacuum switches, in the vault should have a #2 bare copper, loop grounded to the perimeter #2 grounding loop. (See grounding in the specification book.)

For grounded-wye secondary, ground secondary neutral bus at one point at middle transformer in the bank. Do not connect transformer tank grounds to secondary neutral bus.

If the vault is located inside a building where it is impossible to use ground rods, attach the ground loop to the building superstructure steel. (See <u>Customer Responsibility - Inside the Building Vaults</u>). In addition to this, a 2/0 bare copper ground loop should be pulled into the vault through the conduit with the underground primary. Attach this loop to a driven ground rod outside the building and to the vault ground loop.

CABLE ROUTING AND SUPPORT

Primary - cable routing and support is a very important consideration of the vault design. Sometimes duct bank and conduit entrances into vaults will not be located near the equipment on which the cable will terminate. Always rack or support the cable in conduit. Do not lay exposed cable along the floor.

The cable should be supported just after it exits the duct into the vault to eliminate undue mechanical stress of the cable against the conduit edge. The support brackets with porcelain work well for 750 Kcm cable. The cable should be supported every 5'. It is very important to support cable within 5' of switches and junctions to eliminate undue stress on apparatus bushings and junctions. Call for supports on both sides of splices.

Cable racking can be done by:

1) Installing 5/16 span-guys and spiral wrapping the primary to the guy wire.
2) Installing PVC conduit along walls (use bronze or stainless steel screws for the conduit straps for subsurface vaults)
3) Attach cable support brackets to the wall or cluster mount them on the end of cola brackets to support all three phases off one cola bracket. There are two types of single conductor cable supports: 1) The split bracket with porcelain and 2) a split bracket without porcelain that needs cable protectors with it.

Secondary - It is up the customer to supply cable racks, if needed, as specified by Progress Energy, for the customer service entrance cable in the vault. All Progress Energy secondary should be supported much the same as the primary cable.

Submersibility - The primary system (when submersible fuses are used) is submersible. When it is anticipated, the vault will flood above the secondary spades of the transformer. A properly operating sump pump should help to prevent this in most cases.

Less Flammable Dielectric NEC 450-23 (Vaults Inside or on Top of Buildings)

It is the customer's responsibility to provide a transformer location outside of the building that allows us to use our standard mineral oil filled transformers and standard fusing methods. If this is not possible, Progress Energy will install transformers, switches, and fuses inside a building in a customer-supplied vault that is in compliance with NEC Article 450. This article states that under certain conditions mineral oil transformers can be installed inside buildings. However, to avoid confusion and to keep Progress Energy from having to monitor continued compliance with these conditions, all vaults within a building will be equipped with transformers using a less flammable dielectric. In addition (with sufficient available fault current), the transformer(s) will be fused with full-range, current-limiting fuses. This current-limiting fuse (CL) reduces the amount of let-through current available to a primary fault within the transformer tank. The less flammable dielectric raises the fire point of the transformer dielectric to above 300° C. This combination greatly reduces the chance of catastrophic failure during a primary fault in the transformer. The fuse system needs to be coordinated so the conventional fuse clears all secondary faults and secondary overloads reflected through the bank to the conventional primary fuse. The CL fuse will clear all primary faults and reduce the let-through current while doing so.

Transformers - To meet the 300°C. rating, mineral oil filled transformers must be drained and flushed, then filled with a less flammable dielectric. FR3 and BIOTEMP are the currently approved less flammable dielectric fluids for these applications. Arrangements should be made with the transformer shop to have this done. Transformers that have been retro-filled with FR3 should be de-rated by 10% due to the higher viscosity of the less flammable dielectric. If existing transformers are not available, contact Distribution Standards for assistance in ordering less flammable dielectric transformers. Factory- built transformers with FR3 oil will be rated 100% of nameplate.

Fusing – The full range, current-limiting fuse should be sized to minimize the likelihood of nuisance fuse blowing due to motor starting and inrush. If conventional fuses are used in series with current limiting fuses, the conventional fuse should be sized independent of the CL fuse. The conventional fuse should usually be physically located ahead of the CL fuse cabinet to allow for a visual opening point before servicing the fuse cabinet with the CL fuses. The CL fuse must be of a rating to allow the conventional fuse to clear maximum reflected secondary faults before reaching the minimum melt curve of the CL fuse. There are several voltage/current ratings for CL fuses. If the vault is in a 12 kV area that may be converted, the possible combinations become even more complicated. For this reason, contact Distribution Standards with the following information for CL-fusing recommendations:

1) Available primary phase-phase and phase-neutral fault current at the vault.
2) Transformer kVA size and nameplate % impedance
3) Maximum secondary three-phase and phase-neutral bolted fault current reflected through the transformer to the primary.
4) Primary and secondary voltage and bank connection.
5) Single-phase banked transformers or a single three-phase transformer.
6) Full load current.

Auto Transfer Scheme

Auto transfer schemes if requested by the customer, will require a facilities charge. The system requires a preferred source and an alternate source from different feeders. Transfer switchgear automatically restores service to the customers load from the alternate source when the preferred source is interrupted. Depending on the location of the customer, the alternate source may require extensive planning including reserved capacity for large loads. Where extensive line work will be needed the cost of the project may be prohibitive from the customer's standpoint. For this reason it is advisable to do a preliminary layout and discuss estimates with the customer before continuing with detailed plans.

Some of the terms used with transfer schemes are listed below with an explanation:

Transfer Timer: An adjustable timer, which allows the engineer to delay the transfer from the preferred to the alternate source. This can be set to coordinate with any of the feeder breaker or recloser-delayed operations allowing the transfer to take place following a quick trip that did not clear the circuit or allowing preferred source feeder breaker or recloser to lockout before transferring to the alternate source. The customer's operating need will drive the decision on transfer time. In some cases special switchgear will be required that can transfer so fast that it transfers in less than 10 cycles.

Auto-Man Restore Switch: If set in Auto, the load will be returned to the reenergized preferred source. If set in Man, the load will remain on the alternate source even after the preferred source is reenergized. In the Man position, service personnel will manually have to switch back to the preferred source. Most installations are set up to auto transfer back to the preferred feed.

Restore Timer: An adjustable timer, which allows the engineer to delay the automatic transfer back to the re-energized preferred source. NOTE: the transfer back to the preferred source occurs only if the restore switch is set in the AUTO position. A typical restore time is three minutes.

Close-Open Transition Switch: This determines whether the preferred and alternate source will be tied during the AUTO restore sequence. If set to Close, following the timing out of the restore timer, the preferred source will close before the alternate source opens. This ties the two sources for a few cycles. This allows the restoration to the preferred source without the customer experiencing what looks like a quick trip operation. If set to OPEN, following the timing out of the restore timer, the alternate source will open and then a few cycles later the preferred source will close. The customer will experience a momentary during this operation.

Fault-Block: Fault block prevents a faulted circuit from being transferred to the alternate source by sensing overcurrent on the load side fault detectors. This latches the normal transfer scheme out and only allows the preferred source to open without the alternate source closing. If the fault block latches due to in-rush current but there is no loss of voltage, a timer will reset the fault block and the system will return to normal with no transfer occurring. With fuses located on the load tap, faults will be cleared by the fuses and even though the fault block detectors will latch the fault, no under-voltage will occur at the sensors at the preferred source elbows and the inrush restraint timer will cancel the fault block and nothing will occur.

For padmounted transfers there are several packages available that (similar to the submersible version described previously) can be tailored for special applications, as needed. Contact Distribution Standards for assistance in design and order information.

Progress Energy Supplied Vaults for Conversions

When converting large downtown areas from overhead to underground, it may be necessary to consolidate load into a Progress Energy-owned transformer vault or to install large feeder switching and fusing installations. Contact Distribution Standards for ordering and layout information.

In the past, dry-type transformers were installed by Progress Energy. This is no longer our practice. Contact Distribution Standards for assistance with maintaining or replacing dry-type transformer installations.

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FLORIDA

TRANSMISSION – EXTREME WIND LOADING DESIGN CRITERIA GUIDELINE FOR OVERHEAD TRANSMISSION LINE STRUCTURES

Extreme Wind Loading Design Guideline for Overhead Transmission Line Structures

SPS-LINE-X-0004

Standards Position Statement

Applies to: Transmission Operations and Planning Department - Carolinas and Florida

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Table of Contents

Extreme Wind Loading Design Guideline for Overhead Transmission Line Structures

SPS-LINE-X-0004

Standards Position Statement

Applies to: *Transmission Operations and Planning Department - Carolinas and Florida*

1.0 Introduction

The purpose of this guideline is to document the Transmission Department's new extreme wind loading philosophy for designing and analyzing overhead transmission line structures. This guideline is to be used in the design of all new transmission line structures and in the analysis of all existing transmission line structures originally designed per the 2002 National Electric Safety Code. This guideline is also to be used in the design of all replacement structures when the structure or structures being replaced were originally designed per the 2002 National Electric Safety Code. Use of this new guideline is applicable to the following types of transmission line projects:

- New overhead transmission line projects
- Line upgrade projects (i.e. Re-conductoring to increase line ampacity; replacement of overhead static or OPT-GW with larger cable)
- Line relocation projects
- Non-maintenance structure replacement projects
- All requests to add new non-standard equipment or devices to transmission line structures where local regulatory design codes, if applicable, do not govern the extreme wind design criteria.

The extreme wind loading criteria to be used to design new structures for or analyze structures on existing transmission lines for replacement is also addressed in this guideline. The design or analysis of structures associated with the following projects are subject to either the National Electric Safety Code requirements in place at the time the transmission line in question was originally constructed, or if a previous Code design requirements are not known, to this new guideline:

- Routine maintenance pole replacement projects
- Conductor, static wire, or OPT-GW replacement projects (like-for-like change outs or replacement)

2.0 General

All transmission line structures are adversely affected by extreme wind. As a result, they must be designed to resist the loads induced by this phenomenon. Extreme weather-related events can be characterized by their intensity, spatial extent, and rate of occurrence. For example, extreme or hurricane winds may affect with full intensity a large number of transmission line structures during a single occurrence. Or, a localized summer down-draft or tornado might only affect a single structure. It is therefore critical that the effects of an extreme weather-related event such as extreme wind be considered in the design or analysis of all transmission line structures.

Determining the magnitude of extreme wind loads and how they are to be applied in the design or analysis of overhead transmission line structures involve the application of a basic wind force formula that includes several wind-related and structure and line characteristics. Included among the wind-related characteristics are wind speed, terrain roughness, and air density. Among the structure and line characteristics are force coefficients, gust response factors, and the projected surface area of the structure. All of these characteristics are accounted for in the wind force formula to be used in the determination of the wind force acting on the surface of transmission line components.

The basic wind force formula presented in the 2002 National Electric Safety Code and the American Society of Civil Engineer's Manual 74 (ASCE 74) will be used to determine the extreme wind loading design criteria for transmission line structures in Florida and the Carolinas. Determination of wind loads or pressures using the wind force formula involves several variables or parameters. These parameters can generally be divided into four categories: air density, wind climate, localized wind characteristics, and wind-structure interaction.

Air Density Factor

The air density factor converts the kinetic energy of moving air into the potential energy of pressure. This factor is based on the specific weight of air at 60^0 F at sea level. In cases where both the ambient temperature and elevation above mean sea level varies significantly, modifications to the air density factor value will need to be considered.

Wind Climate

- Basic Wind Speed
  In the United States, the basic wind speed is the fastest-mile wind speed 33 feet (10m) above ground in flat and open country terrain and generally associated with a 50-year return period. The fastest-mile wind speed is defined as the average speed of one mile of air passing a wind measuring instrument (anemometer). The U.S. Weather Service and most of the U.S. standards and codes use the fastest-mile wind speed. The 2002 National Electric Safety Code specifies wind speed values based on a nominal 3-second gust at a location 33 feet (10m) above ground.

Transmission Line Importance or Reliability

- A transmission lines importance or reliability is governed by several factors. One is the integrity of the line's structural support system. A transmission line consists of two separate structural systems; the structural support system consisting of towers, poles, and foundations and the wire system including insulators and hardware. Another factor governing the importance or reliability of a transmission line is whether or not the line is defined as a "critical source". A critical source or Reliability Class 1 (RC1) transmission line includes lines connected directly to a generation plant, used as grid interties with other electric utilities, serving critical industrial or commercial customers, and all 500kV transmission lines. RC1 lines have a nominal line rating of 475 MVA or greater. Reliability Class 2 (RC2) transmission lines are all lines not classified by definition as Reliability Class 1 and have a nominal line rating less than 475 MVA.

Localized Wind Characteristics

- Velocity Pressure Exposure Coefficient

The velocity pressure exposure coefficient reflects the change in wind speed due to both the terrain, commonly called the terrain factor, and the height of the structure or wire above the ground line. Wind is basically the movement of air. This airflow across the surface of the ground is retarded due to the friction of the ground. The wind speeds are slower close to the ground and are reduced even more depending on the nature of the ground surface. ASCE 7-98 (2000) defines four exposure categories.

Exposure Category A: Defined as large city areas.
Exposure Category B: Defined as urban, suburban, and wooded areas.
Exposure Category C: Defined as flat, open country, farms, and grasslands.
Exposure Category D: Defined as unobstructed coastal areas directly exposed to large bodies of water.

The wind speed values provided on the wind speed map given in NESC 2000, Figure 250-2(b) are based on Exposure Category C and are for a nominal design 3-second gust at 33 feet above the ground.

The velocity pressure coefficient for a structure is based on the total structure height above the ground line. The velocity pressure coefficient for the wire is based on the height of the wire at the structure.

Wind-Structure Interaction

- Gust Response Factor
  The gust response factor accounts for the response of a structure or wires to turbulence in the wind. It accounts for the dynamic effects of gusts on the wind response of transmission line components. Wind gusts do not generally envelop the entire span of wire between transmission structures and some wind gust speed reduction reflecting the spatial extent of gusts should be included when factoring wind speeds or pressures in the design and analysis of both structures and wires.

  Because the gust response factor for the structure is considered to be equal to two-thirds the total height of the structure, the structure gust response factor is determined using the total structure height, not the total or effective height above ground line. The wire gust response factor is determined using the height of the wire at the structure along with the design wind span.

- Force Coefficient
  The force coefficient in the wind force formula accounts for the effects of a member's characteristics such as member shape, size, orientation with respect to the wind, solidity, shielding, and surface roughness on the resultant force. The force coefficient is also referred to as a drag coefficient, pressure coefficient, or shape factor.

The current practice in both Florida and the Carolinas to determine the extreme wind loading design criteria in the design or analysis of transmission line structures is derived from the 2002 NESC wind load formula as defined in Rule 250C and the Basic Wind Speed contour map (Figure 250-2(b)). There are, however, differences in the philosophy or design criteria on how to correlate basic design extreme wind speeds with a transmission line's importance or reliability classification and the integrity of the transmission infrastructure. The current design criteria or philosophy for each geographic area is explained below.

3.0 Design Bases

Transmission Standard's position is to implement a common extreme wind loading guideline for the design and analysis of the Transmission Department's overhead transmission line structures. This common guideline will define the reliability class of a transmission line, associate 3-second gust wind speeds with each line reliability class, and define each wind region where the 3-second gust wind speeds are to be applied.

The new extreme wind loading design guideline will group all transmission lines in Florida and the Carolinas into either Reliability 1 or 2 lines based on specific line rating criteria and critical or non-critical power source definitions.

A new Transmission Department extreme wind speed and pressure design criteria matrix has been developed and is attached with this document as Addendum A. Also attached with this document are extreme wind speed and pressure maps for both the Carolinas and Florida identified as Addendum B and C respectively.

This guideline is to be used in the design of all new transmission line structures and in the analysis of all transmission line structures installed per this guideline and the 2002 National Electric Safety Code. The design and/or analysis of transmission line structures associated with the following project types and previously installed or modified per the 2002 National Electric Safety Code are subject to this new criterion:

- New overhead transmission line projects
- Line upgrade projects (i.e. Re-conductoring to increase line ampacity; replacement of overhead static or OPT-GW with larger cable)
- Line relocation projects
- Non-maintenance structure replacement projects
- All requests to add new equipment or devices to transmission line structures where local regulatory design codes, if applicable, do not govern the extreme wind design criteria.

Rule 013B of the 2002 National Electric Safety Code (NESC) addresses the application of extreme wind loads to "Existing Installations" or, in this case, existing transmission line structures designed and installed according to previous Code or in-house extreme wind loading criteria. Rule 013B states:

1. Where an existing installation meets, or is altered to meet, these rules, such installation is considered to be in compliance with this edition and is not required to comply with any previous edition.
2. Existing installations, including maintenance replacements, that currently comply with prior editions of the Code, need not be modified to comply with these rules except as may be required for safety reasons by the administrative authority.
3. Where conductors or equipment are added, altered, or replaced on an existing structure, the structure or the facilities on the structure need not be modified or replaced if the resulting installation will be in compliance with either (a) the rules that were in effect at the time of the original installation, or (b) the rules in effect in a subsequent edition to which the installation has been previously brought into compliance, or (c) the rules of this edition in accordance with Rule 013B1.

Existing transmission line structures needing to be replaced as part of routine maintenance or requiring modification due to the addition, alteration, or replacement of conductors or static wires should be analyzed using the Code extreme wind loading criteria in effect at the time the transmission line, including the structures, was originally constructed except for extenuating safety reasons or legislative requirements. If the Code extreme wind loading criteria at the time the line was constructed is unknown, then the criterion of this guideline is to be adhered to when analyzing a structure or structures.

The extreme wind loading design criteria to be used to design new structures for or analyze structures on existing transmission lines for replacement is also addressed in this guideline. The design or analysis of structures associated with the following projects are subject to either the Code requirements in place at the time the transmission line in question was originally constructed, or if a previous Code design requirements is not known, to this new guideline:

- Routine maintenance pole replacement projects
- Conductor, static wire, or OPT-GW replacement projects (like-for-like change outs or replacement)

4.0 Practice/Design Criteria

The 2002 edition of the National Electric Safety Code addresses extreme wind loading for Grade B overhead transmission line construction in Rule 250C. Quoting Rule 250C:

"If no portion of a structure or its supported facilities exceeds 18 m (60 ft) above ground or water level, the provisions of this rule are not required, except as specified in Rule 216A1c or Rule 261 A2f. Where a structure or its supported facilities exceeds 18 m (60 ft) above ground or water level, the structure and its supported facilities shall be designed to withstand the extreme wind load associated with the Basic Wind Speed, as specified by Figure 250-2. The wind pressures calculated shall be applied to the entire structure and supported facilities without ice. The following formula shall be used to calculate extreme wind load."

$$\text{Load (psf)} = (0.00256) \cdot (V_{mi/h})^2 \cdot k_z \cdot G_{rf} \cdot I \cdot C_d$$

where:

0.00256	Air Density Factor based on the specific weight of air at 60^0 F at sea level
V	Basic Wind Speed, 3-second gust wind speed at 33 feet above ground line per new extreme wind pressure design criteria guideline (Addendum A) in miles per hour
k_z	Velocity Pressure Exposure Coefficient, as defined in NESC Rule 250C1, Table 250-2
G_{rf}	Gust Response Factor, as defined in NESC Rule 250C2
I	Importance Factor, 1.0 for utility structures and their supported facilities
C_d	Shape Factor, as defined in NESC Rule 252B2a

The wind pressure parameters (k_z, V, and G_{rf}) are based on open Exposure Category C as defined in ASCE 7-98 and is the basis of the NESC extreme wind criteria.

With the 2002 National Electric Safety Code defining the value of the Importance Factor, I, as 1.0 for utility structures and the facilities they support, the formula for the extreme wind load is:

$$\text{Load (psf)} = (0.00256) \cdot (V_{mi/h})^2 \cdot k_z \cdot G_{rf} \cdot C_d$$

Velocity Pressure Exposure Coefficient, k_z (NESC Rule 250C1)

The velocity pressure exposure coefficient variable, k_z, is a variable that applies to both the transmission structure and conductors/static wires (hereafter referred to as wires). The velocity pressure exposure coefficient for the structure is based on the total structure height above ground. The velocity pressure exposure coefficient for the wires is based on the height of the wires at the structure. The values for k_z for both the structure and the wires are provided in NESC Table 250-2.

The velocity pressure exposure coefficient variable, k_z, value in the wind load formula above and in NESC Table 250-2 is accounted for in the Transmission Line Design software module Pls-Cadd when NESC 2002 is selected as the legislative Code in the criteria file related to wire and structure loading under extreme wind loading conditions.

Gust Response Factor, G_{rf} (NESC Rule 250C2)

The gust response factor, G_{rf}, for a structure is determined using the total structure height. The gust response factor for the wires is determined using the height of the wires at the structure and the design wind span between structures. The values for G_{rf} for both the structure and the wires are provided in NESC Table 250-3.

The gust response variable, G_{rf}, value in the wind load formula above and in NESC Table 250-3 is accounted for in the Transmission Line Design software module Pls-Cadd when NESC 2002 is selected as the legislative Code in the criteria file related to wire and structure loading under extreme wind loading conditions.

Shape Factor, C_d, (NESC Rule 252B2a)

The transverse load on structures shall be computed by applying, at right angles to the direction of the line, the appropriate horizontal wind pressure determined under NESC Rule 250. This load shall be calculated using the projected surface areas of the structures without ice covering.

The following shape factors, C_d, shall be used:

Wind loads on straight or tapered structures that are cylindrical or composed of numerous relatively flat panels: $C_d = 1.0$

Wind loads on flat surfaced structures having solid or enclosed flat sides and an overall cross section that is square or rectangular: $C_d = 1.6$

Wind loads on square or rectangular lattice structures with flat surfaces: $C_d = 3.2$

Wind loads on square or rectangular lattice structures with cylindrical surfaces: $C_d = 2.0$

For most transmission line structures, 12-sided tubular steel and round or cylindrical concrete, a shape factor, C_d, of 1.0 is acceptable.

With both the Velocity Pressure Exposure Coefficient, k_z, and the Gust Response Factor, G_{rf}, being automatically applied to both the structure and wires when NESC 2002 is selected as the legislative Code in Pls-Cadd's criteria file under extreme wind conditions and the Shape Factor, C_d, being 1.0 for 12-sided steel and concrete poles, the extreme wind load value shown in the extreme wind load criteria matrix (Addendum A) and used as input in Pls-Cadd is:

$$\text{Load (psf)} = (0.00256) \cdot (V_{mi/h})^2$$

with the wind speed, $V_{mi/h}$, interpolated from the NESC Basic Wind Speed Map in Figure 250-2(b).

Examples:

Following are examples to better explain how the design engineer is to use the extreme wind load guideline matrix (Addendum A) along with the extreme wind pressure maps (Addendum B or C) to determine the wind load pressure value to apply when designing a transmission structure or structures.

Reference: Extreme Wind Pressure Design Criteria Guideline Matrix, Addendum A and Extreme Wind Pressure Maps, Addendums B and C.

Example 1: Project Scope - Florida Scenario

A new 20 mile, 230kV transmission line is planned to be constructed from an existing generation plant switchyard located approximately 10 miles inland from Florida's Gulf Coast and terminate at a new 230/115kV Transmission Substation located approximately 40 miles inland from the Gulf Coast. The planned or required line rating is 850 MVA.

When setting up the parameters for this new line in Pls-Cadd, what design wind speed and consequent design wind pressure would the design engineer use in designing the transmission support structures?

There are two parameters the design engineer must determine before deciding on the appropriate design wind pressure to use:

1. The new lines Reliability Class
2. The specific Wind Region of interest

1. The line project originates from an existing generation plant and is considered a critical source and the new line is expected to have a line rating of 850 MVA.
2. The line project will originate within 30 miles of the Gulf Coast and terminate at a new substation located 40 miles inland from the Gulf Coast.

From the Extreme Wind Pressure Design Criteria Guideline matrix (Addendum A) and Extreme Wind Pressure Map (Addendum C), the design engineer would categorize the new line as being a Reliability Class 1 line. Part of the new line will be located within 30 miles of the Gulf Coast and part of the line will be located beyond 30 miles of the Gulf Coast. Being conservative, the design engineer would select the Wind Region within 30 miles of the Gulf Coast. So, for a Reliability Class 1 line located within Wind Region 1 (within 30 miles of the Gulf Coast), the design engineer would select a wind speed of 145 mph or a wind pressure of 53.7 psf to design the new structures.

Example 2: Project Scope - Carolinas Scenario

A new 30 mile, 230kV transmission line is planned to be constructed from the Brunswick Nuclear Plant switchyard located approximately 2.0 miles inland from the coast of North Carolina and terminate at a new 230/115kV Transmission Substation located approximately 25 miles from the coast of North Carolina. The planned or required line rating for this new line is 750MVA.

What extreme wind speed should the design engineer apply to the support structures of this new line?

As with the Florida example, there are two specific parameters the design engineer should examine when deciding on the correct wind speed to use to design the support structures:

1. The Reliability Class of the new line
2. The specific wind region or “zone of interest”

Two important pieces of information from the project scope identify the new lines reliability class. The new line originates from a generation plant switchyard and the planned line rating is 750MVA. This helps the design engineer define the new line as a Reliability Class 1 or RC-1 transmission line.

The topographical location of the origination and termination points of the line from the project scope help identify the specific wind region or “zone of interest”. The line originates approximately 2.0 miles from the coast of North Carolina and terminates approximately 25 miles from the coast. Looking at the extreme wind pressure map for the Carolinas, it appears the design engineer can use either a Region 1 or Region 2 wind speed. However, for this application, the design engineer concludes that the majority of the new line will be located within Wind Region 1.

So, using Wind Region 1 and a Reliability Class of 1, the design engineer correctly determines that the correct extreme wind pressure to use in designing the support structures is 57.7 psf.

5.0 Change Management Plan

Parts and material in Warehouse: N/A
Material and Equipment specs revised: N/A
Construction specs updated: N/A
Standard drawings updated: N/A
BOM updated: N/A
Construction procedures updated: N/A
Training completed for engineering: Complete
SPS implemented on projects to be scoped starting on: July 2010

6.0 References

[1] IEEE’s 2002 National Electric Safety Code (NESC), Rule 013B, 250C, and Rule 252B, Pages 2, 250, and 252 respectively, Copyright © 2001.

[2] American Society of Civil Engineers (ASCE) Manual and Report on Engineering Practice No. 74 “Guidelines for Electrical Transmission Line Structural Loading”, Section 2 “Weather-Related Loads Pages 14-32, Copyright © 1991.

[3] American Society of Civil Engineers (ASCE) and the Structural Engineering Institutes (SEI) “Electrical Transmission in a New Age”, Edited by Dan E. Jackman, Copyright © 2002.

7.0 Revisions

Rev #	Revision Date	Revised By	Reviewed By	Description
0	07/31/2006	E.L. Taylor		Initial Release
1	10/24/07	E.L. Taylor		Revised Wind Speed Chart
2	06/25/10	Prasad Yenumula		Wind pressures in Addendum C corrected; Change management plan implemented

Extreme Wind Design Criteria and Line Reliability Classes

Reliability Class	Design Codes	Critical Source	Critical Load	Line Rating (MVA) [6]
1[2]	NESC 2002 & ASCE 74	Yes	Yes	> 475
2[3]	NESC 2002 & ASCE 74	No	No	< 475

Carolinas

NESC Extreme Wind Regions & Corresponding Design Wind Speeds (mph)

Reliability Class	2007 NESC Wind Region					
	1	2	3	4	5	6
1[2]	150	140	130	120	110	100
2[3]	140	130	120	110	100	90

Carolinas

NESC Extreme Wind Regions & Corresponding Design Wind Pressures (psf)

Reliability Class	2007 NESC Wind Region					
	1	2	3	4	5	6
1[2]	57.6	50.2	43.3	36.9	31.0	25.6
2[3]	50.2	43.3	36.9	31.0	25.6	20.7

Florida

NESC Extreme Wind Regions & Corresponding Design Wind Speeds (mph)

Reliability Class	2007 NESC Wind Region	
	1[4]	2[5]
1[2]	145	130
2[3]	135	120

Florida

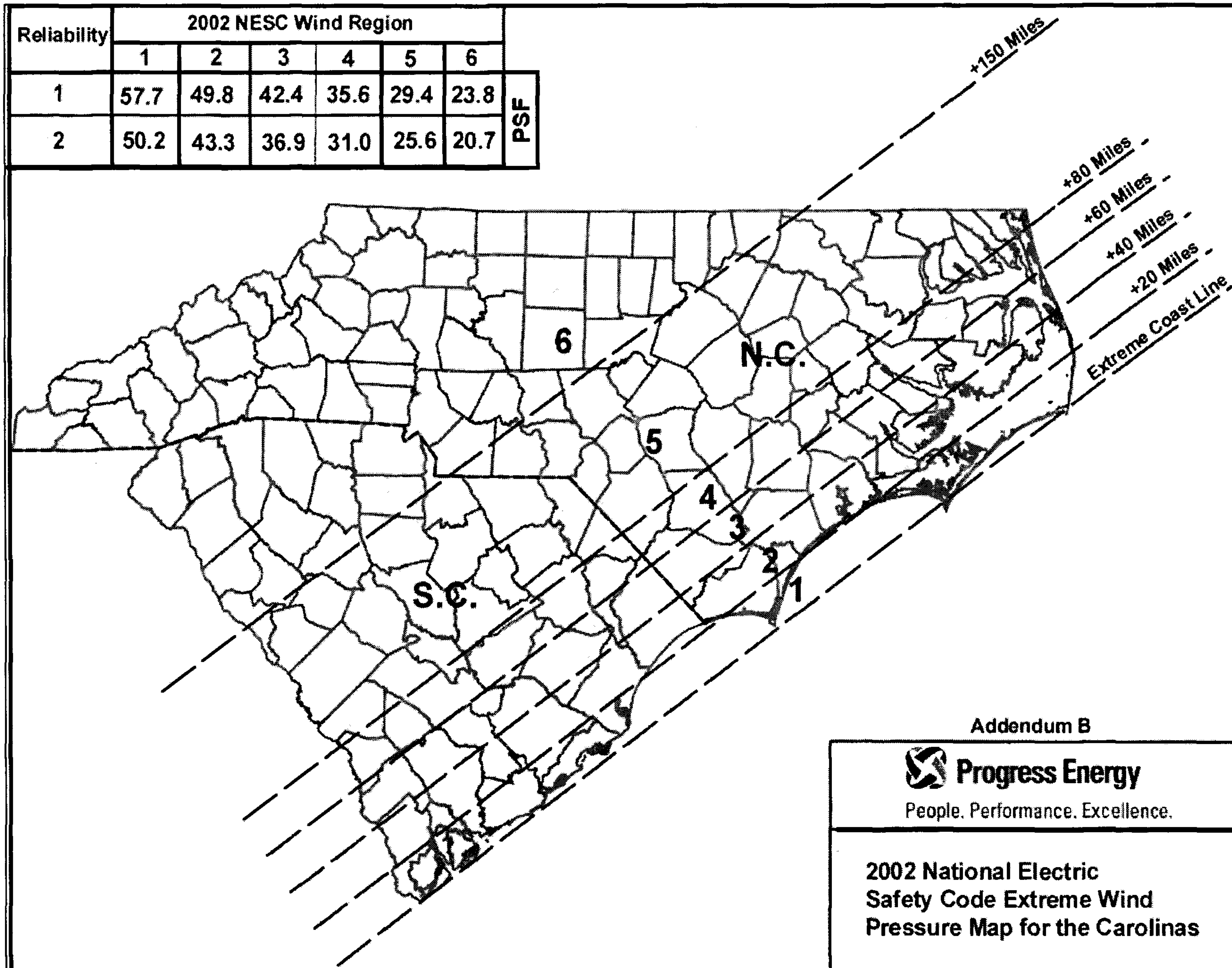
NESC Extreme Wind Regions & Corresponding Design Wind Pressures (psf)

Reliability Class	2007 NESC Wind Region	
	1[4]	2[5]
1[2]	53.8	43.3
2[3]	46.7	36.9

1. Wind speed values based on nominal design 3-second gust wind speed in mph/psf.
2. Line Reliability Class I used for critical sources including generation plant lines, interties, critical customers, and all 500kV lines.
3. Line Reliability Class 2 design wind speeds based on NESC 2002 Basic Wind Speed Map per Figure 250-2(b)
4. 3-second gust wind @ 60^0, Initial **within** 30 miles of the coast
5. 3-second gust wind @ 60^0, Initial **beyond** 30 miles of the coast
6. The MVA reliability class determination criteria is based on the "maximum normal" line rating.

Addendum A

Reliability	2002 NESC Wind Region						
	1	2	3	4	5	6	
1	57.7	49.8	42.4	35.6	29.4	23.8	PSF
2	50.2	43.3	36.9	31.0	25.6	20.7	



Addendum B

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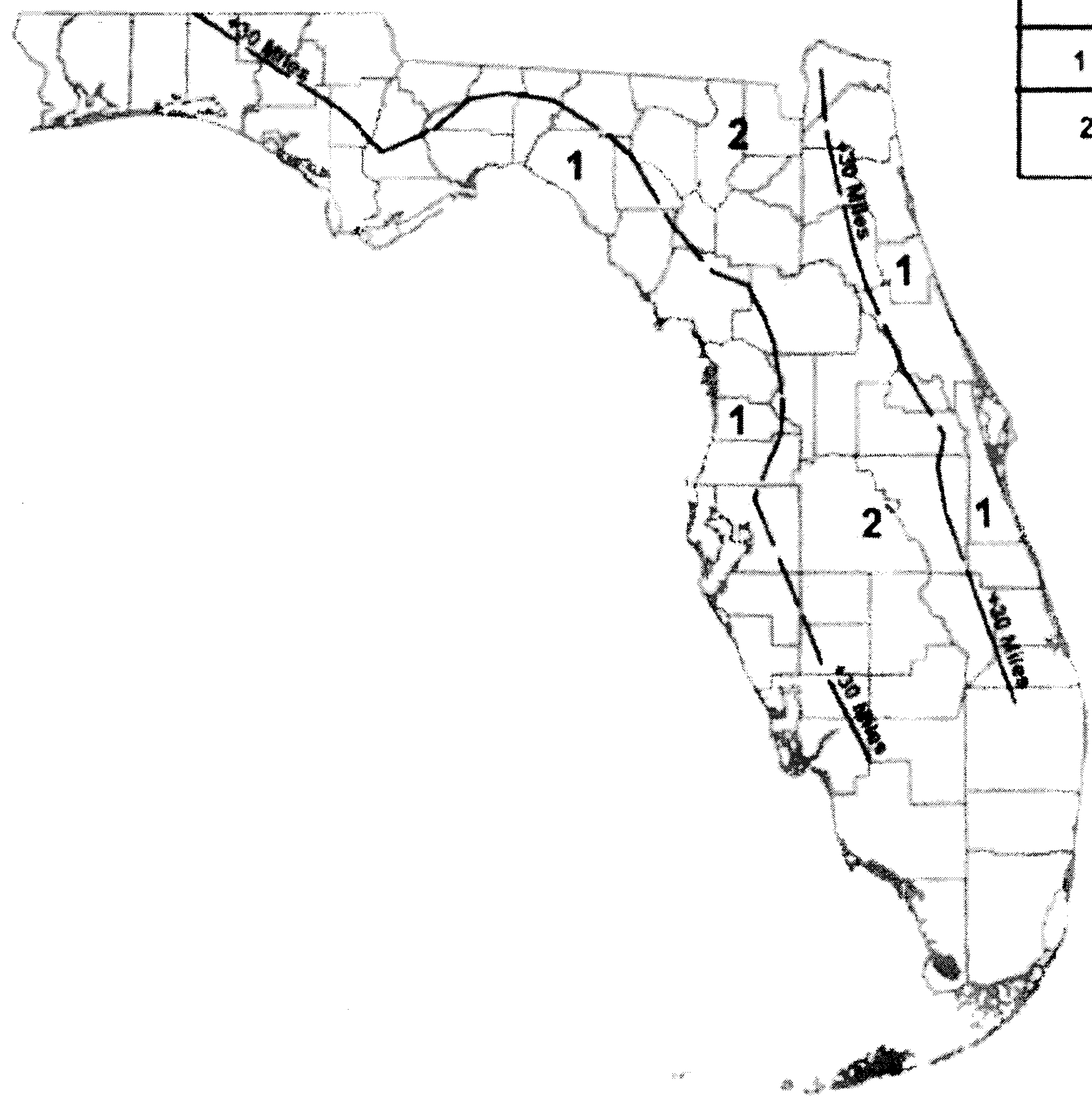
2002 National Electric Safety Code Extreme Wind Pressure Map for the Carolinas

Reliability	2002 NESC Wind Region		
	1	2	
1	53.8	43.3	PSF
2	46.7	36.9	



Addendum C

Progress Energy
People Performance Excellence

2002 National Electric Safety Code Extreme Wind Pressure Map for Florida

Former Florida and Carolina Design Practice
Industry Design Practice
Addendum D

Florida's Current Design Criteria

Florida's interpretation of the 2002 NESC basic wind speed contour map (2002 NESC Figure 250-2(b)) results in the delineation of their service territory into two wind regions: A coastal region encompassing areas located within 30 miles of the gulf coast and an inland region encompassing areas beyond 30 miles of the gulf coast. The coastal region design 3-second gust wind speed is 135 mph at a design ambient temperature of 60^0 F under initial loading conditions. The inland region design 3-second gust wind speed is 120 mph at a design ambient temperature of 60^0 F under initial loading conditions.

Florida utilizes wind reliability or importance factors to provide a higher reliability to the extreme wind load case. The application of importance or load factors is actually a function of a transmission line's relative reliability and the projected return period for a specific extreme wind-related event. The use of importance or load factors is actually a function of ASCE's Manual 74 Load and Resistance Factor Design (LRFD) concept. Importance or load factors are strength factors applied to wind region wind speeds that takes into account variabilities in material, dimensions, workmanship, and the uncertainty inherent in the nominal strength of the component.

In Florida's "Importance Factor Matrix", importance or load factors are applied to regional wind speeds based on a transmission line's voltage, summer normal MVA rating, and number of circuits supported. These load factors range from 1.00 with a load return period of 50 years up to 1.40 with a load return period of 333 years.

Load Case	Load Condition	Overload/Importance Factor
Extreme Wind Coastal - Within 30 miles of the coast Inland - Beyond 30 miles from the coast	135 mph 3-second gust wind, 60 Deg., Initial Conditions 120 mph 3-second gust wind, 60 Deg., Initial Conditions	1.0 – 1.4 for ALL Loads -**See Importance Factor Matrix**

PROGRESS ENERGY FLORIDA IMPORTANCE FACTOR MATRIX

VOLTAGE	SUMMER NORMAL MVA (CONDUCTOR)	IMPORTANCE FACTOR		RETURN PERIOD (YRS)	
		SINGLE CKT	DOUBLE CKT	SINGLE CKT	DOUBLE CKT
69 KV	LESS THAN 100 MVA (336 ACSR and Smaller)	1.00	1.10	50	83
69 KV	100 - 200 MVA (795 AAC TO 954 ACSS/TW)	1.05	1.15	67	100
115 KV	LESS THAN 100 MVA (4/0 ACSR and Smaller)	1.00	1.10	50	83
115 KV	BETWEEN 100 & 200 MVA (336 ACSR AND BUNDLED 4/0 ACSR)	1.05	1.15	67	100
115 KV	GREATER THAN 200 MVA (795 AAC TO 954 ACSS/TW)	1.10	1.20	83	133
230 KV	LESS THAN 600 MVA (SINGLE 954 ACSR)	1.15	1.20	100	133
230 KV	BETWEEN 600 & 1200 MVA (SINGLE GREATER THAN 954 ACSR OR BUNDLED 954 ACSR)	1.20	1.30	133	200
230 KV	GREATER THAN 1200 MVA (BUNDLED 954 ACSS/TW OR GREATER)	1.30	1.40	200	333

Carolinas Current Design Criteria

Carolina's interpretation of the 2002 NESC basic wind speed contour map (2002 NESC Figure 250-2(b)) results in the delineation of their service territory into six wind regions with wind speeds increasing from the extreme coastal region west to the mountain region. The Carolinas defines or delineates all transmission lines as either Reliability Class 1 or Reliability Class 2 and applies extreme wind speeds accordingly. A Reliability Class 1 transmission line is defined as any line termed a "critical source". A critical source transmission line is defined as originating from a Generation Plant, used as a grid intertie, defined as serving a critical customer, and all 500kV transmission lines. The tap or transfer load of a Reliability Class 1 line 200 MVA or greater. A Reliability Class 2 transmission line is defined as any line not meeting the definition of a Reliability Class 1 line and with a tap or transfer load less than 200 MVA. Reliability Class 2 transmission line wind speeds are based on the 2002 NESC basic wind speed contour map (2002 NESC Figure 250-2(b)). Reliability Class I transmission lines wind speeds are increased from 5-8% above the wind speeds for Reliability Class 2 transmission lines. The chart below correlates the six region extreme wind speeds with the reliability class of a transmission line.

Extreme Wind Design Criteria and Reliability Classes					
Reliability Class	Design Codes	Critical Source[1]	Critical Load	Tap Load (MVA)	Transfer Load (MVA)
I	NESC 2002 & ASCE 74	Yes	Yes	> 200	> 200
II	NESC 2002 & ASCE 74	No	No	0-200	0-200
1. Critical Sources include Generation Plant Lines, Grid Interties, and all 500 kV Lines					

NESC Extreme Wind Regions and Corresponding Design Speeds (mph)						
Reliability Class	NESC Wind Region					
	1	2	3	4	5	6
1	150	140	125	115	105	95
2	140	130	120	110	100	90

The design wind speeds for each region are applied at a 60^0 F, no ice, final loading condition. The Carolinas does not apply importance or load factors to any design wind speeds.

Industry Practice

As part of an extreme wind study conducted by Carolina Power and Light Company in the mid-90's, a survey was conducted of various electric utilities asking the practice they followed in determining transmission structural loading and the extreme wind pressure used in calculating structure loads due to hurricane winds on transmission lines located within 50 miles of the coast with wind gust, structure height, and overload factors included.

Based on responses to the survey, applicable utilities that responded indicated the use of the National Electric Safety Code, ASCE's Manual 74, a combination of the National Electric Safety Code and in-house design criteria, or a combination of ASCE's Manual 74 and in-house design criteria. To the question of the magnitude of extreme wind pressure used, the responses ranged from a minimum of 21-30 psf (90mph-108mph) to a maximum exceeding 50 psf (140mph).

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FLORIDA

TRANSMISSION – LINE ENGINEERING DESIGN PHILOSOPHY

Progress Energy Florida
Transmission Department

Line Engineering
DESIGN PHILOSOPHY

Version 1.8
March 2009

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Table of Contents

Progress Energy Florida Transmission Line Design Philosophy

This Design Philosophy is an outline of practices currently in place in the Progress Energy Florida Transmission Line Engineering Unit. It provides the guidelines for the typical structures, framings, material, construction methods and easements used in the design of transmission lines. It is not intended to address every possible situation that may arise. Deviations from this Design Philosophy, where necessary, are permitted with the approval of the Line Engineering Manager. The design philosophy contained in this document is intended to meet or exceed the requirements in the latest edition of the National Electric Safety Code. If there is a conflict, the NESC shall take precedence.

1 Structures

1.1 Typical 69/115kV Construction

1.1.1 Philosophy

All new 69kV lines shall be designed, framed and insulated to 115kV Standards. The primary single circuit tangent framing shall be vertical framing standards 21244 for steel and 21444i (using inserts) for concrete. Framing standards 21240 and 21440i (using inserts) for delta configurations are also allowed where practical. Typically, a vertical configuration is utilized along road rights-of-way and a delta configuration is utilized cross country.

Where a transmission line is proposed to parallel a road right-of-way, the single pole structures will generally be located three feet outside of the road right-of-way in a fifteen foot wide private easement with the OHG and conductors facing the road. Lines may be designed in road rights of way if acquisition costs and / or schedules require design adjustments. Project specifics will dictate alignment criteria.

PEF typically uses concrete poles along roads. Galvanized steel poles may also be used should the site specific conditions warrant. Weathering steel is a third option but typically is not suitable for urban or suburban environments. Rock backfill or natural soil (when utilizing maintenance equivalent poles) should be utilized where ever possible along roads due to the possibility of future road widening projects. Concrete backfill in these areas should be avoided if at all possible for the same reason. Economic and constructability considerations will govern which pole type and backfill should be utilized.

Where the transmission line traverses cross country, generally, the single pole structures are offset such that the centerline of the conductors are situated on the easement centerline for vertically framed structures. For delta or double circuit configurations, the pole centerline shall be situated on the easement centerline. PEF typically uses concrete poles and / or galvanized steel poles for cross country designs. Weathering steel is a third option. There are no backfill restrictions for cross country applications. Economic and constructability considerations will govern which pole type and backfill should be utilized.

When phase over phase (GOABs) switches are required on a project, 69kV installations will be installed with 69kV switches (not 115kV switches) due to cost / design considerations unless otherwise approved. GOAB phase spacing will be suited for full monorupter installation.

1.1.2 Configuration

# of circuits	Structure type	Standards	Pole type
Single	Tangent, vertical	21244, 21444i	Steel / Concrete
Single	Tangent, Delta	21240, 21440i	Steel / Concrete
Single	Angle, vertical (non dead-end)	21244, 21210, 21230, 21444i, 21410i, 21430i	Steel / Concrete
Single	Deadend, vertical	21260, 21271, 21280, 21460i, 21471i, 21480i	Steel / Concrete
Double	Tangent, vertical	22244, 22444i	Steel / Concrete

Note: Concrete pole standards with "i" are standards with inserts for bolts

1.1.3 Material

- Concrete
- Steel

1.1.4 Material Finish

- Concrete - none
- Steel – Galvanized
- Steel - Weathering

1.1.5 Typical Structure Height

- 90 – 95 feet above grade provides height for distribution (with top phase typically located at 38' AG) and cable attachments along roads and longer span construction for cross country designs, since distribution is typically not a factor.
- Maintenance (wood pole equivalents), including LD4 – LD6 light duty steel and type II and type III concrete poles are typically 95' overall and can be utilized for rebuild projects (where feasible)

1.1.6 Typical Ruling Span

- 400 – 500 feet along roads and 500 – 700 feet cross country.
- 275 – 350 feet for typical rebuild applications (project specific)

1.2 Typical 230kV Construction

1.2.1 Philosophy

Where a transmission line is proposed to parallel a road right-of-way, generally, the single pole structures will be located five feet outside of the road right-of-way in a fifteen foot wide private easement with the OHG and conductors facing the road. If the structure is double circuit the easement width will vary. 230kV lines may be designed in road rights-of-way with the approval of the Line Engineering Manager.

Where the transmission line traverses rural areas, the single pole structures are generally offset such that the centerline of the conductors are situated on the right-of-way centerline for single circuit designs and the centerline of the single pole is situated on the right-of-way centerline for double circuit designs.

The structures are to be concrete or steel poles designed, framed, and insulated to PEF's 230kV Standards. Concrete poles are the most cost efficient option where site specific conditions favor concrete pole installation. PEF typically uses galvanized steel poles for 230kV designs when site specific conditions require steel. Weathering steel is a third option. Use of concrete versus steel as well as types of backfill shall take into consideration costs, access, system constraints, constructability, and other project related issues.

1.2.2 Configuration

# of circuits	Structure type	Standards	Pole types
Single	Tangent, vertical	31206, 31406i	Steel / Concrete
Single	Angle, vertical (non deadend)	31206, 31210, 31230, 31406i, 31410i, 31430i	Steel / Concrete
Single	Deadend, vertical	31260, 31271, 31280, 31460i, 31471i, 31480i	Steel / Concrete
Double	Tangent, vertical	32206	Steel

Note: Concrete pole standards with "i" are standards with inserts for bolts

1.2.3 Material

- Steel
- Concrete

1.2.4 Material Finish

- Concrete - none
- Steel – Galvanized
- Steel – Weathering

1.2.5 Typical Structure Height

- 110 – 140 feet above grade provides height for distribution and cable attachments along roads and longer span construction cross country

1.2.6 .Typical Ruling Span

- 500 – 600 feet along roads and 600 – 900 feet cross country.

2 Conductors

2.1 Philosophy

PEF uses conductors referenced below because they have proven to be the most economical when considering initial construction cost and the cost of losses. Also, the majority of lines on the PEF system were constructed using these conductors. Warehouse inventories are more efficiently managed to ensure adequate conductor and associated hardware materials are on hand for new construction as well as for emergency and routine maintenance repairs if the number of conductor sizes are held to a minimum.

2.2 Wire Controls

Design tensions are selected to meet or exceed NESC requirements by utilizing the following wire controls:

<u>All Conductors including ACSS/TW after 2/16/05 (New Construction)</u>
18% Rated Breaking Strength at 30 degrees F, no wind, final condition

*ACSS/TW used to replace 1590 ACSR may be installed up to 26% RBS

Where re-utilizing existing structures and / or addressing clearance issues, other wire controls can be utilized with prior approval of the Line Engineering Manager.

2.3 Usage

Conductor selection is typically determined by collaboration between Transmission Planning and Line Engineering units using the tables below as a guideline for selection.

PEF Line Engineering Standard Conductors to used for Projects (as of April 2007)

Part #	Code Word	Description	Typical Voltage	Comments
200114	Raven	1/0 ACSR 6/1 str	69kV	Should not be used in 115kv lines
200112	Penguin	4/0 ACSR 6/1 str	69 & 115kV	
200133	Linnet	336.4 ACSR 26/7 str	69 & 115kV	
200239	Arbutus	795 AAC 37 str	69 & 115kV	All new lines and rebuilds will require 795 ACSR or ACSS TW in lieu of AAC. If utilized where transferring existing conductor, ruling spans should not exceed 500'
200180	Drake	795 ACSS/TW 20/7 str		used in lieu of Redbird, 954 ACSR 24/7 STR
200195	Cardinal	954 ACSS/TW 20/7 str	69, 115 & 230kV	
200196	Pheasant	1272 ACSS/TW 39/19 str	69, 115 & 230kV	used in lieu of Falcon, 1590 ACSR 54/19 STR
200199	Pecos	1622 ACSS/TW 39/19 str	69, 115 & 230kV	used in lieu of Falcon, 1590 ACSR 54/19 STR
200194	Redbird	2 - 954 ACSR 24/7 str	230kV	Bundling of 954 if Line Capacity Requirements exceed 1622 ACSS/TW

2.4 1200 / 1600 / 2000 / 3000 amp preferred conductors

The following ampacities are for summer normal ratings (104 deg F).

Ampacity	Part #	Conductor	Typical Voltage
1200	200180 200194	795 ACSS/TW 20/7 str 954 ACSR 24/7 st	69 & 115kV
1600	200195	954 ACSS/TW 20/7 str	69, 115, & 230kV
2000	200196 200199	1272 ACSS/TW 39/19 str 1622 ACSS/TW 39/19 str	69, 115, & 230kV
3000	Varies	Bundled 954 ACSS/TW 20/7 str or Bundled 795 ACSS/TW 20/7 str (rated at 2982 amps)	115kV & 230kV

2.5 Conductor Temperatures

	CONDUCTOR TEMPERATURES	
	MCR1	EMR1
	DEG C / DEG F	DEG C / DEG F
AAC / AAAC	100 / 212	130 / 266
ACSR	105 / 221	140/ 284
ACSR (500kv)	71 / 160	NA
HDB COPPER	70 / 158	80 / 176
HYT COPPER	115 / 239	135 / 275
CU / CWLD	70 / 158	80 / 176
ALWLD	100 / 212	105 / 221
ACAR	105 / 221	130 / 266
ACAR (500kv)	90 / 154	NA
ACSS/TW	180 / 356 *	200 / 392 *

See EGR-TRMF-00001 rev 2 for Transmission Conductor and Equipment Ampacity Methodology for Florida

* Note: In 2007, ACSS TW MCR1/EMR1 conductor temperatures increased from 140 / 180 to 180 / 200 respectively after close coordination with the manufacturer. The old conductor temperatures of 140 / 180 will be retained for lines previously designed with these conductor temperatures.

3 Overhead Ground Wire (OHGW)

3.1 Philosophy

Overhead Ground Wire designs shall incorporate a fiber optic design basis unless otherwise instructed. If fiber is not chosen, a 3/8" HS steel OHGW shall be utilized.

The fiber design basis shall incorporate a 24 count fiber OPGW in all applications unless otherwise directed to do so through coordination with IT for third parties. Design shall be to support the 24/36/48 CentraCore fiber. This fiber has the same mechanical characteristics for 24/36/48 count fiber. Design shall include this fiber basis even if it is decided to install 3/8" HS steel.

3.2 OPGW wire controls

0.465" 24 / 36 / 48 CentraCore fiber at 16% Rated Breaking Strength at 30 degrees F, no wind, final condition

3.3 3/8" HS steel wire controls

3/8-inch High Strength (HS) Steel at 15% Rated Breaking Strength @ 30 degrees F, no wind, final condition

3.4 Shield Angle

Maximum shield angle requirements as measured from a vertical line through the OHGW to the phase conductor are as follows:

Structure Height Above Ground	Maximum Shield Angle
Up to 100 ft.	30 degrees
Over 100 feet	20 degrees

Note: some standard PEF structures are designed with lightning shield angles between 25 to 30 degrees. The single pole framings of choice, 21244, 21444i, 31206 and 31406i provide a shield angle of less than 5 degrees regardless of height.

3.5 Ground Resistance

The ground resistance at each structure location shall attain 10 ohms or less to be acceptable. Should a particular location exceed 10 ohms, it will be acceptable if the average of it and the adjacent structures does not exceed 15 ohms. Phase over phase switch locations shall be grounded to 5 Ohms or less. Details of PEF's grounding standards can be found in section 9 of the Standards manual.

