DUKE ENERGY FLORIDA

Matthew R. Bernier
ASSOCIATE GENERAL COUNSEL

March 1, 2019

VIA ELECTRONIC FILING

Adam Teitzman, Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: *Review of 2019-2021 Storm Hardening Plan, Duke Energy Florida, LLC; Docket No. 20180146-EI*

Dear Mr. Teitzman:

Pursuant to Rule 25-6.0342, F.A.C., enclosed for electronic filing on behalf of Duke Energy Florida, LLC is its Petition for Commission approval of its 2019-2021 Storm Hardening Plan.

Thank you for your assistance in this matter. If you have any questions, please feel free to contact me at (850) 521-1428.

Sincerely,

s/ Matthew R. Bernier

Matthew R. Bernier

MRB/mw
Enclosure

106 East College Avenue, Suite 800 ▪ Tallahassee, Florida 32301
Phone: 850.521.1428 ▪ Fax: 727.820.5041 ▪ Email: matthew.bernier@duke-energy.com

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished via compact discs to the following this 1st day of March, 2019.

s/ Matthew R. Bernier
Attorney

Jennifer Crawford / Johana Nieves Office of General Counsel Florida Public Service Commission 2540 Shumard Oak Blvd. Tallahassee, FL 32399-0850 jcrawfor@psc.state.fl.us jnieves@psc.state.fl.us	J. R. Kelly / P. Christensen Office of Public Counsel c/o The Florida Legislature 111 West Madison Street, Room 812 Tallahassee, FL 32399 kelly.jr@leg.state.fl.us christensen.patty@leg.state.fl.us

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

In Re: Review of 2019-2021 Storm Hardening Plan, Duke Energy Florida.	Docket No. 20180146-EI Filed: March 1, 2019

PETITION FOR APPROVAL OF
DUKE ENERGY FLORIDA, LLC'S 2019-2021 STORM HARDENING PLAN

Duke Energy Florida, LLC ("DEF") hereby petitions this Commission for approval of its 2019-2021 Storm Hardening Plan. In support of this Petition, DEF states as follows:

1. DEF is a public 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 the petitioner should be directed to:

Dianne M. Triplett
299 First Avenue North
St. Petersburg, FL, 33701
Dianne.triplett@duke-energy.com

Matthew R. Bernier
106 East College Avenue
Suite 800
Tallahassee, FL 32301
Matthew.bernier@duke-energy.com

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") every 3 years. Rule 25-6.0342 specifies what must be included in

the utility's storm hardening plan, and DEF has tracked those rule provisions in its Storm Hardening Plan which is attached hereto as Exhibit A.

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

WHEREFORE, DEF respectfully requests the Commission approve this Petition and DEF's 2019-2021 Storm Hardening Plan attached as Exhibit A.

Respectfully submitted,

s/Matthew R. Bernier

DIANNE M. TRIPLETT
Deputy General Counsel
Duke Energy Florida, LLC.
299 First Avenue North
St. Petersburg, FL 33701
T: 727.820.4692
F: 727.820.5041
E: Dianne.Triplett@duke-energy.com

MATTHEW R. BERNIER
Associate General Counsel
Duke Energy Florida, LLC
106 East College Avenue
Suite 800
Tallahassee, Florida 32301
T: 850.521.1428
F: 727.820.5041
E: Matthew.Bernier@duke-energy.com

CERTIFICATE OF SERVICE

Docket No. 20180146-EI

I HEREBY CERTIFY that a true and correct copy of the foregoing has been furnished to the following by electronic mail this 1st day of March, 2019, to all parties of record as indicated below.

s/ Matthew R. Bernier
Attorney

Jennifer Crawford / Johana Nieves Office of General Counsel Florida Public Service Commission 2540 Shumard Oak Blvd. Tallahassee, FL 32399-0850 jcrawfor@psc.state.fl.us jnieves@psc.state.fl.us	J. R. Kelly / P. Christensen Office of Public Counsel c/o The Florida Legislature 111 West Madison Street, Room 812 Tallahassee, FL 32399 kelly.jr@leg.state.fl.us christensen.patty@leg.state.fl.us

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") no later than 90 days after the effective date of the rule, and every 3 years as a matter of course. Rule 25-6.0342 specifies what must be included in utility storm hardening plans, and Duke Energy Florida ("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 Standards Manual

i. General Overhead section
    1. *Details Florida's extreme wind contour lines.*
    2. *Discusses the use of the Pole Foreman program.*
    3. *Details Florida's extreme wind contour lines.*
    4. *Discusses the use of the Pole Foreman program.*
ii. Addresses NESC adherence standards
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.*
vi. Underground General Section

1. *Discusses location of UG facilities in accessible locations.*

vii. OH-UG Transition section

1. *Discusses corporate practices for primary framing on dip poles.*

viii. Trenching and Conduit section

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

ix. Flooding and Storm Surge Requirements

1. *Discusses corporate procedures for the installation of UG equipment in areas targeted for storm surge hardening.*

Joint Use – Pole Attachment Guidelines and Clearances

x. Pole Attachment Guidelines

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

xi. Joint Use Clearances

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

Distribution Engineering Manual

xii. Overhead Design guide section

1. *Addresses line location in accessible location.*
2. *Addresses NESC compliance.*
3. *Discusses Pole Foreman program.*

xiii. 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

xiv. 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

xv. 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.*

In addition to the standards, practices, policies, and procedures identified above, DEF's Wood Pole Inspection Plan, Vegetation Management Plan, and Storm Hardening 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**. In the recent years DEF has enhanced the standards to allow for better reliability, shorten restoration time and lower cost of construction. Some of these enhancements include increase the Basic Insulation Level (BIL) of new construction by increasing spacing between conductors, and increasing the insulators from 15kV to 25kV. Increasing the BIL lowers the opportunity of flashovers and outages due to vegetation crossing phases. DEF has also changed from using wood cross arms to fiberglass cross arms which allow for longevity and less chances of failure during storm due to the stronger material and not rotting due to weather. Duke Energy has also rolled these standards changes enterprise wide to lower cost and allow faster restoration when line techs from other Duke Energy jurisdictions respond to storm restoration in another area as they are familiar with the construction. DEF continuously monitors changes to NESC standards and meets and exceeds those standards as they are adopted in FL.

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 2007 version of the NESC does not call for the extreme wind design standard for distribution poles which are less than sixty feet in height. Because 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. During Hurricane Irma at least 72% of DEF's pole failures had vegetation involved.

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, Duke 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. DEF Transmission storm hardening initiatives proved effective in that there were no storm hardened structure failures during the 2017 and 2018 Hurricanes that hit Florida.

While no current data or research supports the application of the extreme wind standard to distribution pole construction, DEF is analyzing the extreme wind standard by using its prioritization model for implementation purposes in selected locations throughout its service territory. 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. After Hurricane Michael, ten Storm Hardened projects – including an Extreme Wind pilot project - were forensically assessed. No broken poles were identified on the Cape San Blas Extreme Wind project; similar results were observed on the other nine projects with only four total broken poles. Several poles along the coastline were leaning badly as a result of the beach shoring and road infrastructure being washed out. Overall, the portions of the system that were Storm Hardened performed well during Hurricane Michael and there was no evidence that Extreme Wind was significantly better than the other project types.

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.*

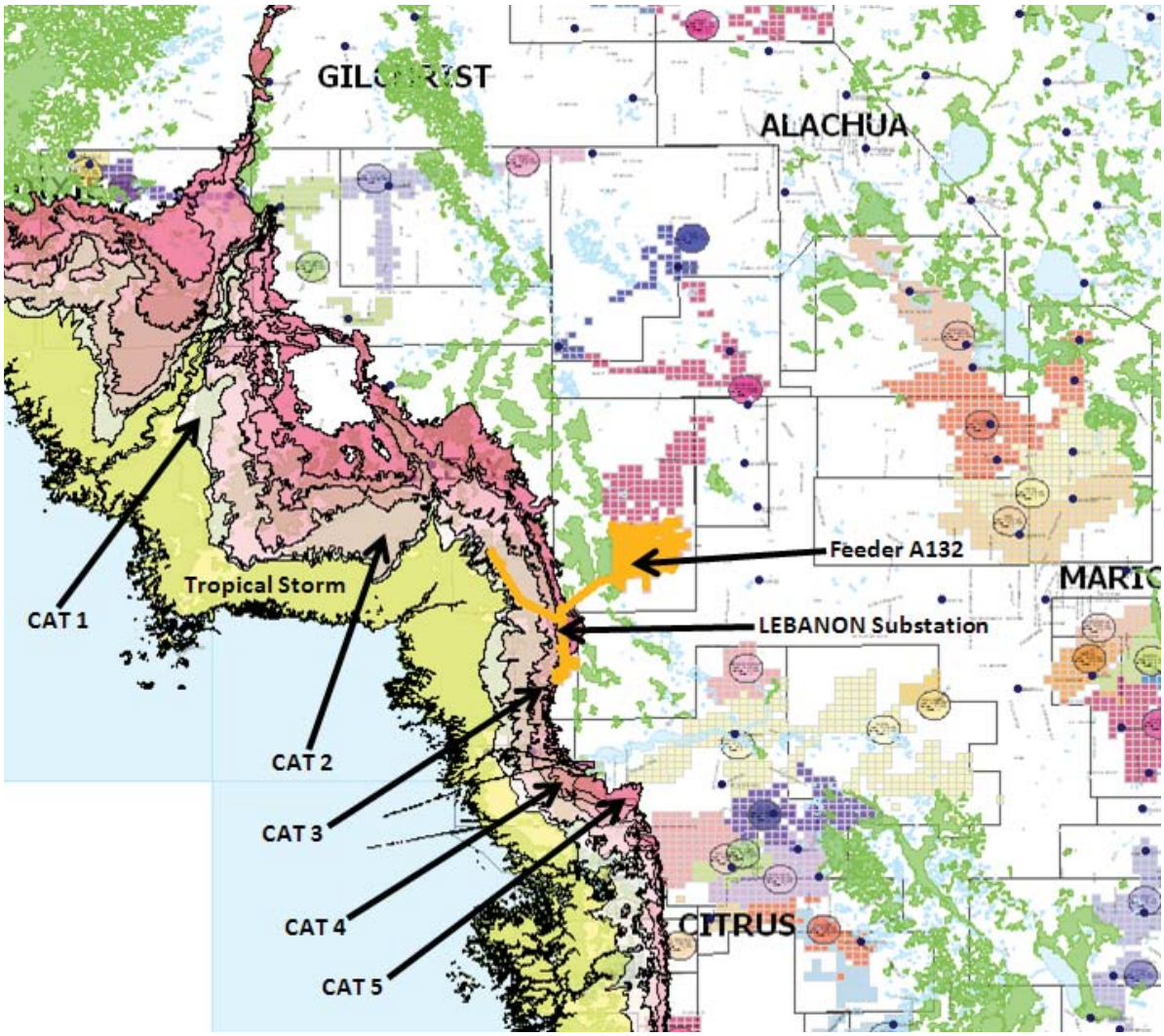
In areas where underground equipment may be exposed to minor storm surge and/or

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, pad mounted 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.

DEF now utilizes ESRI's ArcGIS 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 be assessed, if the conditions exist, will have appropriate modes of protection strategically placed around substations/control houses. Those modes of protection include but are not limited to sand bagging, dam-systems, and other flood substation protection equipment. Mobile substations are utilized where applicable to assist restoration.

25-6.0342(3)(d): *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. See Distribution Engineering Manual, Page 3.

25-6.0342(4): *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 Duke 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. New software technology such as ESRI's ArcGIS will be incorporated into the model. As more data becomes available, DEF will continue to adjust its prioritization model as appropriate.

Using a similar evaluation framework for the 2019-2021 Storm Hardening plan, DEF prioritized its proposed projects based on various components that will be discussed in more detail below.

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

DEF continues to invest in proactive system maintenance activities to improve the reliability and integrity of the system. DEF announced a $25B investment (at the enterprise level) in the grid over 10 years as part of the Grid Investment Plan (GIP). DEF has begun this project in 2018 with programs including the Self-Optimizing Grid, Deteriorated Conductor, Transformer Retrofit and Targeted Underground. These programs are discussed in detail below.

- Targeted Underground Program

  The primary purpose of this hardening activity is to attempt to eliminate tree and debris related outages in the area of exposure by converting heavily vegetated neighborhoods prone to power outages from overhead to underground construction to decrease outages, reduce momentary interruptions, improve major storm restoration time, improve customer satisfaction and reduce costs.

- Deteriorated Conductor Program
  - The primary purpose of this hardening activity is to replace over dutied overhead conductor on the system that is prone to outages due to its brittle composition, small load capacity and poor connection qualities. The GIP focuses on eliminating the small copper conductor with aluminum conductor to improve the overall reliability.

- Transformer Retrofit Program
  - The primary purpose of this hardening activity is to retrofit Completely-Self Protected (CSP) transformers to be locally fused. This work stream corrects common transformer reliability conditions by replacing aged or problematic fuse cutouts and adding fuses where they previously did not exist with more reliable equipment and bringing all associated transformer equipment up to current Duke Energy construction standards. CSP transformers that have not been retrofitted have been a frequent cause of upstream fuse outages. Once retrofitted these transformers would limit the number of customers impacted by transformer or service level issues. This outage mitigation will be accomplished by adding external fused cutouts, replacing bare copper wires with covered copper, and adding animal mitigation to these locations. The retrofitting of CSP transformers is being done in lieu of replacement as a cost-effective method of outage reduction for DEF customers in these locations.

- Self-Optimizing Grid Program

- The primary purpose of this hardening activity is to strategically utilize automated switching device (ASDs) and an automation program to isolate faults on the electric distribution system and automatically reconfigure the system to minimize the number of customers that experience sustained power outages. The Self-Optimizing Grid (SOG) program will transform the radial distribution system into an automated distribution network that provides:
  1) connectivity with automated switching,
  2) capacity on the circuits to allow most circuits to be restored from alternate sources,
  3) automated control with SCADA-enable ASDs to isolate faults and reconfigure the system and
  4) segmentation such that the distribution circuits have much smaller line segments, thus reducing the number of customers that are affected by outages.

- Live Front Switchgear Replacement Program
  - The primary purpose of this hardening activity is to replace aged Live Front Switchgear prior to failure. A switchgear is a pad mounted metal enclosure that contains switches and fuses used for switching underground circuits and underground fault isolation. This program will improve overall reliability, result in faster outage restoration and improve safety for those working in the switchgears.

Base programs include:

DEF continues to invest in proactive system maintenance activities to improve the reliability and integrity of the system. DEF is continuing its normal maintenance and reliability improvements through the following programs discussed in detail below:

- 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.

- Deteriorated Conductor
  - The primary purpose of this hardening activity is similar to the GIP program listed above but targets all over-dutied overhead conductor not just copper.
- 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.
- 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, for example, 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 the recent tropical storms and hurricanes, 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 specific criteria listed below but mainly focuses on the historical reliability data from the outage management system (OMS) to determine the locations that would improve reliability on normal days, such as reducing customer interruption and outage duration. DEF then selects a list of projects to represent a sample of the programs listed above that best represents the overall system. These projects performance will be evaluated after storms to continuously improve the reliability and performance of the entire system. DEF also looks for opportunities to enhance the system that would reduce damages during a storm and allow power to be restored quicker. Other criteria considered is as follows:

- 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 following hardening project questions are asked when developing projects:

- 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 category of hurricane is the area served by this feeder expected to 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 SAIDI that this project could result in?
- What is the change in the annual SAIFI that this project could result in?
- What is the construction cost per customer?

25-6.0342(4)(a): *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**.

25-6.0342(4)(b): *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 varying degrees 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 2018.

Distribution:

The list below is a sampling of the proposed 2019 – 2021 Storm Hardening projects (please note, proposed hardening projects may or may not be completed during the timeframe, based on emergent work and other factors that cannot be foreseen in advance):

Op Center	County	Project	Sub Category
Apopka	Seminole	M109 Smoke Rise Blvd Reliability	OH to UG Conversion/ Backlot Conversion
Apopka	Orange	M34 Dudley Ave Underground Conversion	OH to UG Conversion
Seven Springs	Pinellas	Tarpon Springs C305 Magnolia Heights Reconductor	Feeder Tie
St Petersburg	Pinellas	52nd St Reconductor	Feeder Tie
Seven Springs	Pasco	Anclote Substation Bank 7 and Bank 8 Feeder Ties	Feeder Tie
Winter Garden	Orange	SR408 Crossing West of Good Homes	Overhead Line Crossing/Backlot
Clermont	Lake	Hancock Road Feeder Tie K4833_K4841	Feeder Tie
SE Orlando	Orange	Meadow Woods S Feeder Tie K1789_K1775	Feeder Tie
Inverness	Citrus	Storm Hardening Gasparilla Cay Subdivision	Submersible UG
Inverness	Citrus	Storm Hardening along Riverhaven Dr., Homosassa	Submersible UG
Monticello	Gulf	Feeder N55 tie to rest of Port St Joe Feeders	Feeder Tie
Deland	Volusia	W902- Pierson-Seville Grid Strengthening Project	Deteriorated Conductor

Ocala	Marion	A202- Zuber- County Rd 326 Grid Strengthening Project	Deteriorated Conductor
Clearwater	Pinellas	C104- Dunedin High and Highlander park Grid Strengthening Project	Deteriorated Conductor
SE Orlando	Orange	W392- Seminole Drive & Nela Ave Grid Strengthening Project	Deteriorated Conductor
Apopka	Orange	M400- West Lockhart Transformer Strengthening Project	Transformer Retrofit
Buena Vista	Orange	K925- Sand Lake I-Drive Transformer Strengthening Project	Transformer Retrofit
Highlands	Polk	K3205- North Fort Meade Transformer Strengthening Project	Transformer Retrofit
Monticello	Taylor	N14- Perry Northwest Transformer Strengthening Project	Transformer Retrofit
Buena Vista	Orange	Live front to Deadfront Switchgear Replacement-6418272	Switchgear Replacement
Buena Vista	Orange	Live front to Deadfront Switchgear Replacement-8003405	Switchgear Replacement
Buena Vista	Orange	Live front to Deadfront Switchgear Replacement-8003486 (K4051/K4050)	Switchgear Replacement
Jamestown	Orange	Self- Optimizing Grid Team 407	SOG
Highlands	Highlands	Self- Optimizing Grid Team 408	SOG
Apopka	Orange	Self- Optimizing Grid Team 412	SOG
Monticello	Franklin/ Wakulla	Self- Optimizing Grid Team 505	SOG
Buena Vista	Orange	TUG 442313600 Winwood Way	TUG
Monticello	Jefferson	TUG 442991878 Jefferson St	TUG
Inverness	Citrus	TUG 446946764 Juneau Point	TUG
Jamestown	Orange	TUG 444365498 Lake Pickett	TUG

Regarding 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.

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			
Project Name	**County**	**Type**	**Third Party**
Montverde to Winter Garden - 69 kV Line Rebuild	Lake	Rebuild	Yes
American Cement to Bushnell East -	Sumter	Rebuild/New	Yes
Eustis to Dona Vista 69 kV Line Rebuild	Lake	Rebuild	Yes
Oak Tap to Havana- New Rebuild 115KV Line	Gadsden	Rebuild	Yes
Idylwild - Wacahoota Tap (SI) - Rebuild 69 kV line (Two Phases)	Alachua	Rebuild	Yes
Williston - New 230/69 kV Substati	Levy	Rebuild/New	Yes
Eustis-Eustis South (EES) 69 kV Line Rebuild	Lake	Rebuild	Yes
New Powerline Sub Replacement with	Citrus	Rebuild/New	Yes
Deland West-Dona Vista - New 230 kV	Lake	Rebuild	Yes
Ginnie-Bell Tp (IS) Rebuild_Bell -	Gilchrist	Rebuild	Yes

Shady Hills - 230kV Line	Citrus	Rebuild	Yes
Coleman to Dixie Tap - 69 kV Line Rebuild	Sumter	Rebuild	Yes
Dallas to Orange Blossom - Rebuild 69 kV Line	Sumter	Rebuild	Yes
Central Florida to Federal - 69 kV Line Rebuild	Lake	Rebuild	Yes
Fort White-Luraville 69kV Line Rebuilds	Columbia	Rebuild	Yes
Alachua Tap to Hull Road 69kV Line	Alachua	Rebuild	Yes
Nobleton Tap-(SECO) Floral City Tap	Citrus	Rebuild	Yes
Central Florida - Picciola Tap 69kV Rebuild	Lake	Rebuild	Yes
Tallahassee to Oak City TAP Rebuild	Leon	Rebuild	Yes
Suwannee Springs 115kV Switching St	Suwannee	Rebuild/New	Yes
Lake Talquin-Brickyard 69kV Rebuild dbl-ckt-capable struc	Leon	Rebuild	Yes
Andersen to Wildwood City Tap - 69 kV Line Rebuild	Sumter	Rebuild	Yes
New 115kV Suwannee Transmission Sub	Suwannee	Rebuild/New	Yes
Florida OHG (Static) Replace	Hernando	Rebuild	Yes
Crawfordville - Carrabelle Rebuild as double circuit 115kV & 69kV	Wakulla	Rebuild	Yes

Ross Prairie to Marion Oaks Tap 69 kV Line Rebuild	Marion	Rebuild	Yes
Mondon Hill - New 230/115 kV Substa	Hernando	Rebuild/New	Yes
Dunnellon Town-Rainbow Spgs Tap	Marion	Rebuild	Yes
Rainbow Spgs Tp to Rainbow Lk - Reb	Marion	Rebuild	Yes
FLUOF	Alachua	Rebuild/New	Yes
Industrial Tap - New 15 Mvar Capaci	Lake	Customer Request	Possibly
FLGOV - 230T9 - DR-85 GOAB for FDOT	Marion	Governmental	Possibly
FLGOV - 1373T6 - MS-233 & MS-234 Ro	Marion	Governmental	Possibly
FLGOV - SR 44 BAILEY BRIDGE FOR THE	Sumter	Governmental	Possibly
FLGOV - SR 528 & Landstreet Boxout	Marion	Governmental	Possibly
FLGOV Citrus County Trail aka Withlacoochee Dunnel 437349-1	Citrus	Governmental	Possibly
Coleman to Federal - 69 kV Line Rebuild	Sumter	Governmental	Yes
FLGOV MS--67-6 to MS-67-7 SR 326 a	Marion	Governmental	Possibly
FLCUST Univ of FL AUF Relocation -	Alachua	Customer Request	Yes
US-27 Road Widening - CLC-48A Stub	Lake	Governmental	Possibly

FLGOV CLC-73 69kV Fosgate Road at US 27 Lake County contains D-Line Work	Lake	Governmental	Possibly
FLGOV MS--67-6 to MS-67-7 69kV SR 326 at CR 25A- FPID 435660-2	Marion	Governmental	Possibly
Old Town North Sub to Cross City Su	Dixie	Rebuild	Yes
Brooksville West - Loop in Brookrid	Hernando	Rebuild/New	Possibly
Fort White - Replace/Upgrade 115kV	Columbia	Rebuild	Yes
Suwannee Transmission Substation 23	Suwannee	Rebuild/New	Possibly
Tallahassee - new 115 kV Yard (New	Leon	Rebuild/New	Yes
Install 230/115kV Transformer at Fo	Columbia	Rebuild/New	Possibly
TRMP GP (Buckeye) Foley Substation	Taylor	Customer Request	Yes
Florida Portfolio of Governmental P	Lake	Customer Request	Possibly
Florida Portfolio of Governmental P	Sumter	Governmental	Possibly
Florida Portfolio of Governmental P	Sumter	Customer Request	Possibly
Florida Portfolio of Governmental P	Hernando	Governmental	Possibly
Florida Portfolio of Governmental P	Lake	Governmental	Possibly
Florida Portfolio of Governmental P	Hernando	Customer Request	Possibly

Florida Portfolio of Governmental P	Marion	Governmental	Possibly

South Florida			
Project Name	**County**	**Type**	**Third Party**
60KK8D 285T9 FAIRBANKS	Orange	Customer Request	Yes
Northridge to West Davenport - New	Polk	Rebuild	Yes
TRMP-2098D1-FGT East - Relay Upgrad	Orange	Rebuild	Yes
Bithlo to UCF 69kv Line rebuild	Orange	Rebuild	Yes
West Chapman to Winter Park East 69	Seminole	Rebuild	Yes
Oviedo to Winter Springs - 69 kV Line Rebuild	Seminole	Rebuild	Yes
Wire Road - New River 230kV Line & 69kV Line Rebuild (formerly Zephyrhills)	Pasco	Rebuild/New	Yes
Rio Pinar to Econ to Winter Park East - 230 kV Line Rebuild	Orange	Rebuild	Yes
Keystone - New 230-115 kV Substatio	Pinellas	Rebuild	Yes
Gateway to 32nd Street (HD-7) - 115	Pinellas	Rebuild	Yes
40th Street to 16th Street (BFE-2) - 115 kV Line Rebuild	Pinellas	Rebuild	Yes
Bayview to East Clearwater (HD-3) - 115 kV Line Rebuild	Pinellas	Rebuild	Yes

Bayboro Site Purchase	Pinellas	Rebuild/New	Yes
North Longwood-Sylvan 230kV (NLSX);	Seminole	Rebuild	Yes
Myrtle Lake - Wekiva 230kV Line Rebuild	Seminole	Rebuild	Yes
Piedmont - Wekiva 230kV Line Rebuild	Seminole	Rebuild	Yes
Vandolah to Whidden - 230 kV Line Rebuild	Hardee	Rebuild/New	Yes
West Lake Wales to Lake Wales 69 kV	Polk	Rebuild	Yes
Continental - Loop SECO Substation	Hardee	Customer Request	Yes
TRMP Ulmerton to Tri-City - 115 kV	Pinellas	Rebuild/New	Yes
TRMP 2078 DISSTON-STARKEY RD	Pinellas	Rebuild/New	Yes
Hemple to Ocoee 69 kV Line Rebuild	Orange	Rebuild	Yes
Deleon Springs to Barberville - 115	Volusia	Rebuild	Yes
Fort Meade to West Lake Wales Line Rebuild	Polk	Rebuild	Yes
TRMP-2568 ZUBER INC CAP	Pasco	Rebuild	Yes
Gateway to Ulmerton (HD-6) - 115 kV Line Rebuild	Pinellas	Rebuild	Yes
Dry Prairie - 230/69kV Substation	Hardee	Rebuild/New	Yes