3.6 Lightning Arresters

Lightning arresters are not normally used on PEF transmission lines. Should the use of arresters be required, the line engineer shall select the appropriate assembly for its application.

For 69kV lines designed as 115kV lines, a 69kV surge arrestor may need to be installed at the terminal span to protect the 69kVsubstation equipment due to the higher BIL of the line insulation directing the fault towards the substation. This will require the deadends on substation terminal locations to utilize 69kV deadends. Deciding if a line arrestor is required at the terminal shall be closely coordinated with Substation Engineering.

4 Insulators

4.1 Philosophy

Polymer insulators offer the same insulation value as porcelain. In addition, polymer insulators are lighter and less likely to be damaged by vandals. The mechanical strength of polymer insulators is equivalent or better than porcelain and will not limit structure designs. For 69/115kV single pole construction, an unsupported 115kV polymer post is used. For 230kv single pole construction, a polymer braced post is used which utilizes a suspension unit to diagonally support the conductor end of the post insulator. Polymer suspension units shall not exceed 50% of their Specified Mechanical Load (SML) and polymer post and braced post units shall not exceed the values in its application curve.

4.2 Usage

Polymer insulators are typically used for all new construction for 69, 115, and 230kV voltages.

4.3 Application curves

Application curves of utilized as PEF insulators are available upon request.

5 Foundations

5.1 Philosophy:

Designs for foundations will typically include a 2 degree rotation and / or 6" deflection at ground line (which ever controls). Other rotational and deflection criteria can be established with the permission of the Line Engineering Manager. In addition, foundation designs will include design provisions for axial loading. Rock and concrete backfill are the preferred foundations where soil conditions are favorable. Where constructing in road rights-of-way, rock backfill shall be utilized where ever possible and concrete foundation should be utilized only when absolutely required due to future road widening projects.

5.2 Usage

5.2.1 Direct Embedded – Maintenance Poles / rebuild projects

PEF's light duty concrete and steel poles (wood pole equivalents) may be direct embedded using suitable natural soil as the backfill material. The standard setting depth for concrete Type II and steel H3 (LD4) poles is 10% of the pole length plus three feet. The standard setting depth for concrete Type III and steel H5 (LD6) poles is 10% of the pole length plus five feet.

5.2.2 Direct Embedment – New Lines

Soil borings shall be taken in accordance to PEF's soil boring policy. Foundations shall be designed based on soil boring information utilizing industry based foundation program or PEF's FD6 program. Crushed stone or concrete will be utilized for backfill depending on soil and loading conditions.

5.2.3 Anchor Bolts

Full Length Anchor Bolts or Standard Anchor Bolt Cages are typically not used at PEF, but are available for special applications.

5.2.4 Vibratory Caissons

Bottom section of steel pole is vibrated into place using a vibratory hammer. These types of foundations are typically used in wet, loose sands.

5.3 Soil Borings

For 69/115kV lines sample borings are obtained at major angles and at every third or fourth tangent structure location. For 230kV Lines, a soil boring shall be taken at every structure location. In areas where rock is likely to be encountered, additional soil borings or probes may be justified. For access roads thru wetlands, muck probes along the route of the access road will be required.

6 Guying

6.1 Philosophy

The main philosophy behind the use of these guys and anchors is to economically meet or exceed minimum design requirements while standardizing materials as much as possible. The use of guys greater than 3/4" inch diameter should be avoided because of the difficulty involved with installation. Where right of way can not be acquired for guys, self supporting structures shall be used.

6.2 Capacity Ratings

Below are charts showing standard PEF guys/anchors and their respective capacity ratings.

Guy Ratings

Guy Size	Rated Breaking Strength	NESC Grade B Light Loading & PEF Extreme Wind Tension (90%)
3/8" H.S.	10,800#	9,720#
7/16" U.G.	18,000#	16,200#
1/2" E.H.S.	26,900#	24,210#
9/16" E.H.S.	33,700#	30,330#
5/8" E.H.S.	40,200#	36,180#
3/4" E.H.S.	58,300#	52,470#

Anchor Ratings

Class 5 Soil	2-Helix	3-Helix	4-Helix
Max Design Holding Capacity (lbs.)	27,000	41,000	49,000

When utilizing guy insulator links, reference strength percentages in NESC Rule 277.

7 Switches

7.1 Philosophy

All line segments are to be between substation switches / breakers and / or line switches. Hard taps are not acceptable unless approved prior to construction. Line segments are to be capable of being switched out of service within the safe operational limitations of the equipment. Monorupters may be required. Line ampacity ratings must be included in the proper selection of switches.

7.2 Methodology

Reference procedure OPS-SUBS-00101- Guide for Operating Transmission Line Switches

8 Design Criteria

8.1 Philosophy

Meet or exceed latest edition of NESC Grade B light loading, NESC extreme wind, and PEF extreme wind loading.

8.2 Load Cases

Load Case	**Load Condition**	**Overload/Importance Factor**
NESC Light Loading, Grade B	9 PSF @ 30 Deg., Initial Conditions	2.5 (Transverse Wind) 1.65 (Tension/Longitudinal Wire Loads) 1.5 (Vertical Loads)
NESC Wind & Ice	2.3 psf @ 15 Deg., Initial	1.0 (all loads)
Extreme Wind	Reference 7.3	Not applicable
Maintenance (for arms and supports to support one OHG and one Phase Conductor)	60 Deg., No Wind, Initial Loading	1.0 –(Transverse Wind and Tension Wire Loads.) 1.5 – (Vertical Loads)
Stringing (Special Design Structures Only)	60 Deg., No Wind, Initial Loading	1.5 (Longitudinal and Vertical Wire Loads)
Camber(Steel Structures Only)	60 Deg., No Wind, Initial Loading	1.0 (Longitudinal and Vertical Wire Loads)

8.3 Extreme Wind Guidelines

Progress Energy Transmission Department's Extreme Wind Pressure Design Criteria Guideline

Extreme Wind Design Criteria and Line Reliability Classes				
Reliability Class	Design Codes	Critical Source	Critical Load	Line Rating (MVA) [6]
1[2]	NESC 2002 & ASCE 74	Yes	Yes	> 475
2[3]	NESC 2002 & ASCE 74	No	No	< 475

Carolinas						
NESC Extreme Wind Regions & Corresponding Design Wind Speeds (mph)						
Reliability Class	2002 NESC Wind Region					
	1	2	3	4	5	6
1[2]	150	140	130	120	110	100
2[3]	140	130	120	110	100	90

Carolinas						
NESC Extreme Wind Regions & Corresponding Design Wind Pressures (psf)						
Reliability Class	2002 NESC Wind Region					
	1	2	3	4	5	6
1[2]	57.7	49.8	42.4	35.6	29.4	23.8
2[3]	50.2	43.3	36.9	31.0	25.6	20.7

Florida		
NESC Extreme Wind Regions & Corresponding Design Wind Speeds (mph)		
Reliability Class	2002 NESC Wind Region	
	1[4]	2[5]
1[2]	145	130
2[3]	135	120

Florida		
NESC Extreme Wind Regions & Corresponding Design Wind Pressures (psf)		
Reliability Class	2002 NESC Wind Region	
	1[4]	2[5]
1[2]	53.7	42.4
2[3]	46.7	36.9

1. Wind speed values based on nominal design 3-second gust wind speed in mph/psf.
2. Line Reliability Class I used for critical sources including generation plant lines, interties, critical customers, and all 500kV lines.
3. Line Reliability Class 2 design wind speeds based on NESC 2002 Basic Wind Speed Map per Figure 250-2(b)
4. 3-second gust wind @ 60°, Initial within 30 miles of the coast
5. 3-second gust wind @ 60°, Initial beyond 30 miles of the coast
6. The MVA reliability class determination criteria is based on the "maximum normal" line rating.

Revision No.	Revision Date	Revision	Revised By	Approved By

Addendum A

8.4 Structural Percent Utilization

All NESC and internal PEF design criteria requirements will be met. It is incumbent on the engineer to develop the most economic design of the transmission facility while satisfying all NESC and PEF design criteria. Overly conservative design margins that exceed the NESC and PEF minimums introduce costly designs and will require prior approval before implementing.

Design efforts should strive to obtain a minimum percent utilization of 95% or greater for ultimate design. All designs shall not exceed 100% on the governing load case.

8.5 Wire Clearances

8.5.1 Philosophy

PEF clearances exceed NESC requirements to account for construction, existing design considerations picked up during surveying (wire crossings, billboards, roads, etc), and terrain variables.

8.5.2 Guidelines

All wire clearances shall conform to the respective clearances per standards 10-1020 and 10-1021. All vertical clearances in these two standards include a three foot buffer adder to the NESC required clearance to allow for sagging, pole setting, and steel pole jacking tolerances as well as ground alterations and intermediate pole setting variances. All horizontal clearances in these two standards include a one foot buffer adder to the NESC required clearance to allow for sagging tolerances. These additional clearances provide additional safety margins without a significant increase in construction cost.

8.5.3 Structure Deflection

Foundation rotation and structure deflection shall be taken into consideration when designing clearance requirements for extreme wind conditions.

9 Standard Right of Way Width

9.1 Philosophy

The standard widths referenced below are intended to provide the following:

1. Electrical clearances under adverse wind conditions to all obstructions that could be located at the edge of right-of-way at mid-span.
2. Acceptable EMF levels at edges of right-of-way at low points of sag.
3. Adequate width to reduce the number of danger trees that must be cut.

9.2 Preferred widths

Preferred width is 70 feet for 69/115kV lines and 100 feet for 230kV lines. Additional real estate rights for guying outside of these dimensions may be required

10 Clearing

10.1 Philosophy

Clearing and maintaining the right-of-way will provide greater line reliability by minimizing the possibility of a tree coming into contact with the line and also will provide better access for line crews. Using the clearing methods as defined in the specifications minimizes erosion and complies with existing environmental laws and regulations.

10.2 Methods

Reference PEF Specification 15000, Clearing and Right of Way for details.

11 Environmental

11.1 Philosophy

Project design and construction will comply with all Federal, State, and Local environmental regulations associated with forested wetlands, herbaceous wetlands, parks / recreational / conservation areas, historical / archeological areas, threatened / endangered species, and eagles nests. Design shall also conform to state requirements for EMF.

11.2 Methodology

When environmental sensitive areas are present on a line project, the PEF environmental department will be contacted to initiate assessments for the project to target appropriate responses to environmental permit requirements. Permitting criteria and design changes that may be required due to environmental permitting will be closely coordinated with PEF environmental staff.

12 Constructability

12.1 Philosophy

Ease of construction is a strong consideration for completion of a qualitative, economic, and acceptable line design.

12.2 Methodology

12.2.1 Underground conflicts

Structure locations are to be investigated for underground conflicts. Conflicts are to be identified and rectified prior to construction

12.2.2 Wetlands

Line design in wetlands is to take "BMP" (Best Management Practices) into consideration when designing. BMP requires that low pressure equipment and matting be utilized in wetlands so that the root mass is not disturbed. Where possible, wetlands should be spanned. If spanning a wetland is not possible, installation of steel poles with track equipment is a strong consideration for wetland environments. Heavy concrete poles requiring large capacity, heavy cranes should be avoided unless permanent access roads and structure pads are to be installed. When rebuilding a line in a "like for like" manner (structure for structure), proposed structures must be within 10' of the existing facility to assure compliance to environmental provisions for replacing existing facilities in place.

12.2.3 Overhead conflicts

Existing overhead facilities are to be identified and discussed with Construction prior to completion of line design activities. Temporary relocations, laying out of circuits, hot work, etc are to be discussed with Construction during preliminary design activities. If required, designs may need to be modified to accommodate construction activities for overhead conflicts.

12.2.4 Major crossings

Where line design / build activities include major crossings of limited access highways, rivers, lakes, and other special considerations, efforts will be made to reduce risks during stringing activities. Options include installing deadends at both sides of major crossings. This may require in-line deadends if major crossing is between major angles normally utilized for dead ends. If temporary guys are not practical during stringing efforts, self supporting structures may be required for stringing purposes. Efforts will be closely coordinated with Construction during preliminary design prior to pole orders and during preliminary / final walkthrus.

12.2.5 System Constraints

All designs must take system constraints into consideration. Close coordination with Construction and PEF's Energy Control Center (ECC) is required to discuss the likelihood of securing extended outages for construction purposes. Where extended outages are not possible, additional design options must be explored with Construction and designs may need to be modified to accommodate system constraints. Options could include other alignments, re-routes, temporary lines, taller structures, and other measures to assure designs accommodate system constraints.

13 Revision History

Revision No. Revision description

DUKE ENERGY®
FLORIDA

JOINT USE – POLE ATTACHMENT GUIDELINES AND CLEARANCES

Progress Energy

JOINT USE

POLE ATTACHMENT

GUIDELINES

Progress Energy

Joint Use Pole Attachment Guidelines

GENERAL

Anyone desiring to 1) attach to Duke Energy (Duke) poles or 2) overlash to existing facilities whether owned by proposing attacher or another attacher on Duke poles must first have a contractual agreement in place with Duke. After the contractual agreement is finalized, the proposed attacher must make application to Duke via an Exhibit A. These requirements shall apply to anyone wanting to attach to or occupy Duke facilities, including all cable operators, telecommunications carriers, WiFi and DAS attachers and any affiliates of Duke. Throughout this document, all types of attachers and their facilities other than Duke will be referred to as attachers, third party attachers, communication facilities or attacher's facilities.

Pole utilization requiring permits or notification include: installation of new attachments, removal of existing attachments, upgrade to larger cable, lashing of new cables to existing messengers, rebuilds of cable systems, large scale relocations for road widening, etc. and installation of service drops on lift poles. Service drops may be permitted monthly on one "after the fact" permit.

A permit is required in order to maintain accurate attachment inventories and to obtain technical data necessary to review the adequacy of existing distribution and/or transmission system facilities. The attacher must submit, along with each application for pole attachment, the data contained in items 1-4 of the section below entitled "Pole Attachment and Overlash Application Procedures." All planning costs associated will be the responsibility of the attacher proposing the attachment or overlash.

POLE ATTACHMENT AND OVERLASH APPLICATION PROCEDURES for Progress Energy Carolinas (DukeC)

A pole attachment and/or overlash application shall include:

1. A maximum of 40 Duke poles identified for proposed attachment and/or overlash per application. No more than 500 poles shall be submitted in any 45-day period.

2. One set of marked facility maps depicting the street level route of the proposed attachments to Duke poles.

3. Third party attachers do not need to provide measurements when submitting an Exhibit A Pole Attachment Request. The following is the minimum required on each submitted permit: company name, representative's name, telephone number and e-mail address, county name, project reference number, Duke pole numbers, type of cable (coax, fiber), cable size and messenger size. All poles are subject to wind loading and ice loading as applicable.

4. Clearances from ground and other facilities shall be in accordance with the latest edition of the NESC, or the requirements shown in this manual, whichever is greater. Existing installations which were in compliance with the NESC at the time of their original construction need not be modified unless specified by the latest edition of the NESC handbook or Duke specifications.

POLE ATTACHMENT AND OVERLASH APPLICATION PROCEDURES for Duke Energy (Duke)

A pole attachment and/or overlash application shall include:

1. A maximum of 40 Duke poles identified for proposed attachment and/or overlash per application. No more than 500 poles shall be submitted in any 45-day period.

2. One set of marked facility maps depicting the street level route of the proposed attachments to Duke poles.

3. Third party attachers do not need to provide measurements when submitting an Exhibit A Pole Attachment Request. The following is the minimum required on each submitted permit: company name, representative's name, telephone number and e-mail address, county name, project reference number, Duke pole numbers, type of cable (coax, fiber), cable size and messenger size. All poles are subject to wind loading and ice loading as applicable.

4. Clearances from ground and other facilities shall be in accordance with the latest edition of the NESC, or the requirements shown in this manual, whichever is greater. Existing installations which were in compliance with the NESC at the time of their original construction need not be modified unless specified by the latest edition of the NESC handbook or Duke specifications.

5. Member-operators of the Florida Cable Telecommunications Association shall submit to Duke a notification for overlash or rebuild consistent with the terms and conditions outlined in the Stipulation and Agreement dated 10/1/07.

6. Attachments to transmission poles with distribution underbuild will be accepted for application and should identify the transmission poles on the permit. Attacher's request is subject to the approval of Duke's transmission department. A complete structural analysis will be required and all costs associated with the analysis will be paid by the proposing attacher.

Progress Energy

Joint Use Pole Attachment Guidelines

Pole attachment requests are to be submitted to the following addresses.

In the Carolinas:
Progress Energy Carolinas, Inc.
Joint Use
100 E. Davie Street, TPP16
Raleigh, NC 27601
(919) 546-3297

In Florida:
Progress Energy Florida, Inc.
Joint Use
3300 Exchange Place, NP4D
Lake Mary, FL 32746
(407) 942-9425

Contact Duke's Joint Use Manager at (407) 942-9415 for clarification and examples of any of the above items.

Duke utilizes NJUNS (National Joint Utilities Notification System) for transfer notification purposes and will require all third party attachers on Duke poles to utilize the system. When poles are replaced, Duke will use NJUNS to provide an electronic notification to third party attachers to transfer their facilities in a timely manner per their Pole Attachment Agreement and the FCC guidelines. Attachers will have 60 days from notification to transfer their facilities to the new pole. In case of non-response, Duke may remove or relocate attacher's facilities and bill attacher for all expenses incurred.

Each pole in the application shall be checked to meet NESC clearance requirements. Facility configuration will be rearranged to meet NESC clearance requirements. If clearance standards are not met, make-ready options and costs may be made available for review. All costs associated with this work will be paid by the third party attacher proposing the attachment or overlash. It is the responsibility of the proposing attacher to obtain all necessary easements for their facilities.

A structural analysis will be performed on all worst case poles in a branch line. Should a pole fail the analysis, the next worst case pole in that branch will be analyzed until a pole passes. A new branch line will be considered when the line angle on the pole is greater than 15%. A new branch line will be considered when the span length between any three (3) poles is greater than a 50% difference. For example, wire runs for 150' from pole 1 to pole 2. The wire span from pole 2 to pole 3 is 226'. The spans on either side of pole 2 are greater than 50% of the difference. All costs associated with this work will be paid by the third party attacher proposing the attachment or overlash.

Once the clearance analysis is completed, the attacher will receive an approved permit within 45 days of receipt of permit if no make-ready is required for attachment. If the attacher's application requires make-ready, the attacher will receive an invoice for make-ready costs. Payment of this invoice within 45 days will serve as Duke's authorization to perform the make-ready construction. Failure to provide payment within the 45 days may result in denial of the affected poles. Following receipt of make-ready payment, Duke shall sign and issue the permit authorizing the attachment by providing a copy of the permit to the attacher.

The attacher shall have 120 days from the date of permit authorization in which to complete the attachment installation and any other requirements stated in this standard. If attacher fails to do so, the permit shall expire and the attacher will be required to resubmit to Duke an application for attachment with all current data required as support of its application. Attacher must promptly notify Duke Joint Use upon completion of construction for each application and arrange scheduling of post-inspection. If the attacher chooses to construct its facilities on a portion of the permit, the authorization on the remaining poles will be voided for non-construction. An Exhibit B Removal Request form must be submitted to discontinue future pole rent charges.

The cost of all materials required to adjust facilities shall be paid by the attacher. All costs associated with the application requiring Duke clerical, engineering and crew costs will be paid by the proposing attacher.

All permits are subject to a post inspection within 365 days of the permit's approval to verify the attacher's construction is in compliance with Duke and NESC standards. If any pole on the permit fails inspection, the attacher will be given 30 days to make the necessary correction. If the failed poles are still in non-compliance at the time of the second post inspection, the attacher will be in default of the Pole Attachment Agreement. No additional permits will be approved until the violation is corrected.

Overlashing third parties must have written permission in place with the attacher being overlashed. Written consent of the overlash must be provided to Duke at the time of application.

Each attacher shall install identifying tags on its equipment and at a minimum interval of every four (4) poles for the purpose of identification. Attachers shall install tags at the time attacher's facilities are installed. Identifying tags must be installed on existing attacher's facilities. If attacher fails to install identifying tags, Duke may deem the attacher in violation of Duke Standards and the Pole Attachment Agreement. If identifying tags are not installed at the time of new construction, the permit will fail post inspection.

If attacher's facilities are acquired by another entity, the acquiring entity must notify Duke of said change, provide maps and/or plats of acquired assets, and obtain Duke's consent to assignment of the Pole Attachment Agreement. The acquiring entity will be given one year from 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, Duke may deem the attacher in violation of Duke Standards.

CLEARANCES

All permit requests for new attachments will be assigned an attachment height. The position order is from the bottom up in the communications space on a pole. A physical area on a pole cannot be reserved by a tenant.

At the time of installation, all communications facilities shall be located a minimum of 40" below Duke power facilities (secondary, neutral or top of conduit) per NESC rules 235C and 238.

At the time of installation, all communications facilities passing above or below street light brackets shall be a minimum of 12" away from such brackets per NESC rule 238C. All communications facilities passing above or below grounded street light brackets shall be 4" away from such brackets and 4" away from top of the streetlight luminaire. All communication facilities must maintain a minimum clearance of 12" below the insulated conductor drip loops of the lights per NESC rule 238D.

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, maintaining 12" separation at midspan from other communication cables and 30" separation at midspan from Duke facilities. The cable shall follow Progress Energy's route so as not to compromise the structural integrity of Progress Energy poles. During construction or deconstruction, third party attachers shall not directly or indirectly influence the sag and tension of Duke wire or cause a pole to lean, thus jeopardizing the structural integrity and reliability of its distribution systems.

Attachers are not permitted to dead-end on a primary URD riser pole.

Poles shall not be boxed in and communication cable shall not be installed on both sides of a pole. Communication cable must be installed on the same side as the secondary or neutral. Communication crossarms, extension brackets or buckarms shall not be installed or used for third party's attachments.

The following clearances shall apply to installations by an attacher or by Duke. Any work performed by Duke or by the attacher after the initial installation of facilities shall preserve required clearances of all parties on the pole. If at any time after installation of facilities, an attacher becomes aware that one or more of its facilities is not in compliance with applicable clearance requirements, the attacher shall notify Duke of the clearance violations and make all reasonable efforts to immediately bring its facilities into compliance. Attacher shall notify Duke following its correction of the clearance violations. Attacher shall notify Duke if the attacher has reason to believe that the noncompliance has been caused by the action of some party other than the attacher. However, such a belief will not excuse the attacher from its obligation to remedy the clearance violations. Duke shall also inform the attacher if Duke becomes aware that the attacher's facilities are not in compliance with applicable clearance requirements. The attacher will have sixty (60) days to bring its facilities within compliance or Duke may deem the attacher in violation of Duke Standards.

GUYS AND ANCHORS
Attachers are responsible for their own down guys and anchors and are not permitted to utilize Duke anchors.

The NESC covers the use of guys. Progress Energy expects the third party attachers to place guys where Progress Energy has installed a guy.

Communication company anchors are to be located in the same line lead and line angle as the Duke anchor and with a distance of 4' from the Duke anchor.

OTHER
No permanent climbing aids are allowed on Duke poles.

All power supply installations must have appropriate disconnect devices. All new power supplies and new metering equipment shall be mounted only on attacher owned facilities as per Duke specification drawing #09.04-12 and #09.04-13. Ground blocks, pedestals and power supplies may not be attached to the pole.

Air dryers, nitrogen bottles, cabinets, load coils, etc. shall not be attached to Duke poles.

All vertical runs (pole risers) installed by attacher shall be placed in conduit and attached to the pole using U-guards and other protective covering. Each communication company shall be allowed one riser per pole to facilitate all pole-to-ground attachments. Unguarded cable and service drops stapled or nailed to the pole will fail post inspection until corrected. Vertical runs must be on a 45° angle from the communication company's attachment and never on the face of the pole. See Duke specification drawing #09.04-04.

Horizontal attachments to Duke poles must be made by use of a three-bolt suspension clamp with a center through bolt. A four-inch minimum vertical spacing must be maintained between through bolt holes. Attachers 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.

Strand attachments and/or service drops shall not extend more than 4" from the closest surface of the pole, unless prior approval is obtained from the local Duke Engineering department. Amplifiers and terminals shall be a minimum of 24" from the closest surface of the pole.

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

Attachers must remove all of their out-of-service facilities from Duke poles at the time of new attachment or overlash.

All communication messengers shall be bonded to electrical ground wherever a vertical ground wire exists.

Requests for exceptions to this design guide shall be referred to the Joint Use unit. Any exceptions approved will be distributed to the regions for uniform application on a system-wide basis.

WIRELESS

The minimum information required by Duke includes: pole number, address/location, plat of proposed work, radio frequency information, aerial construction details (dimension, weight connectivity), direction of antennae, and wireless component specifications. Contact the Joint Use Manager at (407) 942-9415.

Only one wireless device (receiver, transmitter, or combination unit) will be allowed per pole. Multiple wireless attachers are not permitted on a single pole. Amplifiers and equipment other than wireless devices will not be allowed on poles. All other locations will be reviewed based on field conditions and approved by Duke.

WiFi standards exist for wood and static cast concrete streetlight poles. Please reference Duke specification drawings #30.10-22, #09.04-32, and #09.04 -35.

DAS standards exist. Please reference Duke specification drawing #09.04-30.

Ball Park Estimates for CATV or CLEC Make-ready

Work Description	*DukeC Cost Estimate	*Duke Cost Estimate
Replace 40' with 45' Pole, Tangent, 1 Phase, no equipment	$1298.29	$578.67
Replace 40' with 45' Pole, Tangent, 3 Phase, Transformer	$2945.16	$1629.20
Replace 35' with 40' Pole, Angle, 1 Phase, Transformer	$2810.51	$1551.65
Replace 40' with 50' Pole, Vertical Angle, 3 phase, Transformer	$4254.21	$2685.09
Replace 40' with 45' Pole, Dead End, 3 Phase, Transformer	$7719.21	$2537.58
Replace 45' with 50' Pole, Vertical DDE, 3 Phase, No equipment	$5074.28	$2961.03
Replace 45' with 50' Pole, Angle, 3 phase, Double Circuit	$5099.25	$2849.75

Progress Energy

Joint Use Pole Attachment Guidelines

Replace 35' with 40' Pole, Secondary, UG Dip	$1489.27	$1180.36
Replace 50' with 60' Pole, 3 Phase, 3 Phase Tap, (congested)	$5153.55	$2446.88
Replace 45' with 50' Pole, 3 Phase, 3 Phase UG Dip	$7086.19	$3484.80
Replace 45' with 50' Pole, 3 Phase, 1200 Capacitor Bank	$6327.15	$3173.32
Install 45' Pole, 3 Phase, In-line	$1270.26	$942.64
Relocate Riser/U-Guard on Pole	$1132.32	$1028.70
Replace 30' with 35' Pole, Secondary and/or Service, Down Guy	$896.09	$832.60
Replace 40' with 45' pole Tangent, 3 Phase, Transformer Vertical	$2964.61	$1629.20
Add Section of U- Guard	$420.14	$368.24
Raise Street Light	$460.96	$393.92

Replace Open Wire Secondary with Triplex	$698.70	$505.70
Relocate Transformer on Pole	$974.19	$381.27
Clip Secondary to Neutral	$312.29	$202.93
Resag Neutral and Dress Transformer Loops	$520.48	$222.47

**Note: This document is a rough guide and intended only to be used as a tool for the licensee in planning their plant route or design. Costs shown do not include crew overtime rates, outage coordination, tree trimming, or other possible additional charges. Duke can provide "Detailed Estimates" at the most current hourly engineering rate.*

Revised
11/20/2008

POST INSTRUCTIONS

CODE	DESCRIPTION	SEPARATION
PC1	Neutral or secondary separation at the pole	40"
PC2	Grounded equipment separation at the pole	30"
PC3	Separation from secondary or transformer drip loops	40"
MC1	Secondary conductor separation at midspan	30"
MC2	Neutral separation at midspan	30"
SL1	Streetlight separation from SL bracket	12"
SL2	Streetlight separation from SL drip loop	12"
V1	Cable is crossing under Duke neutral from different structure	24"
R1	Clearance from top of Duke primary or secondary riser conduit	40"
C1	Cable or service drop above state maintained roadway	18' 0"
C2	Cable above non-state maintained roadway OR subject to truck traffic	15' 6"
RC1	Cable or service drop above residential driveway, not subject to truck traffic	12'0"
C3	Cable or service drop above areas of pedestrian access only	9'6"
C4	Cable or service drop above other areas subject to truck traffic	15'6"
DM3	Telecom service drop separation from Duke service drop at midspan and attachment to building	12"
M4	Wires on different supporting structures crossing at midspan; communications only under Duke	24"
G1	Guy or anchor needed	
G2	Guy or anchor is slack or damaged	
G3	Guy attached to Duke anchor	
G4	Guy marker needed	
GR	Ground; messenger cable must be bonded to Duke ground wire	
L	Cable tagging; missing or unreadable	
AC1	Floating cable; need to properly attach	
TC1	Transfer cable to new pole	
CS1	Communication separation does not meet NESC or Duke specifications at the pole	12"
CS2	Communication separation does not meet NESC or Duke specifications at midspan	12"
MD	Failure to follow make-ready directives	
NC	Not constructed; original attachment approval voided	
RA	Remove unauthorized attachments	

Progress Energy

☑ **EXHIBIT A Attachment Request**

◉ New
○ Rebuild
○ Overlash 3rd Party
○ Service Drop
○ Overlash Self

☐ **EXHIBIT B Removal Request**

Ot05387:
This worksheet is protected. Please complete the areas highlighted in beige.

JOINT USE

Permit # ____________________

Op Center __________

COMPANY NAME: ____________________ Acct. # __________

Reference # ____________________ Location (County, City, State) ____________________

Map #: __________ Node: __________ Project Address: ____________________

EXHIBIT A: In accordance with the terms and conditions of the existing Attachment Agreement, application is made for a permit to attach facilities to Progress Energy's poles as indicated below and on construction drawing(s) attached. Applicant represents it has secured all necessary permits under its franchise and easements or licenses from owners of private property. Applicant is responsible for coordinating the transfer or rearrangement of another attacher's facilities due to the applicant's proposed attachments and for reimbursement of expenses due to those entities. Such work must be completed before applicant commences construction of its attachments.

EXHIBIT B: In accordance with the terms and conditions of the existing Attachment Agreement, PE will remove from its records the attachment(s) from the poles listed below. Applicant represents that it has removed all communication facilities previously attached to the below referenced poles.

Progress Energy Pole No.	√ for Transmission	House and Street Address *and / or* Comments	Progress Energy Pole No.	√ for Transmission	House and Street Address *and / or* Comments

ATTACHMENTS REQUESTED / REMOVED:

__________ Distribution __________ Transmission __________ Telecommunications

SUBMITTED BY:

Name ____________________

Address ____________________

____

Phone No. ____________________

CABLE DETAILS

☐ Coaxial

☐ Fiber Optic

__________ Cable Size

__________ Messenger Size

CUSTOMER SIGNATURE & DATE REQUIRED: ____________________

Double click to open in Excel format.

Duke Energy Construction Standards
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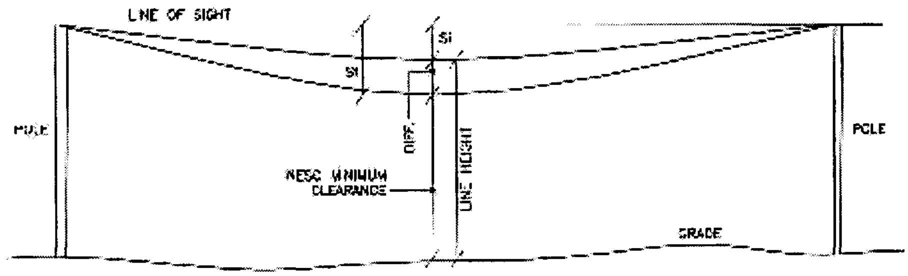
NOTE: Double click on diagram below to open the Duke Construction Standards in Acrobat format.



KEY	Si	INITIAL SAG @ 60°F, NO WIND (FROM SAG TABLES)
	Sf	THE GREATER OF FINAL SAG @ 120°F (180° FOR FP), NO WIND, OR 32°F W/ 1/4" ICE (CP&L ONLY)
	DIFF.	Sf – Si

NOTES:

1. USE THIS METHOD WITH THE TABLE ON DWG. 09.02–01 WHEN DETERMINING MINIMUM LINE HEIGHTS ABOVE GROUND, RAILS, ETC.
2. LINE HEIGHT (AT MID SPAN) = REQUIRED MINIMUM CLEARANCE (SEE DWG. 09.02–01) PLUS (Sf – Si).
3. ROUND UP "DIFF." (Sf–Si) VALUES TO NEAREST 1/2 FT. (E.G., 32" WOULD BECOME 3'–0".)

EXAMPLE OF USE OF INITIAL AND FINAL SAG:

1. 3–Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 300 FT. SPAN –

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: (120°F, NO WIND)	15.5 FT.	(DWG. 09.02–01)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS, FOR 1/0 ACSR, 300 FT. SPAN:	+ 3.0 FT.	
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE, AT INSTALLATION (INITIAL SAG, 60°F):	18.5 FT.	

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

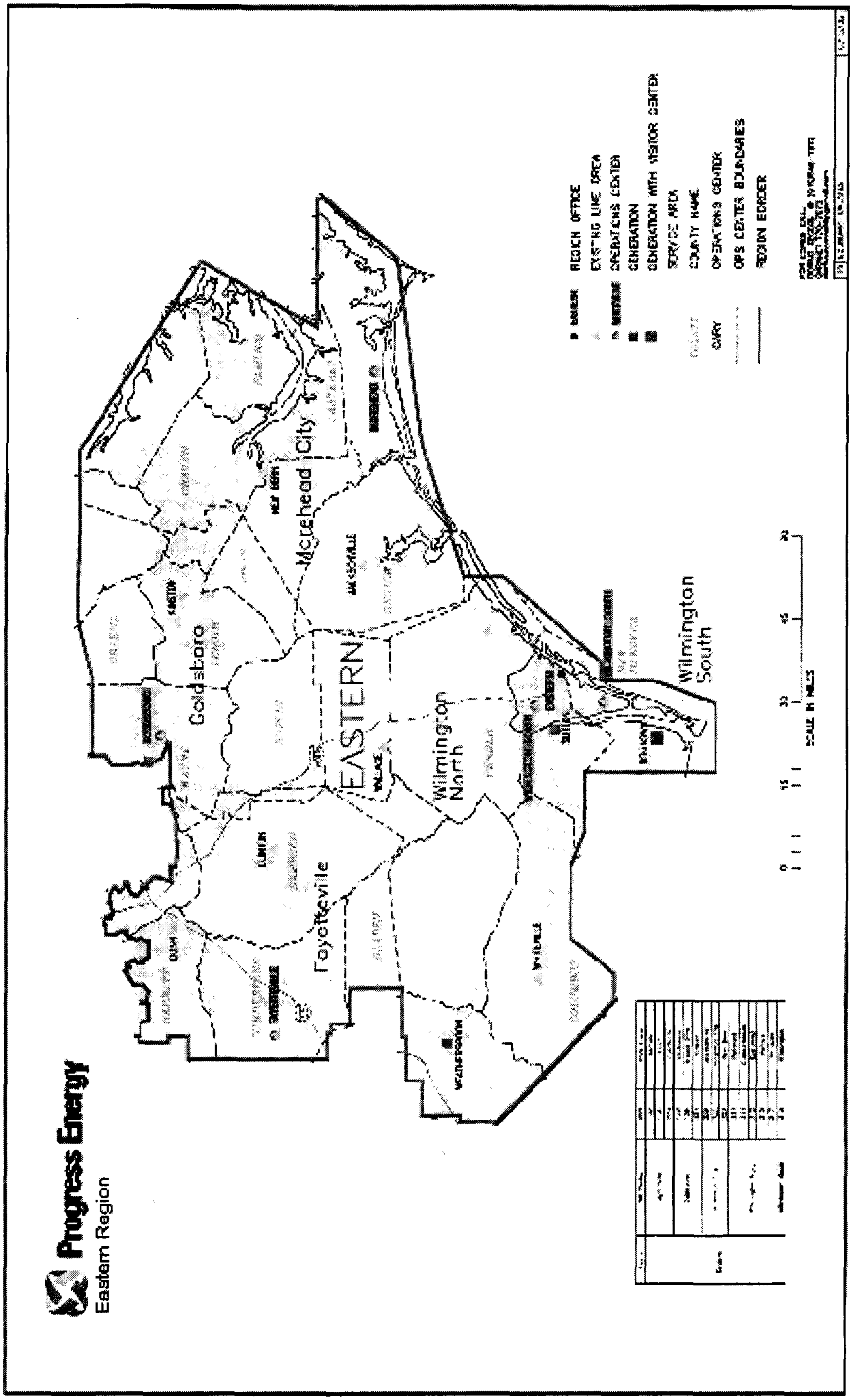
2. 3–Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 150 FT. SPAN –

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: (120°F, NO WIND)	15.5 FT.	(DWG. 09.02–01)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS, FOR 1/0 ACSR, 150 FT. SPAN:	+ 1.5 FT.	
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE, AT INSTALLATION (INITIAL SAG, 60°F):	17.0 FT.	

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

3				MINIMUM LINE HEIGHTS USING CONDUCTOR SAG TABLES		Progress Energy
2						
1						
0	[illegible]	[illegible]	[illegible]	[illegible]	PGN	DWG. 09.00–01
REVISED	BY	CK'D	APPR.			

NOTE: Double click on diagram below to open in Acrobat format.



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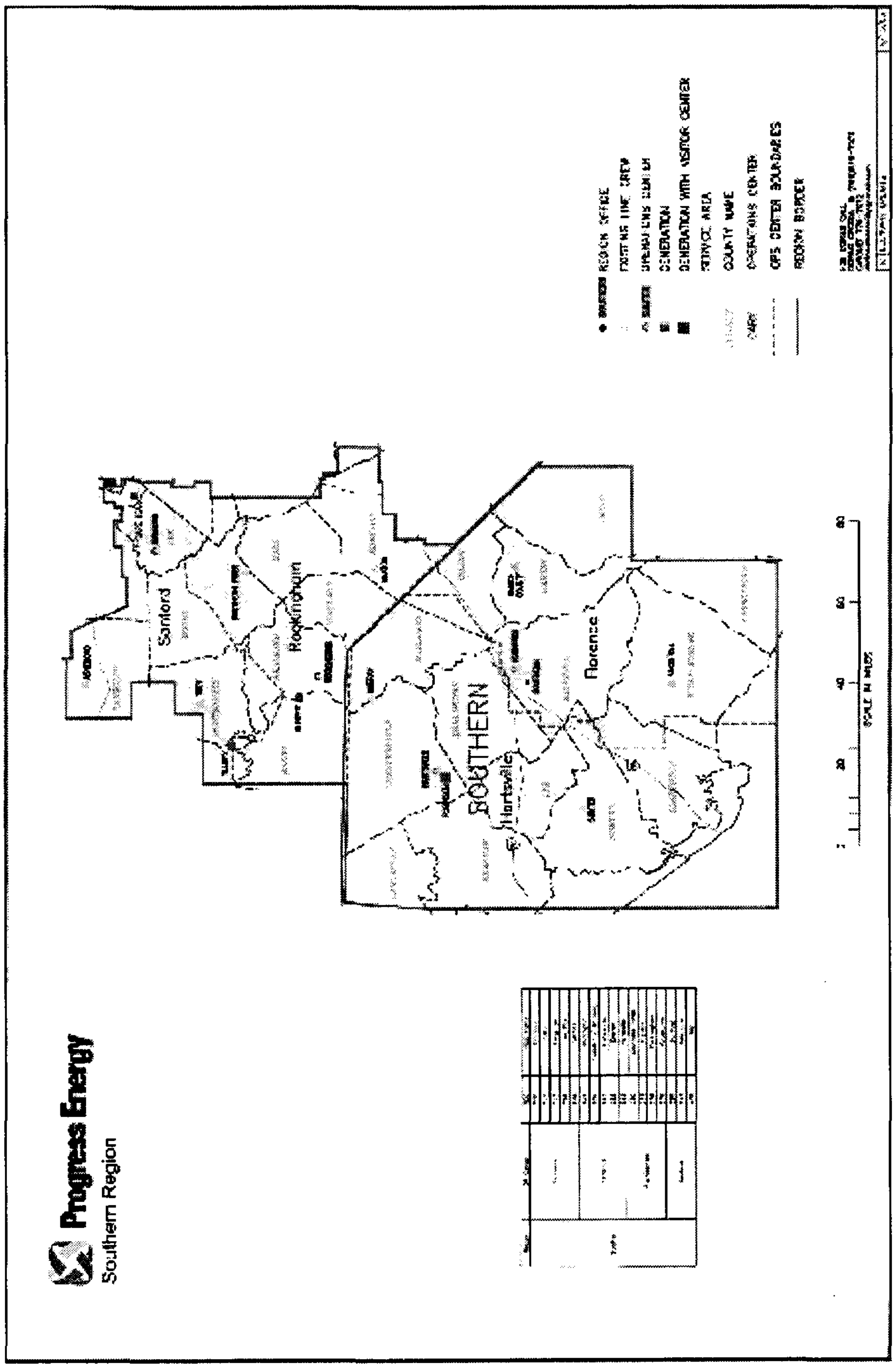

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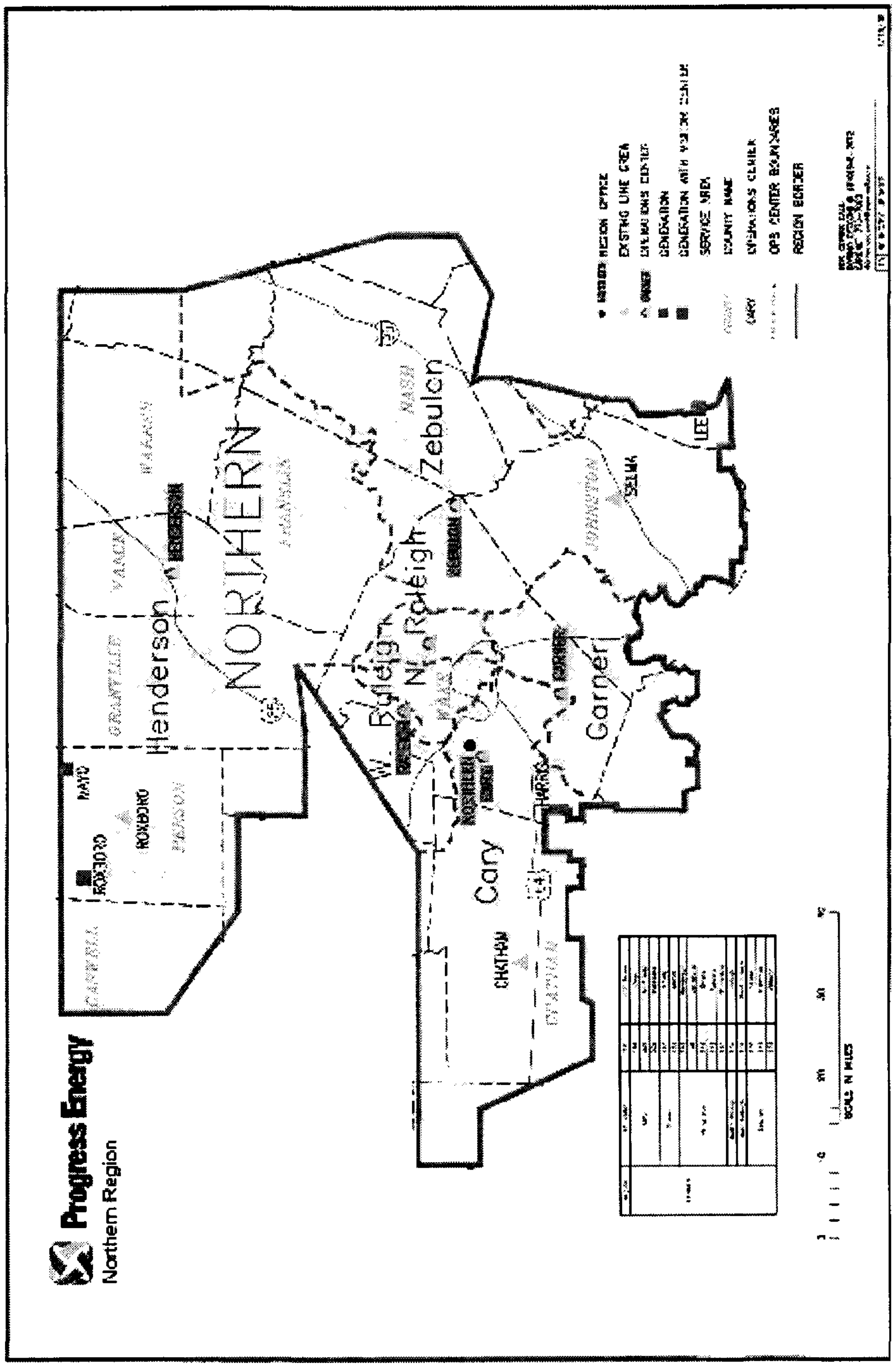

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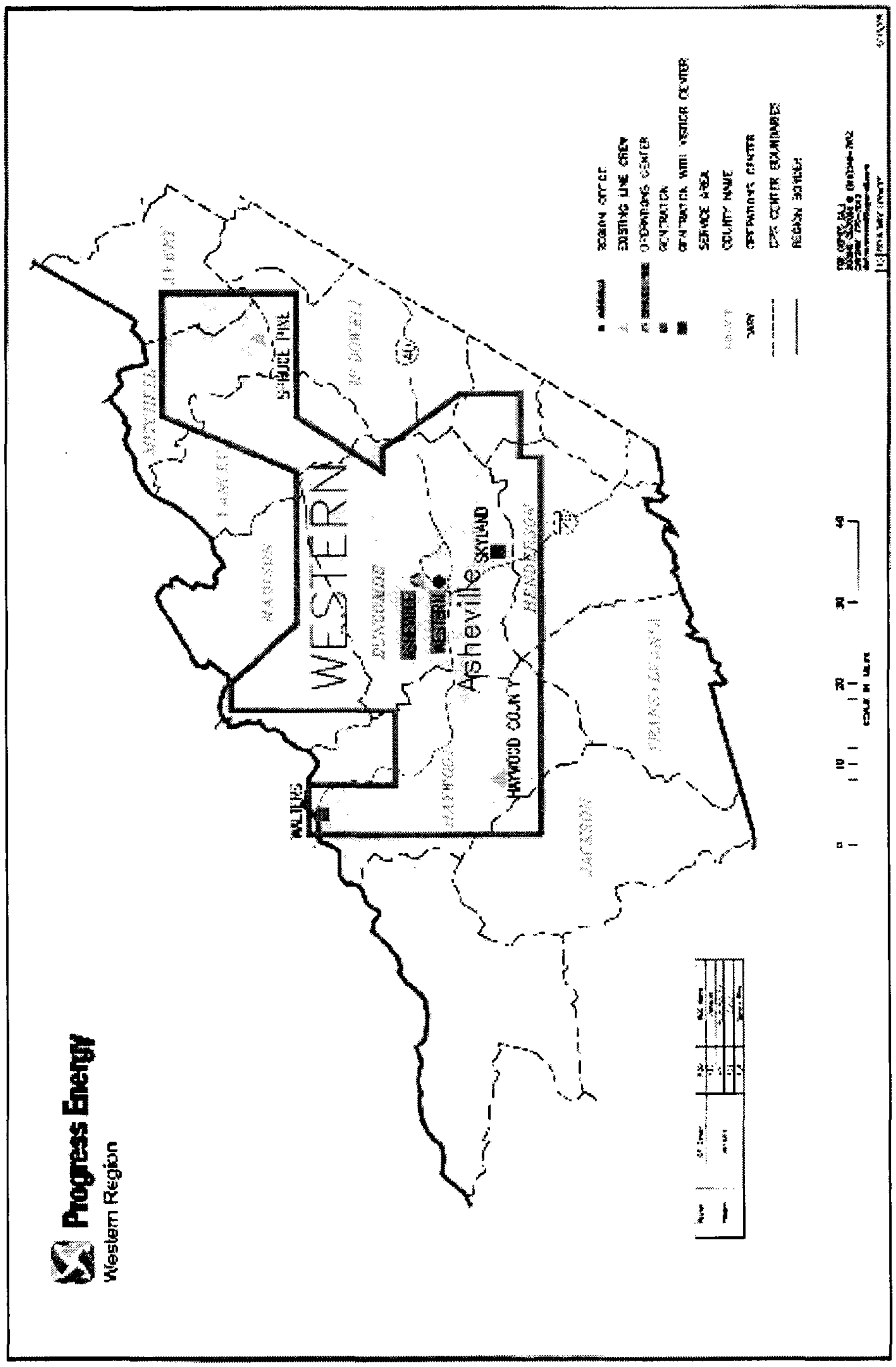
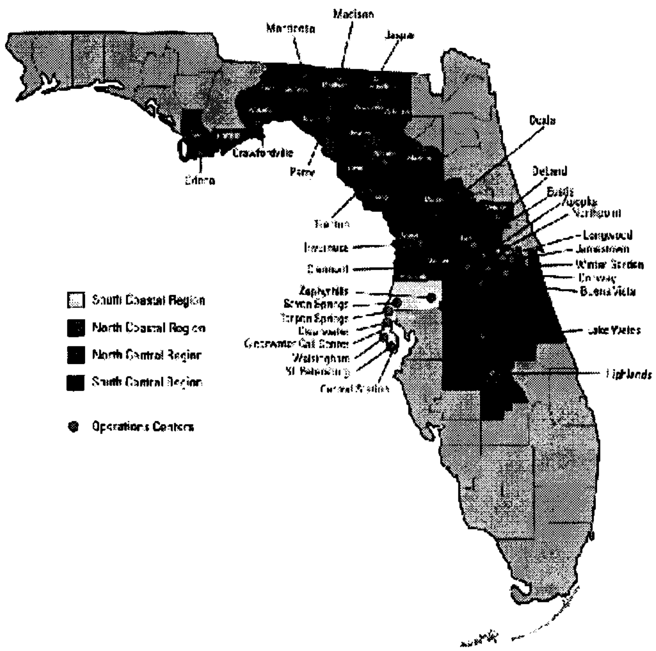


Progress Energy Florida Customer Service Regions



3				
2				
1	1/27/12	CECCONI	BURLISON	ELKINS
0	10/2/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 9 - CLEARANCES AND JOINT USE

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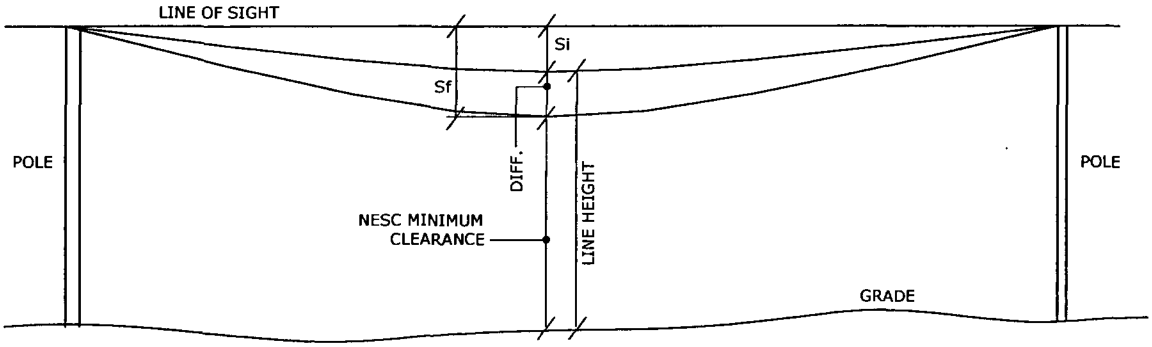
DWG. 09.00-00A



KEY		
KEY	Si	INITIAL SAG @ 60°F, NO WIND (FROM SAG TABLES)
	Sf	THE GREATER OF FINAL SAG @ 120°F (180° FOR FLORIDA), NO WIND, OR 32°F W/ 1/4" ICE (CAROLINAS ONLY)
	DIFF.	Sf - Si

NOTES:

1. USE THIS METHOD WITH THE TABLE ON DWG. 09.02-01 WHEN DETERMINING MINIMUM LINE HEIGHTS ABOVE GROUND, RAILS, ETC.
2. LINE HEIGHT (AT MID SPAN) = REQUIRED MINIMUM CLEARANCE (SEE DWG. 09.02-01) PLUS (Sf - Si).
3. ROUND UP "DIFF." (Sf-Si) VALUES TO NEAREST 1/2 FT. (E.G., 32" WOULD BECOME 3'-0".)

EXAMPLE OF USE OF INITIAL AND FINAL SAG:

1. 3-Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 300 FT. SPAN -

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: 15.5 FT. (DWG. 09.02-01)
(120°F, NO WIND)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS,
FOR 1/0 ACSR, 300 FT. SPAN: + 3.0 FT.
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE,
AT INSTALLATION (INITIAL SAG, 60°F): 18.5 FT.

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

2. 3-Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 150 FT. SPAN -

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: 15.5 FT. (DWG. 09.02-01)
(120°F, NO WIND)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS,
FOR 1/0 ACSR, 150 FT. SPAN: + 1.5 FT.
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE,
AT INSTALLATION (INITIAL SAG, 60°F): 17.0 FT.