Intercession City - Rebuild Interce	Osceola	Rebuild	Yes
Lake Aloma to Winter Park East - 69	Orange	Rebuild	Yes
Conway to Pinecastle - 69 kV Line Rebuild	Orange	Rebuild	Yes
Haines City East to Poinciana 69 kV	Polk	Rebuild	Yes
Davenport to Haines City 69 kV Rebu	Polk	Rebuild	Yes
Haines City to Haines City East 69	Polk	Rebuild	Yes
FLGOV 69kV DWB-169 to 181 and DWB-127-6 SR 15 (US 17) from Ponce De Leon Boulevard to East of SR 40, FPID: 410251-1-52-0	Volusia	Governmental	Possibly
FLGOV - 305T8 - AD-18-20,63,64 Sebr	Highlands	Governmental	Possibly
FLGOV - 341T2 - AFC-12 Sebring Pkwy	Highlands	Governmental	Possibly
FLGOV - 967T4 - WR & RW 69kV Reloca	Orange	Governmental	Possibly
FLGOV - POWERLINE ICLW & HP Road Co	Polk	Governmental	Possibly
FLGOV - DWB-127-6 Str Relocation fo	Volusia	Governmental	Possibly
FLCUST - AUCF-83 Relocate for Dolla	Seminole	Customer Request	Possibly
FLGOV-AL-5 to AL-7, US 27 (SR 25) a	Polk	Governmental	Possibly
FLCUST WLB-22 to WLB-31 UNIVERSAL OH to UG Conversion	Orange	Customer Request	Possibly

Oakhurst to Seminole 69kV Rebuild	Pinellas	Rebuild	Yes
Largo to Ulmerton West 69kV Rebuild	Pinellas	Rebuild	Yes
Sky Lake to Meadow Woods South - New 230 kV Line & 69 kV Line Rebuilds	Orange	Rebuild/New	Yes
Magnolia Ranch to Moss Park -69kV L	Orange	Rebuild	yes
Celebration to Lake Wilson - 69kV L	Osceola	Rebuild	Yes
Lake Bryan to Orangewood - 69kV Lin	Orange	Rebuild	Yes
410755-2 Bayway Structures Removals	Pinellas	Governmental	Possibly
FLGOV West French Ave Pedestrian Bridge ~	Volusia	Governmental	Possibly
FLCUST BFE 52 & BFE 53 115kV DevMar	Pinellas	Customer Request	Possibly
FLGOV WO 69kV I-4 Ultimate, Wymore	Orange	Governmental	Possibly
FLGOV DWL 230kV DWL & WLLW-SR 60 R/R Overpass @ West Lake Wales Sub	Polk	Governmental	Possibly
FLGOV AL-5 to AL-7 69kV US 27 (SR 25) at SR 60- FPID 419243-4-52-01	Polk	Governmental	Possibly
FLGOV SLE 69kV Relocation for Kennedy Blvd Widening (Orange Cnty)	Orange	Governmental	Possibly
605EBD-967T4 WR &RW RELOCATION	Orange	Customer Request	Possibly
60KK8-1967T2 SLM RELO @ KEN	Orange	Customer Request	Possibly

60KK8-1967T3 WO RELO @ KEN	Orange	Customer Request	Possibly
605EBD_287T4_WF-63-77-69KV	Seminole	Customer Request	Possibly
Largo to Taylor Ave (LTW-1) 69kV Li	Pinellas	Rebuild	Yes
Belleair to Largo (LECW-1) - 69 kV Line Rebuild	Pinellas	Rebuild	Yes
Lake Bryan to Vineland - 69 kV Line rebuild	Orange	Rebuild	Yes
Keller Road - Spring Lake 69kV Line Rebuild	Seminole	Rebuild	Yes
Rio Pinar to FGT East 69kv Line Rebuild	Orange	Rebuild	Yes
Rio Pinar to Curry Ford (RX) 230 kV Line Rebuild	Orange	Rebuild	Yes
Hudson-Golden Acres-New Port Richey	Pasco	Rebuild	Yes
Fort Meade - New 69kV Terminal, Ins	Polk	Customer Request	Possibly
32nd Street - Feeder Additions and	Pinellas	Rebuild	Possibly
Pilsbury 115kV Series Reactor	Pinellas	Rebuild/New	Possibly
Bonnet Creek to Intercession City	Osceola	Rebuild	Yes
Barnum City to Westridge - 69 kV Line Rebuild	Polk	Rebuild	Yes
TRMP Bayview to Tri-City - 115 kV L	Pinellas	Rebuild/New	Yes

TRMP Winter Springs to Sanford/Poin	Seminole	Rebuild	Yes
Horse Creek Upgrades to 2,000 amps	Hardee	Customer Request	Possibly
Myrtle Lake - NLSX Rebuild	Seminole	Rebuild	Yes
Florida Portfolio of Governmental P	Seminole	Customer Request	Possibly
Florida Portfolio of Governmental P	Orange	Governmental	Possibly
Florida Portfolio of Governmental P	Pinellas	Governmental	Possibly
Florida Portfolio of Governmental P	Seminole	Customer Request	Possibly
Florida Portfolio of Governmental P	Orange	Governmental	Possibly
Florida Portfolio of Governmental P	Seminole	Customer Request	Possibly
Florida Portfolio of Governmental P	Orange	Customer Request	Possibly
Florida Portfolio of Governmental P	Pinellas	Governmental	Possibly
Florida Portfolio of Governmental P	Orange	Governmental	Possibly
Florida Portfolio of Governmental P	Seminole	Customer Request	Possibly
Florida Portfolio of Governmental P	Pinellas	Customer Request	Possibly
Florida Portfolio of Governmental P	Polk	Governmental	Possibly

Florida Portfolio of Governmental P	Orange	Governmental	Possibly
Florida Portfolio of Governmental P	Pinellas	Governmental	Possibly
Daetwyler Drive Customer Relocation	Pinellas	Customer Request	Possibly

25-6.0342(4)(c): *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 work management 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. DEF completed the required inspection of every joint use pole on the system in the year end of 2013, and are currently in the 7th year of the second round of inspections and anticipate completing the cycle by year end of 2020.

25-6.0342(4)(d): *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 2016, 2017 and 2018 on storm hardening and maintenance:

Duke Energy Florida Storm Hardening and Maintenance Costs

Description	2016 Actual	2017 Actual	2018 Actual
Vegetation Management (Distribution & Transmission)	$40,076,769	$38,691,356	$46,784,730
Joint Use Pole Inspection Audit	$438,525	$448,503	$442,367
Transmission Pole Inspections	$1,918,500	$1,242,836	$1,826,054
Other Transmission Inspections and Maintenance	$5,649,611	$5,649,691	$6,084,476
Transmission Hardening Projects	$110,436,718	$109,829,369	$185,614,179
Distribution Pole Inspections & Treatments	$3,998,798	$4,536,355	$3,992,201
Distribution Hardening Projects	$42,453,504	$41,291,401	$44,801,476
Total	**$204,972,425**	**$201,689,511**	**$244,744,007**

25-6.0342(4)(e): *An estimate of the costs and benefits, obtained pursuant to Rule 25-6.0342(6), provided 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**.

25-6.0342(5): *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 Duke Energy Florida'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 Duke Energy Florida'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**.

25-6.0342(6): *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.

2019 Storm Hardening Plan Attachment List

Attachment A:

1. Distribution Standards Manual
2. Distribution Engineering Manual
3. Transmission Extreme Winds Loading
4. Transmission Line Engineering Design Philosophy

Attachment B:

1. Pole Inspection Plan
2. 2018 PSC Reliability Report Excerpts, pages 39-42, 44-65

Attachment C:

1. Joint Use Pole Guidelines

Attachment D:

1. DEF Storm Harding 2007-2018 Projects

Attachment A

DEF Distribution Standards Manual

01.01 GENERAL

01.02 POLEFOREMAN

01.03 SYMBOLOGY

01.05 SPECIAL APPLICATIONS

01.06 STANDING ORDERS

WELCOME TO THE NEW DUKE ENERGY STANDARDS MANUAL. THIS MANUAL IS BEING INTRODUCED IN SECTIONS IN AN EFFORT TO MANAGE THE AMOUNT OF MATERIAL (MANUAL SHEETS) BEING DELIVERED AND IMPLEMENTED IN THE FIELD AT ONE TIME. THIS IS A MULTI-YEAR PROCESS WHICH BEGAN IN 2015 AND WILL CONTINUE THROUGH 2016 AND 2017.

THESE STANDARDS SPECIFY HOW THE DUKE ENERGY DISTRIBUTION SYSTEM IS TO BE CONSTRUCTED IN EACH DUKE ENERGY JURISDICTION. THESE STANDARDS SHALL BE USED ON ALL NEW CONSTRUCTION. THIS INCLUDES RELOCATION PROJECTS, RECONDUCTORING PROJECTS, AND OTHER TARGETED IMPROVEMENT PROJECTS. WHERE FEASIBLE AND PRACTICAL, THESE STANDARDS SHOULD ALSO BE USED ON EXISTING FACILITIES WHEN INSTALLING NEW EQUIPMENT OR REPLACING EXISTING EQUIPMENT. GOOD ENGINEERING AND ECONOMIC JUDGMENT MUST BE APPLIED. LOCAL DESIGN ENGINEERING SHALL INDICATE THE SCOPE AND EXTENT OF WORK TO BE COMPLETED ON EACH WORK REQUEST. IF ASSISTANCE IS NEEDED BEYOND LOCAL ENGINEERING AND DESIGN, PLEASE CONTACT DISTRIBUTION STANDARDS. CONSTRUCTION QUALITY AUDIT SCORES WILL BE BASED ON REASONABLE APPLICATION OF THE STANDARDS SHOWN IN THIS MANUAL.

FOR STANDARDS RELATED NEEDS NOT YET COVERED IN THE ENTERPRISE WIDE STANDARDS MANUALS, INDIVIDUALS SHOULD DEFAULT TO THEIR LEGACY MANUALS.

THE NATIONAL ELECTRIC SAFETY CODE (NESC) MANDATES THE BASIC STRENGTHS AND CLEARANCES REQUIRED FOR DISTRIBUTION LINES. DUKE ENERGY CONSTRUCTION SPECIFICATIONS ARE DESIGNED TO MEET THE REQUIREMENTS OF THE NESC WHEN FOLLOWED AS SPECIFIED. DEVIATION FROM THESE SPECIFICATIONS MUST BE EVALUATED BY QUALIFIED PERSONNEL TO ENSURE THE DEVIATION DOES NOT CREATE A NESC VIOLATION.

GRADE OF CONSTRUCTION

THE NESC DEFINES THE GRADE OF CONSTRUCTION THAT SHALL BE USED. GRADE C IS REQUIRED FOR MOST DUKE ENERGY DISTRIBUTION LINES. UNLESS SPECIFICALLY NOTED, THESE DUKE ENERGY CONSTRUCTION SPECIFICATIONS MEET THE REQUIREMENTS OF GRADE C. GRADE B IS REQUIRED IN SPECIAL LOCATIONS AS DEFINED BY THE NESC LIKE RAILROAD CROSSINGS, LIMITED ACCESS HIGHWAY CROSSINGS, AND NAVIGABLE WATERWAY CROSSINGS. WHEN GRADE B LINES ARE REQUIRED, POLEFOREMAN SHOULD BE USED TO ANALYZE THE STRENGTH OF POLES, CROSSARMS, BRACKETS, INSULATORS, GUYS AND ANCHORS FOR COMPLIANCE.

LOADING DISTRICTS

THE NESC DEFINES THE LOADING REQUIREMENTS THAT SHALL BE MET BY DISTRIBUTION LINES AND STRUCTURES.

COMBINED ICE AND WIND DISTRICT LOADING

DUKE ENERGY SERVICE TERRITORY IN THE US LIES IN THREE COMBINED ICE AND WIND LOADING DISTRICTS. SEE MAP ON DWG. 01.01-112.

1. FLORIDA LIES IN THE LIGHT LOADING DISTRICT. STRUCTURE, STRUCTURE MEMBERS AND LINES MUST POSSESS SUFFICIENT STRENGTH TO WITHSTAND A 9 LB/FT ^{2}(APPROXIMATELY 60 MPH) WIND AT 30° F.

2. THE CAROLINAS, KENTUCKY AND OHIO AREAS OF DUKE ENERGY LIE IN THE MEDIUM LOADING DISTRICT. STRUCTURE, STRUCTURE MEMBERS AND LINES MUST POSSESS SUFFICENT STRENGTH TO WITHSTAND A 4 LB/FT ^{2} (APPROXIMATELY 40 MPH) WIND AT 15°F WITH THE LINES COVERED WITH 1/4" RADIAL THICKNESS OF ICE.

3. INDIANA LIES IN THE HEAVY LOADING DISTRICT. STRUCTURE, STRUCTURE MEMBERS AND LINES MUST POSSESS SUFFICIENT STRENGTH TO WITHSTAND A 4 LB/FT ^{2}(APPROXIMATELY 40 MPH) WIND AT 0°F WITH THE LINES COVERED WITH 1/2" RADIAL THICKNESS OF ICE.

IN ADDITION, THE NESC DEFINES LOAD FACTORS THAT MUST BE APPLIED TO THE RATED STRENGTH OF STRUCTURES, STRUCTURE MEMBERS AND LINES WHEN DETERMINING THEIR ABILITY TO SUPPORT THE LOADING AT THESE ZONE CONDITIONS.

3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

MECHANICAL LOADING
REQUIREMENTS AND CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

01.01-102A

EXTREME WIND CONDITIONS

IF A STRUCTURE, WIRES OR ANY SUPPORTED FACILITY EXCEEDS 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 DWGS. 01.01-114 AND 01.01-116 SHOW THE WIND SPEED TO BE USED FOR THIS DETERMINATION. THE POLEFOREMAN PROGRAM IS THE COMPANY'S STANDARD FOR STRUCTURE DESIGN TO ENSURE COMPLIANCE WITH THIS RULE.

IN ADDITION TO THE 60 FT. RULE, THERE MAY BE TIMES WHEN EXTREME WIND LOADING REQUIREMENTS WILL BE APPLIED TO ALL STRUCTURES OF A CIRCUIT OR AREA REGARDLESS OF HEIGHT. PQR&I SHALL IDENTIFY CIRCUIT OR LOCATIONS WHERE EXTREME WIND LOADING SHALL BE APPLIED IN ADDITION TO THE 60 FT. RULE.