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/8/10	GUINN	GUINN	ELKINS

MINIMUM LINE HEIGHTS USING CONDUCTOR SAG TABLES

Duke Energy®

PGN DWG. 09.00-01

EQUIPMENT AND CIRCUITS NEAR NATURAL GAS OR GASOLINE FACILITIES

THE FOLLOWING PROCEDURE SHALL BE FOLLOWED WHEN LOCATING OVERHEAD OR UNDERGROUND ELECTRICAL FACILITIES NEAR GASOLINE PUMPS AND RELATED FACILITIES.

DO NOT INSTALL TRANSFORMERS, CAPACITORS, CUTOUTS, SWITCHES, FUSES, RELAYS, OR ANY EQUIPMENT THAT MAY PRODUCE ARCS UNDER NORMAL OPERATING CONDITIONS WITHIN OR ABOVE THE FOLLOWING LOCATIONS:

(1) ANY AREA WITHIN 20 FEET HORIZONTALLY FROM A GASOLINE DISPENSING PUMP.

(2) ANY AREA WITHIN 10 FEET HORIZONTALLY FROM A GASOLINE TANK FILL-PIPE.

(3) ANY POINT WITHIN A 5 FOOT RADIUS FROM THE POINT OF DISCHARGE OF A GASOLINE VENT-PIPE.

(4) ANY POINT WITHIN 15 FEET IN ALL DIRECTIONS OF ABOVE GROUND NATURAL GAS CONNECTIONS, VALVES, OR GAUGES.

DO NOT LOCATE ELECTRIC METERS WITHIN 3 FEET OF NATURAL GAS METERS, LIQUID PETROLEUM GAS TANKS, OR LIQUID PETROLEUM GAS FILL POINTS.

AVOID LOCATING ANY PORTION OF AN ELECTRICAL CIRCUIT OVER THE LOCATIONS SPECIFIED ABOVE. GREATER CLEARANCES MAY BE REQUIRED FOR SPECIAL CONDITIONS OR DURING CONSTRUCTION OR REPAIR NEAR EXISTING LINES. DETERMINATION OF SUFFICIENT CLEARANCES OR OTHER ACTION FOR THE SAFETY OF CONSTRUCTION PERSONNEL MUST BE MADE ON AN INDIVIDUAL BASIS.

COMMUNITY WELL CLEARANCES

NO POTENTIAL SOURCE OF CONTAMINATION CAN BE LOCATED WITHIN 100 FEET OF A COMMUNITY WELL. TRANSFORMERS (POLE MOUNTED, PAD-MOUNTED OR GROUND LEVEL), CAPACITOR BANKS, D-D SUBS AND ANY OIL FILLED EQUIPMENT ARE CLASSIFIED AS POTENTIAL SOURCES OF CONTAMINANTS AND MAY NOT BE LOCATED WITHIN 100 FEET OF A COMMUNITY WELL. COMMUNITY WELLS ARE DEFINED AS WELLS WHICH SERVE 25 OR MORE PERSONS. A SINGLE FAMILY RESIDENTIAL WELL IS NOT CLASSIFIED AS A COMMUNITY WELL. THIS REGULATION IS FOR NEW NEW INSTALLATIONS ONLY. EXISTING COMMUNITY WELLS WHICH HAVE OIL FILLED EQUIPMENT LOCATED WITHIN 100 FEET ARE GRANDFATHERED.

3			
2			
1			
0 9/27/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

EQUIPMENT AND CIRCUITS NEAR NATURAL GAS OR GASOLINE FACILITIES AND COMMUNITY WELL CLEARANCES

Duke Energy®

PGN DWG. 09.00-02

MINIMUM CLEARANCES (IN FEET) OF UNGUARDED WIRES FROM INSTALLATIONS TO WHICH THEY ARE NOT ATTACHED.

CONDUCTOR TYPE / CLEARANCE OF:	EFFECTIVELY GROUNDED NEUTRALS; SPAN & LIGHTNING PROTECTION WIRES; GUYS & MESSENGERS CABLED PRIMARY	INSULATED SUPPLY CABLES 0 - 750V (TRIPLEX & QUADRUPLEX)	0 - 750 V OPEN WIRE SECONDARY & SERVICES;	OPEN WIRE PRIMARY 750 V - 22 kV (PHASE TO GROUND)
1. LIGHTING AND TRAFFIC SIGNAL SUPPORTS; POLES & SUPPORTS OF ANOTHER LINE:				
A. HORIZONTAL	3'	3'	5' (3.5') **	5' (4.5') **
B. VERTICAL	2'	2'	4.5'	4.5'
2. BUILDINGS: A. HORIZONTAL				
1. TO WALLS, PROJECTIONS & GUARDED WINDOWS	4.5'	5'	5.5' (3.5')	7.5' (4.5')
2. TO UNGUARDED WINDOWS	4.5'	5'	5.5' (3.5')	7.5' (4.5')
3. TO BALCONIES AND AREAS ACCESSIBLE TO PEDESTRIANS	4.5'	5'	5.5' (3.5')	7.5' (4.5')
B. VERTICAL 1. OVER & UNDER ROOFS OR PROJECTIONS NOT ACCESSIBLE TO PEDESTRIANS	3'	3.5'	10.5'	12.5'
2. OVER & UNDER ROOFS OR PROJECTIONS ACCESSIBLE TO PEDESTRIANS	10.5'	11'	11.5'	13.5'
3. OVER ROOFS ACCESSIBLE TO VEHICLES BUT NOT SUBJECT TO TRUCK TRAFFIC	10.5'	11'	11.5'	13.5'
4. OVER ROOFS ACCESSIBLE TO TRUCK TRAFFIC	15.5'	16'	16.5'	18.5'
3. SIGNS, CHIMNEYS, BILLBOARDS, RADIO & TV ANTENNAS, AND OTHER INSTALLATIONS NOT CLASSIFIED AS BRIDGES:				
A. HORIZONTAL 1. TO PORTIONS THAT ARE READILY ACCESSIBLE TO PEDESTRIANS	4.5'	5.0'	5.5' (3.5')	7.5' (4.5')
2. TO PORTIONS THAT ARE NOT READILY ACCESSIBLE TO PEDESTRIANS	3.0'	3.5'	5.5' (3.5')	7.5' (4.5')
B. VERTICAL 1. OVER OR UNDER CATWALKS AND OTHER SURFACES UPON WHICH PERSONNEL WALK	10.5'	11.0'	11.5'	13.5'
2. OVER OR UNDER OTHER PORTIONS OF SUCH INSTALLATIONS	3.0'	3.5'	6.0'	8.0'
4. BRIDGES: * A. CLEARANCES OVER BRIDGES 1. ATTACHED	N/A	3'	3.5'	5.5'
2. NOT ATTACHED	N/A	10'	10.5'	12.5'
B. BESIDE, UNDER, OR WITHIN STRUCTURE				
1. READILY ACCESSIBLE PARTS (A) ATTACHED	N/A	3'	3.5'	5.5' (4.5')
(B) NOT ATTACHED	N/A	5'	5.5' (3.5')	7.5' (4.5')
2. INACCESSIBLE PARTS (A) ATTACHED	N/A	3'	3.5'	5.5' (4.5')
(B) NOT ATTACHED	N/A	4'	4.5' (3.5')	6.5' (4.5')
5. SWIMMING POOLS (INCLUDING SWIMMING BEACHES WHERE RESCUE POLES ARE USED):	SEE DWG. 09.01-05			

*BRIDGES WITH SUPPORTING STRUCTURES ABOVE THE ROADWAY MAY SERVE AS SUPPORTING STRUCTURES FOR ELECTRICAL LINES. THE CLEARANCES SHOWN FOR ATTACHED AND NOT ATTACHED IS THE CLEARANCE ABOVE THE BRIDGE SUPPORTING STRUCTURES. SEE DWG. 09.01-04 FOR CLEARANCE TO BRIDGES WITHOUT SUPPORTING STRUCTURES ABOVE THE ROADWAY.

**CLEARANCES SHOWN ARE FOR CONDUCTORS AT REST. THE CLEARANCE IN PARENTHESES IS THE CLEARANCE REQUIRED WITH WIND DISPLACEMENT. THE WIND DISPLACEMENT FOR VARIOUS CONDUCTORS AND SPAN LENGTHS CAN BE FOUND IN THE SAG TABLES IN SECTION 05. SUBTRACT THE WIND DISPLACEMENT FROM THE REQUIRED CLEARANCE AT REST. THE REMAINING CLEARANCE MUST BE REMAINING CLEARANCE MUST BE EQUAL TO OR MORE THAN THE CLEARANCES SHOWN IN PARENTHESES.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS

MINIMUM FINAL SAG CLEARANCES
TO BUILDINGS, ETC.

Duke Energy®

PGN DWG. 09.01-01A

MINIMUM CLEARANCES (IN FEET) OF UNGUARDED WIRES

FROM INSTALLATIONS TO WHICH THEY ARE NOT ATTACHED

CONDUCTOR TYPE / CLEARANCE OF:	EFFECTIVELY GROUNDED NEUTRALS; SPAN & LIGHTNING PROTECTION WIRES; GUYS & MESSENGERS CABLED PRIMARY	INSULATED SUPPLY CABLES 0 - 750 V (TRIPLEX & QUADRUPLEX)	0 - 750 V OPEN WIRE SECONDARY & SERVICES; CABLED PRIMARY	OPEN WIRE PRIMARY 750 V - 22 kV (PHASE TO GROUND)
6. RAILROADS (WHERE WIRES RUN ALONG TRACKS): A HORIZONTAL (FROM NEAREST RAIL)	8.5'	9'	9.5'	11.5'
B. VERTICAL (FROM TOP OF RAILS)	23.5'	24'	24.5'	26.5'
7. GRAIN BINS:			SEE NESC RULE 234.F.	

NOTES:

1. THESE CLEARANCES APPLY UNDER WHICHEVER OF THE FOLLOWING CONDUCTOR TEMPERATURE AND LOADING CONDITIONS PRODUCES THE CLOSEST APPROACH:

   FOR COLUMN ONE IN THE TABLE:
   - NEUTRALS AT 120°F OR 32°F

   ALL OTHER COLUMNS FOR ENERGIZED CONDUCTORS IN THE TABLE:
   - MAXIMUM CONDUCTOR OPERATING TEMPERATURE 185°F
   - 32°F
   - THE MINIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED, NO WIND DISPLACEMENT, INITIAL SAG. (THIS COMES INTO PLAY WHEN A LINE IS RUN UNDER SOMETHING SUCH AS A CATWALK.)

2. WIND DISPLACEMENT CONSIDERATIONS (HORIZONTAL):

   A. FIGURES SHOWN IN PARENTHESIS ARE MINIMUM CLEARANCES WHERE CONSIDERATION OF HORIZONTAL DISPLACEMENT UNDER WIND CONDITIONS IS REQUIRED. IN APPLYING THESE CLEARANCES, THE CONDUCTOR IS DISPLACED FROM REST TOWARDS THE INSTALLATION BY A 6 PSF WIND AT FINAL SAG AT 60°F.

   B. PERPENDICULAR HORIZONTAL DISTANCE REQUIRED BETWEEN THE LINE AND THE STRUCTURE (BUILDING, ETC.) IS THE GREATER OF THE HORIZONTAL CLEARANCE OR THE SUM OF WIND CLEARANCE PLUS WIND SWING.

   C. SEE SECTION 05.01 FOR CONDUCTOR WIND SWINGS.

3. THIS TABLE DOES NOT APPLY TO BUILDINGS OR INSTALLATIONS IN TRANSIT.

4. THIS TABLE DOES NOT APPLY TO CLEARANCE BETWEEN A SERVICE AND THE BUILDING TO WHICH IT ATTACHES (REFER TO DWG. 09.02-05), BUT DOES APPLY TO CLEARANCE BETWEEN SERVICES AND ADJACENT BUILDINGS.

5. FOR BUILDINGS UNDER CONSTRUCTION, THESE CLEARANCES MUST BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION.

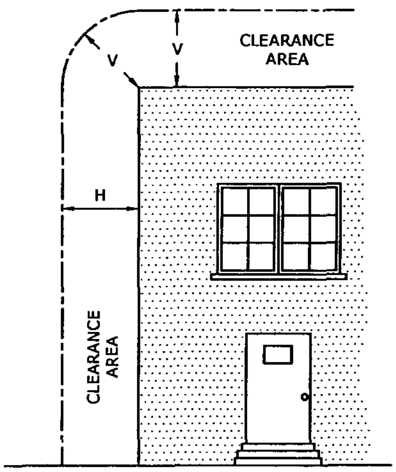
6. REFER TO NATIONAL ELECTRICAL SAFETY CODE RULE 234 FOR EXCEPTIONS AND REFINEMENTS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/1/10	ROBESON	GUINN	ELKINS

MINIMUM FINAL SAG CLEARANCES TO BUILDINGS, ETC.

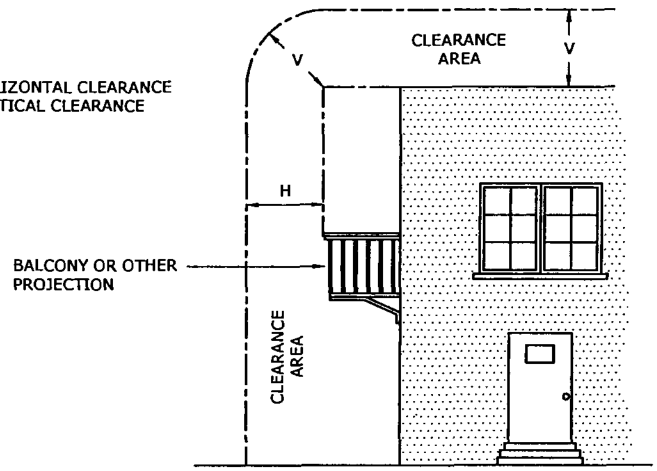
Duke Energy®

FLA DWG. 09.01-01B

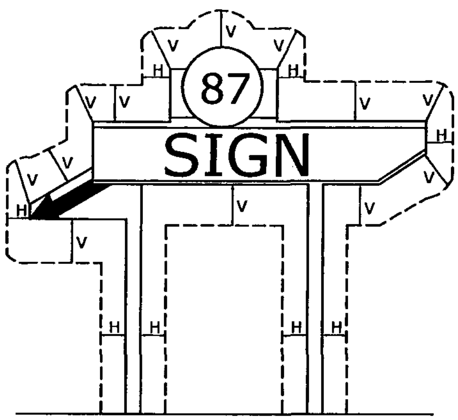


BUILDING ELEVATION

H = HORIZONTAL CLEARANCE
V = VERTICAL CLEARANCE



BUILDING ELEVATION



*VERTICAL	HORIZONTAL
10.5' (0 TO 750V Ø-N)	5.5' (0 TO 750V Ø-N)
12.5' (750 TO 22,000V Ø-N)	7.5' (750 TO 22,000V Ø-N)

NOTES:

1. CONDUCTORS SHALL BE PROPERLY GUARDED WHERE SUCH SUPPLY CONDUCTORS ARE PLACED NEAR ENOUGH TO WINDOWS, FIRE ESCAPES, ETC. TO BE EXPOSED TO CONTACT BY PERSONS.

2. WHERE BUILDINGS EXCEED THREE STORIES (OR 50 FEET) IN HEIGHT, A ZONE AT LEAST 6 FT. WIDE SHOULD EXIST EITHER ADJACENT TO THE BUILDING OR BEGINNING NOT OVER 8 FT. FROM THE BUILDING TO FACILITATE THE RAISING OF LADDERS WHERE NECESSARY FOR FIRE FIGHTING.

   * VERTICAL CLEARANCE ABOVE OR BELOW ROOF ACCESSIBLE TO PEDESTRIANS ADD 1 FT. TO ABOVE VALUES. VERTICAL CLEARANCE ABOVE OR BELOW ROOF ACCESSIBLE TO VEHICLES INCLUDING TRUCKS ADD 6 FT. TO ABOVE VALUES.

   SEE NESC RULE 234.

3. WIND DISPLACEMENT MUST BE CONSIDERED WHEN CHECKING HORIZONTAL CLEARANCES. SEE DWG. 09.01-01B.

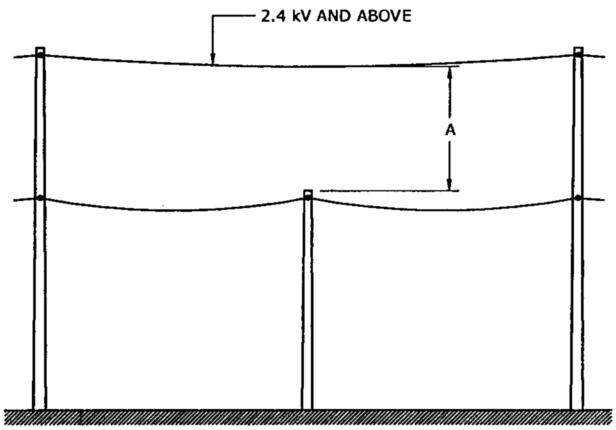
3			
2			
1			
0 7/12/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

MINIMUM FINAL SAG BUILDING CLEARANCE

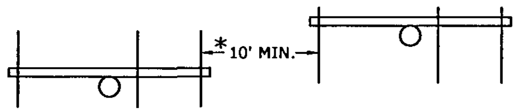
Duke Energy®

PGN DWG. 09.01-02

MINIMUM CLEARANCE BETWEEN OVERHEAD
PRIMARY CIRCUITS AND UNDERBUILT POLES



HORIZONTAL CLEARANCE FOR
PARALLEL LINES UP TO 25kV
*PREFERRED DISTANCE



"A" = 4.5 FEET FOR VOLTAGES 0 TO 22 kV Ø-G
= 5.5 FEET FOR VOLTAGES 22 TO 50 kV Ø-G (69 kV)
= 7 FEET FOR VOLTAGES 70 kV Ø-G (115 kV)
= 9 FEET FOR 140 kV Ø-G (230 kV)

A MINIMUM VERTICAL CLEARANCE "A" SHALL BE MAINTAINED BETWEEN UNINSULATED PRIMARY CONDUCTORS OF ONE LINE AND ANY PART OF CLIMBABLE SUPPORTING STRUCTURES OF ANOTHER LINE INSTALLED BELOW THE PRIMARY. THIS MINIMUM CLEARANCE SHALL BE MAINTAINED FOR CONDUCTOR SAG AT MAXIMUM OPERATING TEMPERATURE, NO WIND.

YOU MAY SUBTRACT 2 FT. FROM DIMENSION "A" IF THE FOLLOWING 2 CONDITIONS ARE MET:

1. BOTH TOP AND BOTTOM CIRCUITS ARE OPERATED AND MAINTAINED BY THE SAME COMPANY.

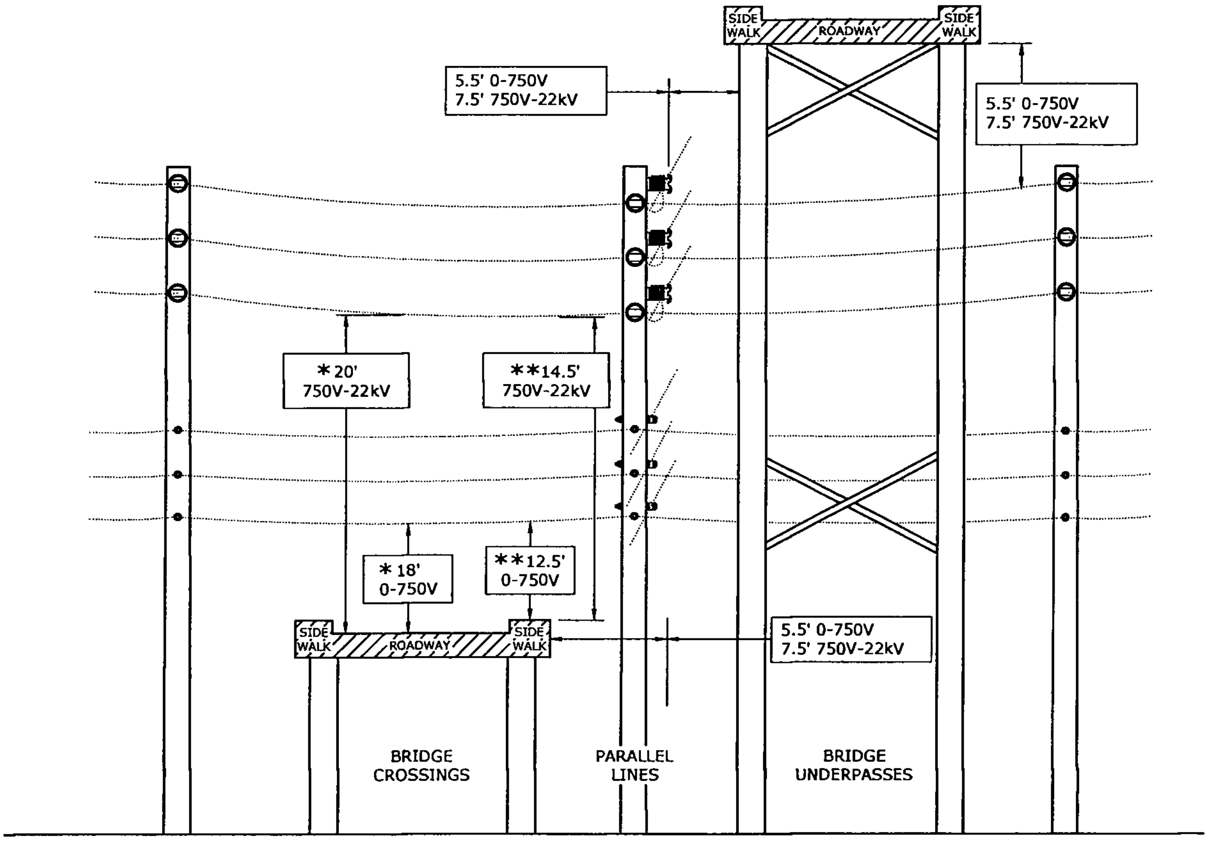
2. EMPLOYEES WILL NOT BE WORKING ABOVE THE INTERMEDIATE POLE WHILE THE UPPER LINE IS ENERGIZED.

3				
2				
1	2/25/11	ROBESON	BURLISON	ELKINS
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

FINAL SAG CLEARANCE DIAGRAM
FOR OTHER STRUCTURES

Duke Energy

PGN DWG. 09.01-03



NOTE: ALL VOLTAGES ARE Ø-G.

IF WIRE CROSSINGS ARE INVOLVED, SEE "MINIMUM WIRE CROSSING CLEARANCES" IN THIS SECTION. DIMENSIONS GIVEN ARE MINIMUMS. ADDITIONAL CLEARANCE SHOULD BE PROVIDED IF POSSIBLE. BRIDGE CROSSINGS HERE ARE NOT OVER NAVIGABLE WATERWAYS.

DOT OR HIGHWAY PERMITS MAY DICTATE CLEARANCE HEIGHTS.

SEE DWG. 09.01-01A FOR LINE CLEARANCES ABOVE BRIDGES WITH A SUPER STRUCTURE ABOVE THE ROADWAY.

*THESE CLEARANCES ARE TO THE ROADWAY SURFACE OF THE BRIDGE.

**THESE CLEARANCES ARE TO THE SIDEWALK WHERE ONLY RESTRICTED TRAFFIC IS NORMALLY EXPECTED. NO HORSEBACK RIDERS OR VEHICLES GREATER THAN 8 FOOT IN HEIGHT.

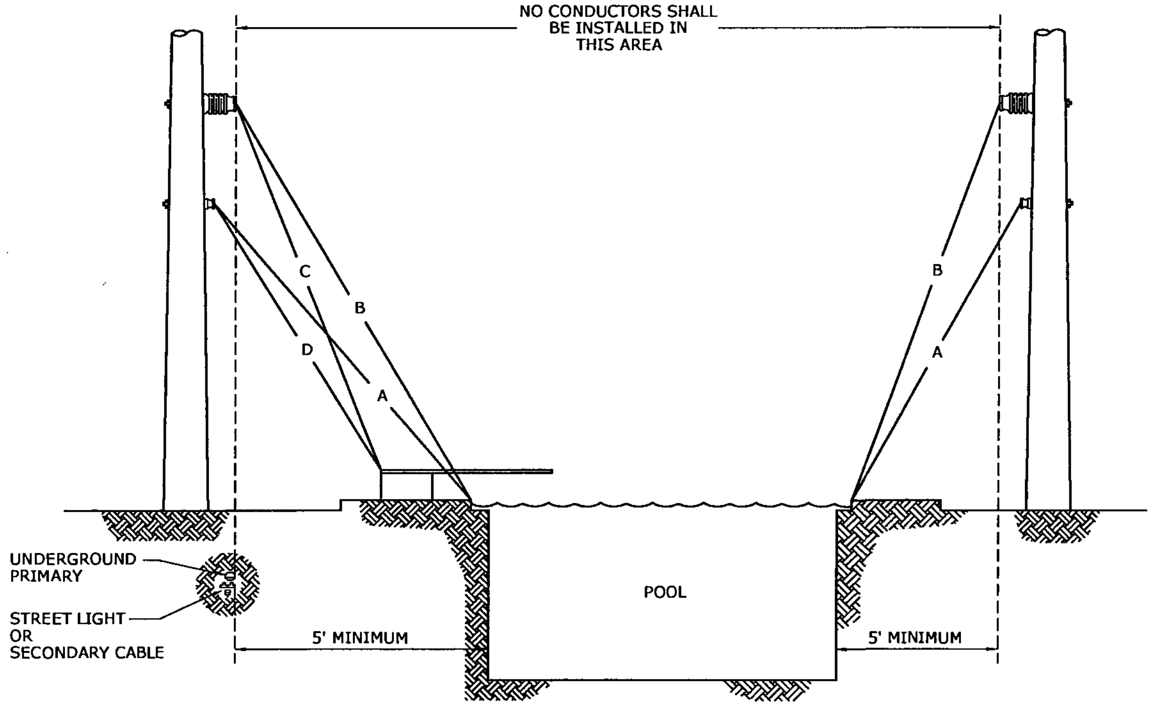
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MINIMUM FINAL SAG CLEARANCES FROM BRIDGES

Duke Energy®

PGN

DWG. 09.01-04



ANGLE	CABLE SECONDARY AND NEUTRAL CONDUCTORS 0-750 VOLTS TO GROUND	ALL OTHER CONDUCTORS 0-22 kV TO GROUND
A	22.5 FT.	25 FT.
B		25 FT.
C		17 FT.
D	14.5 FT.	17 FT.

POOL CONTRACTORS MUST MEET THE GREATER OF THE FOLLOWING CODES:

1. PROGRESS ENERGY POOL CLEARANCE POLICY.
2. CITY AND/OR COUNTY ELECTRICAL CODES.
3. STATE ELECTRICAL CODES.

NOTES:

1. FIVE (5) FEET MINIMUM MUST ALSO BE MAINTAINED FOR UNDERGROUND PRIMARY AND SECONDARY CABLES.
2. SEE DWG. 09.01-01A, "MINIMUM FINAL SAG CLEARANCE TO BUILDINGS, ETC." IN THIS SECTION FOR POOLS FULLY ENCLOSED BY A SOLID OR SCREENED STRUCTURE.
3. SECONDARY AND SERVICE CABLES LOCATED 10' OR MORE HORIZONTALLY FROM THE POOL EDGE, DIVING PLATFORM OR TOWER ARE EXEMPT FROM SWIMMING POOL CLEARANCE REQUIREMENTS. SEE DWG. 09.01-01A, "MINIMUM FINAL SAG CLEARANCES TO BUILDINGS, ETC." FOR ACTUAL CLEARANCE REQUIREMENTS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS

FINAL SAG CLEARANCE OF ENERGIZED CONDUCTORS NEAR SWIMMING POOL AREAS

Duke Energy

PGN

DWG. 09.01-05

NATURE OF SURFACE UNDERNEATH WIRES CONDUCTORS, OR CABLES	INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.) NESC MINIMUM REQUIRED	SERVICE & SECONDARY CABLE, NON-INSULATED COMMUNICATION CONDUCTORS, 0 TO 750 V (FT.) NESC MINIMUM REQUIRED	OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.) NESC MINIMUM REQUIRED	OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.) NESC MINIMUM REQUIRED
1. ROADS, STREETS, AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC	15.5 (SEE NOTE 5)	16 (SEE NOTE 5)	16.5 (SEE NOTE 5)	18.5 (SEE NOTE 5)
2. DRIVEWAYS, PARKING LOTS, AND ALLEYS	15.5	16	16.5	18.5
3. OTHER LAND TRAVERSED BY VEHICLES, SUCH AS CULTIVATED, GRAZING, FOREST, ORCHARD, ETC.	15.5	16	16.5	18.5
4. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY	9.5	12.0	12.5	14.5
5. WATER AREAS NOT SUITABLE FOR SAILBOATING OR WHERE SAILBOATING IS PROHIBITED	14.0	14.5	15.0	17.0
6. WATER AREAS SUITABLE FOR SAILBOATING INCLUDING LAKES, PONDS, RESERVOIRS, TIDAL WATERS, RIVERS, STREAMS, AND CANALS WITH AN UNOBSTRUCTED SURFACE AREA OF:				
A. LESS THAN 20 ACRES	17.5	18.0	18.5	20.5
B. OVER 20 TO 200 ACRES	25.5	26.0	26.5	28.5
C. OVER 200 TO 2000 ACRES	31.5	32.0	32.5	34.5
D. OVER 2000 ACRES	37.5	38.0	38.5	40.5
7. PUBLIC OR PRIVATE LAND AND WATER AREAS POSTED FOR RIGGING OR LAUNCHING SAILBOATS	CLEARANCE ABOVE GROUND SHALL BE 5 FT. GREATER THAN IN 6 ABOVE, FOR THE TYPE OF WATER AREAS SERVED BY THE LAUNCHING SITE.			
WHERE WIRES, CONDUCTORS, OR CABLES RUN ALONG AND WITHIN THE LIMITS OF HIGHWAYS OR OTHER ROAD RIGHT-OF-WAY BUT DO NOT OVERHANG THE ROADWAY				
8. ROADS, STREETS, OR ALLEYS	15.5	16.0	16.5	18.5
9. ROADS IN RURAL DISTRICTS WHERE IT IS UNLIKELY THAT VEHICLES WILL BE CROSSING UNDER THE LINE	13.5	14.0	14.5	16.5

NOTES:

1. THE ABOVE MINIMUM CLEARANCES IN THE TABLE MUST BE MET USING THE CONDUCTOR SAG AT 185°F. THE SAG VALUES ARE LISTED IN THE SAG AND TENSION CHARTS IN SECTION 05.01.

2. SEE NESC RULE 234.I WHERE CONDUCTORS RUN ALONG OR ARE CLOSER THAN 20 FT. HORIZONTALLY TO TRACK RAILS. CONSIDER SWING DUE TO WIND (NESC RULE 234.A.2). ALSO, RAILROADS REQUIRE 50 FT. MINIMUM VERTICAL CLEARANCE WHEN LINE CROSSES RAILS WITHIN 1000 FT. OF RAILROAD, BRIDGE OR TRESTLE.

3. REFER TO NATIONAL ELECTRICAL SAFETY CODE (NESC) RULE 232 FOR MINOR EXCEPTIONS AND REFINEMENTS. ALSO REFER TO SERVICE CLEARANCE DWGS. 09.02-04 AND 09.02-05 FOR MORE DETAILS ON SERVICE CLEARANCES.

4. WHERE HEIGHT OF ATTACHMENT TO BUILDING DOES NOT PERMIT TRIPLEX SERVICE DROPS TO MEET THIS VALUE, THE CLEARANCE MAY BE REDUCED TO 12 FT.

5. THE MINIMUM VERTICAL CLEARANCE OF ALL CONDUCTORS, CABLES, GUYS, ETC. MUST BE MAINTAINED AT 18 FEET FOR DOT MAINTAINED HIGHWAYS. A 24 FOOT CLEARANCE IS REQUIRED ON ALL LIMITED ACCESS HIGHWAYS.

6. FOR BRIDGES, THE MINIMUM VERTICAL CLEARANCE (ABOVE BRIDGE CLEARANCE AS ESTABLISHED BY THE U.S. COAST GUARD) FOR CABLES WITH A NOMINAL SYSTEM VOLTAGE OF 115 KV AND BELOW IS 20 FEET.

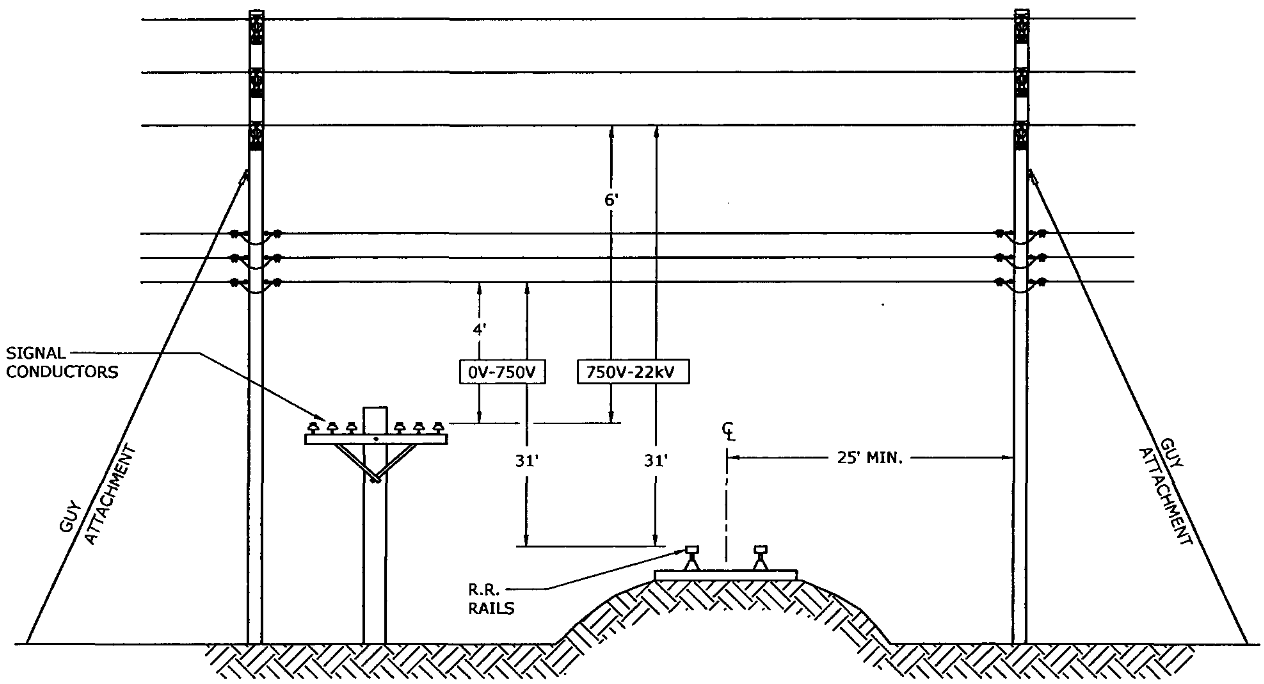
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/1/10	ROBESON	GUINN	ELKINS

STANDARD FINAL SAG CLEARANCES

Duke Energy®

FLA

DWG. 09.02-01



NOTES:

1. ABOVE 22,000 VOLTS, CLEARANCE SHALL BE INCREASED BY 0.4 INCH FOR EACH 1,000 VOLTS IN EXCESS.
2. SEE DWG. 09.02-02B FOR RIGHTS-OF-WAY CONSTRUCTION.
3. BEFORE DESIGNING A RAILROAD CROSSING OR FACILITIES NEXT TO A RAILROAD, CHECK WITH COMPANY PERMIT COORDINATOR FOR SPECIFIC RAILROAD COMPANY CLEARANCE REQUIREMENTS.

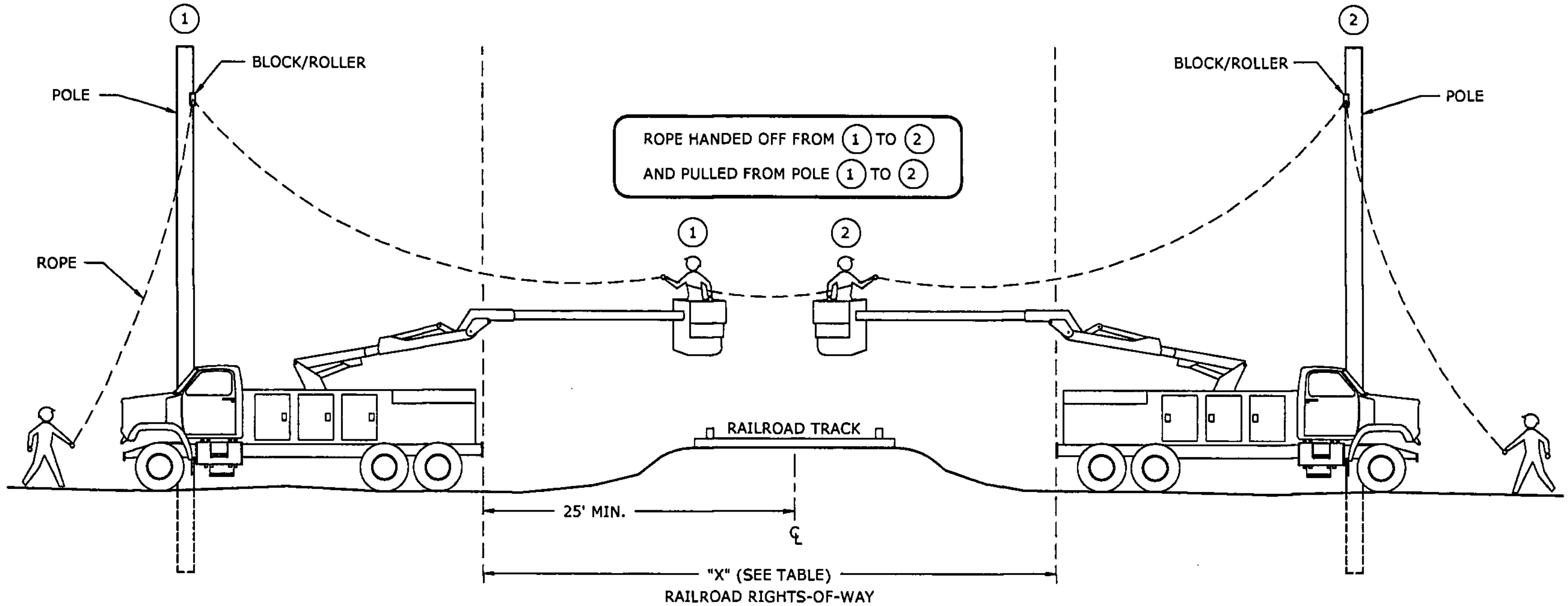
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MINIMUM FINAL SAG CLEARANCES

RAILROAD AND SIGNAL CROSSINGS

Duke Energy®

PGN DWG. 09.02-02A



WORKING "OVER" RAILROAD RIGHT-OF-WAY WITHOUT BEING "IN" RAILROAD ROW

PLACE ONE MAN WITH RADIO APPROXIMATELY 7 MILES UP-TRACK AND DOWN-TRACK (TWO MEN TOTAL) TO WATCH FOR TRAIN COMING - SIGNALS WORKERS TO CLEAR TRACK AREA (15 MINUTES TO CLEAR)

TWO TRUCKS (BUCKET) SET UP ON OPPOSITE SIDE OF ROW

ROLLERS/BLOCK INSTALLED ON EACH SIDE POLE

WORKER (1) HANDS ROPE OFF TO WORKER (2)

ROPE PULLED IN AIR TO CLEAR TRACKS

WIRE PULLED OVER TRACKS VIA ROPE

TRUCK	APPROX. BUCKET REACH	"X"
55' MH	40'	80'
85' MH *	48'	~100'
100' MH *	50'	~100'

*TRANSMISSION

NOTES:

1. SEE DWG. 09.02-02A FOR CLEARANCES.
2. PLAN WORK TO MINIMIZE TIME OVER RIGHTS-OF-WAY.
3. **DO NOT** PERFORM WORK OVER A MOVING TRAIN.

WORKING ON RAILROAD RIGHT-OF-WAY

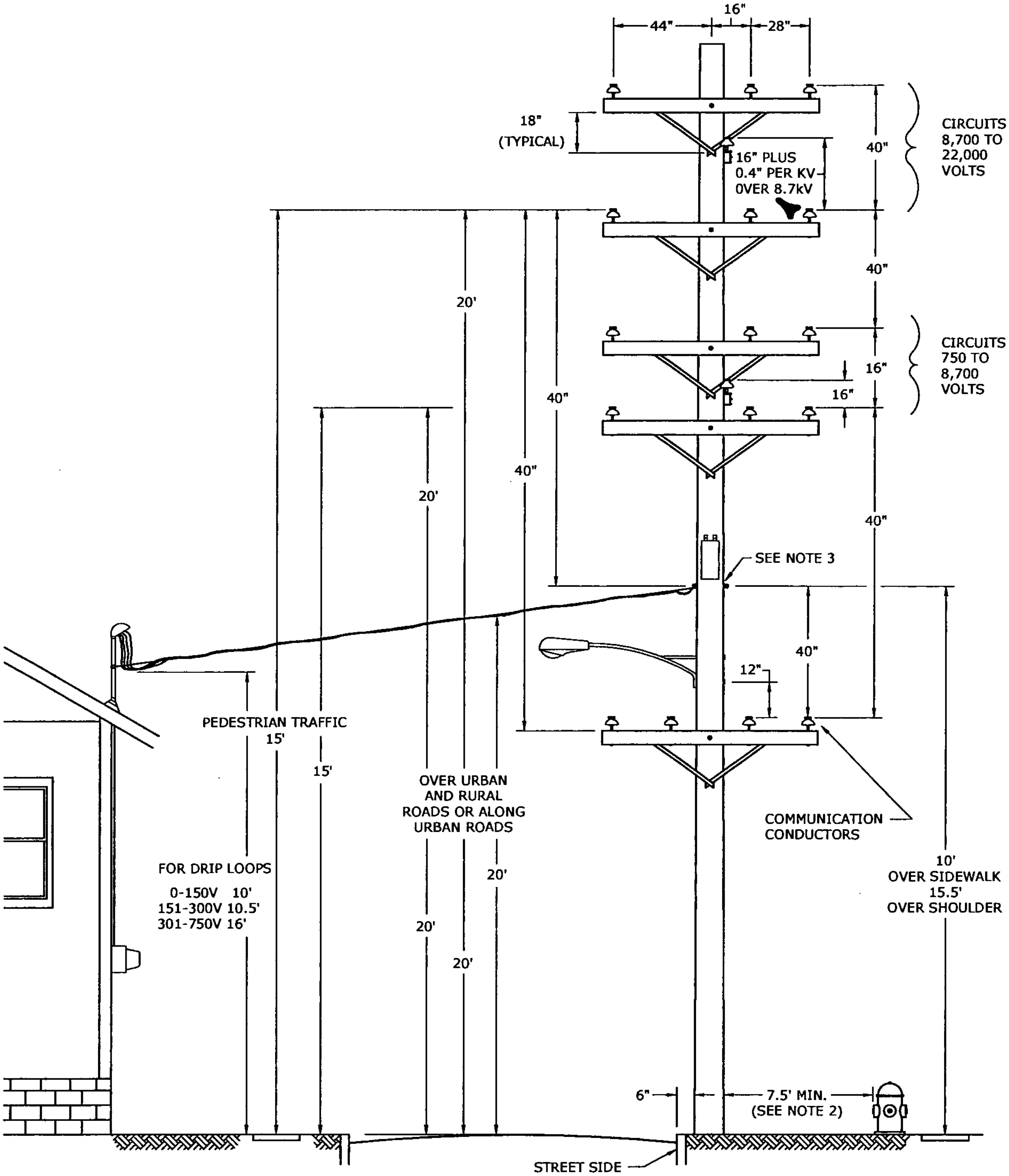
PGN FACILITIES (POLES, GUYS, TRUCKS ETC.) MUST BE 25' MINIMUM FROM THE CLOSEST RAIL.

REVISED	BY	CK'D	APPR.
0 7/12/10	GUINN	GUINN	ELKINS
1			
2			
3			

RAILROAD RIGHTS-OF-WAY CONSTRUCTION

Duke Energy®

PGN DWG. 09.02-02B



NOTES:

1. ALL VOLTAGES ARE MAXIMUM TO GROUND ON GROUNDED SYSTEMS, AND PHASE TO PHASE ON DELTA SYSTEMS.
2. THIS CLEARANCE CAN ONLY BE REDUCED BELOW 7.5' WITH APPROVAL OF LOCAL FIRE AUTHORITY.
3. THE NEUTRAL POSITION SHOWN INDICATES THERE IS ONLY ONE NEUTRAL ON THE POLE SHARED BY ALL CIRCUITS. IF MULTIPLE NEUTRALS ARE USED, ADDITIONAL CLEARANCES ARE REQUIRED TO ACCOMMODATE ADDITIONAL NEUTRALS. SEE DWG. 09.03-01.
4. THE SPACE REQUIREMENT BETWEEN CIRCUITS ABOVE ARE NESC MINIMUM SPACING FOR DIFFERENT UTILITIES. THIS SPACING ALSO APPLIES TO CIRCUITS OWNED BY THE COMPANY. ALL CIRCUIT CLEARANCES AT THE POLE MAY NEED TO BE INCREASED DUE TO SAG TO OBTAIN PROPER MID SPAN CLEARANCES.

3				
2				
1	9/21/12	KATIGBAK	BURLISON	ADCOCK
0	10/1/10	ROBESON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

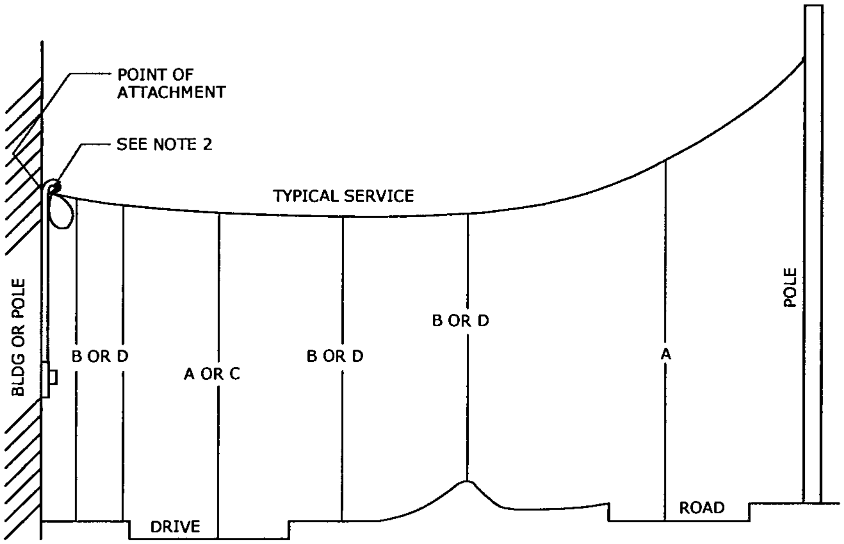
MINIMUM FINAL SAG CLEARANCES FOR CONDUCTOR

Duke Energy

FLA

DWG. 09.02-03

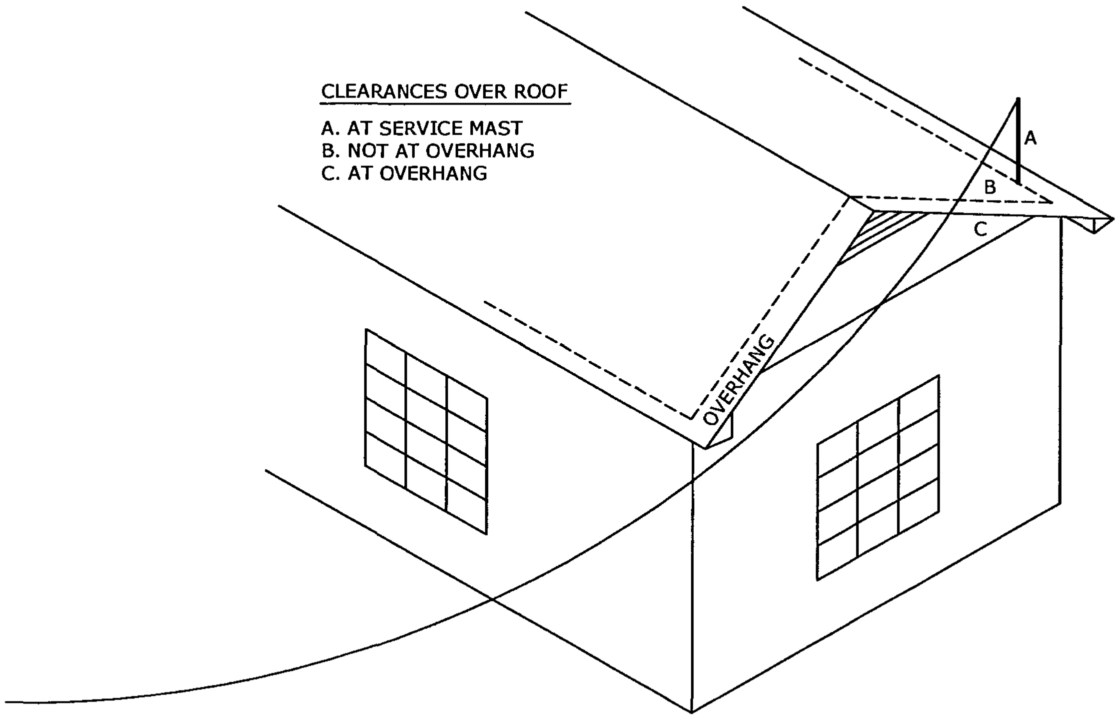
MINIMUM REQUIRED HEIGHTS FOR NEW SERVICES



CONDITION	MINIMUM REQUIRED HEIGHT
A. OVER STREETS, ROADS, NON-RESIDENTIAL DRIVES, COMMERCIAL AREAS, AND PARKING LOTS SUBJECT TO TRUCK TRAFFIC.	18.0'
B. OVER OTHER LAND TRAVERSED BY VEHICLES SUCH AS FARM, GRAZING, FOREST, ETC.	18.0'
C. OVER RESIDENTIAL DRIVEWAYS. (SEE NOTES 4 AND 6)	16.0'
D. OVER FINISHED GRADE, PLATFORMS, AND/OR OTHER SPACES IF NOT NORMALLY TRAVERSED BY VEHICLES.	12.0'

NOTES:

1. THE ABOVE TABLE GIVES REQUIRED MINIMUM INSTALLATION HEIGHTS. THESE INSTALLATION HEIGHTS ARE APPLICABLE TO SERVICE DROP MULTIPLEX CABLES INSTALLED USING THE STANDARD SAGS FOR NORMAL STRINGING TEMPERATURES.
2. POINT OF ATTACHMENT OF SERVICE DROP AT BOTH BUILDING AND POLE MUST BE AT A HEIGHT SUFFICIENT TO ACHIEVE NESC REQUIRED MINIMUM CLEARANCES. REFER TO NESC RULE 232 FOR MINOR EXCEPTIONS AND REFINEMENTS.
3. SERVICE HEAD SHALL BE LOCATED ABOVE THE POINT OF ATTACHMENT OF THE SERVICE DROP CONDUCTORS TO THE STRUCTURE. EXCEPTION: WHEN THIS IS NOT PRACTICABLE, IT MAY BE LOCATED NOT OVER 24" FROM POINT OF ATTACHMENT. [SEE N.E.C. 230.54 (C AND F)].
4. REQUIRED GROUND CLEARANCE FOR INSULATED DRIP LOOPS IS 10 FT. FOR UP TO 150V SERVICES, AND 10.5 FT. FOR UP TO 300V SERVICES AND 16' FOR SERVICES 301-750V.
5. THIS TABLE IS FOR MULTIPLEX (TRIPLEX AND QUADRUPLEX - I.E. "CABLED") SERVICE DROPS. FOR "OPEN WIRE" (UNINSULATED) SERVICE CONDUCTOR CLEARANCES, REFER TO DWG. 09.02-01.
6. WHERE HEIGHT OF ATTACHMENT TO BUILDING WILL NOT PERMIT THIS HEIGHT FOR TRIPLEX SERVICES, THIS HEIGHT MAY BE REDUCED TO 12.5 FT.



1. VERTICAL CLEARANCES OF NEW SERVICES TO BUILDINGS AT LOCATIONS A, B, AND C AS SHOWN ABOVE MUST MEET THE FOLLOWING MINIMUM CLEARANCES FOR THE HIGHEST VOLTAGE BETWEEN ANY TWO CONDUCTORS.

CLEARANCES	LOCATION	MIN. AT 60° FINAL SAG	
		0-300V	300-600V
A OR B	OVER FLAT OR READILY ACCESSIBLE ROOF	8'	8'
A OR B	OVER SLOPED ROOF WHICH IS NOT READILY ACCESSIBLE	36"	8'
C	OVER OVERHANG PORTION OF ROOF (NO MORE THAN 4' OF CABLE)	18"	8'

2. A ROOF IS CONSIDERED READILY ACCESSIBLE WHEN ACCESS IS THRU A DOORWAY, RAMP, STAIRWAY, OR PERMANENTLY MOUNTED LADDER. A SLOPED ROOF IS ONE WHERE ROOF RISES 4" OR MORE IN 12" OF HORIZONTAL DISTANCE.

3. SERVICES MUST NOT BE INSTALLED WITHOUT SPECIFICATION CLEARANCES. FOR INSTALLATIONS SIMILAR TO SKETCH, SERVICE MAST SHOULD BE TALLER AND STRONGER, OR LOCATED NEAR CORNER. IF PRACTICAL, SERVICE SHOULD BE ATTACHED ON SIDE OF BUILDING WHERE IT DOES NOT CROSS THE ROOF. METER MAY BE ON SIDE OF BUILDING OR MAY BE PUT JUST AROUND THE CORNER BY CUSTOMER EXTENDING CONDUIT AROUND THE CORNER. SERVICES OF ALL VOLTAGES MAY BE ATTACHED TO THE SIDE OF BUILDINGS.

4. SERVICES SHALL ALSO HAVE 3' CLEARANCE IN ANY DIRECTION FROM WINDOWS, DOORS, PORCHES, OR SIMILAR LOCATIONS, EXCEPT THIS DOES NOT APPLY TO MULTIPLEX CONDUCTORS ABOVE THE TOP LEVEL OF A WINDOW OR TO WINDOWS NOT DESIGNED TO OPEN. PER N.E.S.C. 234C3d(2)

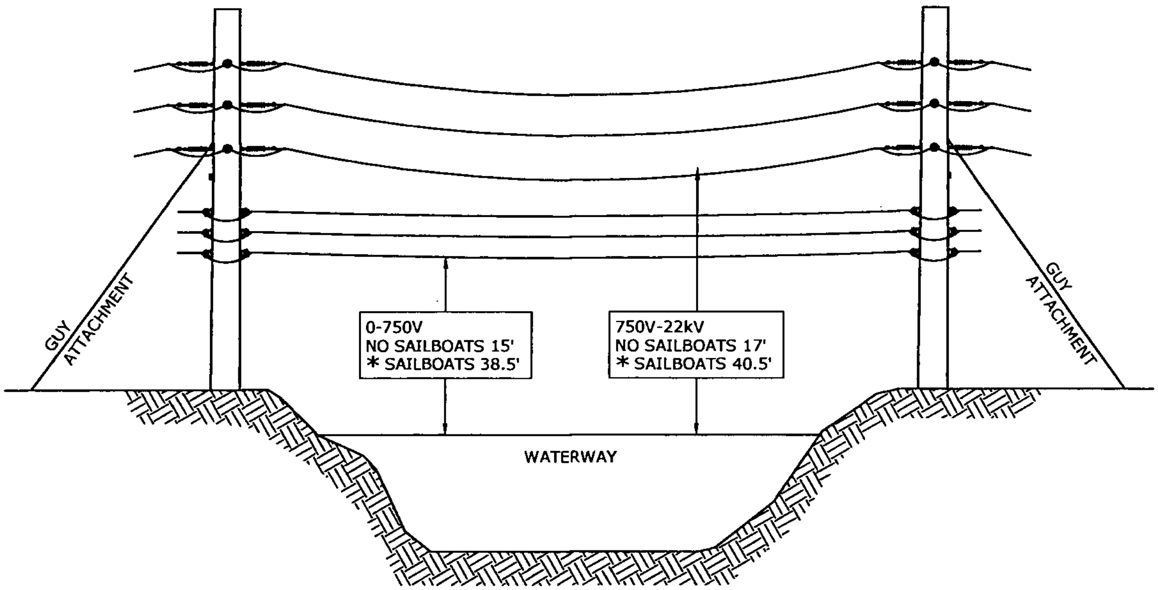
5. POINT OF ATTACHMENT OF SERVICE TO BUILDING SHALL BE HIGH ENOUGH TO PROVIDE THE GROUND CLEARANCES OF DWG. 09.02-04, BUT SHALL NOT EXCEED 25' ABOVE GRADE AT TIME OF INSTALLATION AND SHALL NOT REQUIRE THE USE OF A LADDER ON CARPORT OR OTHER ROOF.

REVISED	DATE	BY	CK'D	APPR.
3				
2				
1	4/1/11	SIMPSON	SIMPSON	ELKINS
0	7/12/10	GUINN	GUINN	ELKINS

DETAILS OF SERVICE FINAL SAG CLEARANCES

Duke Energy

PGN DWG. 09.02-05



DOUBLE DEADENDS ARE REQUIRED FOR ANY WATERWAY CROSSING.

SPECIAL CROSSING PERMIT CLEARANCES SHALL TAKE PRECEDENCE OVER THESE CLEARANCES.

* WHERE THE US ARMY CORPS OF ENGINEERS, OR THE STATE, OR SURROGATE THEREOF HAS ISSUED A CROSSING PERMIT, CLEARANCES OF THAT PERMIT SHALL GOVERN.

* THESE SAILBOAT CLEARANCES OVER NAVIGABLE WATERS PROVIDED NO BRIDGE CROSSINGS ARE ALSO INVOLVED. WHERE THERE IS ALSO A BRIDGE CROSSING, THESE CORPS OF ENGINEERS' CLEARANCES MUST BE MAINTAINED OVER THE BRIDGE RATHER THAN WATER.

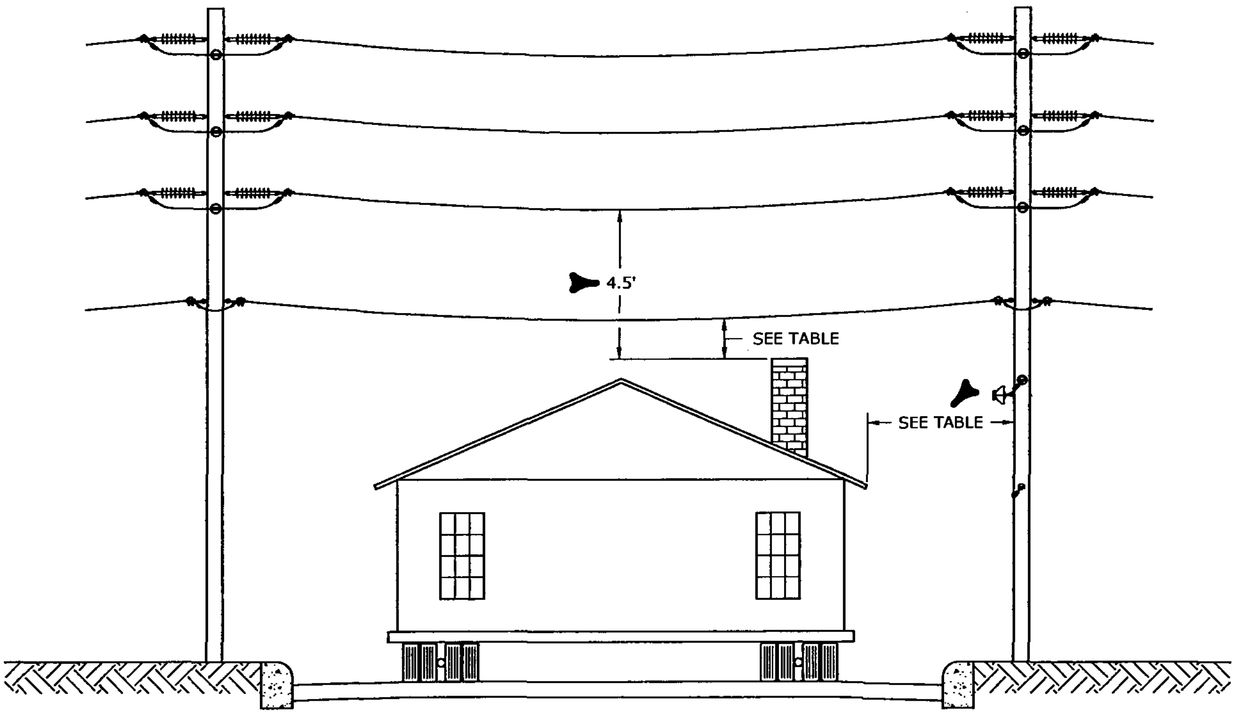
<u>NOTE:</u> CONSULT ENGINEERING FOR MANUAL GUYING REQUIREMENTS.

3				
2				
1				
0	7/12/10	GUINN	GUINN	EVANS
REVISED		BY	CK'D	APPR.

MINIMUM FINAL SAG CLEARANCES OVER WATERWAYS

Duke Energy®

PGN DWG. 09.02-06



THE CLEARANCE OF A BUILDING BEING TRANSPORTED UNDER DISTRIBUTION LINES IS TREATED THE SAME AS A MOVING VEHICLE PER THE NESC UNIFORM SYSTEM OF CLEARANCES. THE VERTICAL CLEARANCE ABOVE GROUND CONSISTS OF A REFERENCE COMPONENT WHICH IN THIS CASE WOULD BE THE HEIGHT OF THE BUILDING ON THE TRANSPORT VEHICLE, PLUS A MECHANICAL AND ELECTRICAL COMPONENT AS FOLLOWS:

CLEARANCE REQUIREMENTS		
CATEGORY	VERTICAL CLEARANCE REQUIRED (FT)	HORIZONTAL CLEARANCE REQUIRED (FT)
INSULATED COMMUNICATIONS: GROUNDED NEUTRALS GROUNDED GUYS AND SPAN GUY	1.5	3
TRIPLEX OR QUADRUPLEX	2	3.5
OPEN SECONDARY	2.5	5.5
PRIMARY (750-22 KV PHASE TO GROUND)	4.5	7

NOTES:

1. DISCONNECTING LINES:

NO CONDUCTOR IS PERMITTED TO BE TAKEN DOWN (INCLUDING THE NEUTRAL) UNLESS A PROPER CLEARANCE IS OBTAINED FORTHE LINE, IN ACCORDANCE WITH STANDARD CLEARANCE PROCEDURES.

2. TEMPORARY LIFTING OR PUSHING CONDUCTORS/CABLES UP WITH INSULATED STICKS, BOOMS OR HOT JACKS:

TEMPORARILY LIFTING IS NOT PERMITTED.

CONDUCTORS/CABLES MAY BE TEMPORARILY RAISED/RELOCATED BY RAISING SUPPORTS AT THE POLES.

3. DURING TRANSPORT OF THE BUILDING:

NO ONE IS PERMITTED ON TOP OF THE BUILDING.

ROAD AND OTHER CONDITIONS CAN CHANGE FROM THE TIME LINE CLEARANCES ARE CHECKED TO THE DAY OF THE MOVE. IT IS REQUIRED THAT A DUKE ENERGY EMPLOYEE ACCOMPANY THE MOVING BUILDING AND RE-CHECK CLEARANCES AS THE BUILDING APPROACHES EACH LINE.

REVISED		BY	CK'D	APPR.
3				
2				
1	3/22/13	GUINN	GUINN	ADCOCK
0	7/12/10	GUINN	GUINN	ELKINS

LINE CLEARANCES FOR MOVING STRUCTURE/HOUSE

DUKE ENERGY.

PGN DWG. 09.02-08

LOWER LEVEL	UPPER LEVEL				
	COMMUNICATION GUYS, SPAN WIRES AND MESSENGERS, COMMUNICATION CONDUCTORS AND CABLES (FT.)	EFFECTIVELY GROUNDED GUYS, SPAN WIRES, NEUTRAL CONDUCTORS AND LIGHTNING PROTECTION WIRES (FT.)	MULTIPLEX SECONDARY AND ALL SERVICES	OPEN WIRE SECONDARY, 0-750V	OPEN SUPPLY CONDUCTORS OVER 750V TO 22 kV (FT.)
EFFECTIVELY GROUNDED GUYS, SPAN WIRES, NEUTRAL CONDUCTORS AND LIGHTNING PROTECTION WIRES	2	2	2	2	4 SEE NOTE 5
COMMUNICATION GUYS, SPAN WIRES AND MESSENGERS; COMMUNICATION CONDUCTORS AND CABLES	2	2	2	4	5 SEE NOTE 3
MULTIPLEX SECONDARY AND ALL SERVICES	2	2	2	4 SEE NOTE 5	4 SEE NOTE 5
OPEN WIRE SECONDARY, 0-750 V	4	2	2	2	4 SEE NOTE 5
OPEN SUPPLY CONDUCTORS, 750 V TO 22 kV	6 SEE NOTE 3, 6	2	4 SEE NOTE 6	4 SEE NOTE 5	4 SEE NOTE 5

NOTES:

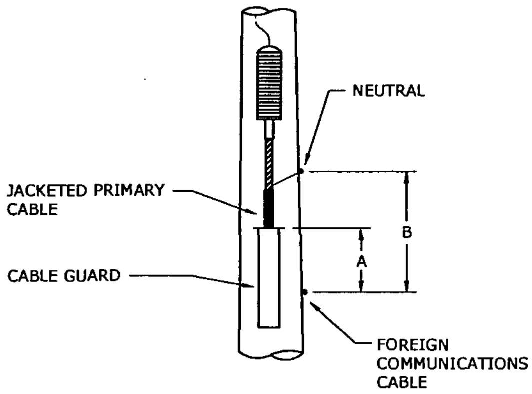
1. NO VERTICAL CLEARANCE IS REQUIRED BETWEEN WIRES ELECTRICALLY INTERCONNECTED AT THE CROSSING.
2. THE ABOVE CLEARANCES ARE FOR ANY LOCATION WHERE THE SUBJECT WIRES CROSS OR COULD BE CLOSEST TOGETHER, REGARDLESS OF SPAN LENGTHS. REFER TO NESC RULE 233.A.1 FOR APPLICABLE WIRE LOADING CONDITIONS TO USE IN DETERMINING WIRE POSITIONS AT CROSSING OR CLOSEST POINT.
3. MAY BE 4 FT. WHERE CROSSING IS MORE THAN 6 FT. HORIZONTALLY FROM A COMMUNICATION STRUCTURE AND VOLTAGE IS LESS THAN 8.7 kV PHASE-TO-GROUND.
4. VOLTAGES ARE PHASE-TO-GROUND FOR EFFECTIVELY GROUNDED WYE AND SINGLE-PHASE SYSTEMS, AND PHASE-TO-PHASE FOR ALL OTHER SYSTEMS.
5. PROGRESS ENERGY PREFERRED CLEARANCES ARE SHOWN.
6. IN GENERAL, CROSSINGS OF LOWER VOLTAGE WIRES ABOVE HIGHER VOLTAGE WIRES IS NOT RECOMMENDED. HIGHER VOLTAGE WIRES SHOULD BE POSITIONED ABOVE LOWER VOLTAGE WIRES WHENEVER POSSIBLE.
7. WHEN CONTEMPLATING UNDERBUILDING BENEATH PROGRESS ENERGY TRANSMISSION LINES, CONTACT THE TRANSMISSION LINE ENGINEERING UNIT.
8. FOR EXCEPTIONS AND REFINEMENTS, REFER TO NATIONAL ELECTRICAL SAFETY CODE RULE 233.
9. THE AREA BETWEEN THE NEUTRAL AND PRIMARY ON THE POLE AND IN THE SPAN IS NOT TO BE VIOLATED BY FOREIGN CONDUCTORS OR CABLES.
10. CROSSINGS SHOULD BE MADE ON A COMMON SUPPORTING STRUCTURE, WHERE PRACTICAL.

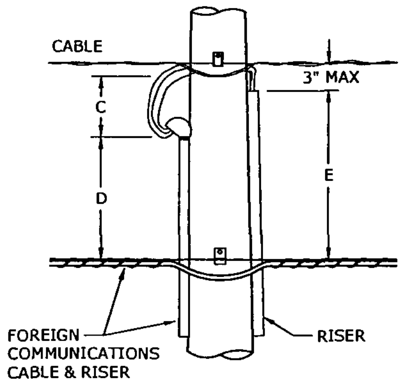
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MINIMUM FINAL SAG WIRE CROSSING CLEARANCES, VERTICAL

Duke Energy®

PGN DWG. 09.03-01





DIMENSION (LETTER)	PREFERRED MINIMUM
A	*40 INCHES
B	40 INCHES
C	16 INCHES
D	40 INCHES
E	40 INCHES

* 40 INCH CLEARANCE REQUIRED. ONLY FOR METALLIC CONDUCTOR OR U-GUARD NOT BONDED TO COMMUNICATIONS MESSENGER. SEE OH-UG TRANSITION SECTION FOR NON-METALLIC CONDUIT OR U-GUARD CLEARANCE.

3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SEPARATION AT POLE
UNDERGROUND RISERS

Duke Energy®

PGN DWG. 09.03-02

GENERAL

1. ANYONE REQUESTING AUTHORIZATION TO INSTALL AND MAINTAIN ATTACHMENTS ON PROGRESS ENERGY POLES SHALL SUBMIT THE APPROPRIATE EXHIBIT (PERMIT) AND/OR WRITTEN NOTIFICATION TO THE JOINT USE UNIT BEFORE ANY FACILITIES CHANGES ARE MADE. A PERMIT IS REQUIRED IN ORDER TO MAINTAIN ACCURATE ATTACHMENT INVENTORIES AND TO OBTAIN TECHNICAL DATA NECESSARY TO REVIEW THE ADEQUACY OF EXISTING DISTRIBUTION AND/OR TRANSMISSION SYSTEM FACILITIES. POLE UTILIZATION REQUIRING PERMITS INCLUDE: INSTALLATION OF NEW ATTACHMENTS, REMOVAL OF EXISTING ATTACHMENTS, UPGRADE TO LARGER CABLE, LASHING OF NEW CABLES TO EXISTING MESSENGERS, REBUILDS OF CABLE SYSTEMS, LARGE SCALE RELOCATIONS FOR ROAD WIDENING, ETC. AND INSTALLATION OF SERVICE DROPS ON LIFT POLES. SERVICE DROPS MAY BE PERMITTED MONTHLY ON ONE "AFTER THE FACT" PERMIT. MODIFICATIONS TO EXISTING FACILITIES WHICH REQUIRE ONLY NOTIFICATION IN WRITING INCLUDE: RELOCATION/REARRANGEMENT OF CABLES ON EXISTING POLES.

2. ALL PERMITTED ATTACHMENTS SHALL BE ON THE SAME SIDE OF THE POLE AS THE SECONDARY OR NEUTRAL, EXCEPT WHEN APPROVED IN WRITING BY PROGRESS ENERGY. PROGRESS ENERGY SHALL MAKE EVERY ATTEMPT TO INSTALL REPLACEMENT POLES ON THE FIELD SIDE OF EXISTING FOREIGN ATTACHMENTS.

3. NO PERMANENT CLIMBING AIDS ARE ALLOWED ON PROGRESS ENERGY POLES.

4. MESSENGER CABLE(S) SHALL BE BONDED WITH APPROPRIATE ELECTRICALLY RATED CONNECTORS TO THE ELECTRIC COMPANY'S VERTICAL GROUND WIRE, WHERE ONE EXISTS. PROTECTIVE MOLDING IF IN PLACE MAY BE CUT TO FACILITATE BONDING; HOWEVER, UNDER NO CIRCUMSTANCE, SHALL THE VERTICAL GROUND VERTICAL GROUND WIRE BE CUT. RUBBER GLOVES THAT ARE RATED FOR THE EXISTING PRIMARY VOLTAGE SHOULD BE USED WHEN MAKING THE BONDING CONNECTION.

5. ALL POWER SUPPLY INSTALLATIONS MUST HAVE APPROPRIATE DISCONNECT DEVICES. NEW STRAND MOUNTED POWER SUPPLIES WILL BE BILLED ON A METERED ACCOUNT BASIS. ALL NEW POWER SUPPLIES AND NEW METERING EQUIPMENT SHALL BE MOUNTED ONLY ON CUSTOMER OWNED FACILITIES.

6. AIR DRYERS, NITROGEN BOTTLES, CABINETS, LOAD COILS, ETC. SHALL NOT BE ATTACHED TO PROGRESS ENERGY POLES.

7. GENERALLY, ATTACHMENTS AND/OR SUPPORTS SHALL NOT EXTEND MORE THAN 4" FROM THE CLOSEST SURFACE OF THE POLE, UNLESS PRIOR APPROVAL IS OBTAINED FROM THE LOCAL PROGRESS ENERGY ENGINEERING DEPARTMENT.

8. CLEARANCES FROM GROUND AND OTHER FACILITIES SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE NESC, OR THE REQUIREMENTS SHOWN IN THIS MANUAL, WHICHEVER IS GREATER. EXISTING INSTALLATIONS WHICH WERE IN COMPLIANCE WITH THE NESC AT THE TIME OF THEIR ORIGINAL CONSTRUCTION NEED NOT BE MODIFIED UNLESS SPECIFIED BY LATEST EDITION OF NESC CODE HANDBOOK OR PROGRESS ENERGY SPECIFICATIONS.

9. ATTACHMENT LOCATIONS MAY BE ASSIGNED BY PROGRESS ENERGY AT SPECIFIC HEIGHTS. UNDER NO CIRCUMSTANCES WILL PROPER CLEARANCES FROM PROGRESS ENERGY FACILITIES BE VIOLATED.

10. ALL ATTACHMENTS ON PROGRESS ENERGY POLES SHALL BE TAGGED IN ACCORDANCE WITH THE LATEST PROGRESS ENERGY REQUIREMENTS.

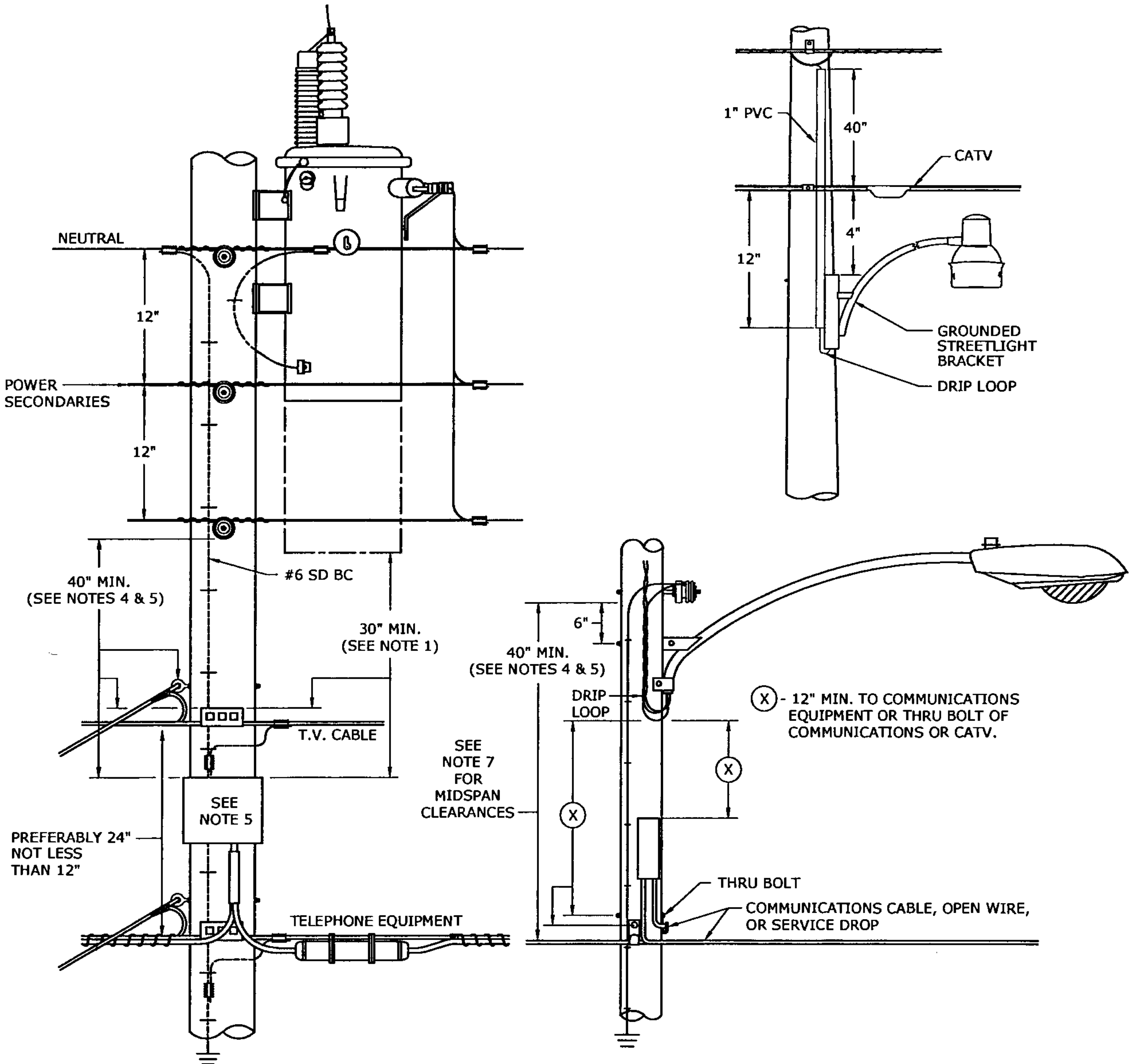
11. REQUESTS FOR EXCEPTIONS TO THIS DESIGN GUIDE SHALL BE REFERRED TO THE JOINT USE UNIT. ANY EXCEPTIONS APPROVED WILL BE DISTRIBUTED TO THE REGIONS FOR UNIFORM APPLICATION ON A SYSTEM-WIDE BASIS.

3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

FOREIGN ATTACHMENTS & CLEARANCES

Duke Energy®

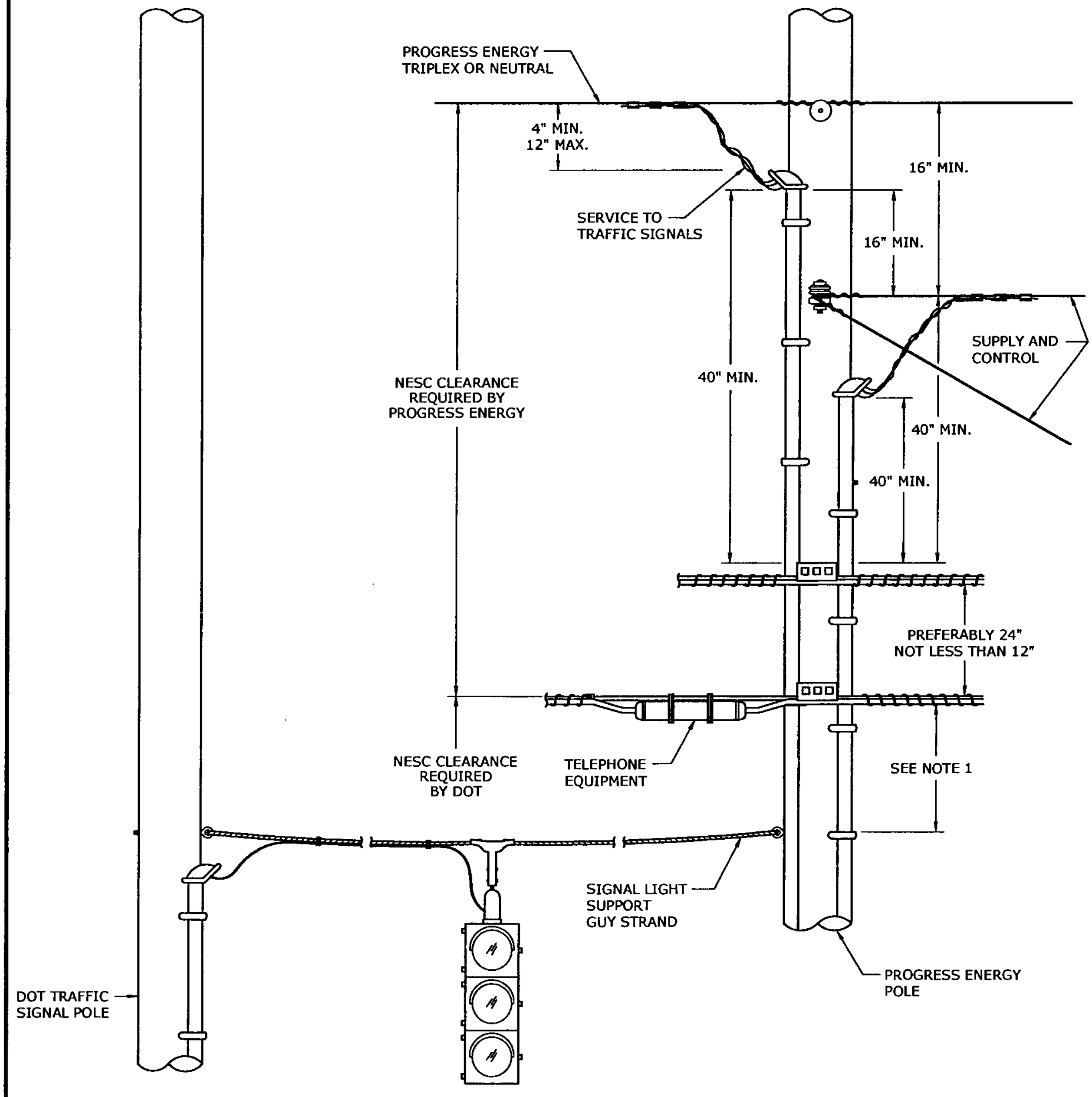
PGN DWG. 09.04-01



NOTES:

1. THIS DIMENSION OF NOT LESS THAN 30" APPLIES BETWEEN CONDUCTORS AND NON-CURRENT CARRYING PARTS OF EQUIPMENT THAT ARE EFFECTIVELY GROUNDED.
2. WHERE T.V. CABLE DOES NOT EXIST, MINIMUM DIMENSIONS APPLY TO TELEPHONE EQUIPMENT.
3. WHERE POWER AND COMMUNICATION LINES ARE BETWEEN THE SAME POLES, THESE CLEARANCES MAY BE INCREASED IF THE COMMUNICATION CONDUCTOR HAS LESS SAG THAN THE POWER CONDUCTORS SO AS TO PROVIDE A MINIMUM OF 30" SEPARATION IN THE SPAN.
4. A 40" MINIMUM CLEARANCE IS REQUIRED BETWEEN CLOSEST METAL PARTS OF COMMUNICATION AND UNGROUNDED POWER EQUIPMENT.
5. ONLY TELEPHONE TERMINAL BOXES AND AMPLIFIERS PERMITTED ABOVE COMMUNICATION CABLES.
6. THE CLEARANCES ON THIS DRAWING APPLY TO BOTH GROUNDED METALLIC COMMUNICATION CABLES AND DIELECTRIC FIBER OPTIC CABLES.
7. MIDSPAN CLEARANCE BETWEEN COMMUNICATION AND SUPPLY CONDUCTORS (INCLUDING THE NEUTRAL) IS TO BE 30".
8. JOINT USER SHALL BOND MESSENGER WIRES TO PE GROUNDWIRE PER NESC REQUIREMENTS.
9. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3					JOINT USE CONSTRUCTION	Duke Energy
2						
1						
0	7/12/10	GUINN	GUINN	ELKINS		PGN DWG. 09.04-02
REVISED		BY	CK'D	APPR.		



FRONT VIEW

NOTES:

1. DOT REQUIREMENTS:
   FOR EFFECTIVELY BONDED SPAN WIRES, THIS CLEARANCE MAY BE 4" (12" PREFERRED). FOR UNBONDED SPAN WIRES, THE CLEARANCE MUST BE 20".

3			
2			
1			
0 7/12/10	GUINN	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

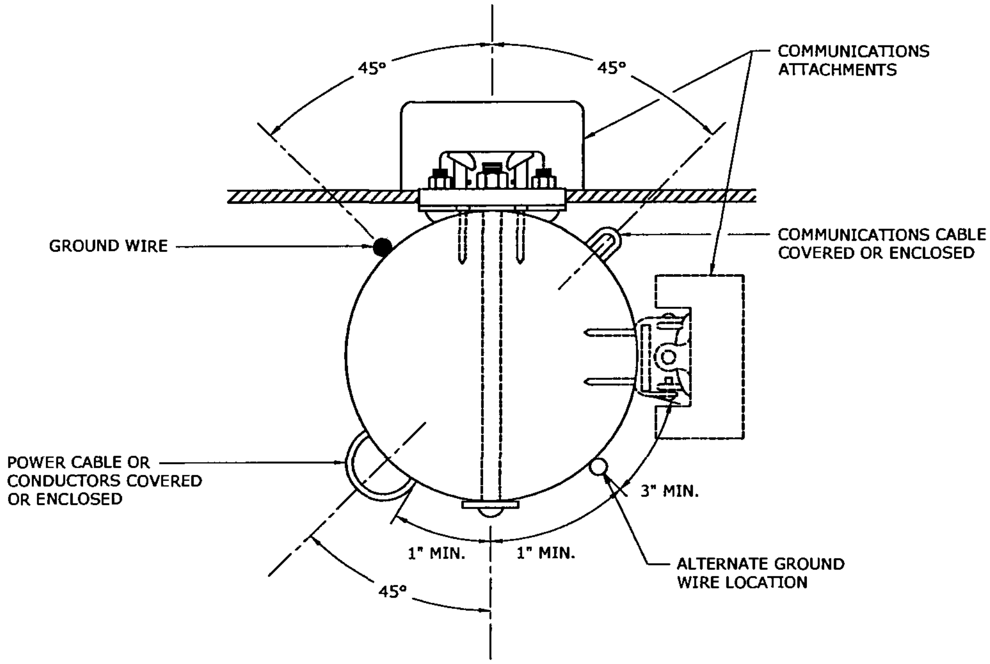
JOINT USE CONSTRUCTION
TRAFFIC SIGNAL SUPPORT AND
POWER OPERATING CIRCUIT CLEARANCES

Duke Energy®

PGN

DWG.
09.04-03

LOCATION OF VERTICAL RUNS

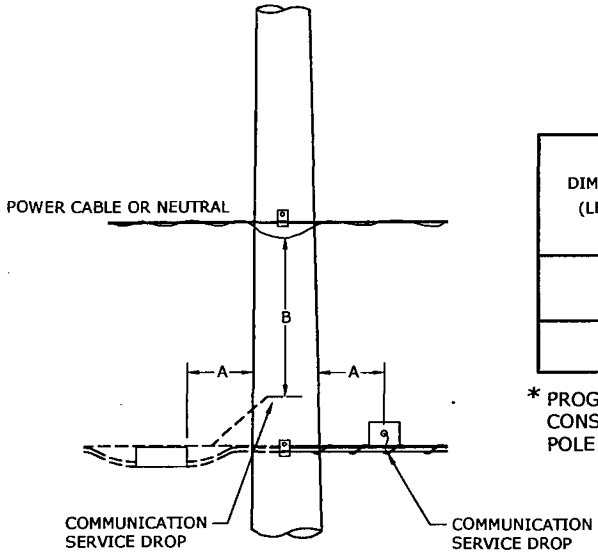


STREET SIDE

NOTES:

1. DO NOT LOCATE GROUNDED EQUIPMENT LESS THAN 1" FROM A BOLT OR STAPLE.
2. LOCATE U-GUARD ON SIDE OF POLE AWAY FROM TRAFFIC.

FOREIGN SERVICE DROPS



DIMENSION (LETTER)	NESC REQUIREMENT MINIMUM	PROGRESS ENERGY PREFERRED MINIMUM	NESC APPLICABLE REFERENCE SECTION
A	ALLOWED ON POLE	* 12 INCHES	239 F2
B	40 INCHES	40 INCHES	239 F2

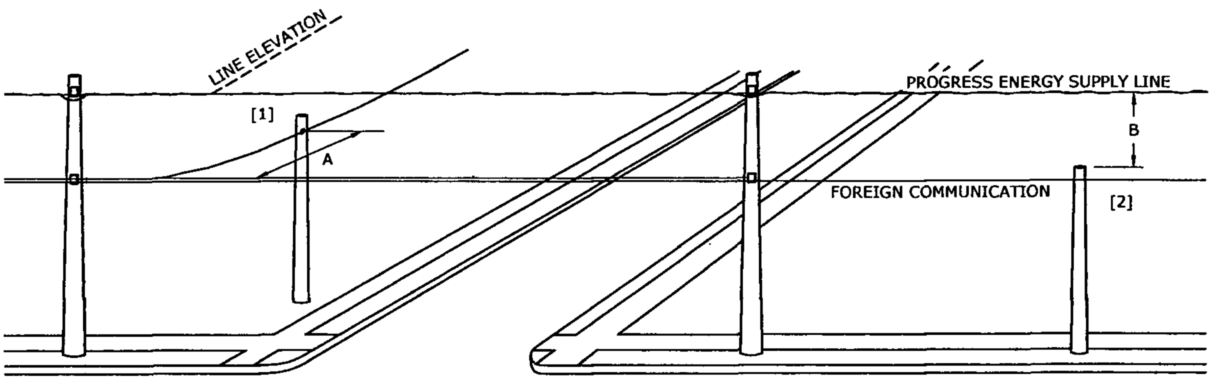
* PROGRESS ENERGY REQUIREMENT - NOT OPTIONAL ON NEW CONSTRUCTION - THIS CLEARANCE TO FACILITATE FUTURE POLE CHANGE OUT AND CLIMBING SPACE.

3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOCATION OF VERTICAL RUNS & FOREIGN SERVICE DROPS

Duke Energy

PGN DWG. 09.04-04



DIMENSION (LETTER)	SITUATION	NEC REQUIRED MINIMUM
A	VERTICAL DISTANCE FROM TOP OF POLE [1] TO LEVEL OF PRIMARY OR OPEN WIRE SECONDARY IS 5 FEET OR LESS	5 FEET
	VERTICAL DISTANCE FROM TOP OF POLE [1] TO LEVEL OF THE PRIMARY OR OPEN WIRE SECONDARY IS MORE THAN 5 FEET	3 FEET
B	POLE [2] FOREIGN OWNED AND PROGRESS ENERGY SUPPLY LINE VOLTAGE OVER 22kV Ø-N	5.5 FEET
	POLE [2] FOREIGN OWNED AND PROGRESS ENERGY SUPPLY LINE VOLTAGE UNDER 22kV Ø-N	4.5 FEET
	POLE [2] OWNED BY PROGRESS ENERGY VOLTAGE <22kV	2.5 FEET
	POLE [2] FOREIGN OR PROGRESS ENERGY OWNED AND PROGRESS ENERGY SUPPLY LINE CLASSIFIED GUY, NEUTRAL OR SECONDARY CABLE, <300V TO GROUND	2 FEET

NOTE: CHART BASED ON CLEARANCES DEFINED IN SECTION 234 OF NESC.

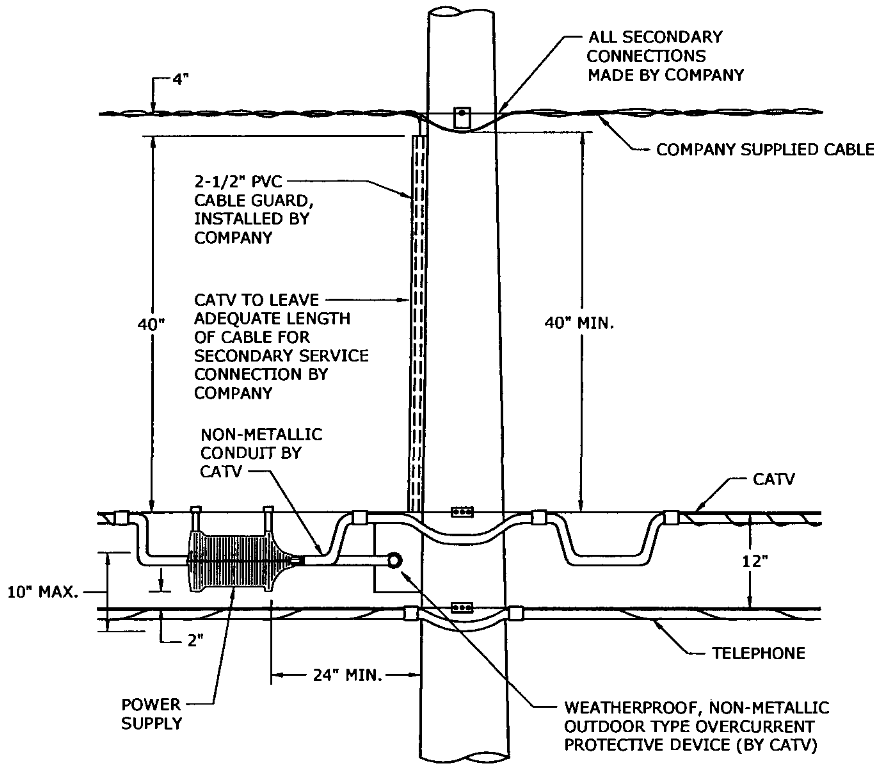
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS

FOREIGN POLE CLEARANCE AT FINAL SAG

Duke Energy®

PGN DWG. 09.04-05

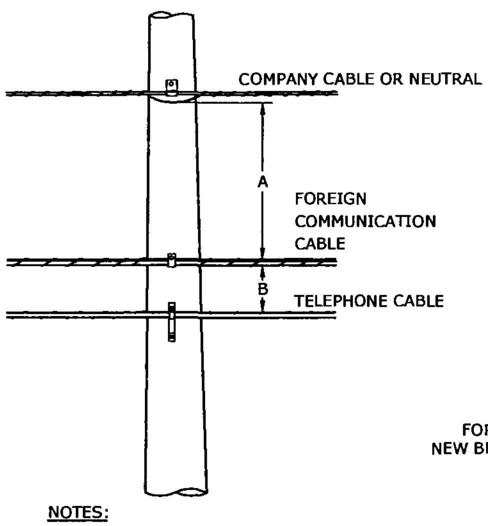
STRAND MOUNTED POWER SUPPLY

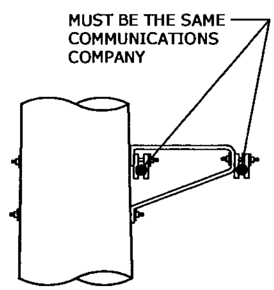


MTNC ONLY

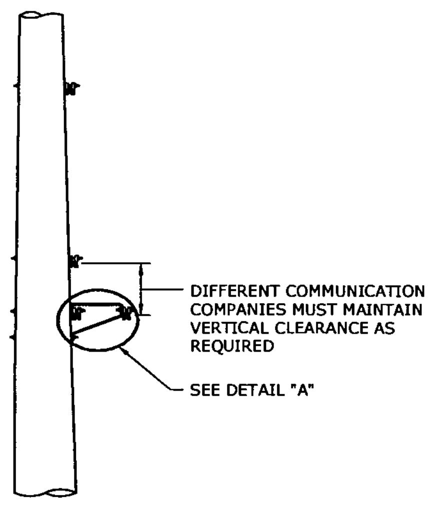
DIMENSION (LETTER)	NESC REQUIREMENT MINIMUM	COMPANY PREFERRED MINIMUM	NESC APPLICABLE REFERENCE SECTION
A	40 INCHES	40 INCHES	235 C1
B	3 INCHES	* 12 INCHES	239 F1

* COMPANY REQUIREMENT - NOT OPTIONAL





DETAIL "A"
FOR MAINTENANCE ONLY
NEW BRACKETS NOT PERMITTED



NOTES:

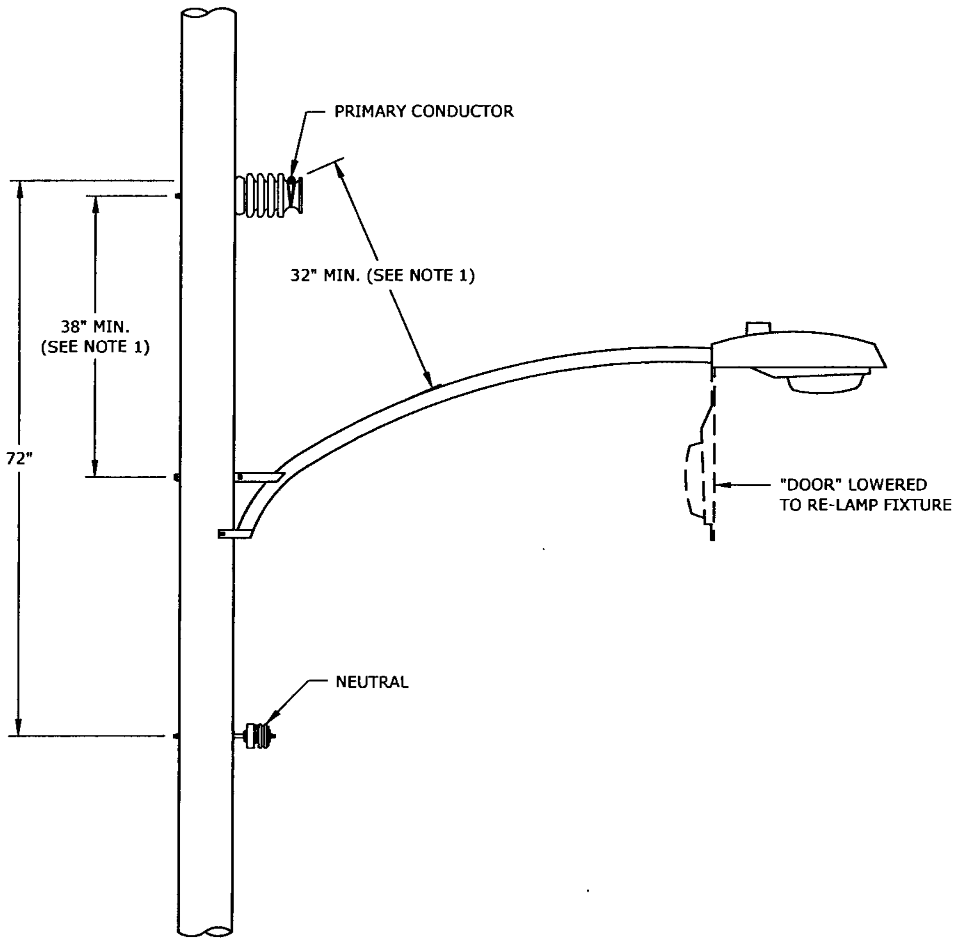
1. EXTENSION BRACKET MUST BE MOUNTED ON EXISTING CABLE SIDE ONLY.
2. EXTENSION BRACKET MAY BE UTILIZED IN TANGENT SITUATIONS ONLY, NOT APPROVED FOR DEAD-END POLES.
3. EXTENSION BRACKET MANUFACTURER'S SPECIFICATIONS MUST RECEIVE COMPANY APPROVAL PRIOR TO UTILIZATION.

3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STRAND MOUNTED POWER SUPPLY &
FOREIGN COMMUNICATION CABLE
EXTENSION BRACKET

Duke Energy

PGN DWG. 09.04-06



LIGHTING UNIT ABOVE NEUTRAL

NOTES:

1. THIS DRAWING SHOWS MINIMUM CLEARANCE, PRIMARY CONDUCTOR TO BRACKET, FOR ONE TYPE OF BRACKET. THIS CLEARANCE SHALL BE MAINTAINED FOR ALL STYLES OF BRACKETS, OR ANY PART OF THE BRACKET. SEE OTHER DRAWINGS AND/OR ENGINEER'S INSTRUCTIONS FOR ACTUAL MOUNTING HEIGHTS.

2. FOR CLEARANCES - LIGHTING UNITS BELOW SECONDARY AND ABOVE COMMUNICATION CIRCUITS OR EQUIPMENT, SEE DWG. 09.04-02.

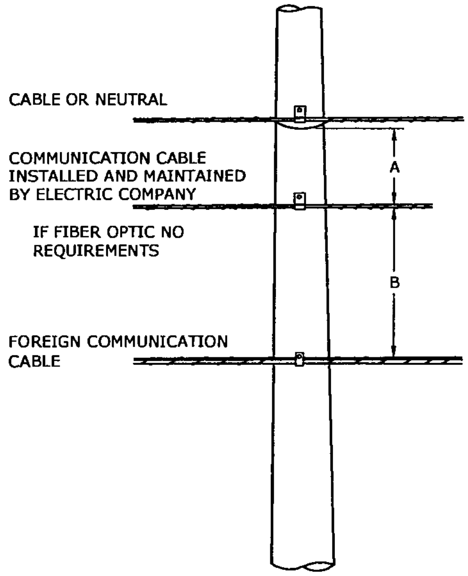
3. SEE DWG. 09.04-02 IF TELECOM IS ATTACHED.

3				
2				
1				
0	10/1/10	ROBESON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

CLEARANCES - LIGHTING UNITS
TO POWER CIRCUITS OR EQUIPMENT

Duke Energy®

FLA | DWG. 09.04-07



DIMENSION (LETTER)	NESC REQUIREMENT MINIMUM
A	* 16 INCHES
B	40 INCHES

* NO CLEARANCE IS SPECIFIED BETWEEN NEUTRAL CONDUCTORS AND INSULATED COMMUNICATION CABLES LOCATED IN THE SUPPLY SPACE AND SUPPORTED BY AN EFFECTIVELY GROUNDED MESSENGER.

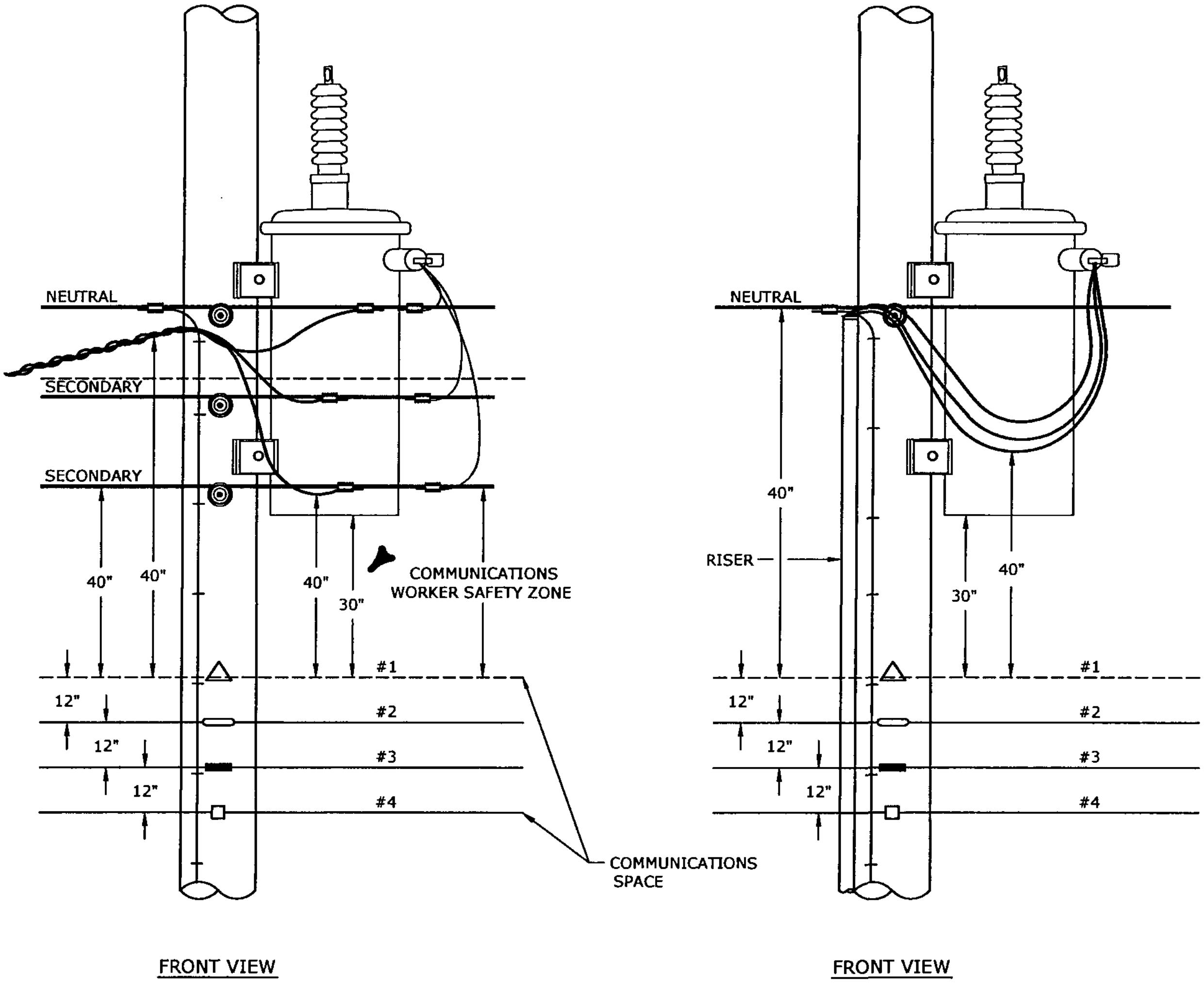
NO CLEARANCE IS SPECIFIED BETWEEN SUPPLY CONDUCTORS AND FIBER-OPTIC SUPPLY CABLES THAT ARE COMPLETELY DIELECTRIC (INCLUDING THE MESSENGER).