EXTREME ICE AND CONCURRENT WIND LOADING

IF A STRUCTURE, WIRES OR ANY SUPPORTED FACILITY EXCEEDS 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 MAP ON DWG. 01.01-120 SHOWS THE ICE AND CONCURRENT WIND SPEED TO BE USED FOR THIS DETERMINATION. THE POLEFOREMAN PROGRAM IS THE COMPANY'S STANDARD FOR STRUCTURE DESIGN TO ENSURE COMPLIANCE WITH THIS RULE.

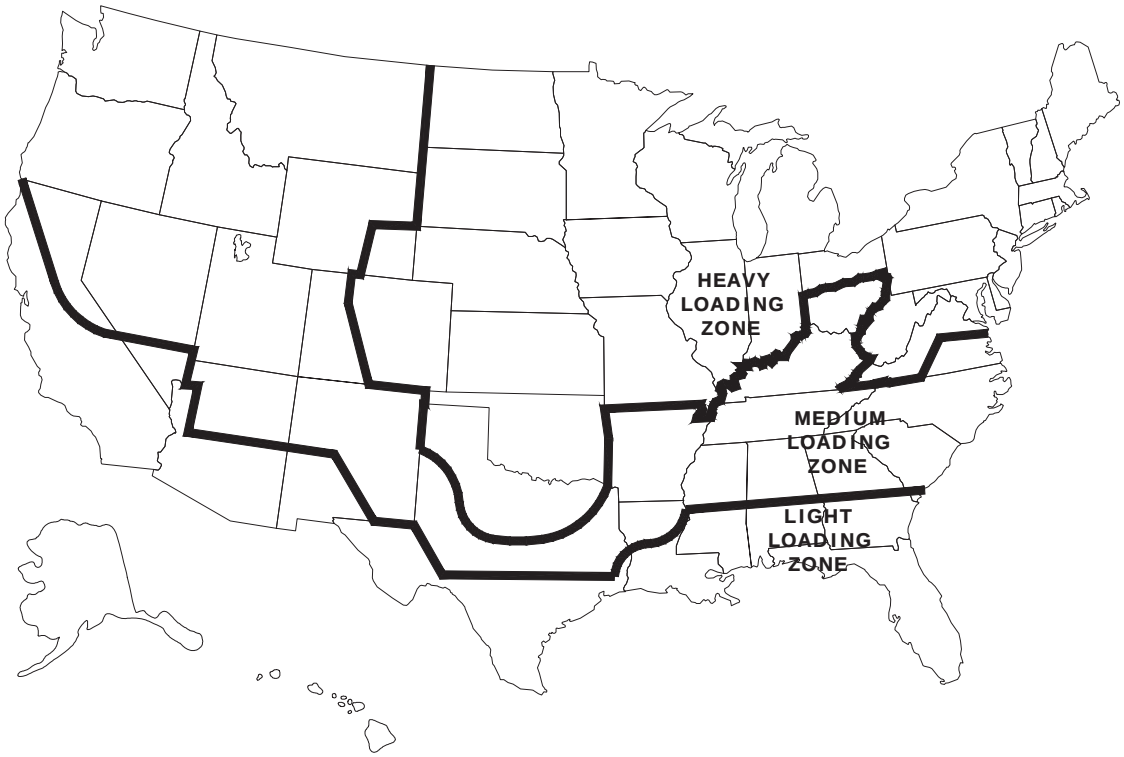
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK

MECHANICAL LOADING

REQUIREMENTS AND CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

01.01-102B



DUKE ENERGY.

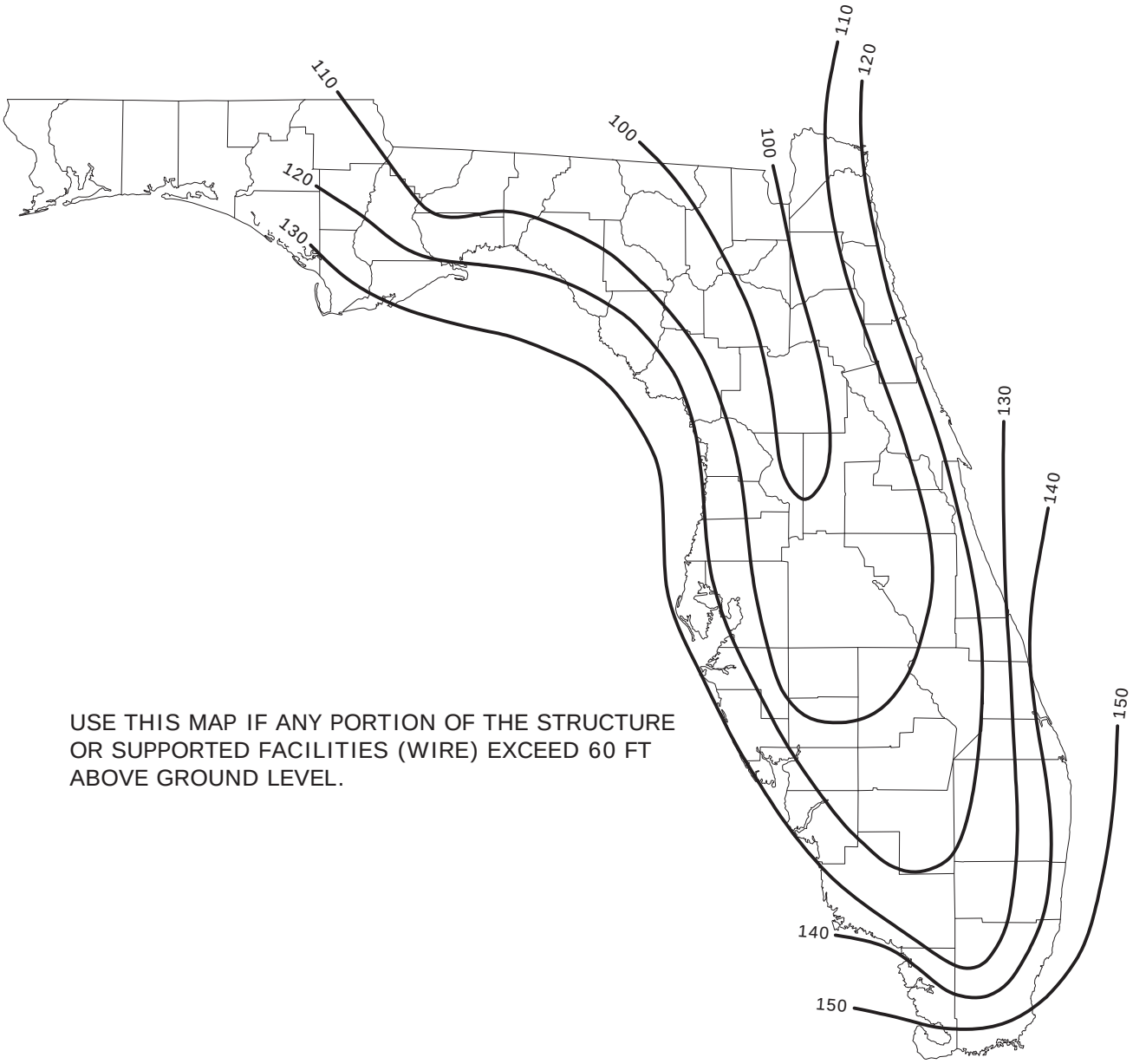
3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

COMBINED ICE AND WIND

DISTRICT LOADING

DEC	DEM	DEP	DEF
X	X	X	X

01.01-112



USE THIS MAP IF ANY PORTION OF THE STRUCTURE OR SUPPORTED FACILITIES (WIRE) EXCEED 60 FT ABOVE GROUND LEVEL.

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 DWGS. 01.01-102A AND 01.01-102B 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. 01.02-100. 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				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

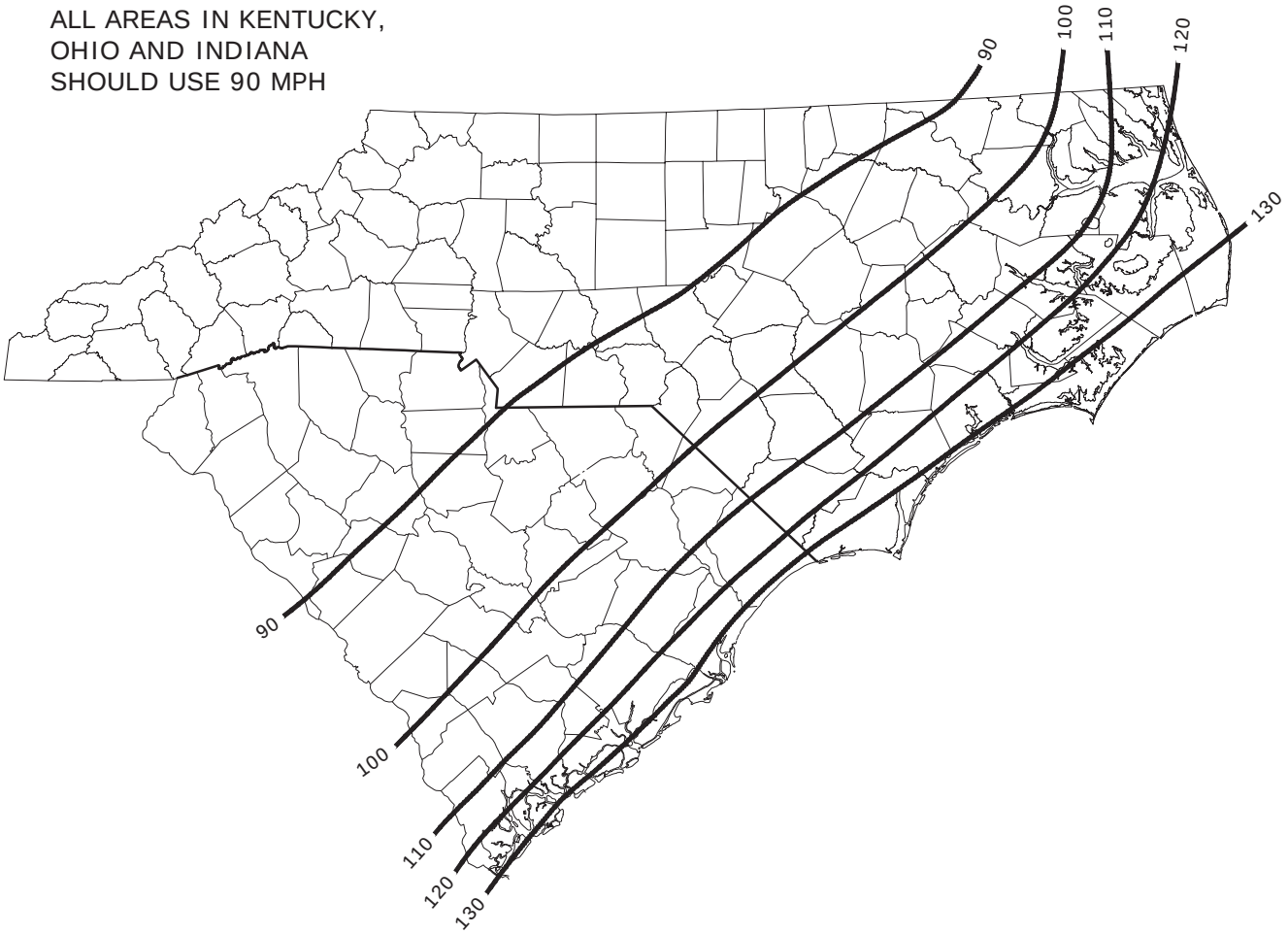
FLORIDA EXTREME WIND REGIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

01.01-114

ALL AREAS IN KENTUCKY,
OHIO AND INDIANA
SHOULD USE 90 MPH



USE THIS MAP IF ANY PORTION OF THE STRUCTURE OR SUPPORTED FACILITIES (WIRE) EXCEED 60 FT ABOVE GROUND LEVEL.

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 DWGS. 01.01-102A AND 01.01-102B TO DETERMINE IF A PARTICULAR LINE MUST BE DESIGNED TO MEET EXTREME WIND LOADING. THESE VALUES ARE TO BE USED IN THE PROGRAM AS DEFINED BY DWG. 01.02-100. 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)

DUKE ENERGY.