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS

COMMUNICATION CABLE INSTALLED AND MAINTAINED BY ELECTRIC COMPANY

Duke Energy

PGN DWG. 09.04-09



ADDITIONAL MIN. CLEARANCES AT THE POLE	
LIGHT BRACKET	12"
SPAN GUY	12"
DOWN GUY	12"

MINIMUM CLEARANCES MIDSPAN	
PRIMARY	30"
NEUTRAL	30"
SECONDARY	30"
SERVICE DROP	30"
SPAN GUY	12"

NOTES:

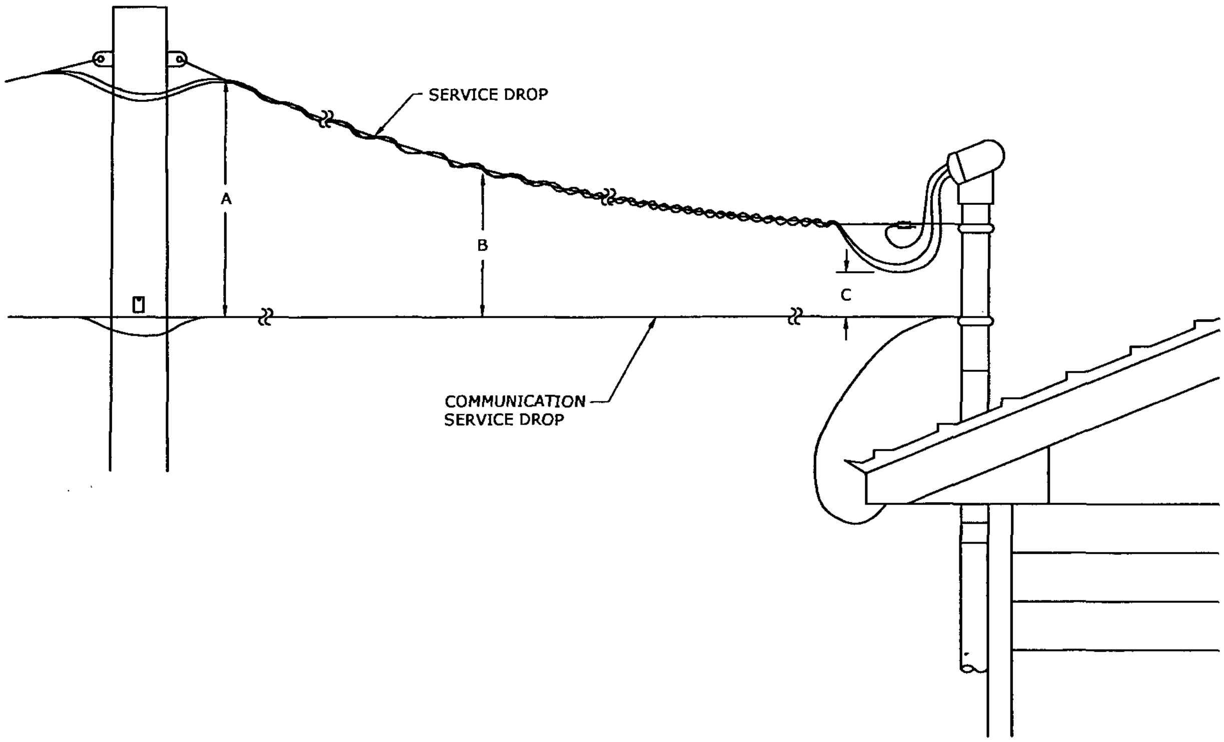
1. PROGRESS ENERGY FIBER OPTIC CABLE LOCATED AT THE BOTTOM OF THE SUPPLY SPACE (i.e. LESS THAN 40" FROM POWER) MUST HAVE A MINIMUM CLEARANCE OF 40" BETWEEN THE FIBER OPTIC CABLE AND THE TOP COMMUNICATIONS CABLE TO ENSURE THE 40" COMMUNICATION WORKER SAFETY ZONE IS NOT VIOLATED.
2. CLEARANCES SHOWN FROM ELECTRICAL FACILITIES TO JOINT USE FACILITIES ARE MINIMUM CLEARANCES.

3				
2				
1	4/19/11	GUINN	BURLISON	ELKINS
0	9/3/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

JOINT USE CLEARANCE REQUIREMENTS

Duke Energy®

PGN DWG. 09.04-14



DIMENSION (LETTER)	* NESC MINIMUM REQUIREMENT	PROGRESS ENERGY PREFERRED MINIMUM REQUIREMENT	NESC APPLICABLE REFERENCE SECTION
A	40"	40"	235-5
B	12"	12"	235 C1 EXCEPTION 3
C	12"	12"	235 C1 EXCEPTION 3

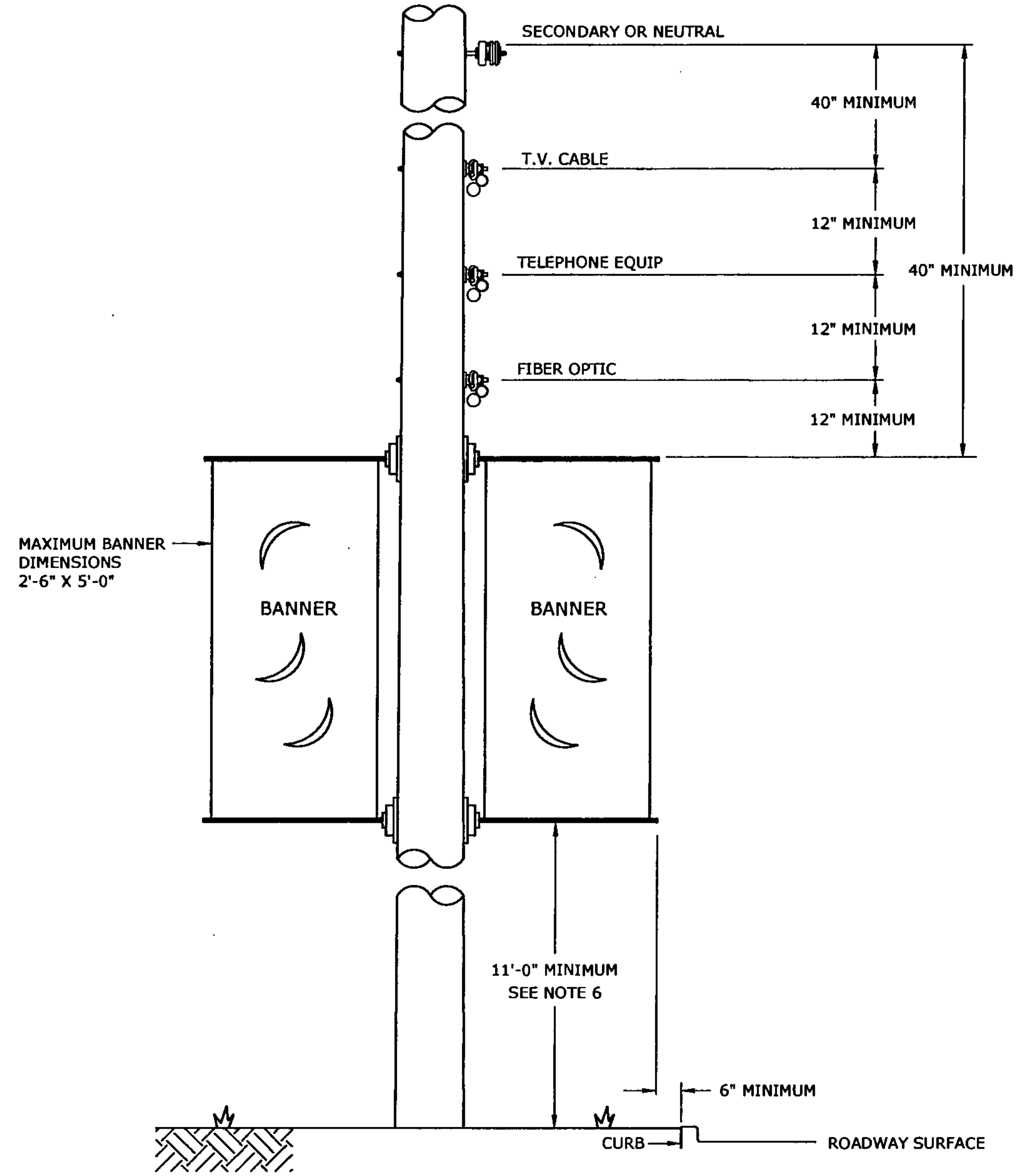
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SERVICE DROP CLEARANCE
TO COMMUNICATION CABLES

Duke Energy®

PGN

DWG.
09.04-16



NOTES:

1. POLE MUST BE INSPECTED FOR STRUCTURAL INTEGRITY PRIOR TO BANNER ATTACHMENT.
2. BANNERS SHOULD NOT BE ATTACHED TO POLES WITH YELLOW OR WHITE INSPECTION TAGS.
3. BANNER AGREEMENT MUST BE COMPLETED PRIOR TO BANNER ATTACHMENT TO COMPANY DISTRIBUTION POLES.
4. BANNERS ATTACHED TO POLES SHOULD BE PERPENDICULAR TO POWER LINES.
5. SEE SECTION 09 FOR ADDITIONAL CLEARANCES.
6. BANNERS THAT EXTEND OVER ROADWAY SHOULD HAVE 18'-0" VERTICAL CLEARANCE FROM ROAD SURFACE.
7. THE BANNERS MUST HAVE HALF CIRCLE AIR POCKETS CUT INTO THEM.
8. COMPANY SHALL NOT BE RESPONSIBLE FOR REMOVING AND/OR REBANDING TOWN'S BANNERS WHENEVER THE POLES ARE REPLACED.
9. CUSTOMER AGREES TO INDEMNIFY, DEFEND, AND SAVE HARMLESS COMPANY FROM ALL CLAIMS, LOSSES, INJURIES, DAMAGES AND OTHER DEMANDS MADE AGAINST IT AND ALL COSTS AND EXPENSES INCURRED BY COMPANY ARISING OUT OF THIS AGREEMENT UNLESS SAME SHALL HAVE RESULTED FROM SOLE NEGLIGENCE OF COMPANY.

3				
2				
1				
0	10/1/10	ROBESON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

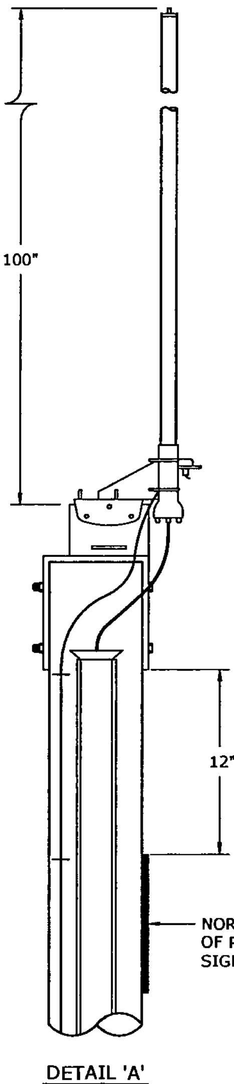
BANNER INSTALLATION

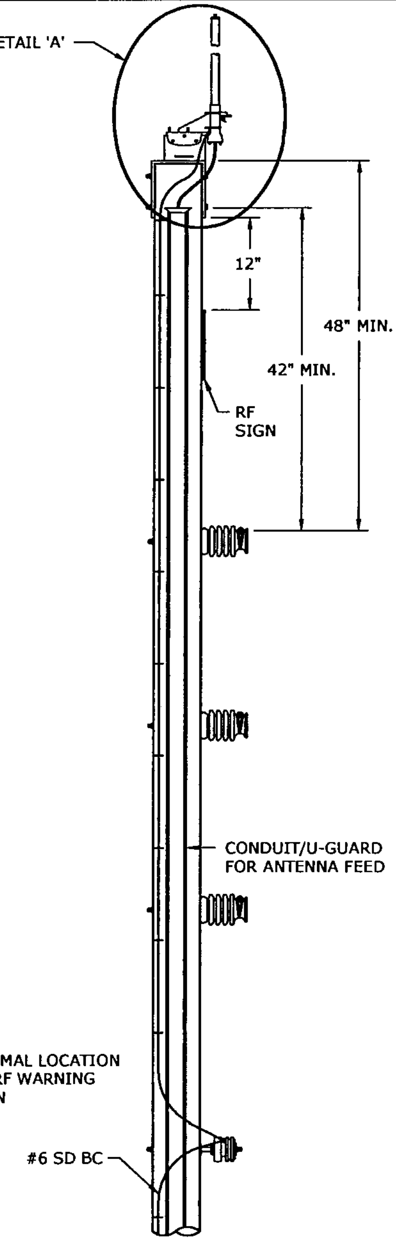
ON DISTRIBUTION POLES

Duke Energy®

FLA

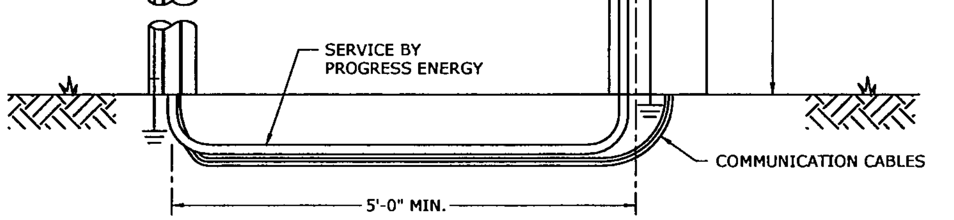
DWG. 09.04-25





NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS APPROVED BY PROGRESS ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. DIP, ETC.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL PGN JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
5. A MINIMUM CLASS 3 POLE IS REQUIRED. IF POLE EXCEEDS 60' ABOVE GROUND, CONTACT DISTRIBUTION STANDARDS FOR STRENGTH AND LOADING ANALYSIS.
6. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC OCCUPATIONAL/CONTROLLED CLASS LIMITS. WARNING SIGN - "WARNING - ANTENNA RADIATION. MINIMUM APPROACH DISTANCE IS X FT."
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY P.E. DISTRIBUTION.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON THE PROGRESS ENERGY POLE IS THE ANTENNA, THE CABLE FEEDING THE ANTENNA AND THE CABLE FEEDING THE AMPLIFIER IN THE PEDESTAL.
9. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.



LINE INSULATION:
BECAUSE POLE GROUND GOES TO TOP OF POLE, EXISTING LINE INSULATORS MUST BE HIGHER VOLTAGE THAN NORMAL.

12KV SYSTEM:
USE 35KV INSULATOR

23KV SYSTEM:
USE 45KV INSULATOR

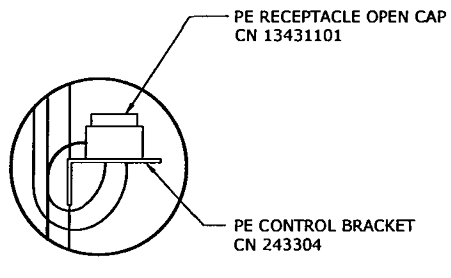
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

JOINT USE CONSTRUCTION

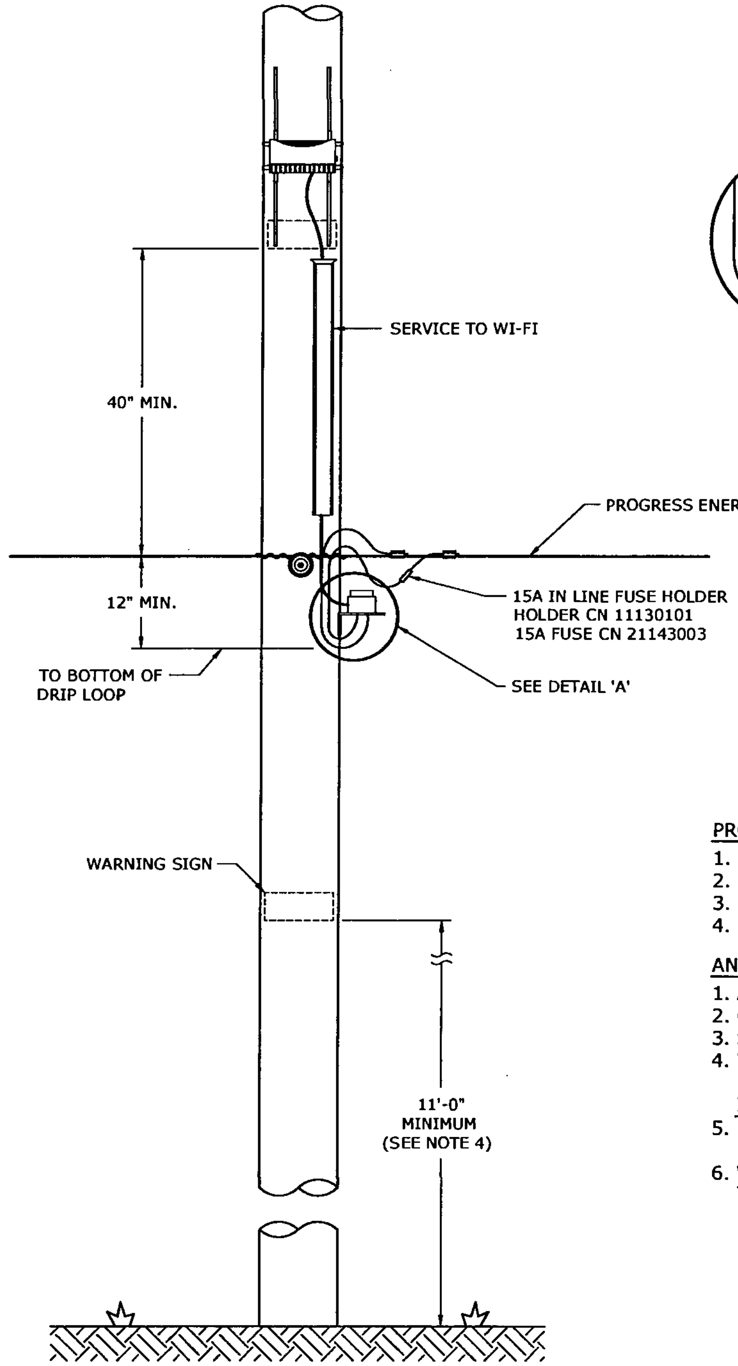
(DAS) DISTRIBUTED ANTENNA SYSTEMS

Duke Energy

PGN DWG. 09.04-30



DETAIL 'A'



FRONT VIEW

PROGRESS ENERGY PROVIDE AND INSTALL:

1. FUSE HOLDER AND FUSE
2. PHOTOCONTROL BRACKET
3. SERVICE CONNECTION
4. RECEPTACLE OPEN CAP

ANTENNA COMPANY PROVIDE AND INSTALL:

1. ANTENNA
2. CONDUIT/ U-GUARD
3. SERVICE CABLE
4. WARNING SIGN - "WARNING - ANTENNA RADIATION. MINIMUM APPROACH DISTANCE IS X FT".
5. PROPER GROUNDING IN ACCORDANCE WITH NESC REQUIREMENTS.
6. WI-FI ANTENNA INSTALLER MUST BE QUALIFIED TO WORK IN SUPPLY SPACE.

NOTES:

1. **DO NOT** INSTALL ANTENNAS ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, REGULATOR, SWITCHES, U.G. DIP, ETC.
2. ALL ANTENNA LOCATIONS MUST BE APPROVED BE BY A PROGRESS ENERGY DISTRIBUTION ENGINEER.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d.

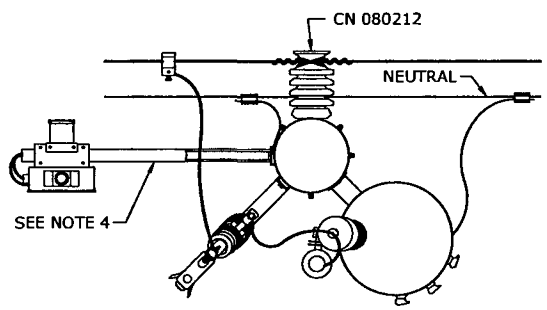
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/1/10	GUINN	GUINN	ELKINS

JOINT USE CONSTRUCTION
WI-FI ANTENNA INSTALLATION
ON SERVICE POLE

Duke Energy®

FLA

DWG. 09.04-32

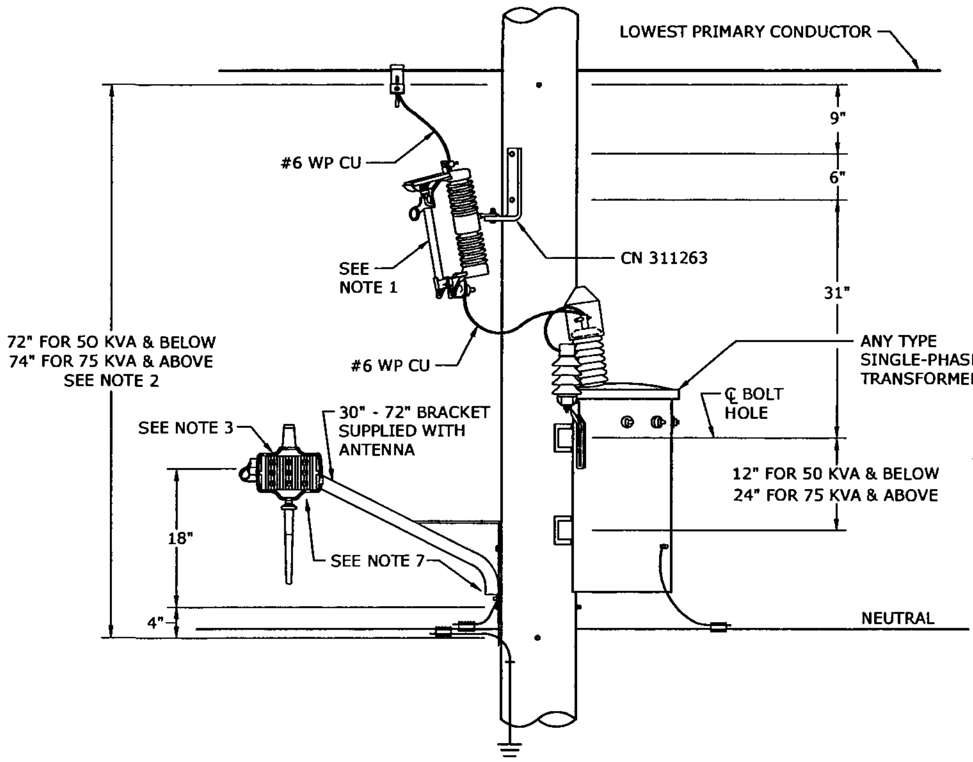


PLAN VIEW

WHAT SHOULD LINE RESOURCES DO IF THEY ENCOUNTER ONE OF THESE DEVICES DURING A RESTORATION EFFORT?

- RECOGNIZE THAT THE DEVICE IS PROGRESS ENERGY/ DUKE ENERGY EQUIPMENT.
- IF THE DEVICE CAN REMAIN ON THE POLE AND CAN BE RE-ENERGIZED AFTER YOU FINISH YOUR POLE WORK, LEAVE THE DEVICE MOUNTED, FINISH YOUR WORK ON THE POLE AND RECONNECT THE POWER TO THE UNIT.
- IF THE DEVICE IS DAMAGED, GATHER UP THE PARTS IN A BAG AND TAG IT WITH THE NEAREST ADDRESS, AND TAKE IT TO THE OPS CENTER OR STAGING AREA YOU ARE ASSIGNED.
- IF THE DEVICE MUST BE REMOVED FROM THE POLE AND CANNOT BE REMOUNTED DUE TO THE WORK YOU ARE PERFORMING OR THE CONDITION OF THE DEVICE, DISCONNECT THE DEVICE, TAG IT WITH THE NEAREST ADDRESS, AND TAKE IT TO THE OPS CENTER OR STAGING AREA YOU ARE ASSIGNED.

PROGRESS ENERGY/ DUKE ENERGY SUPERVISION SHOULD REPORT IT TO IT.



FRONT VIEW

NOTES:

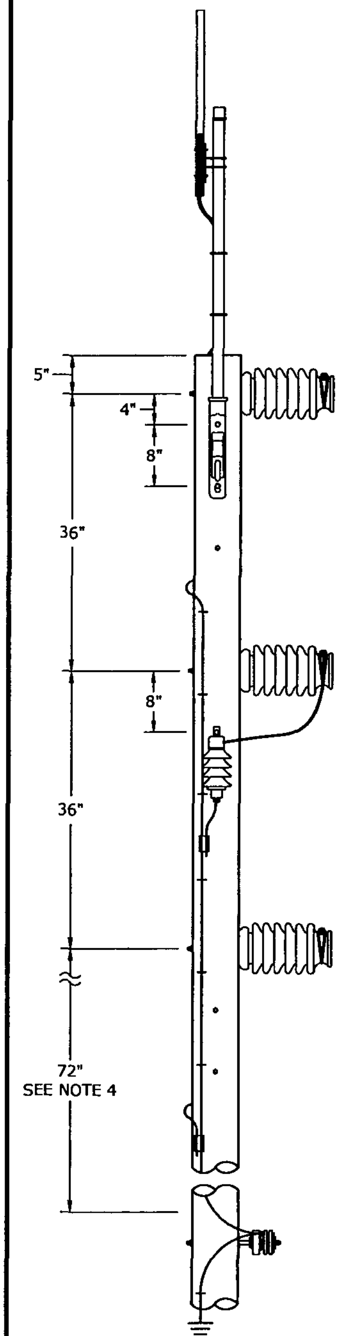
1. TYPICAL INSTALLATION. THE ANTENNA DOES NOT HAVE TO BE LOCATED ON A TRANSFORMER POLE; HOWEVER, 120V POWER IS REQUIRED AT THE POLE. ANTENNA MAY NOT BE INSTALLED ON AN EXISTING BRACKET WITH A LIGHT OR ON A POLE DESIGNATED AS A "STREET LIGHT POLE". IT MAY BE INSTALLED ON A "DISTRIBUTION POLE" THAT ALSO HAS A LIGHT AS LONG AS SITE CONDITIONS PERMIT AND THE ANTENNA IS ON ITS OWN BRACKET.
2. THE QUADRANT FOR THE INSTALLING THE TRANSFORMER, CUTOUT, ANTENNA AND OTHER EQUIPMENT MAY VARY FROM LOCATION TO LOCATION. STANDARD TRANSFORMER/CUTOUT SPACING SHOULD BE FOLLOWED FOR NEW CONSTRUCTION PER SECTION 6 OF THE DISTRIBUTION CONSTRUCTION SPECIFICATIONS. SECTION 6 PERMITS EXISTING LINES WITH 60" NEUTRAL SPACING TO REMAIN AT 60" IF 72" CANNOT BE OBTAINED WITHOUT CHANGING POLE.
3. THE ANTENNA BRACKET MUST BE BONDED TO THE NEUTRAL OR POLE GROUND.
4. WHEN SITE CONDITIONS PERMIT, ORIENT THE ANTENNA BRACKET SO IT EXTENDS OVER ROADWAY TO MAXIMIZE ANTENNA EFFICIENCY.
5. WHEN BRACKET CAN BE INSTALLED PERPENDICULAR TO PRIMARY LINE AND OPPOSITE THE TRANSFORMER AND CUTOUT, A 72" BRACKET CAN BE USED TO MAXIMIZE ANTENNA EFFICIENCY.
6. THE ANTENNA BRACKET SHALL BE INSTALLED WITH THROUGH BOLTS ON WOOD POLES. SQUARE CONCRETE DISTRIBUTION POLES MAY BE DRILLED OR BANDED. THE BRACKET MAY BE MOVED VERTICALLY A FEW INCHES TO AVOID CONFLICT WITH TRANSFORMER BOLTS; HOWEVER, THE ANTENNA MUST REMAIN ABOVE THE NEUTRAL. NO HOLES SHOULD BE DRILLED CLOSER THAN 4" VERTICALLY.
7. AQUASEAL ALL POINTS WHERE WIRE EXITS BRACKETS AND WHERE CONNECTIONS ARE MADE TO THE RELAY/BATTERY. ALSO AQUASEAL THE ENDS OF THE BRACKET TO PREVENT ANIMALS FROM USING AS HOME.
8. SEE DWG. 09.04-33B WHEN MOUNTING ANTENNA ON POLE TOP.

REVISED		BY	CK'D	APPR.
3				
2	10/5/12	BURLISON	BURLISON	ADCOCK
1	2/10/12	BURLISON	BURLISON	ELKINS
0	1/27/12	BURLISON	BURLISON	ELKINS

TYPICAL NGDR AMI TELECOM NAN ATTACHMENT

Duke Energy®

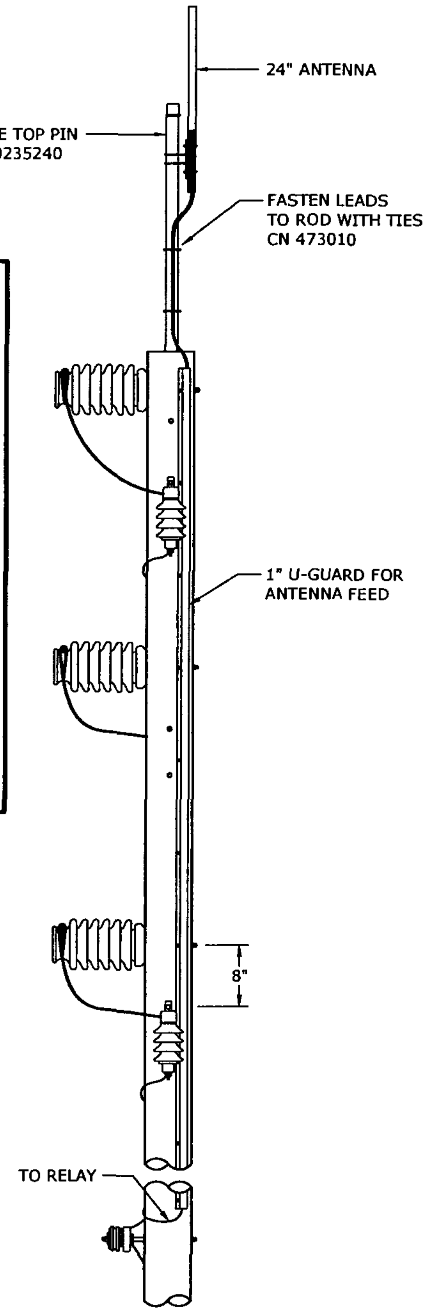
FLA DWG. 09.04-33A



WHAT SHOULD LINE RESOURCES DO IF THEY ENCOUNTER ONE OF THESE DEVICES DURING A RESTORATION EFFORT?

- RECOGNIZE THAT THE DEVICE IS PROGRESS ENERGY/ DUKE ENERGY EQUIPMENT.
- IF THE DEVICE CAN REMAIN ON THE POLE AND CAN BE RE-ENERGIZED AFTER YOU FINISH YOUR POLE WORK, LEAVE THE DEVICE MOUNTED, FINISH YOUR WORK ON THE POLE AND RECONNECT THE POWER TO THE UNIT.
- IF THE DEVICE IS DAMAGED, GATHER UP THE PARTS IN A BAG AND TAG IT WITH THE NEAREST ADDRESS, AND TAKE IT TO THE OPS CENTER OR STAGING AREA YOU ARE ASSIGNED.
- IF THE DEVICE MUST BE REMOVED FROM THE POLE AND CANNOT BE REMOUNTED DUE TO THE WORK YOU ARE PERFORMING OR THE CONDITION OF THE DEVICE, DISCONNECT THE DEVICE, TAG IT WITH THE NEAREST ADDRESS, AND TAKE IT TO THE OPS CENTER OR STAGING AREA YOU ARE ASSIGNED.

PROGRESS ENERGY/ DUKE ENERGY SUPERVISION SHOULD REPORT IT TO IT.



NOTES:

1. POWER SUPPLY/ REPEATER SHALL BE INSTALLED ON A 30" BRACKET NEAR NEUTRAL PER DWG. 09.04-33A.
2. 12 KV, 13 KV AND 25 KV SYSTEM
   USE 35 KV INSULATORS
3. INSTALL LIGHTNING ARRESTERS ON ALL PHASES.
4. 72" CLEARANCE IS FOR NEW CONSTRUCTION. IT IS ACCEPTABLE TO LEAVE SPACING AT 60" IF REPLACING A TRANSFORMER OR IF LOWERING THE NEUTRAL WOULD CAUSE A CLEARANCE ISSUE WITH JOINT USERS BELOW THE NEUTRAL.

3				
2				
1	10/5/12	BURLISON	BURLISON	ADCOCK
0	2/13/12	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

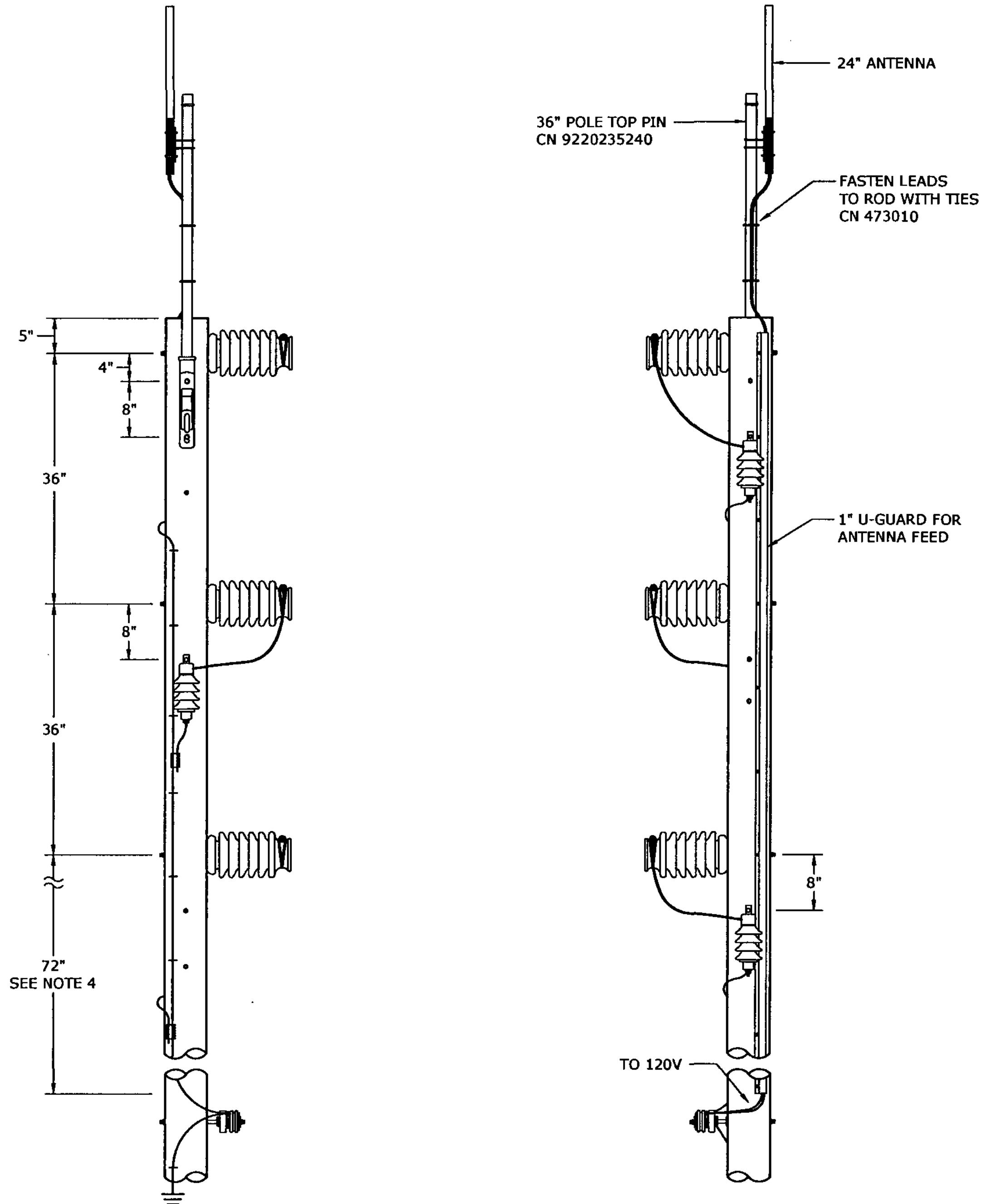
TYPICAL NGDR AMI TELECOM NAN ATTACHMENT

POLE TOP ANTENNA

Duke Energy®

FLA

DWG. 09.04-33B



NOTES:

1. POWER SUPPLY/ REPEATER SHALL BE INSTALLED EITHER :

   A. ON A 30" BRACKET NEAR NEUTRAL PER DWG. 09.04-33A, OR
   B. LOWER ON POLE PER DWG. 09.04-33B.

2. 12 KV, 13 KV AND 25 KV SYSTEM
   USE 35 KV INSULATORS

3. INSTALL LIGHTNING ARRESTERS ON ALL PHASES.

4. 72" CLEARANCE IS FOR NEW CONSTRUCTION. IT IS ACCEPTABLE TO LEAVE SPACING AT 60" IF REPLACING A TRANSFORMER OR IF LOWERING THE NEUTRAL WOULD CAUSE A CLEARANCE ISSUE WITH JOINT USERS BELOW THE NEUTRAL.

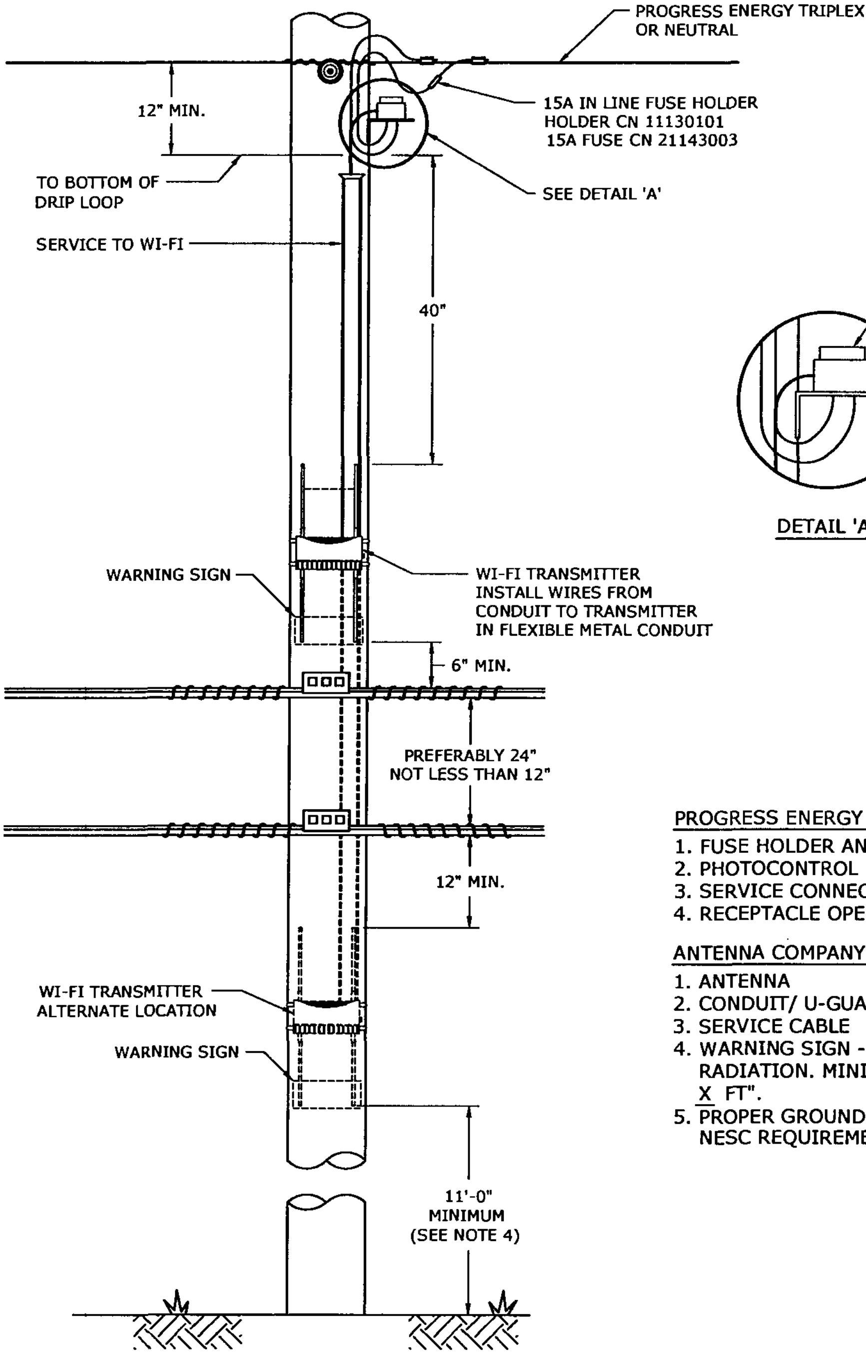
3				
2				
1				
0	1/27/12	BURLISON	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

TYPICAL NGDR AMI TELECOM NAN ATTACHMENT

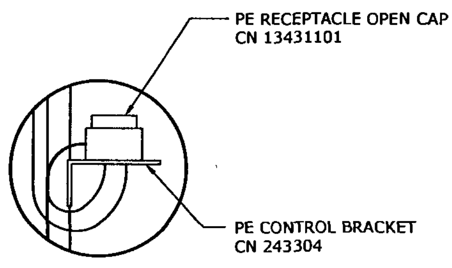
POLE TOP ANTENNA

Progress Energy

FLA DWG. 09.04-33C



FRONT VIEW



DETAIL 'A'

PROGRESS ENERGY PROVIDE AND INSTALL:

1. FUSE HOLDER AND FUSE
2. PHOTOCONTROL BRACKET
3. SERVICE CONNECTION
4. RECEPTACLE OPEN CAP

ANTENNA COMPANY PROVIDE AND INSTALL:

1. ANTENNA
2. CONDUIT/ U-GUARD
3. SERVICE CABLE
4. WARNING SIGN - "WARNING - ANTENNA RADIATION. MINIMUM APPROACH DISTANCE IS X FT".
5. PROPER GROUNDING IN ACCORDANCE WITH NESC REQUIREMENTS.

NOTES:

1. **DO NOT** INSTALL ANTENNAS ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, REGULATOR, SWITCHES, U.G. DIP, ETC.
2. ALL ANTENNA LOCATIONS MUST BE APPROVED BE BY A PROGRESS ENERGY DISTRIBUTION ENGINEER.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d.

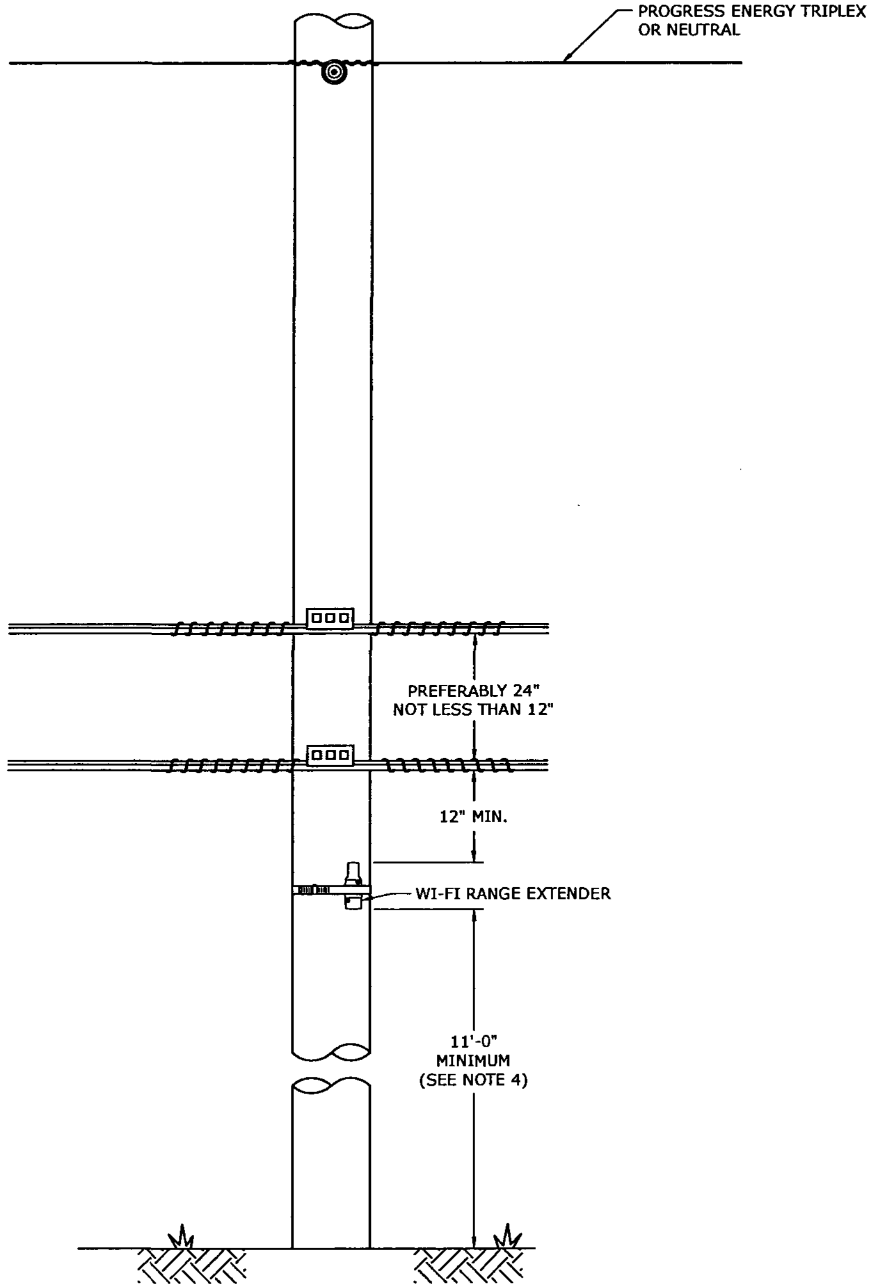
3			
2			
1			
0 10/1/10	ROBESON	GUINN	ELKINS
REVISED	BY	CK'D	APPR.

JOINT USE CONSTRUCTION

WI-FI ANTENNA INSTALLATION

Duke Energy®

FLA | DWG. 09.04-35



FRONT VIEW

NOTES:

1. **DO NOT** INSTALL ANTENNAS ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, REGULATOR, SWITCHES, U.G. DIP, ETC.

2. ALL ANTENNA LOCATIONS MUST BE APPROVED BE BY A PROGRESS ENERGY DISTRIBUTION ENGINEER.

3. ONLY ONE ANTENNA PER POLE ALLOWED.

4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d.

3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

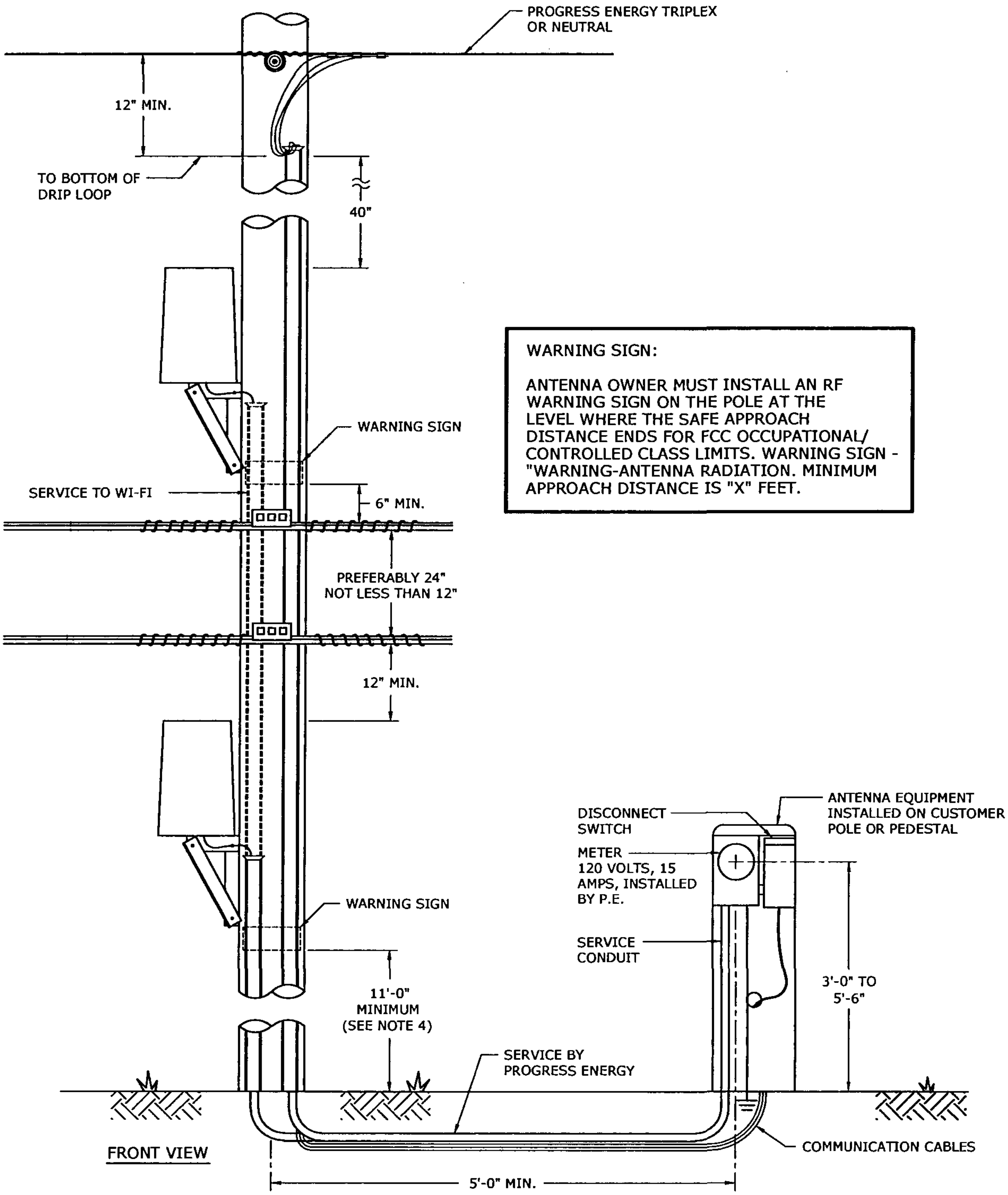
JOINT USE CONSTRUCTION

WI-FI ANTENNA INSTALLATION

Duke Energy®

PGN

DWG. 09.04-36



NOTES:

1. **DO NOT** INSTALL ANTENNAS ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, REGULATOR, SWITCHES, U.G. DIP, ETC.
2. ALL ANTENNA LOCATIONS MUST BE APPROVED BY A PROGRESS ENERGY DISTRIBUTION ENGINEER.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d.

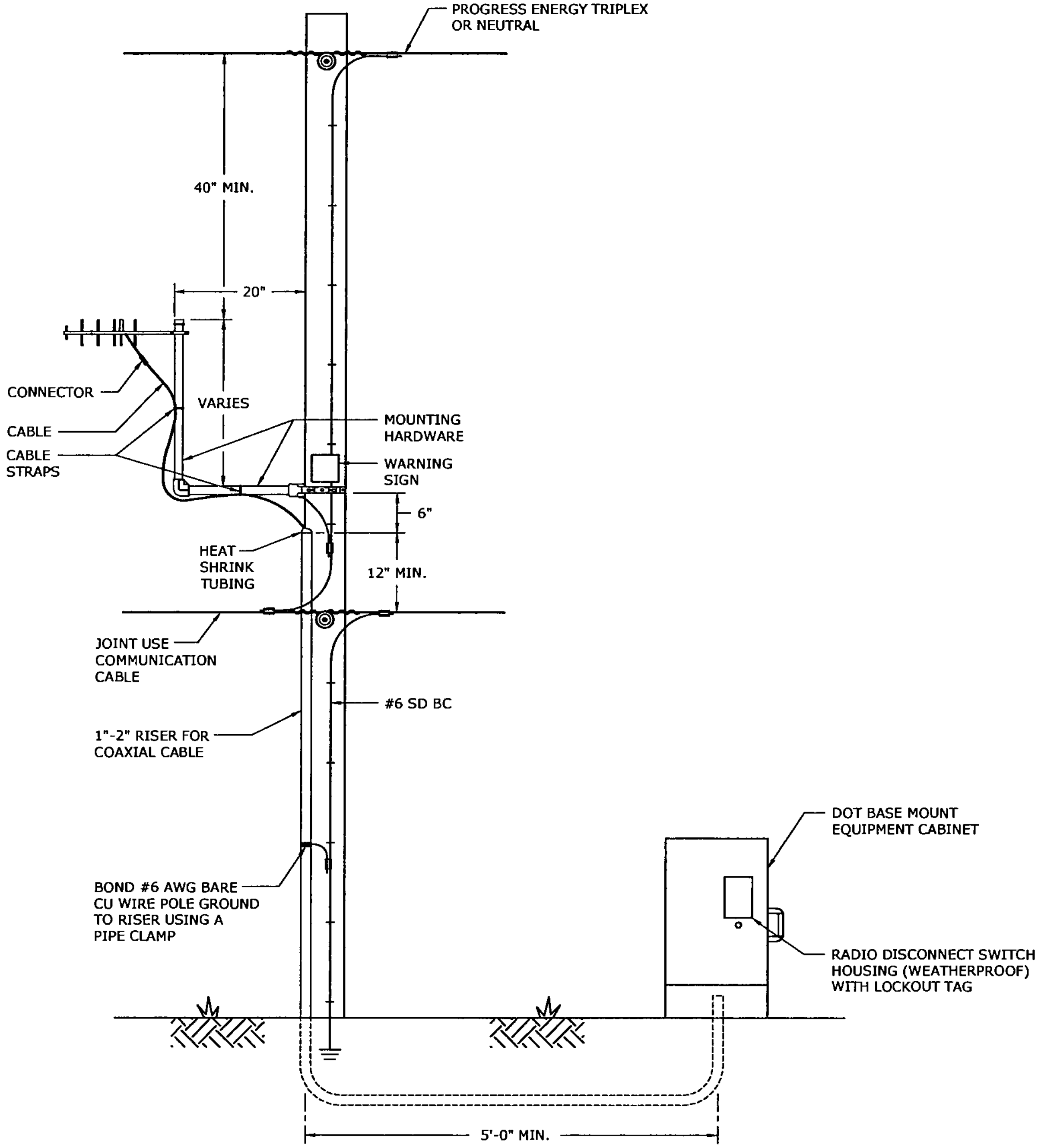
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

JOINT USE CONSTRUCTION

DAS ANTENNA INSTALLATION

Duke Energy®

PGN DWG. 09.04-37



FRONT VIEW

NOTES:

1. POLE LOCATIONS APPROVED BY PROGRESS ENERGY. DO NOT INSTALL ANTENNA ON EQUIPMENT POLE SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. DIP, ETC.
2. ONLY ONE ANTENNA PER POLE ALLOWED.
3. ALL ANTENNA DESIGNS MUST BE APPROVED BY P.E. DISTRIBUTION.
4. THE ONLY JOINT USE EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND CABLE RISER.
5. DOT TO MOUNT WARNING SIGN ON POLE: "WARNING - TURN OFF ANTENNA AT DOT EQUIPMENT CABINET BEFORE WORKING ON POLE".
6. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/12/10	GUINN	GUINN	ELKINS

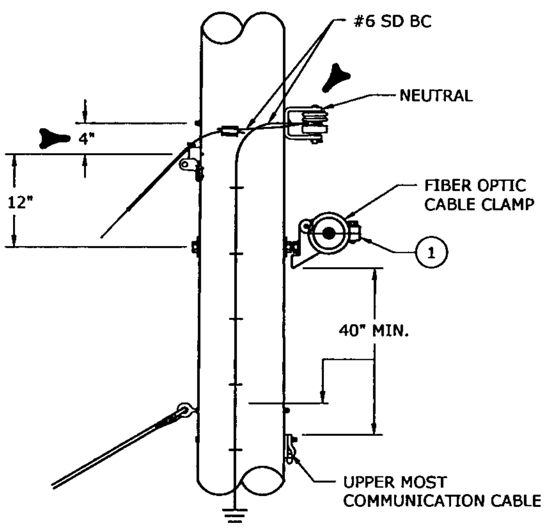
JOINT USE CONSTRUCTION

TRAFFIC SIGNAL ANTENNA

Duke Energy

PGN DWG. 09.04-40

TANGENT AND ANGLES TO 20°



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	-	1	124205	1	TANGENT BLOCK FOR 24 FIBER CABLE. 0.589Ø
				124228	1	TANGENT BLOCK FOR 49/96 FIBER CABLE. 0.695Ø
				VARIABLE	1	BOLT, DOUBLE ARMING, 5/8 IN.
				013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	1	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.

NOTES:

1. GUYING MAY VARY PER ENGINEERING.
2. CLEARANCES SHOWN TO NEUTRAL ALSO APPLY TO LOWEST OPEN-WIRE SECONDARY AND TRIPLEX.
3. USE 5/8" BOLTS FOR FIBER OPTIC CABLE SUPPORTS.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
5. SIMPLE TANGENT LINE TRANSFERS ONLY. MORE COMPLICATED TRANSFERS WILL BE DONE BY TELECOMM.
6. DURING POLE CHANGE OUTS THAT HAVE PROGRESS ENERGY FIBER OPTIC CABLE ATTACHED, CREWS SHOULD TRANSFER ALL TANGENT FIBER ASSEMBLIES BY MOVING ALL EXISTING HARDWARE TO THE NEW POLE. THE COMPATIBLE UNIT FOR THE LABOR TO TRANSFER THE FIBER BRACKET AND WIRE IS PEFIBERTFRF.
7. ALL OTHER TRANSFERS SUCH AS DEADENDS, DAMAGED OR MISSING HARDWARE, ETC. SHOULD BE SENT TO IT FOR FURTHER WORK.

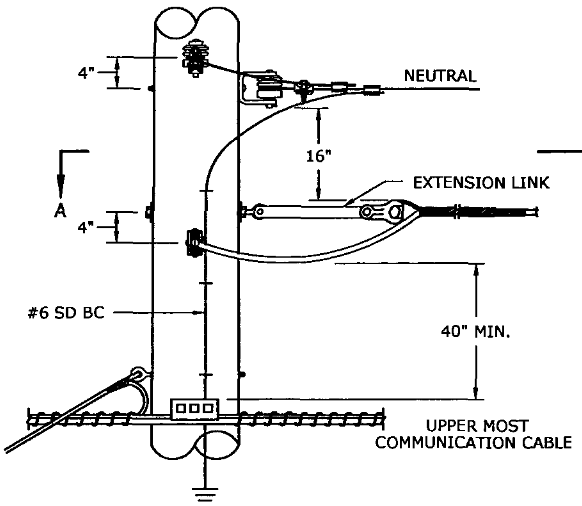
REVISED	DATE	BY	CK'D	APPR.
3				
2				
1	9/27/11	BURLISON	BURLISON	ELKINS
0	11/5/10	BURLISON	GUINN	ELKINS

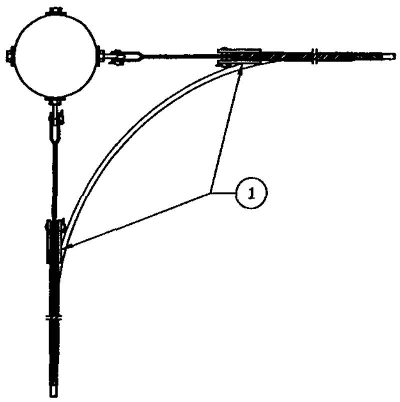
PROGRESS ENERGY FIBER OPTIC CABLE INSTALLED IN SUPPLY SPACE - INSTALLATION DETAILS

Progress Energy

FLA DWG. 09.04-42

ANGLES GREATER THAN 20°





SECTION "A-A"

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	-	2	091312	1	FIBER SIZE: .589 - 24CT (.576-625)
				091309	1	FIBER SIZE: .685 - 48/96CT (.676-.725)
				119666	1	THIMBLE CLEVIS
				119768	1	TURNBUCKLE, 5/8" (FOR ROAD CROSSINGS)
				-	1	EXTENSION LINK
				VARIABLE	1	BOLT, MACHINE, 5/8"

NOTES:

1. NEUTRAL GUYS NOT SHOWN FOR CLARITY.
2. CLEARANCES SHOWN TO NEUTRAL ALSO APPLY TO LOWEST OPEN-WIRE SECONDARY AND TRIPLEX.
3. USE 5/8" BOLTS FOR FIBER OPTIC CABLE SUPPORTS.
4. 30" IF BASE OF FIBERGLASS STANDOFF BRACKET IS BONDED TO POLE GROUND AND THE COMMUNICATION CABLE IS BONDED TO POLE GROUND, 40" IF NOT.
5. SEE DWG. 09.04-49 FOR FIBERGLASS BONDING DETAIL.
6. NEW FOPT REINFORCING RODS MUST BE USED WHEN TRANSFERRING DEADENDS.
7. SEE SECTION O1 FOR ADDITIONAL GROUNDING DETAILS.

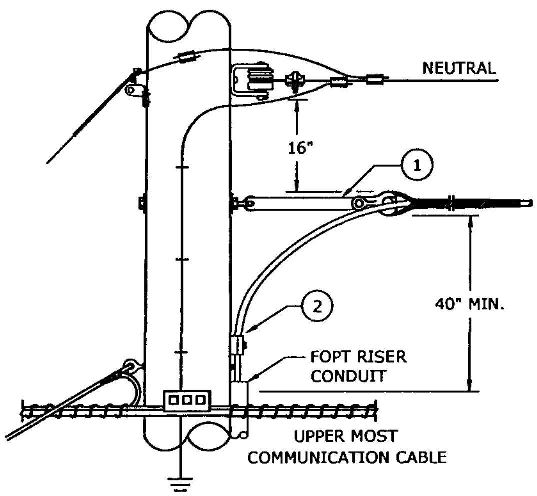
3				
2				
1				
0	9/20/10	ROBESON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PROGRESS ENERGY FIBER OPTIC CABLE
INSTALLED IN SUPPLY SPACE -
INSTALLATION DETAILS

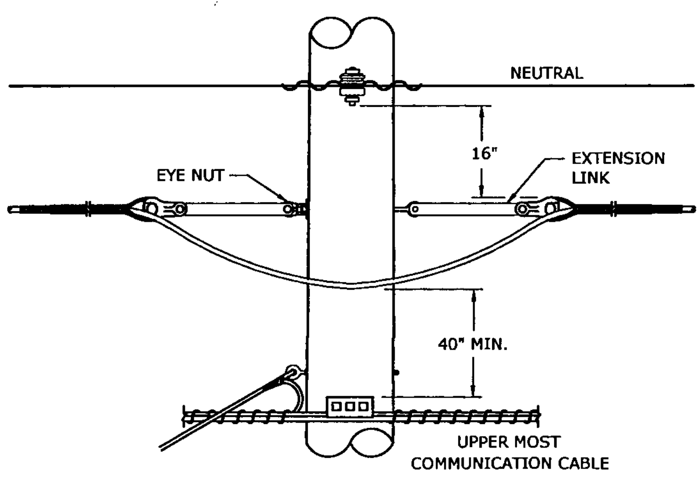
Duke Energy®

FLA DWG. 09.04-46

DEAD-END AND
FOPT DOWNLEAD



DOUBLE DEAD-END



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	-	-	091312	1	FIBER SIZE: .589 - 24CT (.576-625)
				091309	1	FIBER SIZE: .685 - 48/96CT (.676-.725)
				119666	1	THIMBLE CLEVIS
				119768	1	TURNBUCKLE, 5/8" (FOR ROAD CROSSINGS)
				-	1	EXTENSION LINK
				VARIABLE	1	BOLT, MACHINE, 5/8"
	2	-	-	124217	1	FIBER SIZE: .589 - 24CT (.576-625)
				124218	1	FIBER SIZE: .685 - 48/96CT (.676-.725)

NOTES:

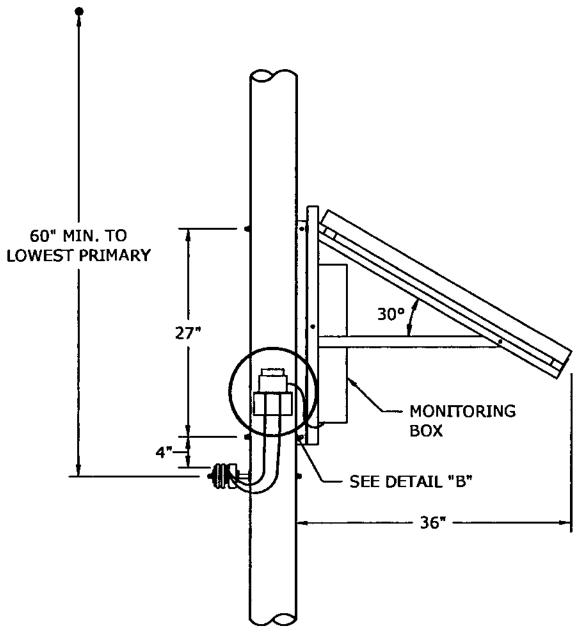
1. CLEARANCES SHOWN TO NEUTRAL ALSO APPLY TO LOWEST OPEN-WIRE SECONDARY AND TRIPLEX.
2. USE 5/8" BOLTS FOR FIBER OPTIC CABLE SUPPORTS.
3. MINIMUM BEND RADIUS OF THIS ADSS FIBEROPTIC CABLE IS 16".
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

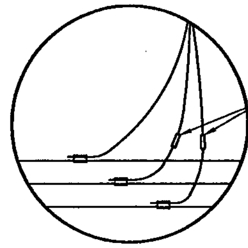
3				
2				
1				
0	9/20/10	ROBESON	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PROGRESS ENERGY FIBER OPTIC CABLE
INSTALLED IN SUPPLY SPACE -
INSTALLATION DETAILS

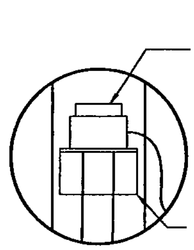
Duke Energy®

FLA DWG. 09.04-52

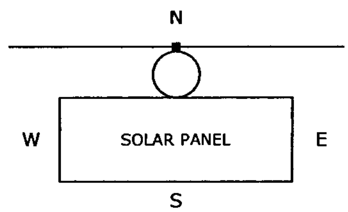




DETAIL 'A'
DISCONNECT



DETAIL 'B'



DETAIL 'C'
PANEL ORIENTATION

TABLE 1
SOLAR PANEL CLEARANCE TO GROUND LEVEL

NATURE OF SURFACE BELOW SOLAR PANEL	CLEARANCE TO GROUND LEVEL (FT)
1. WHERE SOLAR PANEL PARTS OVERHANG:	
A. ROADS, STREETS AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC	15
B. DRIVEWAYS, PARKING LOTS AND ALLEYS	15
C. OTHER LANDS TRAVERSED BY VEHICLES SUCH AS CULTIVATED LAND, GRAZING LAND, FOREST, ORCHARD ETC.	15
D. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY.	11
2. WHERE SOLAR PANEL PARTS ARE ALONG AND WITHIN THE LIMITS OF HIGHWAYS OR OTHER ROAD RIGHTS-OF-WAY BUT DO NOT OVERHANG THE ROADWAY:	
A. ROADS, STREETS AND ALLEYS	15
B. ROADS WHERE IT IS UNLIKELY THAT VEHICLES WILL BE CROSSING UNDER THE LINE	13

NOTES:

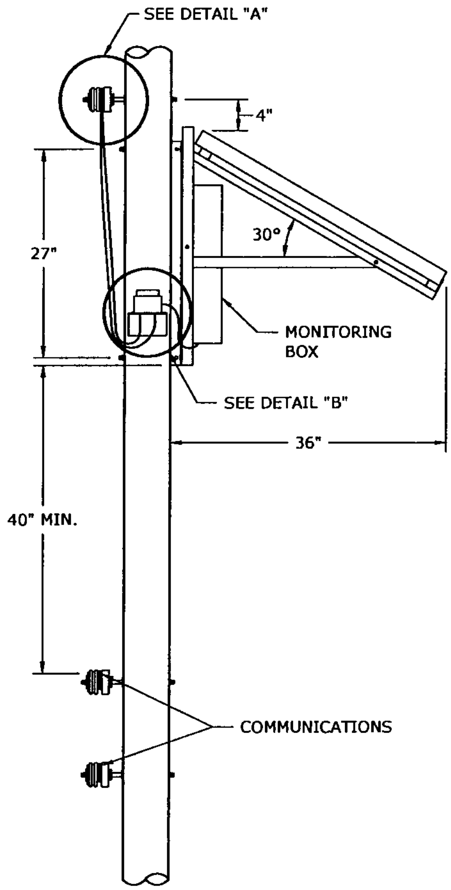
1. INSTALL ONLY ON POLES THAT CAN BE READILY ACCESSIBLE BY BUCKET TRUCK AND NOT ON POLES THAT MUST BE CLIMBED.
2. DRAWING SHOWING RELATIVE MOUNTING HEIGHTS WITH RESPECT TO THE NEUTRAL. SOLAR PANEL MUST BE MOUNTED FACING SOUTH AND INSTALLED WITH A 30° ANGLE AS SHOWN.
3. PRIMARY CONDUCTORS SHOULD RUN EAST-WEST AND MOUNTED ON THE NORTH SIDE OF POLE TO AVOID CASTING SHADOW ON SOLAR PANEL.
4. SEE TABLE 1 FOR GROUND LEVEL CLEARANCE REQUIREMENTS.

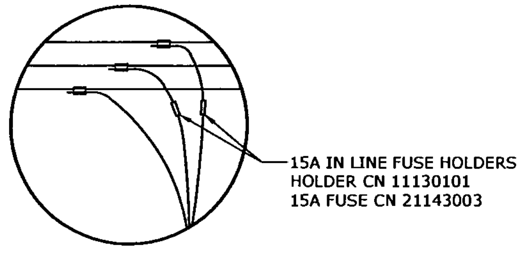
REVISED		BY	CK'D	APPR.
3				
2				
1	12/1/11	BURLISON	BURLISON	ELKINS
0	9/27/11	BURLISON	BURLISON	ELKINS

PE - STUDY
SOLAR PANEL INSTALLATION
ABOVE THE NEUTRAL

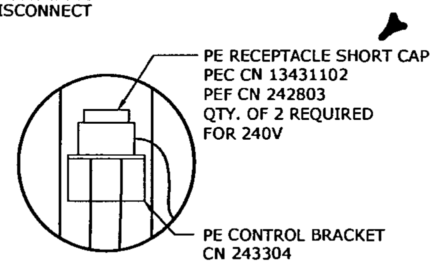
Progress Energy

PGN DWG. 09.04-53

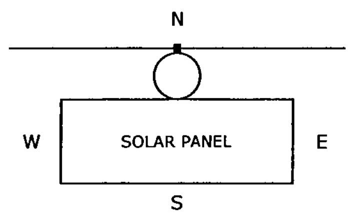




DETAIL 'A'
DISCONNECT



DETAIL 'B'



DETAIL 'C'
PANEL ORIENTATION

TABLE 1 SOLAR PANEL CLEARANCE TO GROUND LEVEL	
NATURE OF SURFACE BELOW SOLAR PANEL	CLEARANCE TO GROUND LEVEL (FT)
1. WHERE SOLAR PANEL PARTS OVERHANG:	
A. ROADS, STREETS AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC	15
B. DRIVEWAYS, PARKING LOTS AND ALLEYS	15
C. OTHER LANDS TRAVERSED BY VEHICLES SUCH AS CULTIVATED LAND, GRAZING LAND, FOREST, ORCHARD ETC.	15
D. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY.	11
2. WHERE SOLAR PANEL PARTS ARE ALONG AND WITHIN THE LIMITS OF HIGHWAYS OR OTHER ROAD RIGHTS-OF-WAY BUT DO NOT OVERHANG THE ROADWAY	
A. ROADS, STREETS AND ALLEYS	15
B. ROADS WHERE IT IS UNLIKELY THAT VEHICLES WILL BE CROSSING UNDER THE LINE	13

NOTES:

1. INSTALL ONLY ON POLES THAT CAN BE READILY ACCESSIBLE BY BUCKET TRUCK AND NOT ON POLES THAT MUST BE CLIMBED.

2. DRAWING SHOWING RELATIVE MOUNTING HEIGHTS WITH RESPECT TO THE NEUTRAL. SOLAR PANEL MUST BE MOUNTED FACING SOUTH AND INSTALLED WITH A 30° ANGLE AS SHOWN.

3. PRIMARY CONDUCTORS SHOULD RUN EAST-WEST AND MOUNTED ON THE NORTH SIDE OF POLE TO AVOID CASTING SHADOW ON SOLAR PANEL.

4. SEE TABLE 1 FOR GROUND LEVEL CLEARANCE REQUIREMENTS.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/1/11	BURLISON	BURLISON	ELKINS
0	9/27/11	BURLISON	BURLISON	ELKINS

PE - STUDY
SOLAR PANEL INSTALLATION
BELOW THE NEUTRAL

Progress Energy

PGN DWG. 09.04-54

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FLORIDA

ATTACHMENT B

Progress Energy

Distribution Standards Governance Policy

All standards and procedures in the Construction Specifications manuals are based on accepted industry practices designed to meet or exceed the requirements of the National Electrical Safety Code (NESC) and are approved by the employees of the Standards Unit as governing company policy for construction and work methods on the Florida and Carolina's distribution systems. These Specifications shall be followed and applied on new construction. In addition, all pole replacements shall be brought up to current Specifications. However, equipment may be added to a pole if NESC clearance and strength requirements can be met without replacing the pole to meet the current Specifications. This is a practice Distribution Standards encourages to avoid replacing poles prematurely or unnecessarily as the NESC affords utilities this provision. Also, maintenance replacements of individual items on a pole may be done without bringing the structure up to current specifications. If there are questions regarding application or interpretation, the appropriate Standards engineer should be contacted for consultation. Any planned or engineered deviation from these standards shall be submitted to the appropriate Standards engineer for approval. Field engineering and construction personnel processing or constructing work are ultimately responsible for ensuring that any proposed construction is in compliance with the NESC.

The standards and procedures contained in this manual are not applicable to installations in mines. Mines include open sandpits and rock quarries. Due to specific and unique requirements for electric service inside mines, overhead and underground facilities installed and maintained by Progress Energy must remain outside of the mine area as defined by the Federal Mine Safety and Health Administration (MSHA).

All stock items of material referred to in these manuals and tools in the Tool Catalog (http://webappint/SpecBookWMIS/ToolCatalog/ToolFrontPage.aspx) are selected based on field evaluations and are approved by the Distribution Standards Unit. The appropriate Distribution Standards Unit Engineer shall be consulted before any substitutions or alterations are made to these standards. Any materials found to be defective or unsatisfactory should be reported to Distribution Standards through the Defective/Failed Material Report System (described on spec pages 01.04-10 or 20.04-10) program so appropriate action can be taken.

Revisions to a specification drawing from the previous edition are marked with an arrow. Please review these changes and incorporate them into your new construction. For information regarding specification updates issued prior to the publishing of new editions, visit the Distribution Standards website http://progressnet/edg-deo-specs/index.htm.

We welcome any suggestions or feedback from the users of this book. All suggestions for improvement should be sent to Distribution Standards, TPP 17, Raleigh, N.C.

Jonathan Elkins, P.E.
Manager, Distribution Standards

DUKE ENERGY®
FLORIDA

ONGOING STORM PREPAREDNESS PLAN

Progress Energy

Ongoing Storm Preparedness Plan

Purpose and Intent of the Plan:

To implement Progress Energy Florida's ("PEF") Ongoing Storm Preparedness Plan (the "Plan") that complies with FPSC Order No. PSC-06-0351-PAA-EI issued April 25, 2006 (the "Order"). The Plan addresses the specific ten-points that the Florida Public Service Commission (the "Commission") identified in the Order.

The Plan includes the following specific sub-plans:

- Vegetation Management Cycle for Distribution Circuits.
- Audit of Joint Use Attachment Agreements.
- Transmission Structure Inspection Program.
- Hardening of Existing Transmission Structures.
- Transmission and Distribution Geographic Information System.
- Post-Storm Data Collection and Forensic Analysis.
- Collection of Outage Data Differentiating Between the Reliability Performance of Overhead and Underground Systems.
- Increased Utility Coordination With Local Governments.
- Collaborative Research on Effects of Hurricane Winds and Storm Surge.
- Natural Disaster Preparedness and Recovery Program.

These ten sub-plans are outlined and described below. PEF has already implemented several of the sub-plans. All of these sub-plans will be evaluated on an ongoing basis to address, among other things, data and data trends, new information, external factors, and cost effectiveness. All cost figures provided in this Plan are PEF's best estimates based on available information and data and are subject to revision and change as circumstances may dictate or as more definitive information becomes available.

1) Vegetation Management Cycle for Distribution Circuits

PEF recommends a fully integrated vegetation management ("IVM") program. The IVM program consists of at least the following subprograms: routine maintenance "trimming," herbicide applications, vine removal, customer request work "tickets," and right-of-way floor brush "mowing." The IVM program incorporates a combination of both cycle based maintenance and reliability driven prioritization of work. Actual spending versus initial budget can vary during any particular year based on a number of factors which may include timing, changes in priorities within the program, and unforeseen events such as major storms and other factors.

Based on these considerations, PEF has revised its vegetation management contracts to add items such as:

- Cutting brush within an eight foot radius of all device poles;

- To the extent practical and reasonably feasible, felling "dead danger trees" within 25 feet of the closest conductor that have a high likelihood of falling on the conductors; and
- Cutting of underbrush instead of topping it.

These items have been added to help address some of the emerging issues in both the preventable and non-preventable tree-caused outage categories.

In general, the main objectives are to optimize the IVM program cost against reliability and storm performance objectives. Some of the main program objectives are:

- Customer and employee safety;
- Tree caused outage minimization, with the objective to reduce the number of tree caused outages, particularly in the "preventable" category;
- Effective cost management; and
- Customer satisfaction, with the goal to provide the customer top quartile service.

As part of the IVM program, PEF has implemented a comprehensive feeder prioritization model to help ensure that tree caused outages are minimized by focusing on the feeders that rate high in the model. Prioritization ranking factors are based on past feeder performance and probable future performance. Some of the criteria used in feeder prioritization include the number of customers per mile, the number of tree caused outages in prior years, outages per mile, the percentage of outages on backbone feeders, the percentage of total tree outages categorized as preventable (i.e., outages caused by trees within PEF rights-of-way), and total tree customer minutes of interruption ("CMI"). In implementing this prioritized process, PEF follows the ANSI 300 standard for pruning and utilizes the "Pruning Trees Near Electric Utility Lines" by Dr. Alex L. Shigo.

Generally, PEF attempts to maintain an average trimming cycle of three years. Although PEF works toward a benchmark goal of a three-year weighted average system maintenance cycle, it balances this goal against overall system reliability, customer impact, and cost effectiveness in determining its ultimate trim cycles. In some instances, PEF may defer maintenance on some feeders without significantly impacting reliability while accelerating maintenance on other feeders that are experiencing more significant issues than others. This approach has resulted in a significant improvement in system reliability, as measured by SAIDI, since 2001, including an improved SAIDI related to tree caused outages.

A mandatory three-year trim cycle without regard to system reliability, customer impact, and cost-effectiveness would not benefit PEF's customers when compared to a focused and targeted plan such as PEF's IVM program. Additionally, in recent years, PEF has experienced availability challenges within the tree trimming labor force in Florida. A non-targeted, mandatory three-year trim cycle would adversely impact all electric utilities within the state by forcing them to compete for an already scarce resource. Such demand could be expected to inflate costs for all utilities. Further, a mandatory, non-targeted three-year cycle would not provide the flexibility that PEF can currently leverage to address tree conditions that can vary significantly depending a number of variables, most significantly weather conditions. PEF estimates that a mandatory three-year cycle would immediately increase costs by approximately $7M in the first year of its implementation and could increase PEF's overall budget needs at a conservative rate of three percent (3%) per year. PEF does not endorse this approach. Rather, PEF can more effectively manage tree resources while providing the maximum benefit to our customers by utilizing PEF's IVM program.

2) Audit of Joint Use Attachment Agreements.

PEF currently has approximately 700,000 joint use attachments on distribution poles and approximately 5,000 joint use attachments on transmission poles. While the majority of these attachments are on wood poles, approximately 15% of the distribution joint use attachments are on concrete or metal structures and approximately 25% of the transmission joint use attachments are on concrete or metal poles. The information provided below outlines PEF's plan to gather information on "non-wood" existing joint use poles over an average 8-year inspection cycle as outlined in Order No. PCS-06-0144-PAA-EI.

PEF plans to inspect all PEF distribution poles (regardless of pole type) with joint use attachments on the 8 year audit cycle outlined in Order No. PCS-06-0144-PAA-EI. These audits will start at the sub-station where the feeder originates. For each group of poles in a tangent line, the pole that has the most visible loading, line angle, and longest or uneven span length will be selected to be modeled for wind loading analysis. Each pole modeled will be field inspected. The attachment heights of all electric and communication cables and equipment will be collected. The pole age, pole type, pole number, pole size / class, span lengths of cables and wires, and the size of all cables and wires on all sides of the pole will be collected.

The selected pole's information will then be loaded into a software program. The pole information will be analyzed and modeled under the NESC Light District settings of 9psf, no ice, 30° F, at 60 MPH winds to determine current loading percentages. If that one pole fails, the next worst case pole in that group of tangent poles will be analyzed as well. Each pole analyzed will determine the existing pole loading of all electric and communication attachments on that pole. If the existing analysis determines that the pole is overloaded, a work order will be issued to replace the pole with a larger class pole. Should the original pole analyzed meet the NESC loading requirements, all similar poles in that tangent line of poles will be noted as structurally sound and entered into the database as "PASSED" structural analysis. The results of the analysis and all communication attachments will be entered into the FRAMME system. Reporting from the FRAMME system will indicate the date and results of the analysis. Poles rated at 100% or lower will be designated as "PASSED." Poles that are analyzed and determined to be more than 100% loaded will be designated as "FAILED," and scheduled to be changed out. Once the pole is changed out, FRAMME will be updated to reflect the date the new pole was installed with the new loading analysis indicated.

PEF plans to inspect all transmission poles (regardless of pole type) with joint use attachments on the 8 year audit cycle outlined in Order No. PCS-06-0144-PAA-EI and PEF's Pole Inspection Plan filed with the Commission on April 1, 2006. Audits will start at the sub-station where the transmission circuit originates. All pole information (pole size, class, type, age, pole number, cable, wire, equipment attachment heights, span lengths) including structural plan and profiles will be sent to an outside engineering firm to be modeled in PLS-CADD/LITE and PLS-POLE software for structural analysis. The firm will determine the worst case structures in a tangent line and request the structural drawings and attachment information on those selected poles. Typically, transmission poles with line angle and uneven span lengths are the poles considered for wind loading analysis.

The selected pole information will be loaded into the PLS-CADD and PLS-POLE software. Depending on the pole location per the NESC wind charts, one of the following load cases is run. **NESC Light District:** 9psf, no ice, 30° F, 60mph; **NESC Extreme:** 3 sec gust for the specific county, no ice, 60° F (Ex: Orange County is 110 mph); or **PEF Extreme** at 36psf, 75° F, wind chart mph. If that one transmission pole fails, the next worst case pole in that group of tangent poles will be analyzed as well. Each transmission pole analyzed will determine the existing pole loading of all electric and communication attachments on that pole. If the existing analysis determines the transmission pole is overloaded, a work order will be issued to replace the pole with a stronger pole. Should the original pole analyzed meet the NESC loading requirements, all similar poles in that tangent line of poles will be noted as structurally sound and entered into the database as "PASSED" structural analysis.

The results of the analysis and all communication attachments will be entered into the FRAMME system. Reporting from the FRAMME system will indicate the date and results of the analysis. Transmission poles rated at 100% or lower will be designated as "PASSED." Transmission poles that are analyzed and determined to be more than 100% loaded will be designated as "FAILED," and scheduled to be changed out. Once the transmission pole is changed out, FRAMME will be updated to reflect the date the new pole was installed with the new loading analysis indicated.

Pursuant to the requirements of FPSC Order No. PCS-06-0144-PAA-EI, PEF will file a wood pole inspection report with the Division of Economic Regulation by March 1st of each year. The report shall contain the following information:

1) A description of the methods used for structural analysis and pole inspection.

2) A description of the selection criteria that was used to determine which poles would be inspected.

3) A summary report of the inspection data including the following:

   a. Number of poles inspected.
   b. Number of poles not requiring remediation.
   c. Number of poles requiring remedial action.

d. Number of pole requiring minor follow up.
e. Number of poles requiring a change in inspection cycle.
f. Number of poles that were overloaded.
g. Number of inspections planned.

In this annual report, PEF will also file the same information for "non-wood" transmission and distribution structures that have joint attachments.

In PEF's wood pole inspection plan previously filed with the Commission under Order No. PCS-06-0144-PAA-EI, all poles, regardless of pole type, were included in the cost estimate for "Joint Use Inspection" Below is an extrapolation of "other than wood" pole audit cost for transmission and distribution poles with joint attachments.

Estimated Cost to Analyze "Other than Wood Poles"

Cycle Year	500,000 Dist Poles in System with JU (15.4%)	10% of Dist Poles Analyzed	Cost per Dist Pole to Analyze	2,500 Trans Poles in System with JU (25%)	30% of Trans Poles Analyzed	Cost per Trans Pole to Analyze	Annual cost to Analyze "Other than Wood" Poles
1	9,625	963	$70.00	78	23	$450.00	$77,940.00

3) Transmission Structure Inspection Program.

Pursuant to FPSC Order No. PSC-06-0144-PAA-EI, PEF filed a wood pole inspection plan for its wooden transmission assets with the FPSC on April 1, 2006. In conjunction with PEF's wood pole inspection plan, PEF will conduct other Transmission Line assessments. These assessments will primarily include Transmission Line Aerial Inspections and Transmission Line Ground Inspections, as well as Transmission substation inspections.

(i). Aerial Patrols

Aerial patrols will utilize helicopter surveys of the transmission system on average three times per year to identify potential problems and needed corrective actions. Patrols will be conducted with qualified Line and Forestry personnel to look for and document conditions on the following items:

Guys	Braces	Conductors	Substation Equipment
Aerial Markers	Poles	Crossarms	Line Traps
Arresters	OHGW & OPGW	Encroachments	ROW Condition
Insulators	Splices/Dampers	Line Sect. Switches	Vegetation Issues

The aerial patrols will inspect the condition of 69 - 500 kV voltage class transmission lines and associated hardware/equipment. These patrols will be used to aid the Transmission Line Maintenance Crew in scheduling and planning preventive/corrective maintenance work.

(ii). Transmission Line Ground Inspections

PEF will perform ground patrols to inspect transmission system line assets to allow for the planning, scheduling, and prioritization of corrective and preventative maintenance work. These patrols will assess the overall condition of the assets including insulators, connections, grounding, and signs, as well as an assessment of pole integrity. Each transmission line shall have a ground patrol conducted once every 5 years. The primary goal of a ground patrol is to inspect transmission line structures and associated hardware on a routine basis with the purpose of finding and documenting any required material repairs or replacements.

(iii) Structural Integrity Evaluation

The joint use inspector will note and record the type and location of non-native utility pole attachments to the pole or structure. This information will be used by the Joint Use Department to perform a loading analysis, where necessary, of the pole or structure. Specific information on this process is contained in the Joint Use section of this Plan.

(iv). Transmission Substation Inspections

PEF will perform monthly inspections of Transmission – Transmission Substations, Transmission – Distribution Substations and Generation Plant Substations. These inspections will consist of a visual analysis of Substation Assets and documentation of operation information. This visual inspection and operation information will be used to develop actions to correct any discrepancies and to schedule preventative maintenance.

(v). Records and Reporting

An asset inspection report will be filed with the Division of Economic Regulation by March 1st of each year. The report shall contain the following information:

1) A description of the methods used for analysis and inspection;

2) A description of the selection criteria that was used to determine which assets would be inspected; and

3) A summary report of the inspection data;

Transmission Line Inspections Cost Estimates

O&M Costs		10 Year Total Cost
	Aerial Patrols	$3,000,000
	Ground Patrols & Misc. Repairs	24,000,000
	Ground Line Inspections	$2,400,000
	Total O&M Cost	$29,400,000

4) Hardening of Existing Transmission Structures.

PEF currently has over 45,000 transmission structures with approximately 4800 miles of transmission lines in the Florida Grid. Approximately 34,000 structures (or 75%) are currently supported with wood poles. PEF currently averages approximately 500 wood pole to concrete or steel pole maintenance change outs per year. Additionally, PEF currently relocates approximately 100 poles per year due to developer requests or highway improvements, and these poles are replaced with concrete or steel poles. Furthermore, PEF will also be performing system upgrades due to system growth on several lines over the next 10 years. This, on average, will result in approximately 250-350 wooden structures per year being changed out and replaced with concrete or steel poles over the next 10 years.

PEF also estimates that it will be adding 300-400 structures per year over the next 10 years due to system expansion and growth. All new structures will be constructed with either concrete or steel and will be designed to meet or exceed current NESC Code requirements. Based upon these projections of new additions and pole change, this should reduce the percentage of wood structures on the PEF system from 75% to less than 50 % during a 10 year period. The following table provides PEF's estimated costs:

Costs	Changeouts or new Poles /Year	Cost/Year	Total Changeouts or new Poles/10 years	Total 10 Year Costs (Present Value)
Maintenance Change outs	500	$7.0 Million	5000	$70 Million
DOT Relocations	100	$7.0 Million	1000	$70 Million
Line Upgrades and Additions	750	$ 50.0 Million	7500	$500 Million
Increased GL Inspection	200	$2.8 Million	2000	$ 28 Million
Total	1550	$66.8 Million	15500	$668 Million

5) Transmission and Distribution Geographic Information System.

Distribution

With respect to Distribution, PEF's ultimate goal for collecting and maintaining asset and performance data is to first create an environment that contains all the elements referenced by the Commission in Order No. PSC-06-0351-PAA-EI (i.e., GIS capable of locating, mapping, and keeping inspection, vintage, and performance data on all transmission and distribution assets). To achieve this goal, additional capital and O&M funding is necessary to enhance existing systems.

Currently, PEF has a GIS system that provides an operational view of our assets. In other words, PEF's current GIS system has information that is location specific, not asset specific. To implement an enhanced GIS, PEF would need to change its current GIS system from location driven to asset driven. This would enable PEF to collect data from many sources including operations, inspections, performance systems, and other sources, which would provide PEF the ability to look for trends in performance of individual assets as well as trends in the aggregate of its assets. To fully implement this strategy, PEF Distribution would need to invest in several systems and perform additional field inspections and audits on it assets. The estimated costs are set forth below.

Systems:

Computer Maintenance Management System
Estimated Costs - $1M

One of the first systems that would need to be developed would be a Computer Maintenance Management System. This system would be responsible for collecting performance and historical data on PEF's assets. This system would be linked to PEF's GIS.

Operational Datamart
Estimated costs - $950k

This system would be responsible for pulling information out of the GIS and the CMMS systems to provide reporting capabilities like asset analysis, trends, and early identification of potential asset failures. This provides decision support tools as well as interfaces to those required systems like GIS, CMMS, and CDMS.

Asset Management - Corporate Document Management Systems (CDMS)
Estimated Costs - $250k

The implementation of a new corporate document management system would support archival of and access to all documents and drawings related to distribution assets and the aggregation of those assets to a system. This would likely facilitate the referencing of standards in the past as well as current design standards.

Facility Baseline Inspection
Estimated Costs - $6.6M

PEF would further need to execute a comprehensive inspection of its distribution facilities to gather additional information and data for its new GIS system. This would be a critical component to establish an informational baseline for PEF facilities and assets. This baseline then would be used in conjunction with the CMMS to store the results of the inspections as well as update the GIS with any net new removals or additions to the Distribution facilities.

Total One time Costs - 1M+950k+250k+6.6M = $8.8M

Transmission

PEF Transmission has a functioning GIS system (MapInfo) that is linked to PEF's work management system. This system contains information on the location of the pole, the type of pole, and it contains a photo image of the pole or structure. Presently, this system does not contain the maintenance history of the facility. Over the next 6 years, PEF plans to populate the system with maintenance data that will be captured in PEF's Transmission Line Inspection Plan. The data would include:

1. Date Inspected;
2. Type of Inspection;
3. Conditional Assessment of the Transmission facility;
4. Status of Remediation/Repair Work Order.

Estimated Costs		Total 10-Yr Cost
	Inspection and Data Entry	$ 2,000,000
	Computer system upgrades	$1,000,000

6) Post-Storm Data Collection and Forensic Analysis.

Distribution

The purpose of forensic assessment is to provide data on causal modes for distribution pole and structure damage due to major storms. Four functional roles have been defined to support the collection of forensic data during major storm response; System Forensic Assessment Coordinator, Regional Forensic Lead, Forensic Assessor, and Forensic Support.

The following is a list of key activities identified for each functional role defined in support of the Forensic Assessment process during major storm response: .

System Forensic Assessment Coordinator- This position is responsible for the coordination of collecting and collating forensic data of distribution pole and structure damage due to a major storm. Key activities may include:

- Monitor path of approaching storm and coordinate a pre-storm conference call with Regional Forensic Leads at least 48 hours prior to expected landfall.
- Facilitate and document substation and feeder assignments among Regional Forensic Leads.
- Coordinate end-of-day conference calls with Regional Forensic Leads to determine daily progress and communicate system forensic assignments for the following day.
- Develop and deliver post-storm System Forensic Summary Report to the Damage Assessment Manager within 2 weeks after storm restoration activity has been completed.

Regional Forensic Lead- This position is responsible for the execution of a forensic review of the assigned region and for coordinating the field activities of the Forensic Assessors and Forensic Support functions. Key activities may include:

- Participate in pre-storm conference call with System Forensic Coordinator at least 48 hours prior to expected landfall to determine high-priority substations for Forensic Assessment and additional calls, as needed.
- Communicate team assignments and expected initial reporting time/location to Forensic Assessor and Forensic Support team members 48 hours in advance of expected landfall.
- Secure and assign vehicles for all Forensic Assessment teams within the region.
- Determine and communicate daily substation and feeder assignments by team.
- Establish protocols and timelines with Forensic Assessment teams within the region for communicating daily start, stop, and safety check-in times and notify system Damage Assessment Manager and System Forensic Coordinator if communication is not established with teams as expected.
- Participate in end-of-day conference calls with System Forensic Coordinator and other Regional Forensic Leads to determine the system-wide status of Forensic Assessment and assign assessment locations for the following day.
- Provide complete Region Substation Forensic Summary Reports to System Forensic Coordinator within 1 week after storm restoration activity has been completed.

Forensic Assessor- This position is responsible for the resources necessary to conduct the Forensic Assessment in the field, including the direct supervision of an assigned Forensic Support team member. Key activities may include:

- Be proficient in the data collection process and procedure necessary to conduct Forensic Assessment.
- Prepare field kit upon initial notification of assignment from Regional Forensic Lead.
- Confirm daily Forensic Assessment assignment with Regional Forensic Lead and confirm protocols and timelines with for communicating daily start, stop, and safety check-in times.
- Initiate contact with assigned Forensic Support team member and provide just-in-time refresher of expectations as required.
- Conduct pre-trip inspection with Forensic Support prior to departing local Operation Center to ensure all materials and resources are available and that the vehicle is in safe working order.
- Conduct pre-job briefing before each inspection.
- Conduct field Forensic Assessment of assigned substations and/or feeders and collect required data for each pole identified as damaged or in need of repair.
- Report daily observations and status update to Regional Forensic Lead as assigned.
- Complete and submit hardcopy checklist to Regional Forensic Lead for each pole identified as damaged or in need of repair no later than 2 days after restoration activity has been completed.

Forensic Support- This position will provide field support to the Forensic Assessor in the collection of required data during Forensic Assessment in the field. Key activities may include:

- Participating in pre-job briefings.
- Safe operation of assigned passenger vehicle.
- Cataloguing time, location, and other required data for each pole identified as damaged or in need of repair.
- Assisting in the preparation of summary reports for use by the Regional Forensic Lead.

PEF has implemented the Forensic Assessment process for the upcoming 2006 storm season.

Transmission

Field Data Collection

PEF Transmission will establish a contract with an engineering/survey firm that will require the firm to provide resources immediately after a storm event. This contractor will collect detailed post storm data necessary to perform storm damage and forensic analysis. This data will include:

1. Photographs of the failed facility;
2. Conditional assessment of the failed facility;

3. Sample collection of any failed components; and
4. Date stamps, name plate data.

Maintenance/GIS Data

The balance of needed data will be collected from the GIS data base and will include:

1. Location of the facility (GPS coordinates);
2. Type and design of the facility;
3. Facility vintage; and
4. Maintenance history of facility.

Data Reduction

The above data will be provided to a consultant. Using the storm data that was collected from the field collection process, data contained in the GIS data base, and available weather data, a forensic analysis will be performed in order to correlate storm intensity, design standards, maintenance history, geographic locations, materials, facility types, and vintage. From this analysis, the consultant will make recommendations storm hardening improvements.

Estimated Costs

Estimated costs will be based on the amount of storm damage that occurs as a result of a single storm in one year. The estimated costs listed below are based upon the illustrative assumption of 100 transmission structures that are damaged and require analysis.

Costs		Total 10-Yr Cost
	Field Data Collection	$5 Million
	GIS Data Collection	$2 Million
	Data Reduction and Recommendations	$2 Million
	Total Cost	$9 Million

7) Collection of Outage Data Differentiating Between the Reliability Performance of Overhead and Underground Systems.

PEF will collect information to determine the percentage of storm caused outages on overhead systems and underground systems. Some assumptions are required when assessing the performance of overhead systems versus underground systems. For example, underground systems are typically protected by overhead fuses. PEF will provide for these factors in its analysis.

PEF has an internal hierarchy in its Outage Management System (OMS) that models how all of its facilities are connected to each other. This information provides the connection to the feeder breaker down to the individual transformer. PEF's Customer Service System (CSS) captures which customer is tied to what individual transformer. PEF's Geographical Information System (GIS) provides several sets of data and information points regarding PEF's assets. PEF will use these systems to help analyze the performance of the following types of assets:

Breakers
Electronic Reclosers
Fuses
Hydraulic Reclosers
Interrupters
Motor Operated Switches
OH Conductors
OH Transformers
Primary Meters
Switch Gear Fuses
Sectionalizers
Services
Switches
Terminal Pole Fuses
Under Ground Conductors
Under Ground Transformers

As part of this process, the location of each feeder circuit point is determined by approximating the geographic midpoint of each circuit. Outages experienced as a result of a named storm will be extracted from system data. The outages will then be grouped by feeder circuit ID and by outage type, where outage type is either overhead or underground. The number of customers interrupted by an overhead device will then be summed by feeder circuit ID and the number of customers interrupted by an underground device will be summed by feeder circuit ID. A single feeder circuit may have overhead and underground outages, so approximations will be made in those circumstances.

Once this information is collected, the percentage of customers interrupted will be calculated by dividing the sum of customers interrupted per feeder circuit by the total customers served for that feeder circuit. This process is applied as the sum of customers interrupted by all overhead devices on a feeder circuit divided by the number of customers served by the feeder circuit and the sum of customers interrupted by all underground devices on a feeder circuit divided by the number of customers served by the feeder circuit. As a result of this process, PEF will produce graphic representations of performance such as those depicted below:

Progress Energy

Ongoing Storm Preparedness Plan

OH Construction Outage Severity

UG Construction Outage Severity

PEF will also collect available performance information as apart of the storm restoration process via servicemen in the field, such as:

Restore time;
Cause code;
Observations and comments;
Failed device name;
Failed device size;
Failed device type;
Failed device phase; and
Failed device location.

The implementation of a new GIS system discussed above would enhance PEF's ability to collect data relevant to asset performance, and PEF would use this data to analyze and compare the performance of its overhead and underground systems.

8) Increased Utility Coordination With Local Governments.

This part of the Plan addresses increased coordination with local governments to enhance PEF's ability to prepare for and respond to storms and other severe weather events. PEF's goal is to provide excellent customer service and collaboration with local governments before, during, and after emergencies through organization, commitment, strong relationships, the provision of resources, and communication and feedback mechanisms. Through a collaborative partnership with local governments, PEF can take advantage of the mutual interest in excellent response to communities through year-round dialogue and planning. Specifically, PEF will focus on the following in implementing this plan in conjunction with local governments:

- Identify opportunities throughout the year to improve preparedness on both the part of the utility and the public taking advantage of government's local knowledge and existing organization.
- Develop enhanced organization and planning to improve readiness.
- Educate the public on proper storm preparation and restoration actions.
- Provide local governments with the support needed to facilitate the coordination of outage restoration in a safe and efficient manner.
- Provide local governments with ongoing information and updates in advance of, during and after storm events to assist them with their local storm preparation and restoration efforts including informing the public.
- Assist in the resolution of local governmental issues and concerns related to storm and emergency situations.

Progress Energy

Ongoing Storm Preparedness Plan

In order to meet the requirements of FPSC Order No. PSC-06-0351-PAA-EI, PEF has established an internal team focused on local governmental coordination activities. These activities include dedicated resources, training, continuous coordination with government, storm preparation, storm restoration and an EOC program.

a) Staffing and Training

A cross-functional internal team has been established utilizing personnel from numerous areas including community relations, regulatory affairs, and account management. The role of the team will be to develop and implement initiatives focused on governmental coordination and to participate in both internal and external storm preparation planning activities.

- Staffing – The governmental coordination team consists of approximately 70 employees throughout PEF's service territory. Each member is assigned to a specific role. Job descriptions have been developed for each role. These will be updated annually to meet current needs and requirements. Below are the roles for this team and the approximate number of employees in each role.

  Government Coordination Roles
  - **Storm Coordinator (1)**
  - **State EOC Coordinator (1)**
  - **Community Relations Manager – CRM (6)**
  - **Manager, CIG Accounts (1)**
  - **Back Up CRM/Support (23)**
  - **EOC Representative (28)**
  - **Operations Center Liaison (10)**

Members of the team are responsible for familiarizing themselves with their job description, participating in annual training and general readiness for storm duty as required. In addition, certain members will work with assigned communities throughout the year to identify opportunities for enhanced coordination and support local community storm preparation activities.

Annually a system-wide internal storm drill will be conducted in which members of the team will participate. The State EOC Coordinator will work with state agencies to coordinate the company's participation in the annual state storm drill.

Staffing scenarios are created to simulate different storm impacts and staffing assignments to support each impact scenario. Personnel are flexible to shift to positions throughout the state as needed. This supports initiatives to coordinate with local government including emergency management organizations throughout the year (i.e. community storm drill activities, updating EOC infrastructure restoration priority account lists and EOC contact lists).

Training is been developed for all team members. Training will be conducted on an annual basis in multiple locations throughout the system and will include the following elements:

Overview of government coordination organization
Storm assignments and roles
Job requirements
Material and resource requirements
EOC crew management module
NIMS training

In addition to classroom training, an internal electronic site is being developed to house information and resources that are accessible by all team members before, during, and after storm events. This site will include, but not be limited to, the information listed below.

Training Presentations and Materials
Staffing Priority List
Maps, Location/Contact Information
Government/Agency Contact Information
Calendar of Activities
Storm Job Descriptions
Team Member Lists/Contact Info
Territorial Maps
Storm Staffing Scenarios
Storm Organization Chart

b) On Going Coordination

Throughout the year, company representatives will work with local government officials and agency representatives to enhance the flow of information and to identify coordination opportunities. Coordination opportunities fall into several categories – storm related activities, vegetation management programs, undergrounding programs, and other coordination efforts.

- Storm Related Activities

  Representatives from PEF will participate in local storm workshops and expositions throughout PEF's service territory. In many cases, PEF will act as presenters or co-sponsor for these events. These events will occur in each region of PEF's service territory. In addition, PEF will hold workshops and other coordination meetings with local officials and agencies to educate on restoration programs, develop coordination plans, exchange feedback and generally enhance communication between organizations. Some key events scheduled for 2006 are listed below.

  - PEF is taking steps to enhance public information through the media. Among a number of activities, PEF will be participating as a panelist in hurricane preparedness town hall-type meetings forums in the Tampa and Orlando television markets. The programs are designed to educate the public and will include representatives from local government emergency management, the Red Cross, and FEMA.

Ongoing Storm Preparedness Plan

- PEF is scheduled to participate in EOC Coordination activities in most counties served including events and briefings in the following counties:

  Pinellas County
  Orange County
  Columbia County
  Gulf County
  Highlands County
  Pasco County
  Volusia County

- PEF is scheduled to participate in State-sponsored events:
  Governor's Hurricane Conference
  State Storm Drill

- PEF Sponsored events:
  South Coastal Community Storm Meeting and Expo (Pinellas and Pasco Counties)
  Progress Energy's 911 First Responders Storm and Safety Expo (Winter Garden Operation Center – covering Orange, Osceola, Seminole, Lake, Volusia, Gilchrist, Sumter and Polk)
  PEF is incorporating into its SCORE workshops for commercial, industrial and governmental customers a segment on hurricane preparedness and PEF restoration processes.

- Vegetation management coordination program

It has become essential to implement programs designed to improve coordination with communities regarding vegetation management. Not only will these activities support efforts to improve overall reliability improvement programs, but they will also support storm preparation and restoration activities. PEF has completed the development of a community vegetation management education program. This program is designed to:

- Ensure that all Progress Energy customers will have received some form of vegetation management education through community outreach, events, web site information, advertising and other communication mechanisms.
- Improve relationships with local governments, offering successful vegetation programs in their communities.
- Launch a Radio/Public Service Announcement Campaign in 2006 that will reach more than 30% of the Progress Energy market.
- Distribution of information in 2006 on vegetation management that will reach more than 30% of the Progress Energy market.
- Vegetation programs and events in Progress Energy communities in Florida.

- Undergrounding Programs

The impact of hurricanes in Florida since 2004 has renewed local government interest in burying overhead power lines. In an effort to work with communities to address this renewed interest in undergrounding their utilities, PEF is enhancing its programs in this area and has seen a marked increase in interest in the programs. PEF has ongoing undergrounding partnerships with a number of communities. Within these projects, the company acts as project manager and facilitates coordination not only with the municipality but also with other utilities (i.e., cable, TV).

Local government underground cost recovery tariff - PEF is in the process of revising its local government underground cost recovery tariff. This tariff allows local governments to recover the CIAC portion of the cost for underground projects through electric bills of customers within the local government's jurisdiction. The revised tariff will increase government flexibility in managing the cost of underground projects. As part of this program, the company is developing the concept of a secure external portal designed to assist governments in managing their underground projects utilizing the tariff.

- Street lighting repair program

PEF has implemented an improved program for customers to report street light outages to enhance the repair process. As part of the effort, we are coordinating with local government to communicate the improved process and encourage better utilization by government of improved reporting mechanisms. Communications have been sent to all city and county governments.

- Other coordination activities

PEF continues to develop opportunities to enhance relationships and communication with local government for improved service, reliability and restoration efforts. For example, the company plans to send out a communication to each local government within our service territory to encourage a link to the company's storm information web site be place on the community web site.

c) Plan implementation during storm events

When a major storm event occurs, the local government coordination storm plan will be executed. All team members will participate in pre-storm planning activities and receive assignments to specific regions and roles. The following is a high-level list of actions that will be performed by the team intended to provide excellent execution of community restoration activities and support of local government efforts.

- Communications with local government officials, agencies and key community leaders prior to the storm event notifying of PEF storm readiness activities and status.
- Ongoing communications to government officials, agencies and key community leaders providing updates of outage and storm restoration efforts of the company.

- Oversight of EOC Representatives (State) assigned to state and local EOCs.
- Provide updates and information for coordination purposes to internal leadership and operation personnel within the company.
- Obtain the Governor's Executive Order and distribute to PEF Logistics personnel for logistical purposes.
- Prepare DOT Waivers and communicate with DOT SEOC personnel (ESF 16) to expedite arrival of out-of-state crews prior to entry into the State of Florida.
- Prepare Aviation Waivers and obtain approvals from ESF 1 & ESF 3 (DOT & Public Works).
- Coordinate with PEF Storm Centers for the exchange of accurate information pertaining to restoration efforts before, during and after a major storm.
- Communicate with local officials regarding power outage data for the county as well as restoration efforts.

d) Emergency Operation Center (EOC) Plan

PEF has created and will be implementing a specific program for the management of restoration activities in coordination with local government at state and county EOCs during storm events. The specific role of the EOC Representative has been created to engage with EOC management on pre-storm planning and during storm events. The company has also assigned specific personnel to represent the company and to be stationed in a number of key EOCs throughout the storm event.