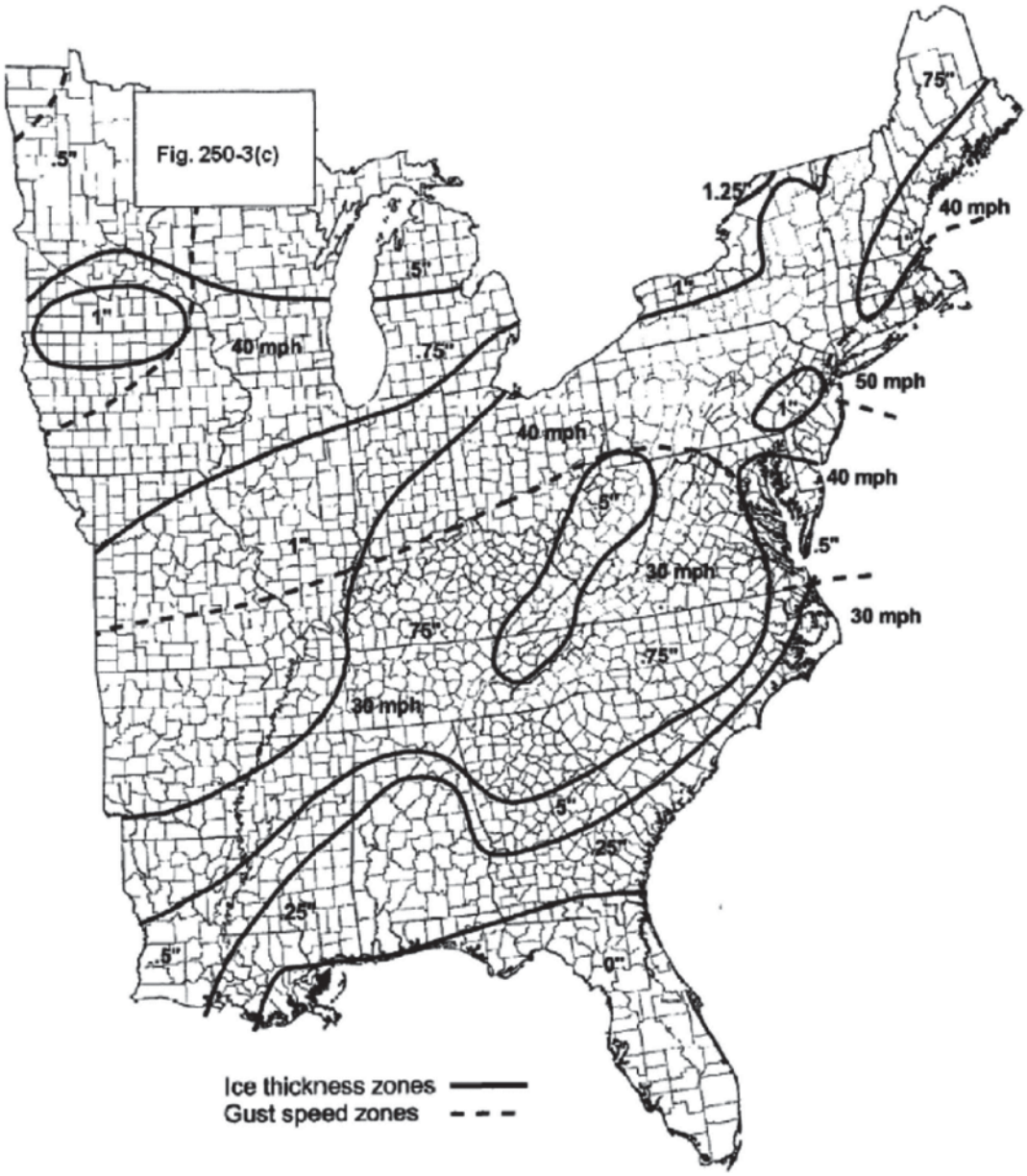
3					
2					
1					
0	3/31/16	BURLISON	WHITE	ADCOCK	
REVISED		BY	CK'D	APPR.	

KENTUCKY, OHIO, INDIANA AND CAROLINAS

EXTREME WIND REGIONS

DEC	DEM	DEP	DEF
X	X	X	X

01.01-116



50 YEAR MEAN RECURRENCE INTERVAL UNIFORM ICE THICKNESS DUE TO FREEZING RAIN
WITH CONCURRENT 3-SECOND GUST SPEEDS: CONTIGUOUS 48 STATES

USE THIS MAP IF ANY PORTION OF THE STRUCTURE OR SUPPORTED FACILITIES (WIRE) EXCEED 60 FT ABOVE GROUND LEVEL.

DUKE ENERGY.

3					
2					
1					
0	3/31/16	BURLISON	WHITE	ADCOCK	
REVISED		BY	CK'D	APPR.	

NORTH AND SOUTH CAROLINA,
INDIANA/OHIO/KENTUCKY
EXTREME ICE AND CONCURRENT WIND REGION

DEC	DEM	DEP	DEF
X	X	X	X

01.01-120

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). DUKE 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.

DWGS. 01.02-102A AND 01.02-102B ARE AN EXAMPLE OF THE OUTPUT FROM POLEFOREMAN. THE INFORMATION CAN BE USED TO VALIDATE COMPLIANCE WITH THE NESC.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLEFOREMAN

DEC	DEM	DEP	DEF
X	X	X	X

01.02-100

PoleForeman - Pole Loading Analysis Report

License: Duke Energy Version 5.8.10

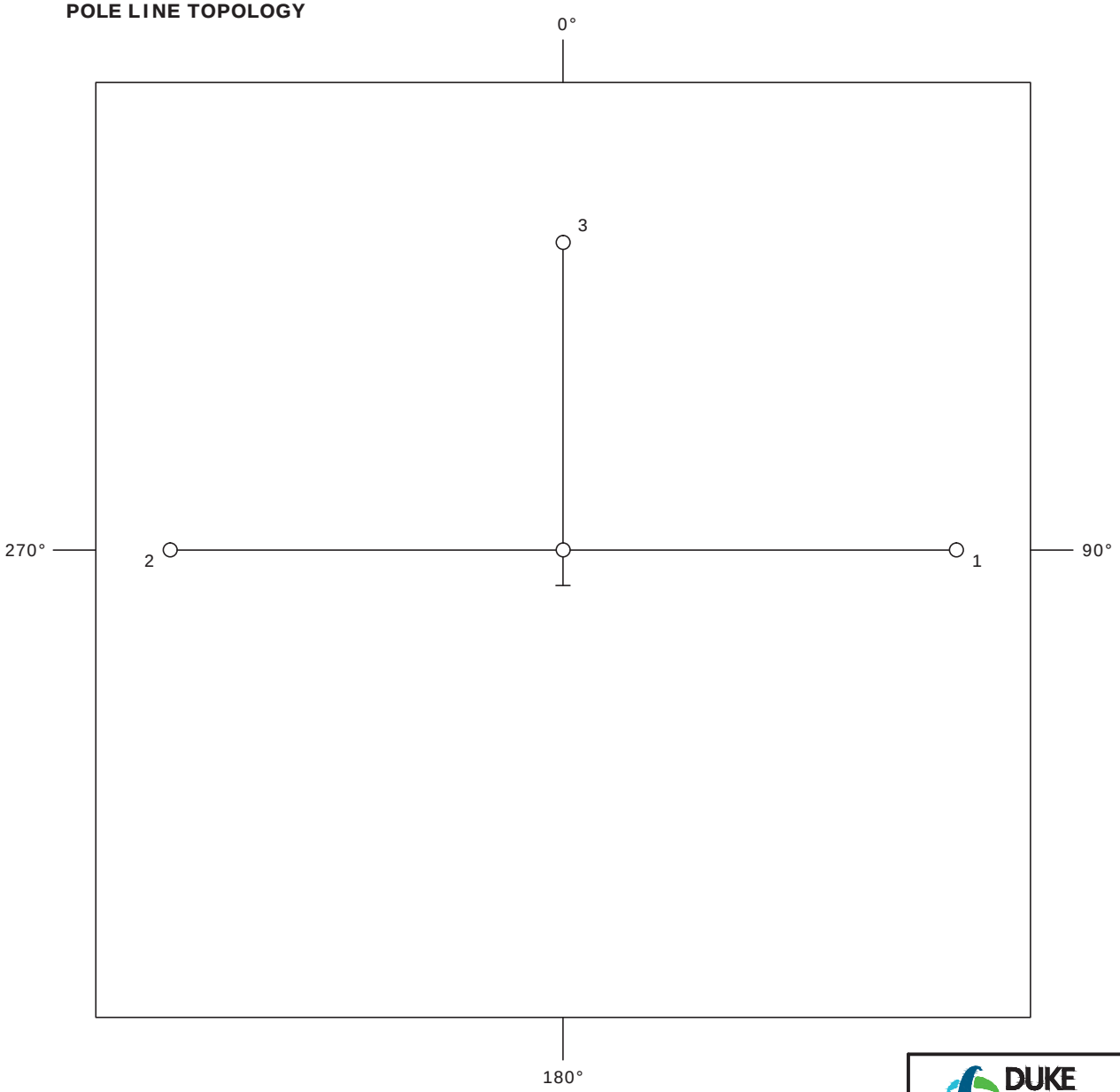
POLE LOADING DATA

Pole: 40/5 Wood
Pole Loading
Horizontal: 37% (250B)
Vertical: 32% (k=0.70)
NESC Edition: 2012
Loading District: Medium
Construction: Grade C (Crossing)
Rule 250B Loading: Wind (psf): 4 Ice (in): 0.25

POLES

Pole #	Length (ft)	Depth (ft)	Elevation (ft)
0	40	6	0
1	40	6	0
2	40	6	0
3	40	6	0

POLE LINE TOPOLOGY



3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLEFOREMAN -

OUTPUT EXAMPLE

DEC	DEM	DEP	DEF
X	X	X	X

01.02-102A

PoleForeman - Pole Loading Analysis Report

License: Duke Energy

GUY STRAND DATA

Anchor	Strand	Attach	Length	Direction	Tension	Strength	Loading
1	3/8" EHS	59"	18"	180°	6,935	13,860	50%
1	3/8" EHS	90"	18"	180°	3,527	13,860	25%

ANCHOR DATA

Anchor	Rod	Anchor	Soil	Tension	Rod Strength	Anchor Strength
1	None	None	None	10,460	0	0

INSULATORS

Insulator	Attach	Loading	Angle
Post	5"	8%	0°
Post	16"	8%	0°
Post	16"	8%	0°
Primary Dead End	43"	20%	0°
Primary Dead End	53"	20%	0°
Primary Dead End	53"	20%	0°
Spool Tangent	96"	6%	0°

ARM/BRACKET DATA

Arm/Bracket	Attach	Vert Loading	Horz Loading
Post Top	5"	10%	18%
Single 8FT	16"	22%	9%
10FT FG DE Arm	53"	1%	12%

SPANS

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

Circuit: 1

Primary	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension
556.5 AAC 3000 LBS (Legacy)	200	44	6	6	2567
556.5 AAC 3000 LBS (Legacy)	200	0	-8	-8	2567
556.5 AAC 3000 LBS (Legacy)	200	-44	6	6	2567
Neutral 1/0 AAAC (7)	200	-1	96	96	1167

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

Circuit: 1

Primary	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension
556.5 AAC 3000 LBS (Legacy)	200	44	6	6	2567
556.5 AAC 3000 LBS (Legacy)	200	0	-8	-8	2567
556.5 AAC 3000 LBS (Legacy)	200	-44	6	6	2567
Neutral 1/0 AAAC (7)	200	-1	96	96	1167

Span: 3 Span Length (ft): 150 Direction: 0°

Circuit: 1

Primary	Ruling Span (ft)	Offset (in)	Attach A (in)	Attach B (in)	Tension
1/0 AAAC(7)	150	0	43	43	1000
1/0 AAAC(7)	150	44	53	53	1000
1/0 AAAC(7)	150	-44	53	53	1000
Neutral 1/0 AAAC (7)	150	0	96	96	1000

DUKE ENERGY.

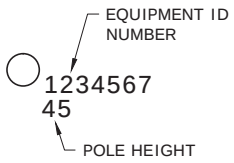
3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLEFOREMAN - OUTPUT EXAMPLE

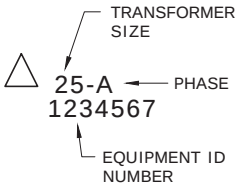
DEC	DEM	DEP	DEF
X	X	X	X

01.02-102B

TAG POLE WITH EQUIPMENT ID NUMBER



POLE

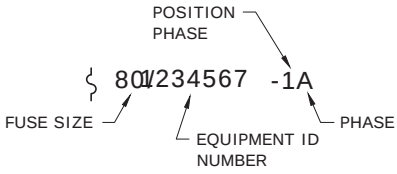


TRANSFORMER

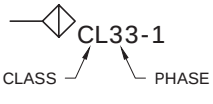
NOTES:

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

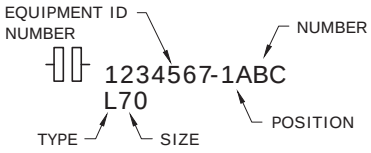
TAG POLE WITH EQUIPMENT ID NUMBER
TAG POSITION NUMBER AS DIRECTED BY ENGINEERING



OH FUSE



STREET LIGHT

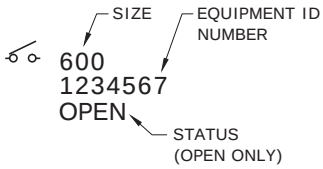


RECLOSER

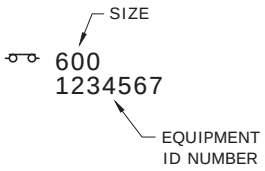
NOTES:

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.

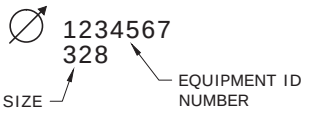
TAG POLE WITH EQUIPMENT ID NUMBER INCLUDING ALPHA DESIGNATOR



SWITCH (OPEN)



SWITCH (CLOSED)



REGULATOR

NOTES:

FOR 300/600 AMP SWITCHES, AND REGULATORS THE EQUIPMENT ID NUMBER HAS SEVEN (7) NUMERICAL DIGITS.

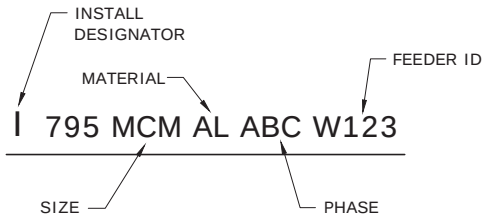
3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GIS DEVICE DESCRIPTIONS

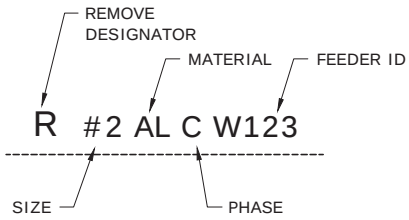
DEC	DEM	DEP	DEF
			X

01.03-100A

PRIMARY



PRIMARY

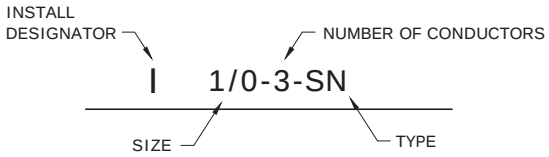


NOTES:

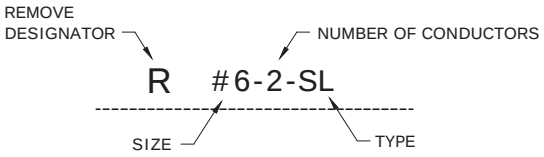
FOR OH & UG PRIMARY WIRE AND CABLE, THERE IS TEXT DESCRIBING THE WIRE/CABLE SIZE, MATERIAL TYPE, PHASE, FEEDER ID AND INSTALL (I) OR REMOVE (R) STATUS. SOME OF THIS TEXT IS OPTIONAL AND WILL NOT BE SHOWN IN ALL CASES.