The primary responsibility of the EOC Representative is to work with the EOC personnel to establish current priorities for restoration, communicate this information to appropriate operating center personnel and ensure EOC priorities are worked successfully. The EOC Representative and other team members are responsible for establishing contact with assigned EOC and to update storm restoration infrastructure priority lists prior to the beginning of the storm season.

Pre-storm duties:

- Work with local governments to update specific city/county and EOC priorities (e.g. designated hospitals, shelters, traffic lights, essential water treatment facilities and lift stations, etc.) and develop prioritized account list for each county.
- Create list of all governmental facilities in the County including responsible operating center, substation, and feeder.
- Review PEF procedures with EOC staff and establish working relationship and rules.
- Work internally with operations personnel to establish EOC priority work flow.
- Provide feeder maps or outage information for the County for use at the EOC.
- Obtain a street level utility territory map for the County.

- Assure a network connection that will accommodate a Progress Energy computer exists at the EOC.
- Attend scheduled meetings as the storm approaches.
- Participate in software training at EOCs.

Duties during major storm event:

- Organize and report "911" type issues to Dispatch
- Advise company of the need for press briefings or public official meetings
- Attend scheduled EOC meetings
- Provide regular briefings on PE progress and deliver key communications to EOC personnel
- Communicate internally for the exchange of timely and accurate information

Duties after major storm:

- Attend scheduled EOC debriefing meetings
- Responsible for "break-down" of PEF area in EOC facility

9) Collaborative Research on Effects of Hurricane Winds and Storm Surge.

PEF will support a collaborative effort to conduct research and development (R&D) on the effects of hurricane winds and storm surge to the electrical system of Florida. The company also will support the leadership of the R&D effort to be facilitated through a centrally coordinated effort managed by an entity within the state that can draw from various universities and research organizations not only in Florida, but across the United States as well.

PEF believes the necessary leadership to serve as the R&D coordinator is available from the Public Utility Research Center ("PURC") in the Warrington College of Business Administration at the University of Florida. PURC is a long-standing research organization with a strong working relationship among the investor-owned utilities, cooperatives and municipals. Therefore, PURC is well positioned to either provide or secure the resources necessary for the R&D effort envisioned by the Commission.

PURC's position within the university community of the state and the nation allows the organization to draw from a number of resources otherwise unknown to utilities. Therefore, by coordinating the overall R&D initiative, unnecessary duplication of effort and superfluous spending should be avoided. However, if a utility has a need for a specific type of research to determine a solution to its unique problem, the utility is not hindered from engaging in independent research on its own through a local university or research organization other than PURC.

Estimated Costs and Timeline

PEF believes the collaborative research plan described above meets the intent of the Commission. The cost for this initiative will be determined by the extent and duration of R&D requested by the IOUs.

10). Natural Disaster Preparedness and Recovery Program.

Please see Attachments A, B and C to this Plan for PEF's Preparedness and Recovery Programs.

- Attachment A – Department Storm Plans
- Attachment B – Transmission Department Corporate Storm Plan
- Attachment C – Distribution & Transmission Storm Plans - Florida

DUKE ENERGY
FLORIDA

POLE INSPECTION PLAN

Progress Energy

Comprehensive Wood Pole Inspection Plan

April 2, 2012

Purpose and Intent of the Plan:

To implement and update a wood pole inspection program that complies with FPSC Order No. PSC-06-0144-PAA-EI issued February 27, 2006 (the "Plan"). The Plan concerns inspection of wooden transmission and distribution poles, as well as pole inspections for strength requirements related to pole attachments. The Plan is based on the requirements of the National Electric Safety Code ("NESC") and an average eight-year inspection cycle. The Plan provides a detailed program for gathering pole-specific data, pole inspection enforcement, co-located pole inspection, and estimated program funding. This Plan also sets forth pole inspection standards utilized by Progress Energy Florida ("PEF") that meet or exceed the requirements of the NESC.

The Plan includes the following specific sub-plans:

- Transmission Wood Pole Inspection Plan ("Transmission Plan").
- Distribution Wood Pole Inspection Plan ("Distribution Plan").
- Joint Use Wood Pole Inspection Plan ("Joint Use Plan").

These three inspection sub-plans are outlined and described below. All of these sub-plans will be evaluated on an ongoing basis to address trends, external factors beyond the Company's control (such as storms and other weather events), and cost effectiveness.

1) Transmission Wood Pole Inspection Plan

A. Introduction

Ground-line inspection and treatment programs detect and treat decay and mechanical damage of in-service wood poles. PEF's Transmission Department accomplishes this by identifying poles that are 8 years of age or older and treating these poles as necessary in order to extend their useful life. As required, PEF also assesses poles and structures for incremental attachments that may create additional loads. Poles that can no longer maintain the safety margins required by the NESC (ANSI C2-2002) will be remediated. These inspections result in one of four or a combination of the following actions: (1) No action required; (2) Application of treatment; (3) Repaired; (4) Replaced.

B. General Plan Provisions

(i). Pole Inspection Selection Criteria

Transmission performs ground patrols to inspect transmission system line assets to allow for the planning, scheduling, and prioritization of corrective and preventative maintenance work. These patrols assess the overall condition of the assets including insulators, connections, grounding, and signs, as well as an assessment of pole integrity. These patrols are be done on a three-year cycle and the assessment data and reports generated from these patrols are used to plan the ground-line inspections set forth in Section 1B(ii) below. The ground patrol inspections categorize wood poles into four conditions or states (State 2-5). PEF conducts ground-line inspections of State 2 and 3 poles. State 3 poles are given priority for ground-line inspection scheduling. PEF replaces State 4 and 5 poles. PEF no longer utilizes the State 1 category.

In performing inspection and patrols, the following Transmission Line Wood Poles Inspection State Categories shall apply:

State 2 : Meeting all of the criteria listed below:

- No woodpecker holes or woodpecker holes have been repaired.
- A pole that has been cut and capped.
- Checks/cracks show no decay or insect damage.
- Ground-line inspected/treated with no data in the remarks field of the report and no noted reduction in effective pole diameter.
- Hammer test indicates a hard pole.
- No pole top deflection noted.

State 3 : Meeting one or more of the criteria listed below:

- Checks/cracks show decay or insect damage, or the presence of minimal shell cracking.
- Ground-line inspected/treated with decay noted in the remarks field of the report and a noted reduction in effective pole diameter.
- Hammer test indicates a minimal amount of ground-line decay.
- Pole has been repaired (e.g., C-truss).
- Poles with a wood bayonet or a pole that needs to be cut and capped.
- Pole can be partially hollow but with no less than 3 – 4 inches of shell thickness and cannot be caved during a hammer test.
- Pole top deflection is less than 3 feet.

State 4 : Meeting one or more of the criteria listed below and should be scheduled to be replaced:

- Woodpecker holes which have deep cavities and are not repairable.
- Checks/cracks show significant decay or insect damage, or the presence of substantial shell cracking.
- Decay in the pole top is extensive such that the pole cannot be cut and capped nor is the pole top section a candidate for a bayonet.
- Ground-line inspected/treated and identified as rejected/restorable or rejected/non-restorable.
- When hammer tested, ground-line decay pockets are found and are greater than 5 inches wide and 2 inches deep.
- Pole is hollow with less than 3 – 4 inches of shell thickness extending over more than one-quarter of the pole circumference, determined by hammer test and/or a screw driver.
- Pole top deflection is between 3 to 5 feet.

State 5 : Meeting one or more of the criteria listed below. (This pole should be scheduled to be replaced as soon as possible):

• Woodpecker holes which have deep cavities and are not repairable, severely affecting the integrity of the pole.
• Ground-line inspection indicates the pole as "priority."
• When hammer tested, ground-line decay pockets are found and are greater than 8 inches wide by 3 inches deep.
• Pole is hollow with less than 2 inches of shell thickness extending over more than one-third of the pole circumference.
• Pole deflection exceeds 5 feet.

(ii). Ground-Line Inspections

Ground-line inspections of wood transmission poles are conducted by qualified pole inspectors on an average 8-year cycle. This results in, on average, approximately 12.5% of the remaining population of wood poles receiving this type of inspection on an annual basis. Treatment and inspection work shall be done or supervised by a foreman with a minimum of six months experience and shall be certified as being qualified for this work.

For poles without an existing inspection hole, the pole will be bored at a 45 degree angle below the ground line to a depth that extends past the center of the pole. For previously inspected poles, the original ground-line inspection plug shall be bored out and the depth of the inspection hole measured to ensure that the pole has been bored to the required depth. Treatment application plug(s) will be bored out and the depth of these holes measured to ensure compliance. Hammer marks should be evident to show that the pole has been adequately sounded.

All work done, materials used, and materials disposed of shall be in compliance and accordance with all local, municipal, county, state, and federal laws and regulations applicable to said work. Preservatives used shall conform to the minimum requirements as set forth in this Transmission Plan.

The inspection method used is a sound and bore inspection that will include the following components:

- Above Ground Observations - Visual inspection of the exterior condition of the pole and visual inspection of components hanging from the pole.
- Sound with Hammer – The exterior of the pole is tested with a hammer and the inspector listens for "hollowness" of the pole.
- Bore at Ground Line – The pole is bored at a 45 degree angle below the ground line. This inspection method helps to determine internal decay at the base as well as measure the amount of "good wood" left on the interior of the pole.

- Excavate to 18 inches (Full Ground Line Inspection) – The soil is removed 18 inches below ground line. Decay pockets are identified and bored to determine the extent of decay.
- Removal of Surface Decay – Identified areas of decay are removed down to "good wood" using a sharp pick.
- Assessment of Remaining Strength – All data collected from the inspection will be used to determine effective circumference and remaining strength of the pole. In evaluating pole conditions, deductions shall be made from the original ground line circumference of a pole to account for hollow heart, internal decay pockets, and removal of external decay. The measured effective critical circumference shall be at the point of greatest decay removal in the vicinity of the ground line taking into account the above applicable deductions. A pole circumference calculator shall be used to determine the measured effective critical circumference. To remain in service "as-is," the pole shall meet minimum NESC strength requirements. The measured effective critical circumference will be compared to the minimum acceptable circumference for the applicable class pole listed in the latest version of ANSI 05.1-1992, American National Standard for Wood Poles and NESC-C2-1990(1). Poles below the minimum acceptable circumference shall be rejected and will be marked in the field for replacement as either a State 4 or State 5 pole.
- Where excavation at the ground line cannot be achieved due to concrete or similar barriers, pole integrity will be assessed using a drilling resistance measuring device. These devices are now available on the market and are able to accurately detect voids and decay in poles at and below the ground where excavation is not possible.

(iii) Structural Integrity Evaluation

As part of the visual inspection of the poles, the inspector will note and record the type and location of non-native utility pole attachments to the pole or structure. This information will be used by the Joint Use Department to perform a loading analysis on certain poles or structures, where necessary, as more fully described in the Joint Use section of this Plan. In such cases, the loading information obtained from this analysis will be used along with the strength determined in the ground-line inspection. If the loads exceed: a) the strength of the structure when new and b) the strength of the existing structure exceeds the strength required at replacement, according to the NESC, the structure will either be braced to the required strength or will be replaced with a pole of sufficient strength. Specific information on this process in contained in the Joint Use section of this Plan.

(iv). Records and Reporting

A pole inspection report will be filed with the Division of Economic Regulation by March 1st of each year. The report shall contain the following information:

1) A description of the methods used for structural analysis and pole inspection.

2) A description of the selection criteria that was used to determine which poles would be inspected.

3) A summary report of the inspection data including the following:

   a. Total number of wood poles in Company inventory.
   b. Number of pole inspections planned.
   c. Number of poles inspected.
   d. Number of poles failing inspection.
   e. Pole failure rate (%) of poles inspected.
   f. Number of poles designated for replacement.
   g. Total number of poles replaced.
   h. Number of poles requiring minor follow-up.
   i. Number of poles overloaded.
   j. Methods of inspection used.
   k. Number of pole inspections planned for next annual inspection cycle.
   l. Total number of poles inspected (cumulative) in the 8-year cycle to date.
   m. Percentage of poles inspected (cumulative) in the 8-year cycle to date.

4) A pole inspection report that contains the following detailed information:

   a. Transmission circuit name.
   b. Pole identification number.
   c. Inspection results.
   d. Remediation recommendation.
   e. Status of remediation.

C. Program Cost and Funding

- PEF continues to meet the obligations set forth in Order No. PCS-06-0144-PAA-EI. The number of poles inspected per year will start at approximately 3,800 poles, but may vary from year to year depending on previous years' accomplishments.

PEF is currently on track to meet the 8-year cycle requirements. The number of poles inspected may vary year to year depending on the previous year's accomplishments with the intent to complete inspections in the required timeframe. The estimated figures in the chart below are "best estimates," given information and facts known at this time and are subject to change or modification.

Wood Pole Program Cost Estimates

Annual Unit & C[illegible]mate		
Cycle		
Years per cycle	8	
Poles inspected per year	3,800	On average; may vary year to year
Assumed poles replaced*	5%	Current future projections

O&M Cost		
GL Inspection & Treatment	$250,000	On average; may vary year to year
Capital Cost		
Pole & Insulator Replacements	$6,000,000	On average; may vary year to year
Hurricane Hardening	$7,000,000	On average; may vary year to year

* Assumption is made that approximately 5% of the poles inspected will be identified for replacement.

2) Distribution Wood Pole Inspection Plan

A. Introduction

In accordance with FPSC Order No. PSC-06-0144-PAA-EI, PEF's Distribution Department inspects Company-owned wood poles on an average 8-year cycle. These inspections determine the extent of pole decay and any associated loss of strength. The information gathered from these inspections is used to determine pole replacements and to effectuate the extension of pole life through treatment and reinforcement. Additionally, information collected from the wood pole inspections is used to populate regulatory reporting requirements, provide data for loading analyses, identify other equipment maintenance issues, and used to track the results of the inspection program over time.

B. General Plan Provisions

(i). Ground-line Inspection Purpose

- The ground-line inspection process is the industry standard for determining the existing condition of wood pole assets. This inspection helps to determine extent of decay and the remaining strength of a pole. Ground-line inspections also provide insight into the remaining life of a wood pole.

- The ground-line inspection is performed at the base of the pole because the base is the location of the largest "bending moment," as well as the area subject to the most fungal decay and insect attack. Assessing the condition of the pole at the base is the most efficient way to effectively treat and restore a wood pole.

(ii). Pole Inspection Process

When a wood distribution pole, other than a CCA pole, is inspected, the tasks listed below will be performed. For a CCA type wood distribution pole less than 16 years of age, the inspection will consist of a visual above ground inspection and sounding with hammer, both procedures are described below.

For CCA poles 16 years of age and greater, all inspection methods described below are used. Boring at Ground Line is also performed on type CCA poles when decay is present.

- Above Ground Observations - Visual inspection of the exterior condition of the pole and visual inspection of components hanging from the pole.
- Partial Excavation – The soil is removed around the base of the pole and the pole is inspected for signs of decay.
- Sound with Hammer – The exterior of the pole is tested with a hammer and the inspector listens for "hollowness" of the pole.
- Bore at Ground Line – The pole is bored at a 45 degree angle below the ground line. This inspection method helps to determine internal decay at the base as well as measure the amount of "good wood" left on the interior of the pole.
- Excavate to 18 Inches (Full Ground Line Inspection) – If significant decay is found during the full excavation, the soil is removed 18 inches below ground line. Decay pockets are identified and bored to determine the extent of decay.
- Removal of Surface Decay – Identified areas of decay are removed down to "good wood" using a sharp pick.
- Prioritization of rejected poles – rejected poles shall be assessed on their overall condition and then prioritized accordingly. Generally these poles will then be replaced in order of priority, from highest to lowest.
- For poles where obstructions, such as concrete encasement, make full excavation impractical PEF will utilize the best economical inspection process in accordance with Order No. PSC-08-0644-PAA-EI issued October 6, 2008.

(iii) Data Collection

All data collected through the inspection process will be submitted to PEF's Distribution Department in electronic format by inspection personnel. This data will be used to determine effective circumference and remaining strength of the pole. In evaluating pole conditions, deductions shall be made from the original ground line circumference of a pole to account for hollow heart, internal decay pockets, and removal of external decay. The measured effective critical circumference shall be at the point of greatest decay removal in the vicinity of the ground line taking into account the above applicable deductions. A pole circumference calculator shall be used to determine the measured effective critical circumference. To remain in service "as-is," the pole shall meet minimum NESC strength requirements. The measured effective critical circumference will be compared to the applicable minimum acceptable circumference listed in the most current versions of ANSI 05.1-1992, American National Standard for Wood Poles, and NESC-C2-1990(1). Poles below the minimum acceptable circumference shall be rejected and will be marked in the field for replacement.

(iv). Structural Integrity Evaluation

- See Joint Use Pole Inspection Plan, section B, paragraph (i).

(v). Records and Reporting

A pole inspection report will be filed with the Division of Economic Regulation by March 1st of each year. The report shall contain the following information:

1) A description of the methods used for structural analysis and pole inspection.

2) A description of the selection criteria that was used to determine which poles would be inspected.

3) A summary report of the inspection data including the following:

a. Total number of wood poles in Company inventory.
b. Number of pole inspections planned.
c. Number of poles inspected.
d. Number of poles failing inspection.
e. Pole failure rate (%) of poles inspected.
f. Number of poles designated for replacement.
g. Total number of poles replaced.
h. Number of poles requiring minor follow-up.
i. Number of poles overloaded.
j. Methods of inspection used.
k. Number of pole inspections planned for next annual inspection cycle.
l. Total number of poles inspected (cumulative) in the 8-year cycle to date.
m. Percentage of poles inspected (cumulative) in the 8-year cycle to date.

4) A pole inspection report that contains the following detailed information:

a. Distribution circuit name.
b. Pole identification number.
c. Inspection results.
d. Remediation recommendation.
e. Status of remediation.

C. Program Cost and Funding

(i). Poles Program Cost Estimates

PEF continues to successfully meet the obligations set forth in Order No. PSC-06-0144-PAA-EI and continues to inspect poles based on the 8-year cycle as mandated by the FPSC. The number of poles inspected per year is expected to be approximately 96,000 poles, but may vary from year to year depending on previous years' accomplishments with the intent to complete inspections in the required timeframe. Funding requirements to meet all aspects of this program will be adjusted from year to year, as well. PEF is currently on track to meet the 8-year cycle requirements.

The estimated figures in the charts below are "best estimates," given information and facts known at this time and are subject to change or modification.

[illegible]

Years per Cycle	# of Wood Poles to be inspected per year	Non-CCA Replacements*	CCA Replacements	Non-CCA Bracing	CCA Bracing	Non-CCA Treatments	CCA Treatments
8	95,000	4,340	120	770	30	17,300	8,300

* *Assumption is made that approximately 2% of the non-CCA poles inspected will be identified for replacement.*

[illegible]

Years per Cycle	O&M Costs		Capital		O&M Total	Capital Total	Program Total Cost
	Inspections (S&B Excavation)	Treatments (add'l to inspection)	Replacements	Braces			
8	$2,800,000	$470,000	$9,900,000	$450,000	$3,270,000	$10,350,000	$13,620,000

3) Joint Use Pole Inspection Plan

A. Introduction

PEF currently has approximately 784,000 joint use attachments on distribution poles and approximately 8,300 joint use attachments on transmission poles. On average, PEF receives approximately 10,000 new attachment requests per year. All new attachment requests are reviewed in the field to assure the new attachments meet NESC and company clearance and structural guidelines. The information provided below outlines PEF's attachment permitting process and how PEF intends to gather structural information on certain existing joint use poles over an average 8-year inspection cycle to meet the obligations set forth in Order No. PCS-06-0144-PAA-EI.

B. General Plan Provisions

(i). Structural Analysis for a Distribution Pole New Joint Use Attachment

When the Joint Use Department receives a request to attach a new communication line to a distribution pole, the following is done to ensure that NESC clearance and loading requirements are met before permitting the new attachment:

- Each pole is field inspected, and the attachment heights of all electric and communication cables and equipment are collected. The pole number, pole size and class (type) are noted as well as span lengths of cables and wires on all sides of the pole.
- For each group of poles in a tangent line, the pole that has the most visible loading, line angle and longest or uneven span length is selected to be modeled for wind loading analysis.
- The selected pole's information is loaded into a software program called "SPIDA CALC" from IJUS. The pole information is analyzed and modeled under the NESC Light District settings of 9psf, no ice, 30° F, at 60 MPH winds to determine current loading percentages.
- If that one pole fails, the next worst case pole in that group of tangent poles is analyzed as well.
- Each pole is analyzed to determine existing pole loading and the proposed loading with the new attachment.
- If the existing analysis determines the pole is overloaded, a work order is issued to replace the pole with a larger class pole. If the pole fails only when the new attachment is considered, a work order estimate is made and presented to the communication company wishing to attach.
- The results of the analysis and the new attachment are entered into the FRAME system.

(ii). <u>Structural Analysis for a Transmission Pole New Joint Use Attachment</u>

When the Joint Use Department receives a request to attach a new communication line to a transmission pole with distribution underbuild, the following will be done to ensure that NESC clearance and loading requirements are met before permitting the new attachment:

- Each pole is field inspected, and the attachment heights of all electric and communication cables and equipment are collected. The pole number, pole size and class (type) are noted as well as span lengths of cables and wires on all sides of the pole.
- All pole information including structural plan and profiles are sent to the engineering company, Enercon in Longwood, Florida, to be modeled in PLS-CADD/LITE and PLS-POLE for structural analysis.
- Enercon engineers determine the worst case structures in a tangent line and request the structural drawings and attachment information on those selected poles. Typically, transmission poles with line angle and uneven span lengths are the poles considered for wind loading analysis.
- The selected pole information is loaded into the PLS-CADD and PLS-POLE software. Depending on the pole location per the NESC wind charts, one of the following load cases is run. **NESC Light District:** 9psf, no ice, 30° F, 60mph; **NESC Extreme:** 3 sec gust for the specific county, no ice, 60° F (Ex: Orange County is 110 mph); or **PEF Extreme** at 36psf, 75° F, wind chart mph
- If that one pole fails, the next worst case pole in that group of tangent poles is analyzed as well.
- Each pole is analyzed to determine existing pole loading and the proposed loading with the new attachment.

- If the existing analysis determines the pole is overloaded, a work order is issued to replace the pole with a larger class pole. If the pole fails only when the new attachment is considered, a work order estimate is made and presented to the communication company wishing to attach.
- The results of the analysis and the new attachment are entered into the FRAME system.

(iii). Analysis of Existing Joint Use Attachments On Distribution Poles

There are approximately 784,000 joint use attachments on approximately 515,000 distribution poles in the PEF system. All distribution poles with joint use attachments will be inspected on an average 8-year audit cycle to determine existing structural analysis for wind loading. These audits will start at the sub-station where the feeder originates. For each group of poles in a tangent line, the pole that has the most visible loading, line angle, and longest or uneven span length will be selected to be modeled for wind loading analysis. Each pole modeled will be field inspected. The attachment heights of all electric and communication cables and equipment will be collected. The pole age, pole type, pole number, pole size / class, span lengths of cables and wires, and the size of all cables and wires on all sides of the pole will be collected.

The selected pole's information will then be loaded into a software program called "SPIDA CALC" from IJUS. The pole information will be analyzed and modeled under the NESC Light District settings of 9psf, no ice, 30° F, at 60 MPH winds to determine current loading percentages. If that one pole fails, the next worst case pole in that group of tangent poles will be analyzed as well. Each pole analyzed will determine the existing pole loading of all electric and communication attachments on that pole. If the existing analysis determines the pole is overloaded, a work order will be issued to replace the pole with a larger class pole. Should the original pole analyzed meet the NESC loading requirements, all similar poles in that tangent line of poles will be noted as structurally sound and entered into the database as "PASSED" structural analysis. The results of the analysis and all communication attachments will be entered into the FRAMME system. Reporting from the GIS database will indicate the date and results of the analysis. Poles rated at 100% or lower will be designated as "PASSED." Poles that are analyzed and determined to be more than 100% loaded will be designated as "FAILED," and scheduled to be changed out. Once the pole is changed out, the GIS database will be updated to reflect the date the new pole was installed with the new loading analysis indicated.

(iv). Analysis of Existing Joint Use Attachments On Transmission Poles

There are approximately 8,300 joint use attachments on approximately 2,800 transmission poles in the PEF system. All transmission poles with joint use attachments will be inspected on an average 8-year audit cycle to determine existing structural analysis for wind loading. Audits will start at the sub-station where the feeder originates. All pole information (pole size, class, type, age, pole number, cable, wire, equipment attachment heights, span lengths) including structural plan and profiles will be sent to the engineering company, Enercon in Longwood Florida, to be modeled in PLS-CADD/LITE and PLS-POLE for structural analysis. Enercon engineers will determine the worst case structures in a tangent line and request the structural drawings and attachment information on those selected poles. Typically, transmission poles with line angle and uneven span lengths are the poles considered for wind loading analysis.

The selected pole information will be loaded into the PLS-CADD and PLS-POLE software. Depending on the pole location per the NESC wind charts, one of the following load cases is run. **NESC Light District:** 9psf, no ice, 30° F, 60mph; **NESC Extreme:** 3 sec gust for the specific county, no ice, 60° F (Ex: Orange County is 110 mph); or **PEF Extreme** at 36psf, 75° F, wind chart mph. If that one transmission pole fails, the next worst case pole in that group of tangent poles will be analyzed as well. Each transmission pole analyzed will determine the existing pole loading of all electric and communication attachments on that pole. If the existing analysis determines the transmission pole is overloaded, a work order will be issued to replace the pole with a larger class pole. Should the original pole analyzed meet the NESC loading requirements, all similar poles in that tangent line of poles will be noted as structurally sound and entered into the database as "PASSED" structural analysis.

The results of the analysis and all communication attachments will be entered into the GIS database. Reporting from the GIS database will indicate the date and results of the analysis. Transmission poles rated at 100% or lower will be designated as "PASSED." Transmission poles that are analyzed and determined to be more than 100% loaded will be designated as "FAILED," and scheduled to be changed out. Once the transmission pole is changed out, the GIS database will be updated to reflect the date the new pole was installed with the new loading analysis indicated.

(v). Records and Reporting

A pole inspection report will be filed with the Division of Economic Regulation by March 1st of each year. The report shall contain the following information:

1) A description of the methods used for structural analysis and pole inspection.

2) A description of the selection criteria that was used to determine which poles would be inspected.

3) A summary report of the inspection data including the following:

   a. Number of poles inspected.
   b. Number of poles not requiring remediation.
   c. Number of poles requiring remedial action.
   d. Number of pole requiring minor follow up.
   e. Number of poles requiring a change in inspection cycle.
   f. Number of poles that were overloaded.
   g. Number of inspections planned.

C. Program Cost and Funding

(i). Pole Analysis Funding

As stated above, there are currently approximately 784,000 joint use attachments on approximately 515,000 distribution poles and approximately 8,300 joint use attachments on approximately 2,800 transmission poles. PEF will analyze the "worst case" poles in a tangent line of similar poles as deemed appropriate during field inspections.

In order to meet the obligations set forth in Order No. PCS-06-0144-PAA-EI, PEF requires incremental funding annually to successfully gather data and enter it into the required reporting format. See calculation that follows. The estimated figures in these charts are "best estimates," given information and facts known at this time and are subject to change or modification.

[illegible]									
Distribution poles with joint use	Annual inspected (8-yr cycle)	10% of Distribution poles analyzed	1% of Distribution poles replaced	Transmission poles with joint use	Annual inspected (8-yr cycle)	30% of Transmission poles analyzed	10% of Transmission poles replaced	Total cost to analyze poles (O&M)	Total cost to replace poles (capital)
510,000	63,750	6,375	191	2,800	338	101	10	$907,183	$505,600

DUKE ENERGY®
FLORIDA

VEGETATION PLAN
(INCLUDED IN ONGOING STORM PREPAREDNESS PLAN)

DUKE ENERGY®
FLORIDA

2012 PSC RELIABILITY REPORT;
Pages 40-43, 45-47, 48-63

II. STORM HARDENED FACILITIES

Pursuant to the Stipulation regarding the "Process within the Process" entered into and filed jointly by the third-party attachers and IOU's with the FPSC on September 26, 2007, paragraph 7 requires each electric utility to file by March 1 each year a status report of its implementation of its storm hardening plan. Please see *Attachment I - "Spreadsheet of Storm Hardening Project Status"*.

PEF continues to maintain an open line of communication with third-party attachers pertaining to storm hardening projects in PEF's territory.

a. Describe each storm hardening activity undertaken in the field during 2012.

Distribution

In addition to the activities identified in PEF's Storm Hardening Plan (Attachment J), Wood Pole Inspection Plan (Attachment K), and other initiatives identified and discussed herein, Progress Energy Florida Distribution undertook the following specific activities that deliver a storm hardening benefit during 2012:

Existing Overhead to Underground Conversion:

See Attachment L - "Major Conversions Historical Data".

New Construction Cable footage installed underground:
In 2012, PEF installed 145 circuit miles of new underground cable. Overall, the PEF distribution system consists of 41.7%% primary underground circuit miles (12,980 circuit miles).

Network Maintenance and Replacement:
2012 Actuals - $900k
Switchgear Replacement – 2012 Actuals - $1.4M

Midfeeder Electronic Sectionalizing (Reclosers):
2012 Actuals - $570k

Wood Pole Inspection and Treatment:
2012 Actuals - $2.6M

Wood Pole Replacement:
2012 Actuals - $12.7M

Padmount Transformer Replacement:
2012 Actuals - $10.9M

Storm Hardening Pilot Projects
2012 Actuals - $4.7M

Transmission

In addition to the activities identified in PEF's Storm Hardening Plan (Attachment J), Wood Pole Inspection Plan (Attachment K), and other initiatives identified and discussed herein, Progress Energy Florida Transmission undertook the following specific Storm Hardening Activities during 2012:

Maintenance Change outs:
Progress Energy Florida Transmission is installing either steel or concrete poles when replacing existing wood poles. This activity resulted in the replacement of 1,080 wood poles with steel or concrete during 2012.

DOT/Customer Relocations and Line Upgrades and Additions:
Progress Energy Florida Transmission will design any DOT or Customer Requested Relocations and any line upgrades or additions to meet or exceed the current NESC Code Requirements and will construct these projects with either steel or concrete poles. This activity resulted in replacement of approximately 857 poles with steel or concrete during 2012.

Note: In Attachment O, it is reported that 803 wood poles were replaced. The difference is due to the timing of database updates. The numbers above reflect the actual field work completed.

b. **Describe the process used by your company to identify the location and select the scope of storm hardening projects.**

Distribution

The location and scope of projects that deliver hardening benefits varies by type of construction, maintenance, or replacement activity. Primary factors considered include operational and storm performance, remaining life, condition assessment of equipment as determined by inspection, and cost to repair or replace. In all cases, the cost to install, maintain, or replace equipment is balanced against the expected long term operational and cost benefit.

For additional information, please see Attachment J - PEF's Storm Hardening Plan.

Transmission

Maintenance Change outs
Poles that require change out are identified by Procedure MNT-TRMX-00053, "Ground Patrols" (Attachment M). The change out schedule is determined by the condition of the wood pole based upon inspector experience.

DOT/Customer Relocations
Poles that are changed out and upgraded are identified by requests from DOT or customers.

Line Upgrades and Additions
Progress Energy Florida Transmission Planning will determine where and when lines need to be upgraded.

For additional information, please see Attachment J - PEF's Storm Hardening Plan.

c. **Provide the costs incurred and any quantified expected benefits.**

Distribution

See Subsection (a) above.

Transmission

Line Maintenance Change outs
Progress Energy Florida Transmission spent approximately $15,723,729 for Capital Improvements in 2012. Capital Improvements includes pole change outs and complete insulator replacements.

Quantified benefits will be a stronger and more consistent material supporting Transmission Circuits. Over the next 10 years, the percentage of wood poles on Progress Energy Florida's Transmission system should reduce wood poles on the system from approximately 75% today to 50%.

DOT/Customer Relocations and Line Upgrades and Additions
Progress Energy Florida Transmission spent approximately $90,771,847 for DOT/Customer Relocations and Line Upgrades and Additions in 2012.

Quantified benefits will be a stronger and more consistent material supporting Transmission Circuits. Over the next 10 years, the percentage of wood poles on Progress Energy's Transmission system should reduce wood poles on the system from approximately 75% today to 50%.

d. **Discuss any 2013 projected activities and budget levels.**

Distribution

Progress Energy Florida Distribution's storm hardening strategy and activities for 2013 are still ongoing and under development. At this time, however, Progress Energy Distribution reports as follows:

Existing Overhead to Underground Conversion:
Major Underground Conversions are a customer driven activity based upon a willingness to pay the conversion costs. While specific annual totals are difficult to forecast, the trend indicated by Attachment L, "Major Conversions Historical Data" over the last 10 years is expected to continue.

New Construction Cable footage installed underground:
The specific span miles of new underground cable installed is driven by the level of new connect activity. While the number of span miles installed varies from year to year, the

percentage of new primary distribution span miles installed underground is expected to continue.

Network Maintenance and Replacement:
2013 Projections - $600k
Livefront Switchgear Replacement – 2013 Projections - $300k

Wood Pole Inspection and Treatment:
2013 Projections - $1.6M

Wood Pole Replacement:
2013 Projections - $14.2M

Padmount Transformer Replacement:
2013 Projections - $10.3M

Storm Hardening Pilot Projects
2013 Projections - $5.9M

Transmission

Progress Energy Florida Transmission's storm hardening strategy and activities for 2013 are still ongoing and under development. At this time, however, Progress Energy Transmission reports as follows:

Line Maintenance Change outs
Progress Energy Florida Transmission should replace approximately 700 poles in 2013. Capital Budget for Line Maintenance is $13,885,669 for 2013 which includes pole change outs, insulator replacements and any overhead ground wire (OHGW) replacements.

DOT/Customer Relocations and Line Upgrades and Additions
Progress Energy Florida Transmission should replace approximately 890 poles in 2013. Current identified DOT/Customer Relocation Projects and Line Upgrades and Additions has a capital budget of $95 million.

IV. WOOD POLE INSPECTION PROGRAM

a. Provide a detailed description of the Company's wood pole inspection program.

PEF's wood pole inspection program philosophy is to determine the condition of the wood pole plant and provide remediation for any wood poles that are showing signs of decay or fall below the minimum strength requirements outlined by NESC standards.

PEF is utilizing the expertise of Utility Pole Technologies, Inc. ("UPT"), a division of Asplundh, to perform the inspections on an eight year cycle. UPT is using visual inspection, sound and boring, and full excavation down to 18 inches below ground line to determine the condition of all poles with the exception of CCA poles less than 16 years of age. For CCA poles less than 16 years of age, UPT is using visual inspection and sound, as well as, selective boring to determine the pole condition. In addition, UPT is providing remediation of decayed poles through external and internal treatments. If the pole is below NESC standards and has the minimum remaining wood above ground line, UPT will also reinforce the pole back to original strength.

For additional information, please see Attachment K - "Wood Pole Inspection Plan". Pursuant to FPSC Order No. PSC-06-0144-PAA-EI, FAC, PEF filed its updated Wood Pole Inspection Plan on April 1, 2012.

b. 2012 accomplishments

Distribution

PEF inspected 91,306 wood poles that for the 2012 inspection. This total will keep us on target to meet an 8 year pole inspection cycle. In addition to the inspections, GPS coordinates and physical attributes were updated and/or verified and inspection results were collected in a central database on all poles inspected.

Transmission

In 2012, PEF Transmission ground patrol inspected 13,914 wood pole structures. This represents approximately 47% of the wood pole structures on the PEF Transmission system.

c. Projected accomplishments for 2013

Distribution

Among other things, PEF's goal for 2013 is to inspect at least 96,000 wood poles throughout the PEF territory and to continue verifying and updating GPS coordinates, inspection results, and physical attributes for all poles inspected. Progress Energy will continue to utilize the same inspection procedures in 2013 that we have in the past. In the last weeks of 2012, Osmose Utilities Services, Inc. purchased Utility Pole Technologies from Asplundh. We anticipate a smooth transition back to Osmose with this acquisition.

Transmission

Current plans are to inspect approximately 1/3 to 1/5 of the system, which equates to approximately 1,000 miles of Transmission Circuits (or approximately 7,500 wood structures). We will have a 3rd party contract crew complete ground line sound and bore inspections for approximately 7,500 wood poles. We also will aerial patrol the entire transmission system two (2) times during 2013. We will perform a ground inspection on all lines 200kv and higher. These patrols will begin in March 2013.

d. Wood pole inspection reports.

Each wood pole inspection report contains the following:

- A description of the methods used for structural analysis and pole inspection,
- A description of the selection criteria that was used to determine which poles would be inspected, and
- A summary report of the inspection data.

Distribution

Please see Attachment O - 2012 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2013.

For a description of the methods used for structural analysis and pole inspection – please refer to Attachment K - "Wood Pole Inspection Plan", pages 1 - 4 and 6 - 8.

For the summary report of the inspection data - See Attachment P - CD Rom containing Excel file - "2012 Distribution Pole Inspection Data".

Transmission

Please see Attachment O - 2012 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2013.

For a description of the methods used for structural analysis and pole inspection – please refer to Attachment K - "Wood Pole Inspection Plan", pages 1 - 4 and 6 - 8.

For the summary report of the inspection data – See Attachment Q – CD containing Excel files - "2012 Pole Data" and "2012 Structure Data".

CCA Pole Sampling Report

Pursuant to Order No. PSC-08-0615-PAA-EI issued September 23, 2008 in Docket No. 080219-EI, the Commission approved modification to the sounding and boring excavation requirements of Order No. 06-0144-PAA-EI with regard to CCA wood poles less than 16 years old. On Pages 3 and 4 of Order No. PSC-08-0615-PAA-EI, it states, *"ORDERED that, consistent with the deviation granted to Gulf Power Company in Order No. PSC-07-0078-PAA-EU, Progress Energy Florida, Inc., Florida Power & Light Company, and Tampa Electric Company shall be required to sound and selectively bore all CCA poles under the age of 16 years, but shall not be required to perform full excavation on these poles. It is further*

ORDERED that Progress Energy Florida, Inc., Florida Power & Light Company, and Tampa Electric Company shall also be required to perform full excavation sampling to validate their inspection method. It is further

ORDERED that the results of the utilities' sampling shall be filed in their annual distribution reliability reports."

2012 CCA Pole Sampling Results

Please see Attachment O – PEF's 2012 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2013. The "CCA Sampling Results for 2012" is included in PEF's Wood Pole Inspection Report as "Attachment B".

V. EIW INITIATIVES

VEGETATION MANAGEMENT – THREE YEAR CYCLE (*Initiative 1*)

a. **Provide a complete description of the Company's vegetation management program (policies, guidelines, practices) for 2012 and 2013 in terms of both activity and costs.**

- *See Attachment R - "PEF's Storm Preparedness Plan".*
- *See Attachment S - "Internal Policy & Guidelines".*
- *For activities and costs - See information herein on pages 49 - 52.*

b. **Describe tree clearing practices in utility easements and authorized rights-of-ways.**

See Attachment S - "Internal Policy & Guidelines".

c. **Identify relevant portions of utility tariffs pertaining to utility vegetation management activities within easements and authorized rights-of-ways.**

PEF's tariffs do not contain specific language pertaining to utility vegetation management activities within easements and authorized rights-of-ways.

d. **Describe tree removal practices for trees that abut and/or intrude into easements and authorized rights-of-ways.**

See Attachment S - "Internal Policy & Guidelines".

e. **Describe tree clearing practices outside of utility easements and authorized rights-of-ways.**

See Attachment S - "Internal Policy & Guidelines".

f. **Identify relevant portions of utility tariffs pertaining to utility vegetation management activities outside of easements and authorized rights-of-ways.**

PEF's tariffs do not contain specific language pertaining to utility vegetation management activities outside of easements and authorized rights-of-ways.

g. **Describe tree removal practices for trees outside of easements and authorized rights-of-ways.**

See Attachment S - "Internal Policy & Guidelines".

h. **Identify relevant portions of utility tariffs pertaining to customer vegetation management obligations as a term or condition of electric service.**

There is no specific language in PEF's tariffs that pertain to customer vegetation management obligations as a term or condition of electric service. However, in Section 4 of PEF's tariff book, Sheets 4.11 and 4.123, reference is made to a customer's responsibility regarding vegetation management.

i. **Describe Company practices regarding customer trim requests.**

When a customer calls into the call center, either a tree work ticket is generated or a Progress Energy Florida field resource will submit a ticket using the work management system. For the remaining process, please see Attachment T - "Vegetation Management – Customer Demand Tree Trimming Requests".

j. **Describe the criteria used to determine whether to remove a tree, replace a tree, spot-trim, demand trim, or mid-cycle trim, etc.**

The criteria used is comprised of a number of considerations, i.e., location, customers on the line, removal vs. trim candidate, species, customer permission, easement rights and risk. Apart from identifying these factors, as a general matter, PEF cannot elaborate as to how these factors may apply in a given factual circumstance.

k. **Discuss any 2013 projected activities and budget levels.**

See charts below.

SYSTEM VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	176	N/A *	N/A *	7,491	N/A *
(B) Customer Interruptions	N/A *	240,316	N/A *	N/A *	226,249	N/A *
(C) Miles Cleared	N/A *	196	N/A *	N/A *	3,214	N/A *
(D) Remaining Miles	N/A *	0	N/A *	N/A *	991	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.89	N/A *	N/A *	3.37	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	1,218.33	N/A *	N/A *	101.76	N/A *
(G) Number of Hotspot trims	N/A *	11,259	N/A *	N/A *	45,038	N/A *
(H) All Vegetation Management Costs	N/A *	$1,629,559	N/A *	N/A *	$22,830,060	N/A *
(I) Customer Minutes of Interruption	N/A *	12,511,210	N/A *	N/A *	26,141,792	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2012	N/A *	$1,423,658	N/A *	N/A *	$25,122,196	N/A *
(L) Vegetation Goal (current year) - 2012	N/A *	195	N/A *	N/A *	4,205	N/A *
(M) Vegetation Management Budget (next year) – 2013	N/A *	$3,684,126	N/A *	N/A *	$22,315,874	N/A *
(N) Vegetation Management Goal (next year) – 2013	N/A *	541	N/A *	N/A *	3,465	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

Note: Total miles cleared in 2012 was 3,410. Annual variations from target are expected as PEF manages resource and unit cost factors associated with its integrated vegetation management plan. Based on the 3-year feeder / 5- year lateral tree trimming cycle, since 2006 initiation, PEF is at 5% of total 3-year cycle feeder miles and 31% of total 5-year cycle lateral miles. PEF is on target to complete all its tree trimming for both feeder and lateral circuits within the current 3-year and 5-year cycles, respectively.

* There is no unadjusted data on tree caused storm events that would be relevant to PEF's tree trimming program. It would not be reasonably possible to gather this data and furthermore the data would not be accurate if we could obtain it. It would take extraordinary effort and considerable conjecture to estimate the impact of trees on PEF's distribution system for outage causes that are currently coded "storm". It would not be reasonably possible to gather such data because contractors move around the System and operate under a myriad of restoration contracts and agreements. To track this data, it would require the establishment of both a financially based tracking system to monitor costs as well as crew activity system-wide during a catastrophic event. Additionally, it is not practical to perform a forensic analysis of outages during a catastrophic event for the purpose of obtaining the root cause since several agencies assist in the effort as well as the magnitude of damage that impact a localized area of the system. During a storm event, outage tracking migrates from Outage Management System event to a Damage Assessment event. As such, our ability to capture reliable data becomes significantly compromised.

** This data is actual complete in 2012 and scheduled in 2013.

*** Distance varies according to species' growth rates.

**** This data was not previously tracked. A means of extracting tree outage data from total storm restoration costs is still being investigated.

MANAGEMENT REGION (NORTH CENTRAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	51	N/A *	N/A *	1,814	N/A *
(B) Customer Interruptions	N/A *	72,822	N/A *	N/A *	55,314	N/A *
(C) Miles Cleared	N/A *	64	N/A *	N/A *	635	N/A *
(D) Remaining Miles	N/A *	11	N/A *	N/A *	257	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.95	N/A *	N/A *	4.80	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	1,362.18	N/A *	N/A *	146.32	N/A *
(G) Number of Hotspot trims	N/A *	3,528	N/A *	N/A *	14,112	N/A *
(H) All Vegetation Management Costs	N/A *	$603,988	N/A *	N/A *	$5,965,820	N/A *
(I) Customer Minutes of Interruption	N/A *	3,876,504	N/A *	N/A *	7,600,114	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Budget (current year) – 2012	N/A *	$587,861	N/A *	N/A *	$7,034,540	N/A *
(L) Vegetation Goal (current year) – 2012	N/A *	74.54	N/A *	N/A *	891.97	N/A *
(M) Vegetation Budget (2013)	N/A *	$1,184,888	N/A *	N/A *	$6,182,584	N/A *
(N) Vegetation Management Goal (next year) - 2013	N/A *	136	N/A *	N/A *	707	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT REGION (SOUTH CENTRAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	26	N/A *	N/A *	896	N/A *
(B) Customer Interruptions	N/A *	40,710	N/A *	N/A *	25,913	N/A *
(C) Miles Cleared	N/A *	35	N/A *	N/A *	708	N/A *
(D) Remaining Miles	N/A *	6	N/A *	N/A *	195	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.88	N/A *	N/A *	1.75	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	1,384.22	N/A *	N/A *	50.54	N/A *
(G) Number of Hotspot trims	N/A *	1,549	N/A *	N/A *	6,194	N/A *
(H) All Vegetation Management Costs	N/A *	$206,891	N/A *	N/A *	$4,207,417	N/A *
(I) Customer Minutes of Interruption	N/A *	1,783,981	N/A *	N/A *	3,105,283	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2012	N/A *	$218,095	N/A *	N/A *	$4,853,652	N/A *
(L) Vegetation Goal (2012)	N/A *	40.59	N/A *	N/A *	903.32	N/A *
(M) Vegetation Management Budget (next year) – 2013	N/A *	$950,307	N/A *	N/A *	$4,010,685	N/A *
(N) Vegetation Management Goal (next year) – 2013	N/A *	198	N/A *	N/A *	837	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT REGION (NORTH COASTAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	70	N/A *	N/A *	2,592	N/A *
(B) Customer Interruptions	N/A *	68,503	N/A *	N/A *	84,851	N/A *
(C) Miles Cleared	N/A *	42	N/A *	N/A *	1,235	N/A *
(D) Remaining Miles	N/A *	14	N/A *	N/A *	439	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	1.25	N/A *	N/A *	3.25	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	1,222.39	N/A *	N/A *	106.54	N/A *
(G) Number of Hotspot trims	N/A *	3,926	N/A *	N/A *	15,702	N/A *
(H) All Vegetation Management Costs	N/A *	$179,219	N/A *	N/A *	$5,272,969	N/A *
(I) Customer Minutes of Interruption	N/A *	4,550,998	N/A *	N/A *	8,980,814	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Budget (current year) – 2012	N/A *	$97,276	N/A *	N/A *	$5,822,412	N/A *
(L) Vegetation Goal (2012)	N/A *	28	N/A *	N/A *	1,674	N/A *
(M) Vegetation Budget (2013)	N/A *	$425,172	N/A *	N/A *	$5,485,920	N/A *
(N) Vegetation Management Goal (next year) - 2013	N/A *	100	N/A *	N/A *	1,290	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT REGION (SOUTH COASTAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	29	N/A *	N/A *	2,189	N/A *
(B) Customer Interruptions	N/A *	58,281	N/A *	N/A *	60,171	N/A *
(C) Miles Cleared	N/A *	55	N/A *	N/A *	636	N/A *
(D) Remaining Miles	N/A *	3	N/A *	N/A *	100	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.50	N/A *	N/A *	4.08	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	998.99	N/A *	N/A *	112.20	N/A *
(G) Number of Hotspot trims	N/A *	2,257	N/A *	N/A *	9,029	N/A *
(H) All Vegetation Management Costs	N/A *	$639,461	N/A *	N/A *	$7,383,854	N/A *
(I) Customer Minutes of Interruption	N/A *	2,299,727	N/A *	N/A *	6,455,581	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2012	N/A *	$520,426	N/A *	N/A *	$7,411,592	N/A *
(L) Vegetation Management Goal (current year) – 2012	N/A *	52	N/A *	N/A *	736	N/A *
(M) Vegetation Management Budget (next year) – 2013	N/A *	$1,123,759	N/A *	N/A *	$6,636,684	N/A *
(N) Vegetation Management Goal (next year) - 2013	N/A *	107.00	N/A *	N/A *	631.00	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

Local Community Participation: A discussion addressing utility efforts to collect and use input from local communities and governments regarding (a) r-o-w tree clearing, (b) easement tree clearing, (c) hard-to-access facilities, (d) priority trees not within r-o-w or within easements where the utility has unobstructed authority to remove the danger tree, and (e) trim-back distances.

Please see pages 70-74.

PriorityTrees

a) Number of priority trees removed? **1,169**
b) Expenditures on priority tree removal? **$237,874 (*includes tree removal, removal trims, overhang & vines*)**
c) Number of request for removals that were denied? **26 (*These trees were on private property. The owners refused a request for removal. The trees were instead trimmed as much as possible within the legal rights that PEF had to do so.*)**
d) Avoided CI with priority trees removed (estimate)? **[See Below]**
e) Avoided CMI with priority trees removed (estimate)? **[See Below]**

In response to items d) and e), the determination of the number of customers (CI) that would have been interrupted and/or the extent of an outage (CMI) is dependent upon a number of variables such as: species of tree; tree wind resistance characteristics; age of tree; condition of tree; type of failure – electrical vs. mechanical (limb or stem); location along the feeder; soil conditions, the extent of any disease and/or insect infestation; the type, magnitude and duration

of a storm; etc. To quantify or estimate the avoided CI or CMI as a general matter for all possible conditions would require PEF to guess and speculate on conditions for which it has neither reliable nor supporting data. PEF therefore cannot provide data for these fields.

JOINT-USE POLE ATTACHMENT AUDITS FOR THE YEAR 2012 (*Initiative 2*)

a) **Percent of system audited.** *Feeders and Laterals: 100%*

b) **Date audit conducted?** *A Joint-Use Pole Loading Analysis is conducted every 8 years per FPSC mandates. In 2012, one eighth (1/8) of the joint attachments were audited to fulfill the 8-year requirement.*

c) **Date of previous audit?** *2011 Partial Joint Use Structural Analysis System Audit.*

d) **List of audits conducted annually.** *Partial system audits are conducted annually. A full Joint-Use Pole Loading Analysis is conducted every eight years.*

2012 Joint-Use Structural Audits – Distribution Poles (all pole types)

(A) Number of company owned distribution poles.	963,005
(B) Number of company distribution poles leased.	449,832
(C) Number of owned distribution pole attachments (cable & phone attachments on PE poles)	770,211
(D) Number of leased distribution pole attachments. (PE attachments on phone poles)	13,603
(E) Number of authorized attachments. (3952 new attachments permitted in 2012)	774,163
(F) Number of unauthorized attachments. (*pole attachment audit completed in Sept 2011*) *	8,085
(G) Number of distribution poles strength tested. (complete loading analysis needed)	66,565
(H) Number of distribution poles passing strength test. (complete loading analysis needed) **	66,439
(I) Number of distribution poles failing strength test (overloaded).	126
(J) Number of distribution poles failing strength test (other reasons). (Hardware upgrades required)	0
(K) Number of distribution poles to be corrected (strength failure) (added down guy)	75
(L) Number of distribution poles corrected (other reasons).	0
(M) Number of distribution poles to be replaced. (Overloaded poles entered into the DARTS database)	51
(N) Number of apparent NESC violations involving electric infrastructure.	None
(O) Number of apparent NESC violations involving 3rd party facilities.	None

* *Attachment audits are completed every 5 years.*

** *For each group of poles in a tangent line, the pole that had the most visible loading, line angle, and longest or uneven span length was selected to be modeled for wind loading analysis. If that one pole failed, the next worst case pole in that group of tangent poles was analyzed as well. Each pole analyzed determined the existing pole loading of all electric and communication attachments on that pole. If the existing analysis determined the pole was overloaded, that pole was added to a current year work plan to be corrected. Should the original pole analyzed meet the NESC loading requirements, all similar poles in that tangent line of poles was noted as structurally sound and entered into the database as "PASSED" structural analysis.*

2012 Joint-Use Attachment Audits – Transmission Poles (all pole types)

(A) Number of company owned transmission poles.	48,295
(B) Number of company transmission poles leased.	5,580
(C) Number of owned transmission pole attachments (cable & phone attachments on PE poles)	8,786
(D) Number of leased transmission pole attachments. (PE attachments on phone poles)	0
(E) Number of authorized attachments.	8,786
(F) Number of unauthorized attachments.	0
(G) Number of transmission poles strength tested.	576
(H) Number of transmission poles passing strength test.	566
(I) Number of transmission poles failing strength test (overloaded).	10*
(J) Number of transmission poles failing strength tests (other reasons).	0
(K) Number of transmission poles corrected (sent to transmission to be scheduled for change out)	12
(L) Number of transmission poles corrected (other reasons).	0
(M) Number of transmission poles replaced	0
(N) Number of apparent NESC violations involving electric infrastructure.	None
(O) Number of apparent NESC violations involving 3rd party facilities.	0

* *The poles identified in 2012 as overloaded will be prioritized and replaced in 2013.*

State whether pole rents are jurisdictional or non-jurisdictional. If pole rents are jurisdictional, then provide an estimate of lost revenue and describe the company's efforts to minimize the lost revenue.

Pole attachment rents are jurisdictional and are booked in Account 454 – "Rent from Electric Property". PEF conducts partial audits of its pole attachments throughout the year. A full Joint-Use Pole Loading Analysis is conducted every eight years. When PEF discovers unauthorized attachments on PEF poles, PEF follows-up with the attacher who owns the unauthorized attachments and PEF seeks all revenue applicable under controlling laws, rules, and regulations.

SIX YEAR INSPECTION CYCLE FOR TRANSMISSION STRUCTURES (*Initiative 3*)

Describe the extent of the inspection and results pertaining to transmission wires, towers, and substations for reliability and NESC safety matters. The intent is to assure the Commission that utilities know the status of their facilities and that reasonable efforts are taken to address transmission structure reliability and NESC safety matters.

Progress Energy Florida's Transmission Department follows Procedure MNT-TRMX-00053 titled "Ground Patrols" (Attachment M) to periodically assess the condition of the transmission circuits. The primary goal of the ground patrol is to inspect transmission line structures and associated hardware and conductor on a routine basis to identify any required material repairs or replacements. Please also see Initiative 3 in PEF's Storm Hardening Plan.

Transmission Circuit, Substation and Other Equipment Inspections

	2012 Activity		2012 Current Budget		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total transmission circuits.	N/A	564	$3,873,989	$3,927,081	N/A	$2,780,056
(B) Planned transmission circuit inspections.	120	N/A	N/A	N/A	120	N/A
(C) Completed transmission circuit inspections.	N/A	195	N/A	N/A	N/A	N/A
(D) Percent of transmission circuit inspections	N/A	35%	N/A	N/A	23%	N/A
(E) Planned transmission substation inspections.	N/A	487	$16,211,014	$15,278,604	487	$16,238,702
(F) Completed transmission substation inspections.	N/A	487	N/A	N/A	N/A	N/A
(G) Percent transmission substation inspections	N/A	100%	N/A	N/A	N/A	N/A
(H) Planned transmission equipment inspections (other equipment).	N/A	N/A	N/A	N/A	N/A	N/A
(I) Completed transmission equipment inspections (other equipment).	N/A	N/A	N/A	N/A	N/A	N/A
(J) Percent of transmission equipment inspections completed (other	N/A	N/A	N/A	N/A	N/A	N/A

Note: For most entries of "N/A" in the chart above, Progress Energy Florida does not specifically budget for Transmission line or substation inspections on an item by item basis. The budget and actual figures that are entered include inspections, emergency response, preventative maintenance, training, and other O&M Costs.

Transmission Tower Structure Inspections

	2012 Activity		2012 Current Budget		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total transmission tower structures.	N/A	3,485	Please see note 1	N/A	N/A	Please see note 1
(B) Planned transmission tower structure inspections	N/A	Please see note 2	N/A	Please see note 2	N/A	N/A
(C) Completed transmission tower structure inspections.	N/A	1,110	N/A	N/A	N/A	N/A
(D) Percent of transmission tower structure inspections completed.	N/A	32%	N/A	N/A	N/A	N/A

Note 1: Please see the previous budget and actuals on page 56 for line inspections. All inspections for wood poles, towers, steel and concrete structures are included in the O&M budget. Progress Energy Florida does not specifically budget for Transmission line or substation inspections on an item by item basis. The budget and actual figures that are entered include inspections, emergency response, preventative maintenance, training, and other O&M Costs.

Note 2: Transmission circuits with towers are inspected on a 5-year cycle. Inspections are planned and completed based upon the 5-year cycle.

Transmission Pole Inspections

	2012 Activity		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of transmission pole structures.	N/A	48,295	$3,873,989 See Note 1	$3,927,081 See Note 1	N/A	$2,778,056 See Note 1
(B) Number of transmission pole structures strength tested. *Item A: number of poles analyzed* *Item B: Number of pole structures ground inspected (wood, steel & concrete)*	N/A	A: 576 B: 18,774	N/A	N/A	See Note 3	N/A
(C) Number of transmission pole structures passing strength test. *Item A: number of poles analyzed* *Item B: Number of pole structures ground inspected (wood, steel & concrete)*	N/A	A: 566 B: 18,774	N/A	N/A	N/A	N/A
(D) Number of transmission poles failing strength test (overloaded).	N/A	10	N/A	N/A	N/A	N/A
(E) Number of transmission poles failing for other reasons – *Ground Inspection (See Note 2)*	N/A	1,124	N/A	N/A	N/A	N/A
(F) Number of transmission poles corrected (strength failure).	N/A	0 See note 4	N/A	N/A	N/A	N/A
(G) Number of transmission poles corrected for other reasons - *Ground Inspection*	N/A	803 see note 2	N/A	N/A	N/A	N/A
(H) Total transmission poles replaced.	N/A	1,080 see note 5	N/A	N/A	N/A	N/A

Note 1: Progress Energy Florida does not specifically budget for Transmission line or substation inspections on an item by item basis. The budget and actual figures that are entered include inspections, emergency response, preventative maintenance, training, and other O&M costs.

Note 2: Progress Energy Florida Transmission has prioritized the remaining number of transmission poles that need to be corrected based upon the inspection results and the status of the poles. Poles that needed to be replaced quickly have already been replaced as reflected above. Poles that can remain in service have been prioritized and PEF is in the process of working through corrections based on those prioritizations.

Note 3: Transmission circuits are inspected on a 3 or 5 year cycle depending on structural material. Inspections are planned and completed based on the 5 year cycle.

Note 4: PEF Transmission identified the potential strength failure using approximate calculations. The identified strength failing poles are being reviewed using exact wind and weight spans of attachments. The poles that fail the strength requirement will be prioritized to be replaced.

Note 5: Maintenance Change outs of wood poles inclusive of (G).

Please also see Attachment O – "Wood Pole Inspection Report" filed on March 1, 2013 with the FPSC.

STORM HARDENING ACTIVITIES FOR TRANSMISSION STRUCTURES (*Initiative 4*)

Describe the extent of any upgrades to transmission structures for purposes of avoiding extreme weather, storm surge or flood-caused outages, and to reduce storm restoration costs. The intent is to assure the Commission that utilities are looking for and implementing storm hardening measures.

Hardening of Existing Transmission Structures

	2012 Activity		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Transmission structures scheduled for hardening.	1,725	N/A	$91.0M	N/A	1,590	$108.8M
(B) Transmission structures hardening completed.	N/A	1,819	N/A	$106.5M	N/A	N/A
(C) Percent transmission structures hardening	N/A	105%	N/A	N/A	N/A	N/A

Note: Budget and Actual costs include maintenance pole change-outs, insulator replacements, and other capital costs. The budget and actual figures also include DOT/Customer Relocations, line rebuilds and System Planning additions. Structures are designed to withstand current NESC Wind Requirements and are build utilizing steel or concrete structures. PEF does not break out the cost of the structures separately and is reporting the entire construction costs for the Transmission Line Projects.

GEOGRAPHIC INFORMATION SYSTEM (GIS) (*Initiative 5*)

In 2008, PEF completed the transition to the new GIS system (G-Electric). The move to G-Electric enabled PEF to migrate from a location based GIS system to an asset based GIS system (consistent with Commission Order No. PSC-06-0351-PAA-EI).

In addition to this effort, Progress Energy created a team dedicated to upgrading the Work Management system. The scope of this project included the implementation of the Facilities Management Data Repository (FMDR) along with the Compliance Tracking System (CTS). The implementation of these two systems was completed in 2011, allowing for Progress Energy to facilitate the compliance tracking, maintenance, planning, and risk management of the major Distribution assets.

Since its creation in 2010, the Distribution Data Integrity department has continued to ensure the accuracy and quality of the data within the Geographical Information System (GIS) and the Outage Management System (OMS). This department has created and enhanced key performance indicators that are used to continually measure and monitor the quality of PEF's GIS and OMS data. The consistency, accuracy, and dependability of these systems have led to improvements in the reliability and performance of our utility system, contributing to the safety of the PEF field crews.

Distribution OH Data Input

	Activity (2012)		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of system wide OH assets for input.	N/A	N/A	N/A	N/A	N/A	N/A
(B) Number of OH assets currently on system.	N/A	1,333,701	N/A	N/A	N/A	N/A
(C) Percent of OH assets already on system.	N/A	100%	N/A	N/A	N/A	N/A
(D) Annual OH assets targeted for input (goal).	N/A	N/A	N/A	N/A	N/A	N/A
(E) Annual OH assets input to system (actual).	N/A	N/A	N/A	N/A	N/A	N/A
(F) Annual percent of OH assets input.	N/A	100%	N/A	N/A	N/A	N/A

Distribution UG Data Input

	Activity (2012)		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of system wide UG assets for input.	N/A	N/A	N/A	N/A	N/A	N/A
(B) Number of UG assets currently on system.	N/A	170,710	N/A	N/A	N/A	N/A
(C) Percent of UG assets already on system.	N/A	100%	N/A	N/A	N/A	N/A
(D) Annual UG assets targeted for input (goal).	N/A	N/A	N/A	N/A	N/A	N/A
(E) Annual UG assets input to system (actual).	N/A	N/A	N/A	N/A	N/A	N/A
(F) Annual percent of UG assets input.	N/A	100%	N/A	N/A	N/A	N/A

Transmission OH Data Input

	Activity (2012)		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of system wide OH transmission assets for input.	N/A	48,778	N/A	N/A	N/A	N/A
(B) Number of OH transmission assets currently on system.	N/A	48,295	N/A	N/A	N/A	N/A
(C) Percent of OH transmission assets already on system.	N/A	99%	99%	N/A	99%	N/A
(D) Annual OH transmission assets targeted for input.	N/A	N/A	N/A	N/A	N/A	N/A
(E) Annual OH transmission assets input to system.	N/A	N/A	N/A	N/A	N/A	N/A
c(F) Annual percent of OH transmission assets input.	N/A	N/A	1%	N/A	1%	N/A

Transmission UG Data Input

	Activity (2012)		Current Budget (2012)		Next Year (2013)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of system wide UG transmission assets for input.	N/A	69.87 miles	N/A	N/A	N/A	N/A
(B) Number of UG transmission assets currently on system.	N/A	69.87 miles	N/A	N/A	N/A	N/A
(C) Percent of UG transmission assets already on system.	N/A	100%	N/A	N/A	N/A	N/A
(D) Annual UG transmission assets targeted for input.	N/A	N/A	100%	N/A	N/A	N/A
(E) Annual UG transmission assets input to system.	N/A	N/A	N/A	N/A	N/A	N/A
(F) Annual percent of UG transmission assets input.	N/A	100%	N/A	N/A	N/A	N/A

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ATTACHMENT C

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JOINT USE POLE GUIDELINES

Progress Energy

JOINT USE

POLE ATTACHMENT

GUIDELINES

10/1/2010

GENERAL

Anyone desiring to 1) attach to Progress Energy (PE) poles or 2) overlash to existing facilities whether owned by proposing attacher or another attacher on PE poles must first have a contractual agreement in place with PE. After the contractual agreement is finalized, the proposed attacher must make application to PE via an Exhibit A. These requirements shall apply to anyone wanting to attach to or occupy PE facilities, including all cable operators, telecommunications carriers, WiFi and DAS attachers and any affiliates of PE. Throughout this document, all types of attachers and their facilities other than PE will be referred to as attachers, third party attachers, communication facilities or attacher's facilities.

Pole utilization requiring permits or notification include: installation of new attachments, removal of existing attachments, upgrade to larger cable, lashing of new cables to existing messengers, rebuilds of cable systems, large scale relocations for road widening, etc. and installation of service drops on lift poles. Service drops may be permitted monthly on one "after the fact" permit.

A permit is required in order to maintain accurate attachment inventories and to obtain technical data necessary to review the adequacy of existing distribution and/or transmission system facilities. The attacher must submit, along with each application for pole attachment, the data contained in items 1-4 of the section below entitled "Pole Attachment and Overlash Application Procedures." All planning costs associated will be the responsibility of the attacher proposing the attachment or overlash.

POLE ATTACHMENT AND OVERLASH APPLICATION PROCEDURES for Progress Energy Carolinas (PEC)

A pole attachment and/or overlash application shall include:

1. A maximum of 40 PE poles identified for proposed attachment and/or overlash per application. No more than 500 poles shall be submitted in any 45-day period.

2. One set of marked facility maps depicting the street level route of the proposed attachments to PE poles.

3. Third party attachers do not need to provide measurements when submitting an Exhibit A Pole Attachment Request. The following is the minimum required on each submitted permit: company name, representative's name, telephone number and e-mail address, county name, project reference number, PE pole numbers, type of cable (coax, fiber), cable size and messenger size. All poles are subject to wind loading and ice loading as applicable.

4. Clearances from ground and other facilities shall be in accordance with the latest edition of the NESC, or the requirements shown in this manual, whichever is greater. Existing installations which were in compliance with the NESC at the

time of their original construction need not be modified unless specified by the latest edition of the NESC handbook or PE specifications.

POLE ATTACHMENT AND OVERLASH APPLICATION PROCEDURES for Progress Energy Florida (PEF)

A pole attachment and/or overlash application shall include:

1. A maximum of 40 PE poles identified for proposed attachment and/or overlash per application. No more than 500 poles shall be submitted in any 45-day period.

2. One set of marked facility maps depicting the street level route of the proposed attachments to PE poles.

3. Third party attachers do not need to provide measurements when submitting an Exhibit A Pole Attachment Request. The following is the minimum required on each submitted permit: company name, representative's name, telephone number and e-mail address, county name, project reference number, PE pole numbers, type of cable (coax, fiber), cable size and messenger size. All poles are subject to wind loading and ice loading as applicable.

4. Clearances from ground and other facilities shall be in accordance with the latest edition of the NESC, or the requirements shown in this manual, whichever is greater. Existing installations which were in compliance with the NESC at the time of their original construction need not be modified unless specified by the latest edition of the NESC handbook or PE specifications.

5. Member-operators of the Florida Cable Telecommunications Association shall submit to PEF a notification for overlash or rebuild consistent with the terms and conditions outlined in the Stipulation and Agreement dated 10/1/07.

6. Attachments to transmission poles with distribution underbuild will be accepted for application and should identify the transmission poles on the permit. Attacher's request is subject to the approval of PE's transmission department. A complete structural analysis will be required and all costs associated with the analysis will be paid by the proposing attacher.

Pole attachment requests are to be submitted to the following addresses.

In the Carolinas:
Progress Energy Carolinas, Inc.
Joint Use
100 E. Davie Street, TPP16
Raleigh, NC 27601
(919) 546-3297

In Florida:
Progress Energy Florida, Inc.
Joint Use
3300 Exchange Place, NP4D
Lake Mary, FL 32746
(407) 942-9425

Contact PE's Joint Use Manager at (407) 942-9415 for clarification and examples of any of the above items.

PE utilizes NJUNS (National Joint Utilities Notification System) for transfer notification purposes and will require all third party attachers on PE poles to utilize the system. When poles are replaced, PE will use NJUNS to provide an electronic notification to third party attachers to transfer their facilities in a timely manner per their Pole Attachment Agreement and the FCC guidelines. Attachers will have 60 days from notification to transfer their facilities to the new pole. In case of non-response, PE may remove or relocate attacher's facilities and bill attacher for all expenses incurred.

Each pole in the application shall be checked to meet NESC clearance requirements. Facility configuration will be rearranged to meet NESC clearance requirements. If clearance standards are not met, make-ready options and costs may be made available for review. All costs associated with this work will be paid by the third party attacher proposing the attachment or overlash. It is the responsibility of the proposing attacher to obtain all necessary easements for their facilities.

A structural analysis will be performed on all worst case poles in a branch line. Should a pole fail the analysis, the next worst case pole in that branch will be analyzed until a pole passes. A new branch line will be considered when the line angle on the pole is greater than 15%. A new branch line will be considered when the span length between any three (3) poles is greater than a 50% difference. For example, wire runs for 150' from pole 1 to pole 2. The wire span from pole 2 to pole 3 is 226'. The spans on either side of pole 2 are greater than 50% of the difference. All costs associated with this work will be paid by the third party attacher proposing the attachment or overlash.

Once the clearance analysis is completed, the attacher will receive an approved permit within 45 days of receipt of permit if no make-ready is required for attachment. If the attacher's application requires make-ready, the attacher will receive an invoice for make-ready costs. Payment of this invoice within 45 days will serve as PE's authorization to perform the make-ready construction. Failure to provide payment within the 45 days may result in denial of the affected poles. Following receipt of make-ready payment, PE shall sign and issue the permit authorizing the attachment by providing a copy of the permit to the attacher.

The attacher shall have 120 days from the date of permit authorization in which to complete the attachment installation and any other requirements stated in this standard. If attacher fails to do so, the permit shall expire and the attacher will be required to resubmit to PE an application for attachment with all current data required as support of its application. Attacher must promptly notify PE Joint Use upon completion of construction for each application and arrange scheduling of post-inspection. If the attacher chooses to construct its facilities on a portion of the permit, the authorization on the remaining poles will be voided for non-construction. An Exhibit B Removal Request form must be submitted to discontinue future pole rent charges.

The cost of all materials required to adjust facilities shall be paid by the attacher. All costs associated with the application requiring PE clerical, engineering and crew costs will be paid by the proposing attacher.

All permits are subject to a post inspection within 365 days of the permit's approval to verify the attacher's construction is in compliance with PE and NESC standards. If any pole on the permit fails inspection, the attacher will be given 30 days to make the necessary correction. If the failed poles are still in non-compliance at the time of the second post inspection, the attacher will be in default of the Pole Attachment Agreement. No additional permits will be approved until the violation is corrected.

Overlashing third parties must have written permission in place with the attacher being overlashed. Written consent of the overlash must be provided to PE at the time of application.

Each attacher shall install identifying tags on its equipment and at a minimum interval of every four (4) poles for the purpose of identification. Attachers shall install tags at the time attacher's facilities are installed. Identifying tags must be installed on existing attacher's facilities. If attacher fails to install identifying tags, PE may deem the attacher in violation of PE Standards and the Pole Attachment Agreement. If identifying tags are not installed at the time of new construction, the permit will fail post inspection.

If attacher's facilities are acquired by another entity, the acquiring entity must notify PE of said change, provide maps and/or plats of acquired assets, and obtain PE's consent to assignment of the Pole Attachment Agreement. The acquiring entity will be given one year from 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, PE may deem the attacher in violation of PE Standards.

CLEARANCES
All permit requests for new attachments will be assigned an attachment height. The position order is from the bottom up in the communications space on a pole. A physical area on a pole cannot be reserved by a tenant.

At the time of installation, all communications facilities shall be located a minimum of 40" below PE power facilities (secondary, neutral or top of conduit) per NESC rules 235C and 238.

At the time of installation, all communications facilities passing above or below street light brackets shall be a minimum of 12" away from such brackets per NESC rule 238C. All communications facilities passing above or below grounded street light brackets shall be 4" away from such brackets and 4" away from top of the streetlight luminaire. All communication facilities must maintain a minimum clearance of 12" below the insulated conductor drip loops of the lights per NESC rule 238D.

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, maintaining 12" separation at midspan from other communication cables and 30" separation at midspan from PE facilities. The cable shall follow Progress Energy's route so as not to compromise the structural integrity of Progress Energy poles. During construction or deconstruction, third party attachers shall not directly or indirectly influence the sag and tension of PE wire or cause a pole to lean, thus jeopardizing the structural integrity and reliability of its distribution systems.

Attachers are not permitted to dead-end on a primary URD riser pole.

Poles shall not be boxed in and communication cable shall not be installed on both sides of a pole. Communication cable must be installed on the same side as the secondary or neutral. Communication crossarms, extension brackets or buckarms shall not be installed or used for third party's attachments.

The following clearances shall apply to installations by an attacher or by PE. Any work performed by PE or by the attacher after the initial installation of facilities shall preserve required clearances of all parties on the pole. If at any time after installation of facilities, an attacher becomes aware that one or more of its facilities is not in compliance with applicable clearance requirements, the attacher shall notify PE of the clearance violations and make all reasonable efforts to immediately bring its facilities into compliance. Attacher shall notify PE following its correction of the clearance violations. Attacher shall notify PE if the attacher has reason to believe that the noncompliance has been caused by the action of some party other than the attacher. However, such a belief will not excuse the attacher from its obligation to remedy the clearance violations. PE shall also inform the attacher if PE becomes aware that the attacher's facilities are not in compliance with applicable clearance requirements. The attacher will have sixty (60) days to bring its facilities within compliance or PE may deem the attacher in violation of PE Standards.

GUYS AND ANCHORS

Attachers are responsible for their own down guys and anchors and are not permitted to utilize PE anchors.

The NESC covers the use of guys. Progress Energy expects the third party attachers to place guys where Progress Energy has installed a guy.

Communication company anchors are to be located in the same line lead and line angle as the PE anchor and with a distance of 4' from the PE anchor.

OTHER

No permanent climbing aids are allowed on PE poles.

All power supply installations must have appropriate disconnect devices. All new power supplies and new metering equipment shall be mounted only on attacher owned facilities as per PE specification drawing #09.04-12 and #09.04-13. Ground blocks, pedestals and power supplies may not be attached to the pole.

Air dryers, nitrogen bottles, cabinets, load coils, etc. shall not be attached to PE poles.

All vertical runs (pole risers) installed by attacher shall be placed in conduit and attached to the pole using U-guards and other protective covering. Each communication company shall be allowed one riser per pole to facilitate all pole-to-ground attachments. Unguarded cable and service drops stapled or nailed to the pole will fail post inspection until corrected. Vertical runs must be on a 45° angle from the communication company's attachment and never on the face of the pole. See PE specification drawing #09.04-04.

Horizontal attachments to PE poles must be made by use of a three-bolt suspension clamp with a center through bolt. A four-inch minimum vertical spacing must be maintained between through bolt holes. Attachers 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.

Strand attachments and/or service drops shall not extend more than 4" from the closest surface of the pole, unless prior approval is obtained from the local PE Engineering department. Amplifiers and terminals shall be a minimum of 24" from the closest surface of the pole.

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

Attachers must remove all of their out-of-service facilities from PE poles at the time of new attachment or overlash.

All communication messengers shall be bonded to electrical ground wherever a vertical ground wire exists.

Requests for exceptions to this design guide shall be referred to the Joint Use unit. Any exceptions approved will be distributed to the regions for uniform application on a system-wide basis.

WIRELESS

The minimum information required by PE includes: pole number, address/location, plat of proposed work, radio frequency information, aerial construction details (dimension, weight connectivity), direction of antennae, and wireless component specifications. Contact the Joint Use Manager at (407) 942-9415.

Only one wireless device (receiver, transmitter, or combination unit) will be allowed per pole. Multiple wireless attachers are not permitted on a single pole. Amplifiers and equipment other than wireless devices will not be allowed on poles. All other locations will be reviewed based on field conditions and approved by PE.

WiFi standards exist for wood and static cast concrete streetlight poles. Please reference PE specification drawings #30.10-22, #09.04-32, and #09.04 -35.

DAS standards exist. Please reference PE specification drawing #09.04-30.

Progress Energy

Ball Park Estimates for CATV or CLEC Make-ready

Work Description	*PEC Cost Estimate	*PEF Cost Estimate
Replace 40' with 45' Pole, Tangent, 1 Phase, no equipment	$1298.29	$578.67
Replace 40' with 45' Pole, Tangent, 3 Phase, Transformer	$2945.16	$1629.20
Replace 35' with 40' Pole, Angle, 1 Phase, Transformer	$2810.51	$1551.65
Replace 40' with 50' Pole, Vertical Angle, 3 phase, Transformer	$4254.21	$2685.09
Replace 40' with 45' Pole, Dead End, 3 Phase, Transformer	$7719.21	$2537.58
Replace 45' with 50' Pole, Vertical DDE, 3 Phase, No equipment	$5074.28	$2961.03
Replace 45' with 50' Pole, Angle, 3 phase, Double Circuit	$5099.25	$2849.75
Replace 35' with 40' Pole, Secondary, UG Dip	$1489.27	$1180.36
Replace 50' with 60' Pole, 3 Phase, 3 Phase Tap, (congested)	$5153.55	$2446.88
Replace 45' with 50' Pole, 3 Phase, 3 Phase UG Dip	$7086.19	$3484.80
Replace 45' with 50' Pole, 3 Phase, 1200 Capacitor Bank	$6327.15	$3173.32
Install 45' Pole, 3 Phase, In-line	$1270.26	$942.64
Relocate Riser/U-Guard on Pole	$1132.32	$1028.70
Replace 30' with 35' Pole, Secondary and/or Service, Down Guy	$896.09	$832.60
Replace 40' with 45' pole Tangent, 3 Phase, Transformer Vertical	$2964.61	$1629.20
Add Section of U- Guard	$420.14	$368.24
Raise Street Light	$460.96	$393.92

Replace Open Wire Secondary with Triplex	$698.70	$505.70
Relocate Transformer on Pole	$974.19	$381.27
Clip Secondary to Neutral	$312.29	$202.93
Resag Neutral and Dress Transformer Loops	$520.48	$222.47

**Note: This document is a rough guide and intended only to be used as a tool for the licensee in planning their plant route or design. Costs shown do not include crew overtime rates, outage coordination, tree trimming, or other possible additional charges. PE can provide "Detailed Estimates" at the most current hourly engineering rate.*

Revised
11/20/2008

Progress Energy

POST INSPECTIONS

CODE	DESCRIPTION	SEPARATION
PC1	Neutral or secondary separation at the pole	40"
PC2	Grounded equipment separation at the pole	30"
PC3	Separation from secondary or transformer drip loops	40"
MC1	Secondary conductor separation at midspan	30"
MC2	Neutral separation at midspan	30"
SL1	Streetlight separation from SL bracket	12"
SL2	Streetlight separation from SL drip loop	12"
V1	Cable is crossing under PE neutral from different structure	24"
R1	Clearance from top of PE primary or secondary riser conduit	40"
C1	Cable or service drop above state maintained roadway	18' 0"
C2	Cable above non-state maintained roadway OR subject to truck traffic	15' 6"
RC1	Cable or service drop above residential driveway, not subject to truck traffic	12'0"
C3	Cable or service drop above areas of pedestrian access only	9'6"
C4	Cable or service drop above other areas subject to truck traffic	15'6"
DM3	Telecom service drop separation from PE service drop at midspan and attachment to building	12"
M4	Wires on different supporting structures crossing at midspan; communications only under PE	24"
G1	Guy or anchor needed	
G2	Guy or anchor is slack or damaged	
G3	Guy attached to PE anchor	
G4	Guy marker needed	
GR	Ground; messenger cable must be bonded to PE ground wire	
L	Cable tagging; missing or unreadable	
AC1	Floating cable; need to properly attach	
TC1	Transfer cable to new pole	
CS1	Communication separation does not meet NESC or PE specifications at the pole	12"
CS2	Communication separation does not meet NESC or PE specifications at midspan	12"
MD	Failure to follow make-ready directives	
NC	Not constructed; original attachment approval voided	
RA	Remove unauthorized attachments	

Progress Energy

JOINT USE

☑ **EXHIBIT A Attachment Request**
◉ New
○ Rebuild ○ Overlash 3rd Party
○ Service Drop ○ Overlash Self
☐ **EXHIBIT B Removal Request**

Permit # ____________
Op Center ________

COMPANY NAME: ________________________________ Acct. # ____________

Reference # ________________ Location (County, City, State) ________________

Map #: __________ Node: __________ Project Address: ________________

EXHIBIT A: In accordance with the terms and conditions of the existing Attachment Agreement, application is made for a permit to attach facilities to Progress Energy's poles as indicated below and on construction drawing(s) attached. Applicant represents it has secured all necessary permits under its franchise and easements or licenses from owners of private property. Applicant is responsible for coordinating the transfer or rearrangement of another attacher's facilities due to the applicant's proposed attachments and for reimbursement of expenses due to those entities. Such work must be completed before applicant commences construction of its attachments.

EXHIBIT B: In accordance with the terms and conditions of the existing Attachment Agreement, PE will remove from its records the attachment(s) from the poles listed below. *Applicant represents that it has removed* ***all*** *communication facilities previously attached to the below referenced poles.*

Progress Energy Pole No.	√ for Transmission	House and Street Address *and / or* Comments	Progress Energy Pole No.	√ for Transmission	House and Street Address *and / or* Comments

ATTACHMENTS REQUESTED / REMOVED:

__________ Distribution __________ Transmission __________ Telecommunications

SUBMITTED BY:
Name ____________________
Address ____________________
____
ne No. ____________________

CABLE DETAILS
☐ Coaxial
☐ Fiber Optic
__________ Cable Size
__________ Messenger Size

CUSTOMER SIGNATURE & DATE REQUIRED: ____________________

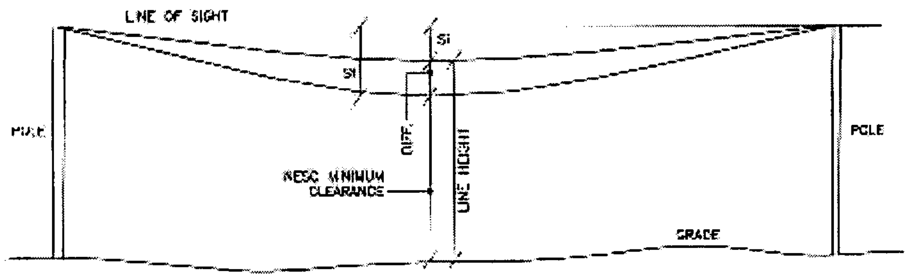
Double click to open in Excel format.

Progress Energy

Progress Energy Construction Standards

Table of Contents

NOTE: Double click on diagram below to open the PE Construction Standards in Acrobat format.



KEY	Si	INITIAL SAG @ 60°F, NO WIND (FROM SAG TABLES)
	Sf	THE GREATER OF FINAL SAG @ 120°F (180° FOR FP), NO WIND, OR 32°F W/ 1/4" ICE (CP&L ONLY)
	DIFF.	Sf − Si

NOTES:

1. USE THIS METHOD WITH THE TABLE ON DWG. 09.02-01 WHEN DETERMINING MINIMUM LINE HEIGHTS ABOVE GROUND, RAILS, ETC.
2. LINE HEIGHT (AT MID SPAN) = REQUIRED MINIMUM CLEARANCE (SEE DWG. 09.02-01) PLUS (Sf − Si).
3. ROUND UP "DIFF." (Sf−Si) VALUES TO NEAREST 1/2 FT. (E.G., 32" WOULD BECOME 3'-0".)

EXAMPLE OF USE OF INITIAL AND FINAL SAG:

1. 3-Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 300 FT. SPAN −

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: (120°F, NO WIND)	15.5 FT.	(DWG. 09.02-01)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS, FOR 1/0 ACSR, 300 FT. SPAN:	+ 3.0 FT	
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE, AT INSTALLATION (INITIAL SAG, 60°F):	18.5 FT.	

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

2. 3-Ø 477 SAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 150 FT. SPAN −

REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD: (120°F, NO WIND)	15.5 FT.	(DWG. 09.02-01)
DIFFERENCE BETWEEN INITIAL AND FINAL SAGS, FOR 1/0 ACSR, 150 FT. SPAN:	+ 1.5 FT.	
REQUIRED NESC HEIGHT OF NEUTRAL ABOVE ROAD SURFACE, AT INSTALLATION (INITIAL SAG, 60°F):	17.0 FT.	

** (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

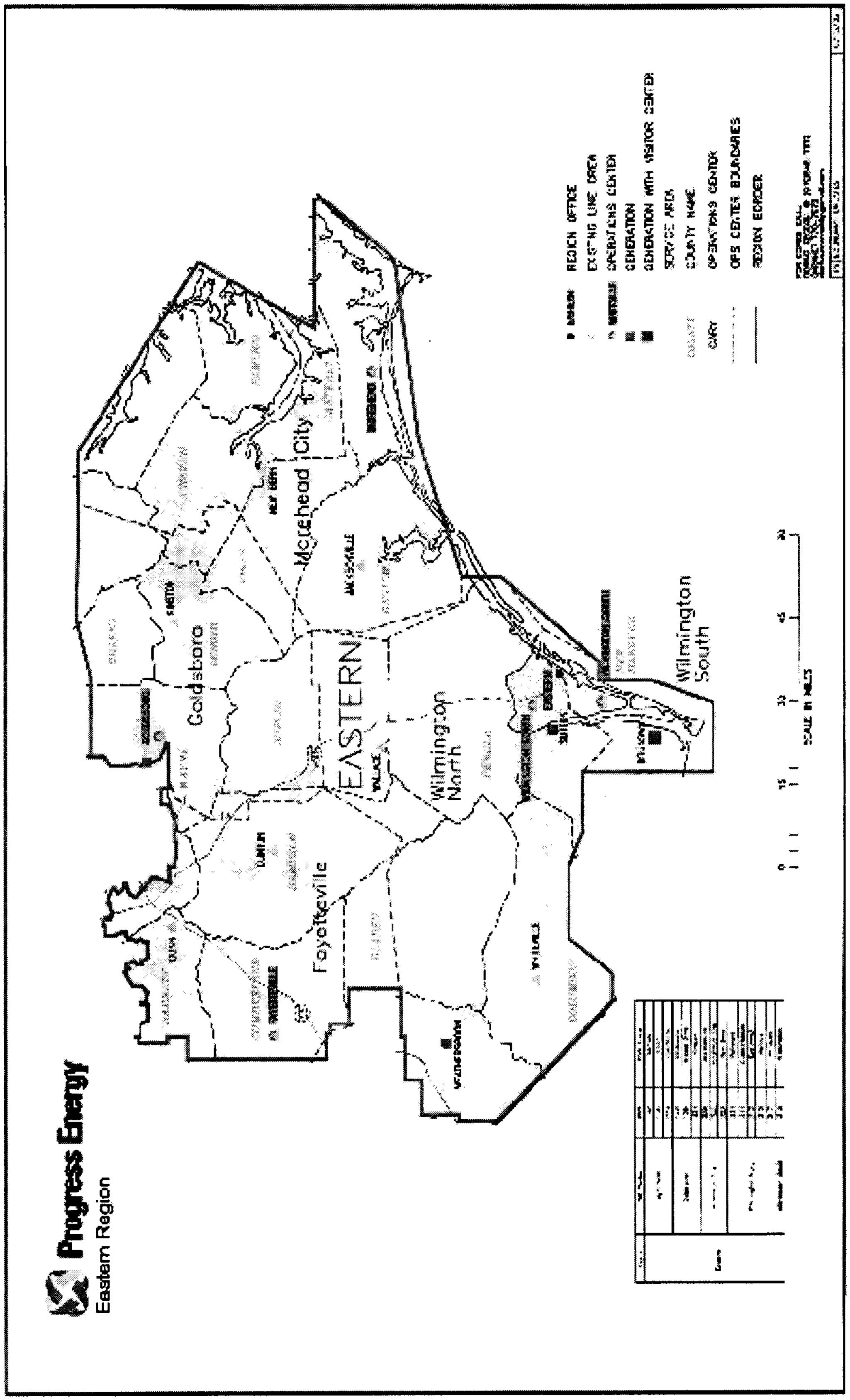
3				
2				
1				
0	[illegible]	[illegible]	[illegible]	[illegible]
REVISED		BY	CK'D	APPR.

MINIMUM LINE HEIGHTS USING CONDUCTOR SAG TABLES

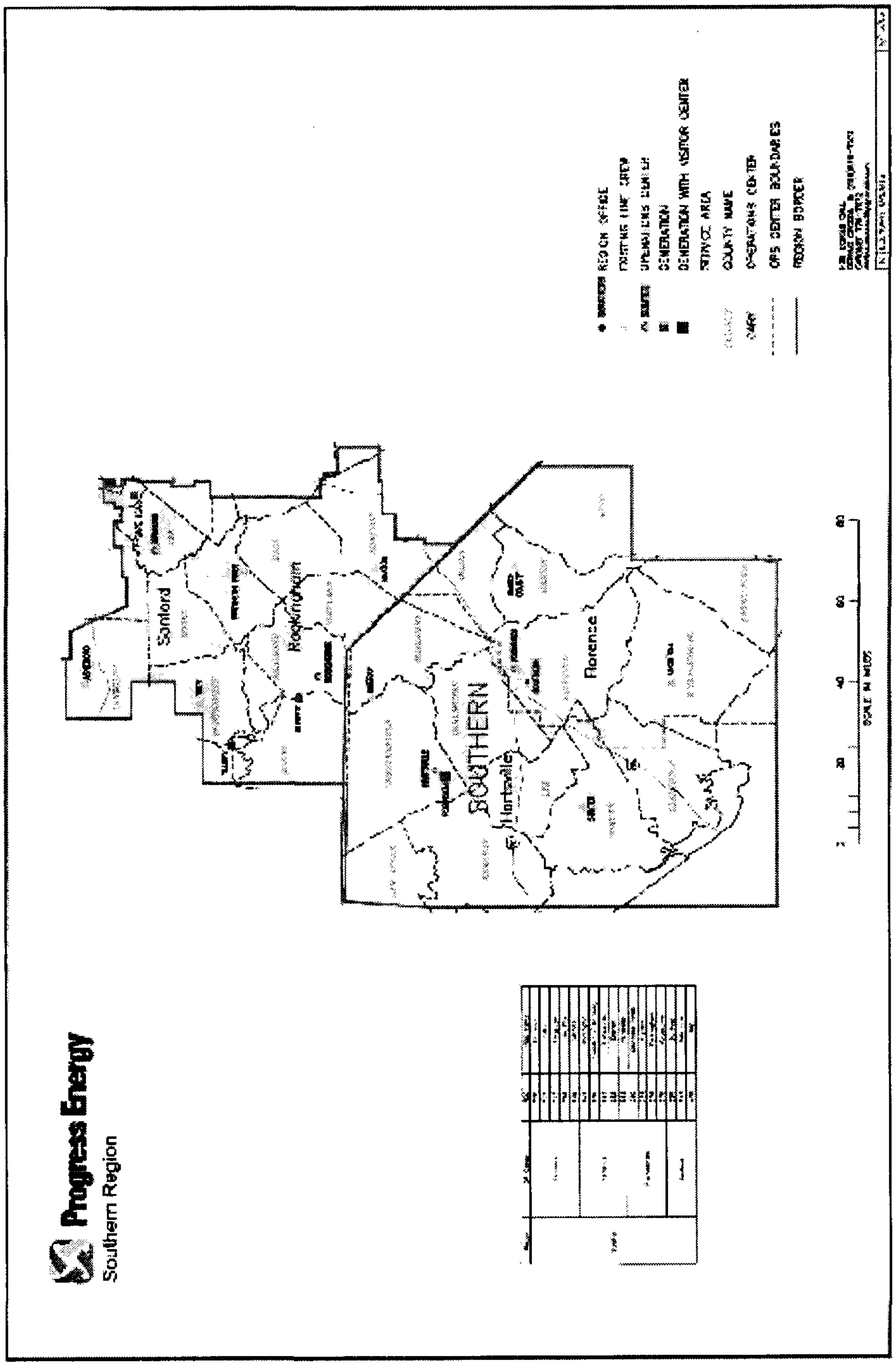
Progress Energy

PGN DWG. 09.00-01

NOTE: Double click on diagram below to open in Acrobat format.



NOTE: Double click on diagram below to open in Acrobat format.



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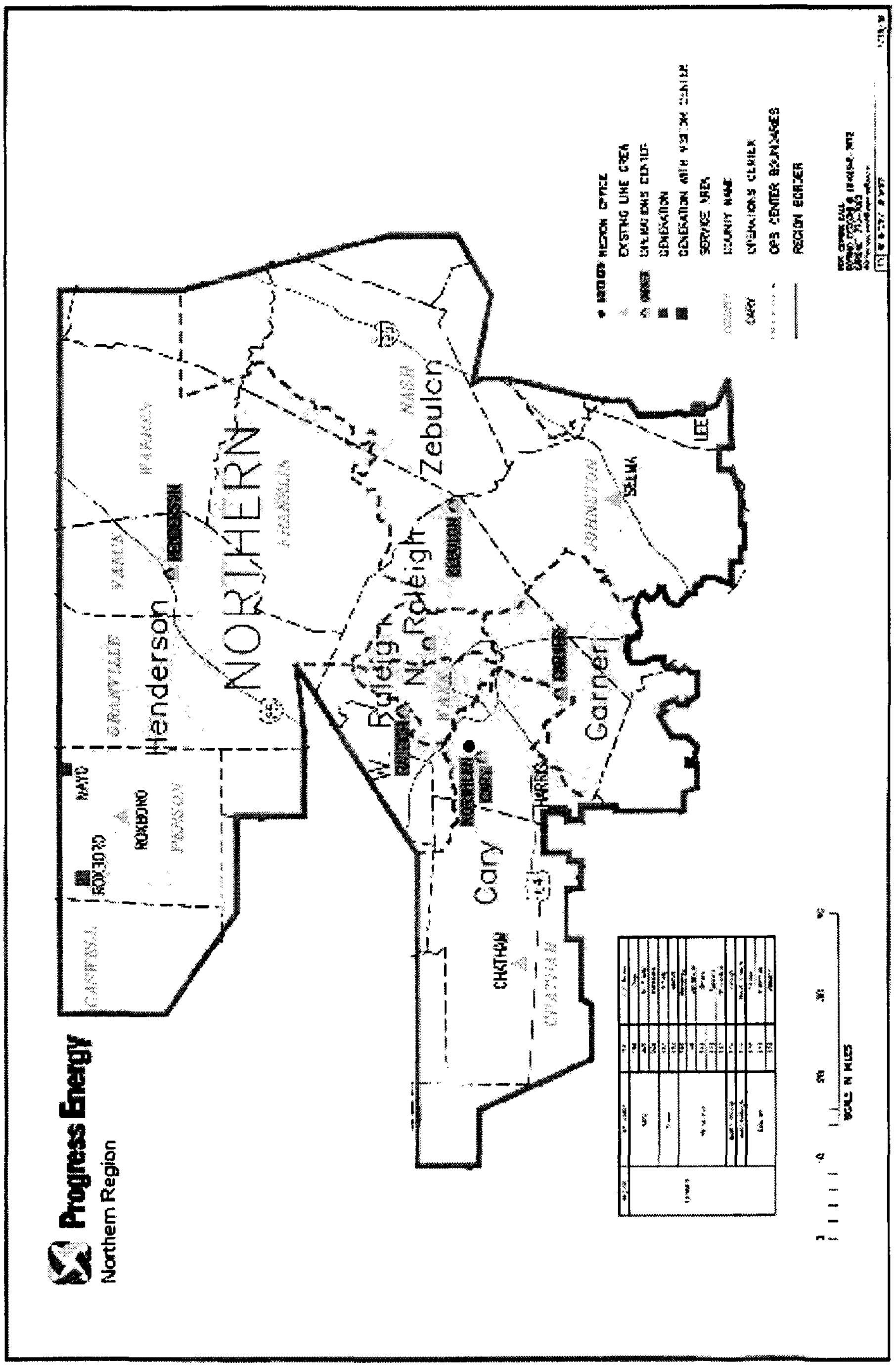

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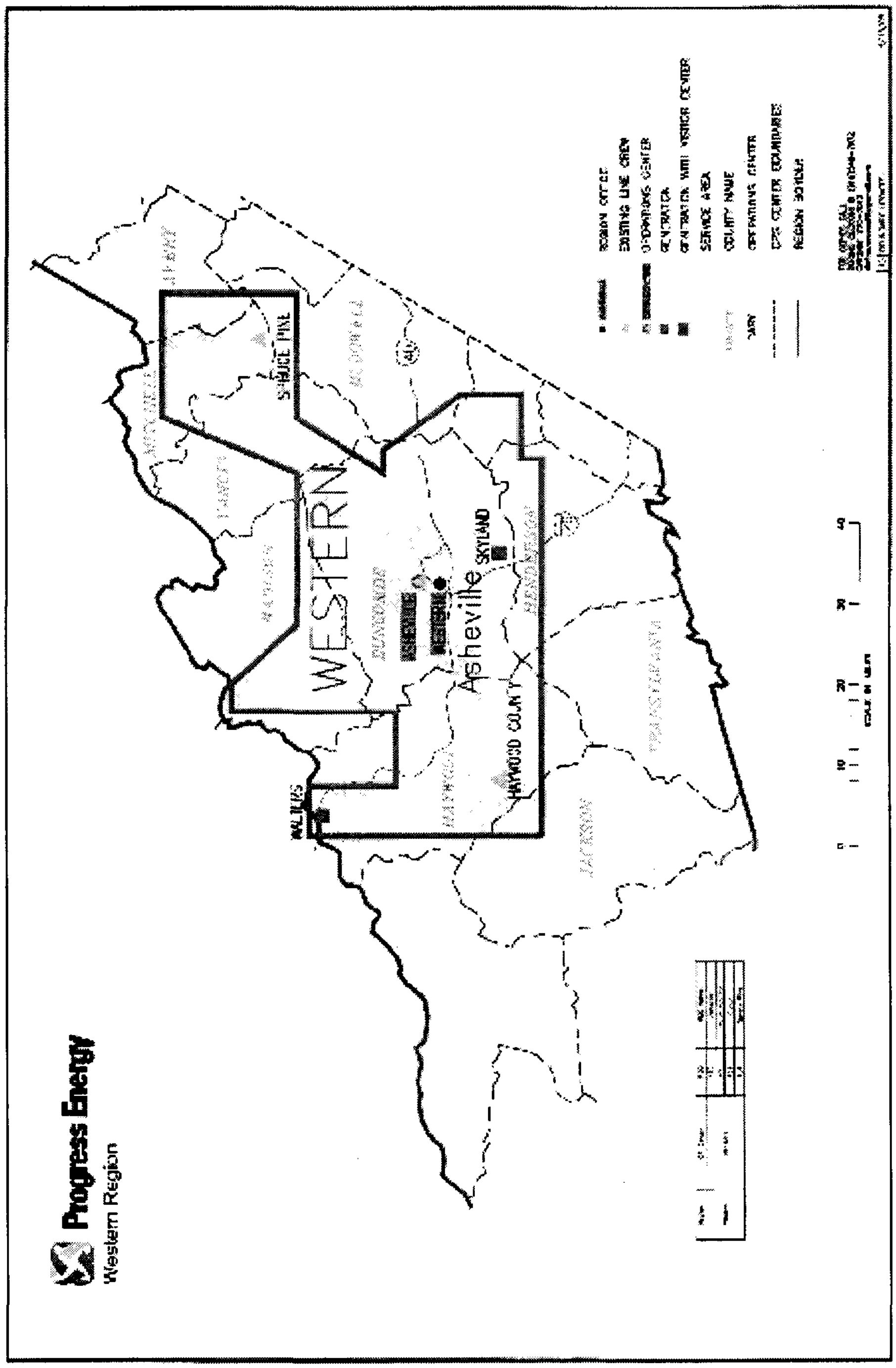
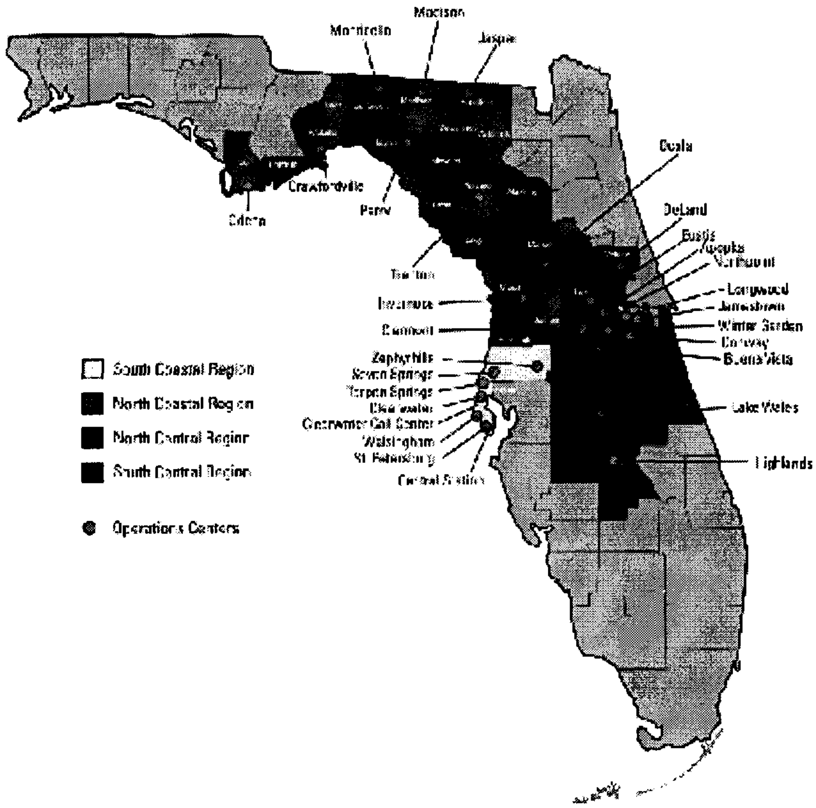


Progress Energy Florida Customer Service Regions



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ATTACHMENT D

DUKE ENERGY®
FLORIDA

COMPLETED DISTRIBUTION STORM HARDENING PROJECTS 2007 THROUGH 2012

DUKE ENERGY
FLORIDA

Storm Hardening Plan – Attachment D May 1, 2013

Distribution Storm Hardening Projects Planned and Completed, 2007 through 2012

Op Center	Project Name	Sub Category	Comments
Monticello	St Geroge Is - Plantation	Submersible UG	
Apopka	US 441 west of Hwy 19	OH to UG Conversion	
Inverness	Homosassa - Riverhaven	Submersible UG	
Inverness	US 98 - Brooksville	Small Wire Upgrade	
St-Petersburg	Coquina Key	Small Wire Upgrade	
Monticello	A192 - Luraville	Small Wire Upgrade	
Clearwater	Indigo	Small Wire Upgrade	
Ocala	US 301 - Citra	Small Wire Upgrade	
SE Orlando	Sprint Earth Station & Cocoa Water Wells	Small Wire Upgrade	
Lake Wales	Highland Park	Small Wire Upgrade	
Lake Wales	Hibiscus Feeder Tie	Small Wire Upgrade	
Inverness	R448 - Dunnellon	Back lot to Front lot conversion	
SE Orlando	Holden Ave E) Orange Blossom Trail	Small Wire Upgrade	
Buena Vista	Calle De Sol	Back lot to Front lot conversion	
Jamestown	SR-408 @ Woodbury Rd	OH to UG Conversion	
SE Orlando	Florida Turnpike @ Sandlake Rd (746')	OH to UG Conversion	

Buena Vista	OH Crossing of Turnpike (K68 @K5255)	OH to UG Conversion	
SE Orlando	OH Crossing of Turnpike 2 (K1780 @ K6434991 and K1775 @ K5021)	OH to UG Conversion	
SE Orlando	Florida Turnpike @ Sandlake Rd (485')	OH to UG Conversion	
SE Orlando	OH Crossing of Turnpike (K1025 @ K1025 & K1028 @ K128)	OH to UG Conversion	
SE Orlando	Florida Turnpike @ Orange Blossom Trail	OH to UG Conversion	
Ocala	Ranch Hand Dr	Small Wire Upgrade	
Monticello	Carrabelle Beach	Extreme Wind	
Inverness	Willinston Reconductor	Small Wire Upgrade	
Lake Wales	Cabbage Island	Extreme Wind	
Seven Springs	Banana St	Small Wire Upgrade	
Monticello	Monticello N69 Reconductor	Small Wire Upgrade	
Jamestown	Feeder Tie loop Lockwood Blvd	Feeder Tie	
Inverness	Florida Highlands	Extreme Wind	
SE Orlando	Holden Ave - Orange Blossom Trail	Small Wire Upgrade	
Lake Wales	Hibiscus Feeder Tie	Small Wire Upgrade	
Inverness	Homosassa-Riverhaven	Submersible UG	
Longwood	Reconductor, O'Brien/Spring Lake Rd	Feeder Tie	
Lake Wales	Walnut St Feeder Tie	Feeder Tie	

Lake Wales	Lake Marion Feeder Tie	Feeder Tie	
Clermont	Turnpike Crossing @ Blackstill Lake Rd	OH to UG Conversion	
Jamestown	Bithlo	Feeder Tie	
Jamestown	Black Hammock	Feeder Tie	
SE Orlando	Rio Pinar / Old Cheney	Feeder Tie	
Deland	Veterans Pkwy	Feeder Tie	
Jamestown	Econ Trail	Feeder Tie	
Jamestown	Bedford Rd	Feeder Tie	
St Petersburg	Jungle Prada	Small Wire Upgrade	
Monticello	Crawfordville Reconductor	Small Wire Upgrade	
Monticello	Cape San Blas	Extreme Wind Upgrade	
Highlands	Sebring Airport	Feeder Tie	
Walsingham	Feeder X132	Extreme Wind Upgrade	
Walsingham	Feeder X142	Extreme Wind Upgrade	
Monticello	N67 Feeder Relocation From Abrams to SR 59 On US 90	Back lot to Front lot conversion	
Monticello	N67 Old Lloyd Road Single Phase to Three Phase	Small Reconductor	
Monticello	SR 65 Line Relocation	Back lot to Front lot conversion	
St Petersburg	22nd St. S Reconductor	Feeder Tie	
St Petersburg	Connecticut Ave. Reconductor	Feeder Tie	
St Petersburg	22nd Ave. S Reconductor	Feeder Tie	

Inverness	Brooksville - SR 50 E of Cortez	Small Reconductor	
Inverness	Holder A48 - Arrowhead Subd	Small Reconductor	
Monticello	Madison N1 - Fdr to Lee	Small Reconductor	