EQUIPMENT ID NUMBER FORMAT FOR SWITCHGEAR

SECONDARY



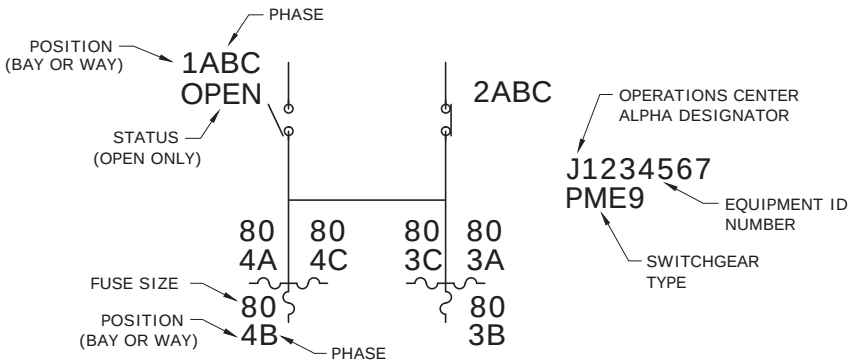
SECONDARY



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				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GIS DEVICE DESCRIPTIONS

DEC	DEM	DEP	DEF
			X

01.03-100B

ARRESTER		
BREAKER		
CAPACITOR		
DOWN GUY		
ELBOWS	OPEN	
	CLOSED	
FAULT INDICATOR		
GENERATOR		
	UPS	
INTERRUPTER (VFI'S)		
POLES	NON-DUKE 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		

DUKE ENERGY.

3				
2				
1				
0	3/21/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DEC	DEM	DEP	DEF
		X	X

01.03-102A

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				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DUKE ENERGY.

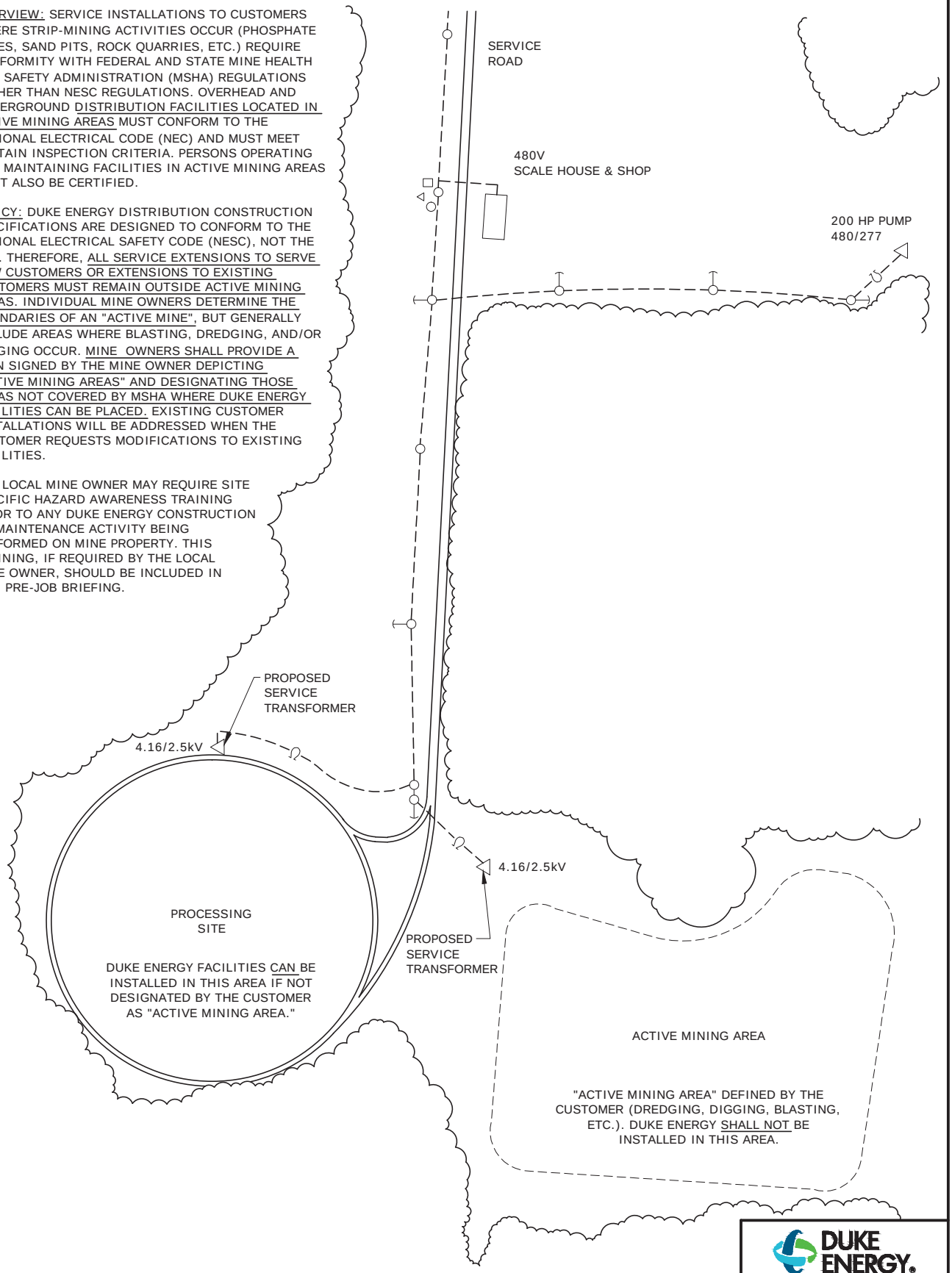
DEC	DEM	DEP	DEF
		X	X

01.03-102B

OVERVIEW: SERVICE INSTALLATIONS TO CUSTOMERS WHERE STRIP-MINING ACTIVITIES OCCUR (PHOSPHATE MINES, SAND PITS, ROCK QUARRIES, ETC.) REQUIRE CONFORMITY WITH FEDERAL AND STATE MINE HEALTH AND SAFETY ADMINISTRATION (MSHA) REGULATIONS RATHER THAN NESC REGULATIONS. OVERHEAD AND UNDERGROUND DISTRIBUTION FACILITIES LOCATED IN ACTIVE MINING AREAS MUST CONFORM TO THE NATIONAL ELECTRICAL CODE (NEC) AND MUST MEET CERTAIN INSPECTION CRITERIA. PERSONS OPERATING AND MAINTAINING FACILITIES IN ACTIVE MINING AREAS MUST ALSO BE CERTIFIED.

POLICY: DUKE ENERGY DISTRIBUTION CONSTRUCTION SPECIFICATIONS ARE DESIGNED TO CONFORM TO THE NATIONAL ELECTRICAL SAFETY CODE (NESC), NOT THE NEC. THEREFORE, ALL SERVICE EXTENSIONS TO SERVE NEW CUSTOMERS OR EXTENSIONS TO EXISTING CUSTOMERS MUST REMAIN OUTSIDE ACTIVE MINING AREAS. INDIVIDUAL MINE OWNERS DETERMINE THE BOUNDARIES OF AN "ACTIVE MINE", BUT GENERALLY INCLUDE AREAS WHERE BLASTING, DREDGING, AND/OR DIGGING OCCUR. MINE OWNERS SHALL PROVIDE A PLAN SIGNED BY THE MINE OWNER DEPICTING "ACTIVE MINING AREAS" AND DESIGNATING THOSE AREAS NOT COVERED BY MSHA WHERE DUKE ENERGY FACILITIES CAN BE PLACED. EXISTING CUSTOMER INSTALLATIONS WILL BE ADDRESSED WHEN THE CUSTOMER REQUESTS MODIFICATIONS TO EXISTING FACILITIES.

THE LOCAL MINE OWNER MAY REQUIRE SITE SPECIFIC HAZARD AWARENESS TRAINING PRIOR TO ANY DUKE ENERGY CONSTRUCTION OR MAINTENANCE ACTIVITY BEING PERFORMED ON MINE PROPERTY. THIS TRAINING, IF REQUIRED BY THE LOCAL MINE OWNER, SHOULD BE INCLUDED IN THE PRE-JOB BRIEFING.



3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

SERVICE TO MINES

DEC	DEM	DEP	DEF
X	X	X	X

01.05-100

FROM TIME TO TIME, DUKE ENERGY IS REQUESTED TO PUT "MARKER BALLS" ON DUKE ENERGY OVERHEAD DISTRIBUTION FACILITIES TO MAKE THEM MORE VISIBLE. MARKER BALL REQUESTS ARE USUALLY ASSOCIATED WITH NON-FAA CONTROLLED AIRSTRIPS OR WITH SITES WHERE HEAVY EQUIPMENT CROSSES UNDER EXISTING OVERHEAD LINES.

AIRSTRIP AND CONSTRUCTION SITE OPERATIONS CAN PRESENT A HAZARD TO THE DISTRIBUTION LINES AND TO THE OPERATORS OF AIRCRAFT AND CONSTRUCTION EQUIPMENT.

THE FOLLOWING PROCEDURES ADDRESS STEPS THAT ARE TO BE TAKEN TO ENSURE THE PROTECTION OF OUR DISTRIBUTION FACILITIES AND THE SAFETY OF OTHERS WHEN A CUSTOMER REQUESTS US TO INSTALL MARKER BALLS.

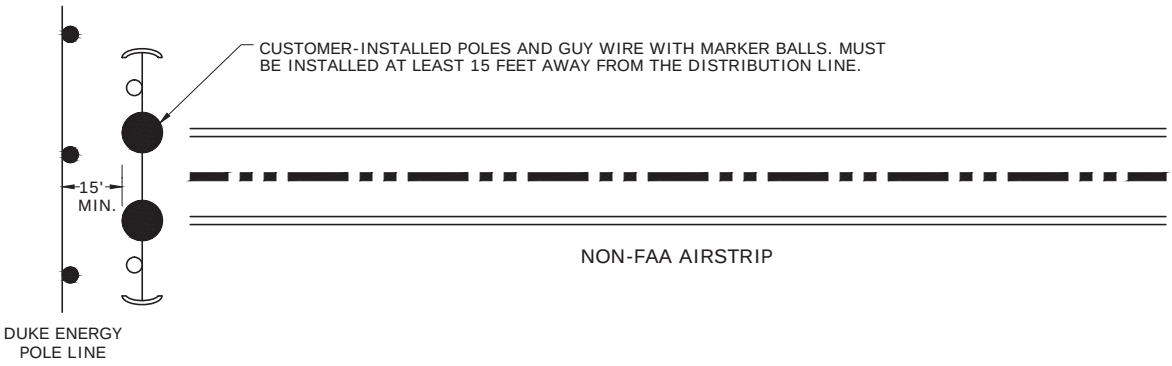
MARKER BALLS ARE NOT FAVORED AND THE BEST SOLUTION IS ALWAYS TO RELOCATE OR PLACE THE FACILITIES UNDERGROUND.

REQUESTS: WHEN MEMBERS OF THE PUBLIC REQUEST MARKER BALLS, WE WILL REVIEW THE SPECIFICS OF THE REQUEST AND, AS INDICATED, OFFER THE FOLLOWING OPTIONS:

1. MOVE THE LINES AT REQUESTER'S COST.
2. BURY THE LINES AT REQUESTER'S COST.
3. REQUESTER MAY PLACE POLES AND STATIC LINE WITH MARKER BALLS OUTSIDE THE CLEARANCE AREA UNDER OWNERSHIP OF THE REQUESTER AND AT REQUESTER'S COST.
4. LICENSE THE REQUESTER TO HAVE MARKER BALLS PLACED AND MAINTAINED ON OUR FACILITIES AT THEIR EXPENSE. LEGAL WILL PROVIDE THE CONTRACT TO LICENSE THE REQUESTER. THE LICENSE WILL INCLUDE PROTECTION FOR THE COMPANY BY WAY OF THE BROADEST POSSIBLE INDEMNITY OBLIGATION TO THE LICENSEE. THE REQUESTER WILL PURCHASE MARKER BALLS FROM APPROVED DUKE ENERGY MANUFACTURERS. DUKE ENERGY DESIGNER WILL CONTACT LOCAL STANDARDS' REPRESENTATIVE TO GET CURRENT APPROVED MANUFACTURERS AND MANUFACTURER'S PART NUMBER. DUKE ENERGY RESOURCES WILL INSTALL REQUESTER PURCHASED MARKER BALLS ON OUR FACILITIES AT THE REQUESTER'S COST.

KNOWN DANGERS: WITH DISTRIBUTION CONFLICTS, THE APPROACH WILL BE TO CONTACT OPERATORS AND REQUEST THAT THEY CEASE OPERATIONS THAT ARE IN CONFLICT WITH OUR LINES OR PAY TO UNDERTAKE ONE OF THE FOUR OPTIONS ABOVE.

EXISTING MARKER BALLS: IN PLACES WHERE WE HAVE EXISTING MARKER BALLS ON OUR FACILITIES THAT HAVE NOT BEEN PLACED AT THE DIRECTION OF A REGULATORY AGENCY, A REVIEW WILL BE MADE AND ACTION TAKEN.



REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK

REQUESTS FOR MARKER BALLS ON OVERHEAD DISTRIBUTION FACILITIES

DEC	DEM	DEP	DEF
X	X	X	X

01.05-102

A. CONSTRUCTION EQUIPMENT TRAVERSING UNDER OVERHEAD LINES

1. DETERMINE THE HEIGHT OF THE EQUIPMENT THAT WILL BE TRAVERSING UNDER THE OVERHEAD FACILITIES. ENSURE THAT COMPANY FACILITIES MEET NESC CLEARANCES ABOVE THE EQUIPMENT. IF THE CLEARANCE IS ADEQUATE, INFORM THE EQUIPMENT OWNER/OPERATOR THAT THE CLEARANCE IS ADEQUATE.

2. IF CLEARANCE ABOVE THE EQUIPMENT IS INADEQUATE TO MEET THE NESC, REQUEST THAT THE ACTIVITY UNDER THE POWER LINES CEASE UNTIL THE CONFLICT IS RESOLVED.

   NOTE: NESC TABLE 232-1, FOOTNOTE 25 STATES THAT WHEN DESIGNING LINES FOR OVERSIZED VEHICLES, THE REQUIRED CLEARANCE SHALL BE INCREASED BY THE KNOWN HEIGHT OF THE VEHICLE, LESS 14 FEET.

   FOR EXAMPLE: IF THE LINE CLEARANCE REQUIREMENT IS 21 FEET AND THE VEHICLE IS 16 FEET HIGH, THEN THE LINE CLEARANCE MUST BE INCREASED BY 2 FEET (16-14=2 FEET) FOR A TOTAL CLEARANCE OF 23 FEET (21+2=23 FEET).

   PROVIDE CUSTOMER WITH THE COST TO RAISE/RELOCATE/CONVERT (TO UNDERGROUND) THE FACILITIES TO ELIMINATE THE CONFLICT. IF THE CUSTOMER AGREES TO PAY, CONFLICT IS RESOLVED.

3. IF NONE OF THE ACTIONS ABOVE ARE ACCEPTABLE TO THE CUSTOMER/EQUIPMENT OWNER/OPERATOR AND/OR NO RESPONSE HAS BEEN RECEIVED IN 30 DAYS, CONTACT THE LEGAL DEPARTMENT FOR ADVICE AND ASSISTANCE.

B. CRANE AND OTHER EQUIPMENT WORKING IN CLOSE PROXIMITY TO OVERHEAD LINES

FOR INFORMATION ONLY:

THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION 29 CFR PART 1926 CRANES AND DERRICKS IN CONSTRUCTION, REQUIRES CRANES (INCLUDES RIGGING, LOAD, ETC) AND OTHER EQUIPMENT TO STAY OUTSIDE A 20 FOOT ZONE FROM ELECTRIC POWER LINES UNLESS ONE OF THE FOLLOWING THREE OPTIONS ARE SELECTED.

OPTION 1. DE-ENERGIZE AND GROUND: IF THE LINE CAN BE SAFELY DE-ENERGIZED AND GROUNDED WITHOUT UNDUE HARDSHIP ON CUSTOMERS, OUR CREWS ARE AUTHORIZED TO DE-ENERGIZE THE LINE AND PROVIDE GROUNDS IN THE VICINITY OF THE WORK AREA. THE REQUESTOR MUST PAY THE COST OF PERFORMING THIS SERVICE BEFORE WORK COMMENCES.

OPTION 2. MAINTAIN 20 FOOT CLEARANCE: IF ANY OF THE EQUIPMENT BEING OPERATED (LOAD LINE, LOAD, ETC) HAS POTENTIAL OF ENTERING THE 20 FOOT ZONE, MEASURES SPECIFIED IN OSHA 1926.1408 (b) MUST BE IMPLEMENTED TO ENSURE NOTHING ENTERS THE 20 FOOT ZONE.

OPTION 3. TABLE "A" CLEARANCE: TABLE "A" CLEARANCES PERMIT OPERATION WITHIN THE 20 FOOT ZONE BUT NO CLOSER THAN 10 FOOT TO LINES BELOW 50 KV. IF ANY OF THE EQUIPMENT BEING OPERATED (LOAD LINE, LOAD, ETC) HAS POTENTIAL OF ENTERING THE 10 FOOT ZONE, MEASURES SPECIFIED IN OSHA 1926.1408 (b) MUST BE IMPLEMENTED TO ENSURE NOTHING ENTERS THE 10 FOOT ZONE.

PART (b) OF OSHA 1926.1408 HAS SEVERAL REQUIREMENTS THAT MUST BE MET. THESE REQUIREMENTS ARE DESIGNED TO PREVENT ANY PORTION OF THE EQUIPMENT BEING OPERATED FROM ENTERING THE CLEARANCE ZONE SELECTED.

IF THE COMPANY IS REQUESTED TO PROVIDE THE OPERATING VOLTAGE OF THE DISTRIBUTION LINE BY A FIRM PLANNING TO DO WORK NEAR THE LINE, OSHA REQUIRES THIS INFORMATION BE PROVIDED WITHIN TWO WORKING DAYS.

COMPANY PERSONNEL MUST NOT ATTEMPT TO EXPLAIN PART (B) OF OSHA 1926.1408 TO A REQUESTOR, OR ACT AS SPOTTER FOR THE REQUESTOR DURING CRANE OR OTHER EQUIPMENT OPERATIONS.

DUKE ENERGY.

3					
2					
1					
0	3/31/16	BURLISON	WHITE	ADCOCK	
REVISED		BY	CK'D	APPR.	

REQUIREMENTS FOR CRANES AND OTHER EQUIPMENT WORKING NEAR OR UNDER DISTRIBUTION LINES

DEC	DEM	DEP	DEF
X	X	X	X

01.05-104

DEFECTIVE/FAILED MATERIAL REPORT SYSTEM

WHEN REPORTING A DEFECTIVE/FAILED MATERIAL, COMPLETE A DEFECTIVE/FAILED MATERIAL TAG (ITEM # 9220099314 SEE FIGURES BELOW), AND ATTACH IT TO THE FAILED MATERIAL. THE TAGGED MATERIAL IS COLLECTED AT A CENTRAL LOCATION AT EACH OPERATIONS CENTER, FOR SHIPMENT BACK TO THE GENERAL WAREHOUSE IN WILDWOOD.

UPON RECEIPT OF THE MATERIAL, A DEFECTIVE/FAILED MATERIAL REPORT (FORM 2480) WILL BE COMPLETED AND DISPOSITIONED BY THE APPROPRIATE DISTRIBUTION STANDARDS ENGINEER. IF ANALYSIS OF THE MATERIAL FAILURE IS REQUIRED IT WILL BE PERFORMED BY THE STANDARDS ENGINEER OR SENT BACK TO THE MANUFACTURER FOR EVALUATION.

ACCURATE REPORTING ENABLES DISTRIBUTION STANDARDS TO IDENTIFY POOR PERFORMING PRODUCTS, AND REMOVE THEM FROM THE SYSTEM BEFORE POWER QUALITY AND SYSTEM RELIABILITY IS ADVERSELY AFFECTED.

TAG#

DEFECTIVE/FAILED MATERIAL TAG

REGION: _____

LOCATION: _____

PREPARED BY _____
(NAME)

DIS/GIS # _____

PHONE # _____

CATALOG # _____

DATE _____

REASON FOR RETURN

☐ FAILED IN SERVICE

☐ BROKEN/DEFECTIVE WHEN RECEIVED

☐ OTHER-EXPLAIN _____

CLAIM INVOLVED ?

☐ YES NO ☐

DO YOU WANT A RESPONSE REPORT ON THIS ITEM

☐ YES NO ☐

DO NOT REMOVE THIS TAG

DUKE ENERGY.

ATTENTION

Fill out tag completely

Attach to material

Notify appropriate standards personnel if urgent

Send material to Material Recovery or Distribution Standards for review

If tagging a transformer, write the pole/pad ID number and "CLAIM" on the unit with a black waterproof marker

TF Serial #

COMMENTS: _____

3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

DEFECTIVE TAG

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

01.05-106

IF A JOB REQUIRES A CREW TO BE SET UP AT A POLE AND IT IS POSSIBLE FOR THAT CREW TO COMPLETE ANY OF THESE TASKS, THEN THESE TASKS SHALL BE DESIGNED, CHARGED AND COMPLETED IN CONJUNCTION WITH THE OTHER WORK TO BE DONE. THIS REQUIREMENT IS FOR NORMAL, DAY-TO-DAY WORK ONLY. IT DOES NOT INCLUDE OUTAGE RESPONSE WHEN UNASSIGNED OUTAGE ORDERS ARE ON QUEUE.

1. RETROFIT OVERHEAD TRANSFORMERS TO CURRENT STANDARDS.

2. STRIP POLE AND CROSS ARM GROUNDS TO THE NEUTRAL LEVEL UNLESS REQUIRED FOR EQUIPMENT GROUNDING.

3. INSTALL GUY INSULATORS ON PRIMARY GUYS ONLY PER SPECIFICATIONS.

4. BOND ALL DUKE ENERGY DISTRIBUTION PRIMARY, SECONDARY AND SERVICE GUYS TO SYSTEM NEUTRAL PER SPECIFICATIONS (**NOTE: COASTAL AREAS HAVE DIFFERENT SPECIFICATIONS**).

5. REPLACE ANY OF THE FOLLOWING FOUND:

   A. DETERIORATED FUSE BARRELS INCLUDING FUZZY, TAPED, ETC.
   B. LAPP 27 KV 1970-1974 POST INSULATORS AND MCGRAW EDISON 1973-1974 POST INSULATORS.
   C. 9KV LIGHTNING ARRESTERS.

6. ELIMINATE BURIED ANCHOR ROD EYES (BURIED PREFORMS OR GUY WIRES).

7. REMOVE ARRESTERS ON NORMALLY CLOSED SWITCH POINTS AND STRIP POLE GROUNDS TO THE NEUTRAL LEVEL.

NOTE: STANDING ORDERS **DO NOT** INCLUDE ITEMS THAT HAVE ALREADY FAILED. NEVERTHELESS, IT IS EXPECTED THE DESIGNER AND/OR THE CREW WORKING A JOB RECOGNIZE AN ITEM THAT HAS ALREADY FAILED AND FIX OR REPLACE IT. EXAMPLES INCLUDE BROKEN INSULATORS, CUT GUY WIRES, BLOWN ARRESTERS, ROTTEN POLES, OVERGROWN VEGETATION, MISSING POLE GROUNDS AND NEUTRALS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

STANDING ORDERS

DEC	DEM	DEP	DEF
			X

01.06-100

02.01 GENERAL

02.02 POLES

02.03 GROUNDS

02.04 GUYS AND ANCHORS

DUKE ENERGY.

3				
2				
1	11/13/17	KATIGBAK	BURLISON	ADCOCK
0	6/30/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SECTION 2 - POLES, GUYS AND ANCHORS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

02.05 GUY TABLES

POLE LOCATION

POLE LOCATIONS AND THE LINES THEY SUPPORT ARE SUBJECT TO MANY OBSTACLES SUCH AS ROADS, WATER AND GAS LINES, RIVERS, LAKES, BUILDINGS, SWIMMING POOLS, RAILROADS, ETC. SPECIAL ATTENTION MUST BE GIVEN TO ASSURE ALL CODE CLEARANCE AND STRENGTH REQUIREMENTS ARE MET AND THE LINE CAN BE OPERATED AND MAINTAINED WITH MINIMAL COSTS AND EFFORT.

POLES SHALL BE LOCATED AS SPECIFIED ON THE WORK ORDER. THEY SHOULD BE STAKED BY THE PLANNER OR SO INDICATED ON THE FIELD DRAWING AS TO ELIMINATE ANY QUESTION AS TO WHERE THEY GO. THE FIELD SHALL NOT CHANGE A POLE LOCATION WITHOUT APPROVAL OF THE PLANNER.

POLES FOR NEW LINES ALONG CITY STREETS SHOULD BE BACK OF THE SIDEWALK OR ACCORDING TO CITY/TOWN SPECIFICATIONS. SEE DWG. 10.01-01. IF CURBS ARE NOT ALREADY ESTABLISHED, APPROPRIATE AUTHORITIES SHOULD BE CONTACTED IN ORDER TO CONDUCT A SURVEY AND ESTABLISH FUTURE CURB LINES.
FOR CLEARANCES TO HYDRANTS, SEE DWG. 10.01-03.

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.

CONSIDERATION SHOULD ALSO BE GIVEN TO THE IMPACT A NEW LINE WILL HAVE ON EXISTING OVERHEAD AND UNDERGROUND FACILITIES EITHER RUNNING PARALLEL OR CROSSING.

PROPERTY OWNERS INCONVENIENCE SHOULD BE TAKEN INTO CONSIDERATION AND CARE GIVEN TO MINIMIZE THE IMPACT.

DUKE ENERGY.

3				
2				
1	7/29/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLES - GENERAL

DEC	DEM	DEP	DEF
X	X	X	X

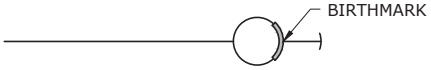
02.01-100

ORIENTATION

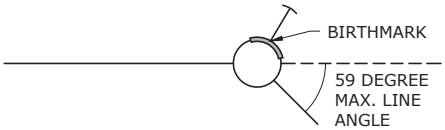
WHEN SETTING NEW POLES ON DEADENDS OR ANGLES OF UP TO 59 DEGREES, THE POLE'S BIRTHMARK SHOULD BE FACING THE ANCHOR. ON ANGLED POLES EXCEEDING 59 DEGREES, THE BENCHMARK SHOULD FACE THE ANCHORS THAT SUPPORT THE LARGEST STRAIN AND CONDUCTOR TENSION. WHEN TENSIONS ARE EQUAL, TURN THE BIRTHMARK TOWARD EITHER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

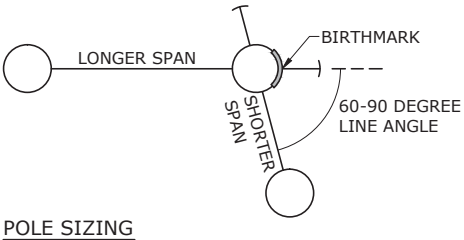
DEAD END CONSTRUCTION



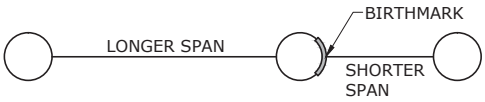
BISECT GUY LINE ANGLE TO 59 DEGREES



LINE ANGLE 60-90 DEGREES



TANGENT CONSTRUCTION



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.

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	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

WOOD POLES - ORIENTATION

DEC	DEM	DEP	DEF
X	X	X	X

02.02-105A

COMPATIBLE UNITS FOR DISTRIBUTION WOOD POLES					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	*POLE-WD-30-C6-F	1	155284	1	POLE, WOOD, 30', CLASS-6
2	*POLE-WD-35-C5-F	1	50123122	1	POLE, WOOD, 35', CLASS-5
3	POLE-WD-35-C3-F	1	4021600	1	POLE, WOOD, 35', CLASS-3
4	*POLE-WD-40-C5-F	1	155240	1	POLE, WOOD, 40', CLASS-5
5	POLE-WD-40-C4-F	1	50123125	1	POLE, WOOD, 40', CLASS-4
6	POLE-WD-40-C3-F	1	1421111	1	POLE, WOOD, 40', CLASS-3
7	POLE-WD-40-C2-F	1	50123123	1	POLE, WOOD, 40', CLASS-2
8	POLE-WD-40-C1-F	1	50131280	1	POLE, WOOD, 40', CLASS-1
9	POLE-WD-40-H1-F	1	50106138	1	POLE, WOOD, 40', CLASS-H1
10	*POLE-WD-45-C4-F	1	50123128	1	POLE, WOOD, 45', CLASS-4
11	*POLE-WD-45-C3-F	1	155257	1	POLE, WOOD, 45', CLASS-3
12	POLE-WD-45-C2-F	1	50123126	1	POLE, WOOD, 45', CLASS-2
13	POLE-WD-45-C1-F	1	4173204	1	POLE, WOOD, 45', CLASS-1
14	POLE-WD-45-H1-F	1	50124586	1	POLE, WOOD, 45', CLASS-H1
15	POLE-WD-45-H2-F	1	561678	1	POLE, WOOD, 45', CLASS-H2
16	*POLE-WD-50-C3-F	1	155260	1	POLE, WOOD, 50', CLASS-3
17	POLE-WD-50-C2-F	1	50123129	1	POLE, WOOD, 50', CLASS-2
18	POLE-WD-50-C1-F	1	4021613	1	POLE, WOOD, 50', CLASS-1
19	POLE-WD-50-H1-F	1	1003706	1	POLE, WOOD, 50', CLASS-H1
20	POLE-WD-50-H2-F	1	561684	1	POLE, WOOD, 50', CLASS-H2
21	*POLE-WD-55-C3-F	1	155263	1	POLE, WOOD, 55', CLASS-3
22	*POLE-WD-55-C2-F	1	50123130	1	POLE, WOOD, 55', CLASS-2
23	*POLE-WD-55-C1-F	1	4021627	1	POLE, WOOD, 55', CLASS-1
24	POLE-WD-55-H1-F	1	1003711	1	POLE, WOOD, 55', CLASS-H1
25	POLE-WD-55-H2-F	1	50124641	1	POLE, WOOD, 55', CLASS-H2
26	POLE-WD-60-C3-F	1	155265	1	POLE, WOOD, 60', CLASS-3
27	POLE-WD-60-C2-F	1	50123132	1	POLE, WOOD, 60', CLASS-2
28	POLE-WD-60-C1-F	1	50123131	1	POLE, WOOD, 60', CLASS-1
29	POLE-WD-60-H1-F	1	50123133	1	POLE, WOOD, 60', CLASS-H1
30	POLE-WD-60-H2-F	1	50123134	1	POLE, WOOD, 60', CLASS-H2
31	POLE-WD-65-C3-F	1	4021746	1	POLE, WOOD, 65', CLASS-3
32	POLE-WD-65-C2-F	1	50123140	1	POLE, WOOD, 65', CLASS-2
33	POLE-WD-65-C1-F	1	50123135	1	POLE, WOOD, 65', CLASS-1
34	POLE-WD-65-H1-F	1	50123141	1	POLE, WOOD, 65', CLASS-H1
35	POLE-WD-65-H2-F	1	50123142	1	POLE, WOOD, 65', CLASS-H2
36	POLE-WD-70-C2-F	1	50123144	1	POLE, WOOD, 70', CLASS-2
37	POLE-WD-70-C1-F	1	50123143	1	POLE, WOOD, 70', CLASS-1
38	POLE-WD-70-H1-F	1	50124590	1	POLE, WOOD, 70', CLASS-H1
39	POLE-WD-70-H2-F	1	50124767	1	POLE, WOOD, 70', CLASS-H2
40	POLE-WD-75-C2-F	1	50124452	1	POLE, WOOD, 75', CLASS-2
41	POLE-WD-75-C1-F	1	50124451	1	POLE, WOOD, 75', CLASS-1
42	POLE-WD-75-H1-F	1	50124449	1	POLE, WOOD, 75', CLASS-H1
43	POLE-WD-75-H2-F	1	50124671	1	POLE, WOOD, 75', CLASS-H2
44	POLE-WD-80-C2-F	1	50124457	1	POLE, WOOD, 80', CLASS-2
45	POLE-WD-80-C1-F	1	50124456	1	POLE, WOOD, 80', CLASS-1
46	POLE-WD-80-H1-F	1	50124453	1	POLE, WOOD, 80', CLASS-H1
47	POLE-WD-80-H2-F	1	50124455	1	POLE, WOOD, 80', CLASS-H2
48	POLE-WD-85-C2-F	1	50124461	1	POLE, WOOD, 85', CLASS-2
49	POLE-WD-85-C1-F	1	50124460	1	POLE, WOOD, 85', CLASS-1
50	POLE-WD-85-H1-F	1	50124458	1	POLE, WOOD, 85', CLASS-H1
51	POLE-WD-85-H2-F	1	50124459	1	POLE, WOOD, 85', CLASS-H2
52	POLE-WD-90-C2-F	1	50124465	1	POLE, WOOD, 90', CLASS-2
53	POLE-WD-90-C1-F	1	50124464	1	POLE, WOOD, 90', CLASS-1
54	POLE-WD-90-H1-F	1	50124462	1	POLE, WOOD, 90', CLASS-H1
55	POLE-WD-90-H2-F	1	50124463	1	POLE, WOOD, 90', CLASS-H2
56	POLE-WD-95-C2-F	1	50124470	1	POLE, WOOD, 95', CLASS-2
57	POLE-WD-95-C1-F	1	50124469	1	POLE, WOOD, 95', CLASS-1
58	POLE-WD-95-H1-F	1	50124466	1	POLE, WOOD, 95', CLASS-H1
59	POLE-WD-95-H2-F	1	14955	1	POLE, WOOD, 95', CLASS-H2
60	POLE-WD-100-C2-F	1	50128875	1	POLE, WOOD, 100', CLASS-2
61	POLE-WD-100-C1-F	1	14961	1	POLE, WOOD, 100', CLASS-1
62	POLE-WD-100-H1-F	1	14963	1	POLE, WOOD, 100', CLASS-H1
63	POLE-WD-100-H2-F	1	14964	1	POLE, WOOD, 100', CLASS-H2

* DENOTES COMMON STOCKED SIZES. HOWEVER, STOCKING MAY VARY FROM LOCATION TO LOCATION. PLANNERS SHOULD FAMILIARIZE THEMSELVES WITH LOCAL STOCKINGS. UNUSUAL QUANTITIES, NON-STOCKED OR NON-STANDARD POLES WILL NEED TO BE SPECIAL ORDERED.

DUKE ENERGY.

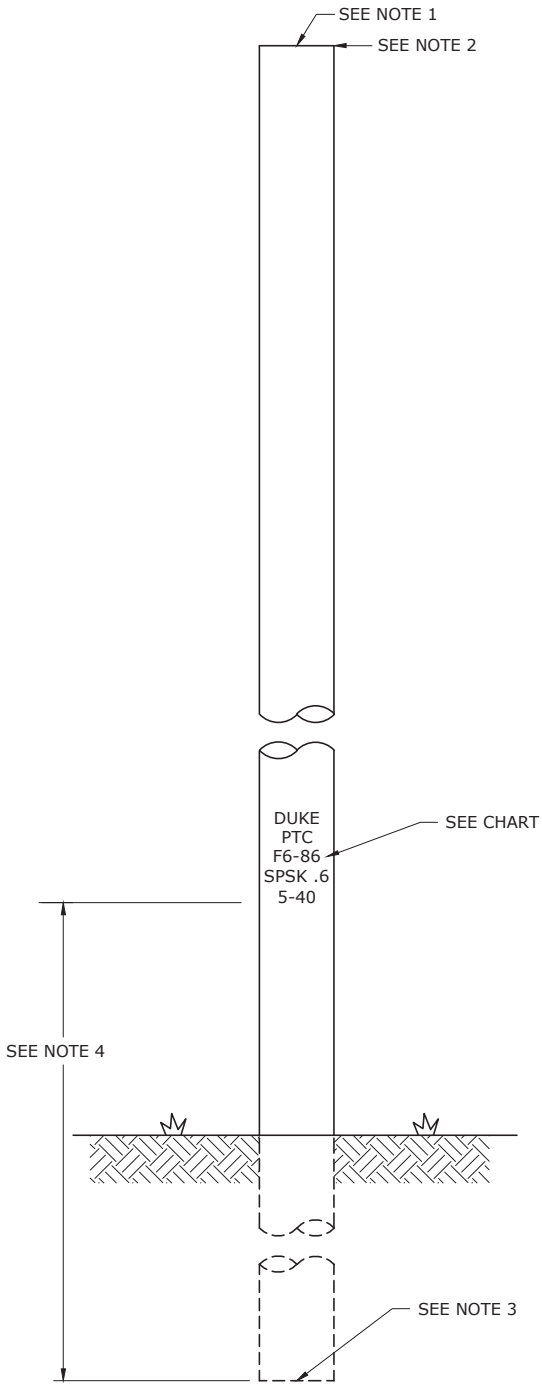
REVISED		BY	CHK'D	APPR.
3				
2				
1	9/30/18	BENDER	BURLISON	ADCOCK
0	10/8/17	LOOSIER	BURLISON	ADCOCK

POLES - WOOD -

CU'S AND COMMON SIZES

DEC	DEM	DEP	DEF
			X

02.02-105B



CODE	DESCRIPTION
DUKE	DUKE 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. DUKE 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	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLES - WOOD - STANDARD FRAMING AND BRANDING FOR DISTRIBUTION CCA POLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.02-108

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 IF THEY ARE TO REMAIN IN SERVICE.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	BURLISON	WHITE	ADCOCK	
REVISED		BY	CK'D	APPR.	

POLES - WOOD -

ANSI DIMENSIONS

DEC	DEM	DEP	DEF
X	X	X	X

02.02-110

* 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		

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

MINIMUM SETTING DEPTH OF POLE		
POLE LENGTH	SOIL CLASSES 1-5 (CLAY - FIRM SAND)	SOIL CLASSES 6-8 (LOOSE SAND & MARSH/POOR SOIL)
30'	5'-6"	6'-0"
35'	6'-0"	6'-6"
40'	6'-0"	7'-0"
45'	6'-6"	7'-6"
50'	7'-0"	8'-0"
55'	7'-6"	8'-6"
60'	8'-0"	9'-0"
65'	8'-6"	9'-6"
70'	9'-0"	10'-0"'
75'	9'-6"	10'-6"'
OTHER	SEE TRANSMISSIONS SPEFIFICATIONS	

SOIL CLASSES	
CLASS 0	SOUND HARD ROCK
CLASS 1	VERY DENSE AND/OR CEMENTED SANDS; COARSE GRAVEL AND COBBLES
CLASS 2	DENSE FINE SANDS; VERY HARD SILTS AND CLAY (MAY BE PRELOADED)
CLASS 3	DENSE SANDS AND GRAVEL; HARD SILTS AND CLAY
CLASS 4	MEDIUM DENSE SAND AND GRAVEL; VERY STIFF TO HARD SILTS AND CLAY
CLASS 5	MEDIUM DENSE COARSE SANDS AND SANDY GRAVELS; STIFF TO HARD SILTS AND CLAY
CLASS 6	LOOSE TO MEDIUM DENSE FINE TO COARSE SANDS TO STIFF CLAYS AND SILTS
CLASS 7	LOOSE FINE SANDS; ALLUVIUM LOESS; MEDIUM STIFF AND VARIED CLAYS; FILL
CLASS 8	PEAT, ORGANIC SILTS; INUNDATED SILTS, FLY ASH, VERY LOOSE SANDS, VERY SOFT TO SOFT CLAYS

MINIMUM SETTING DEPTH OF POLE																	
POLE LENGTH	DEPTH BELOW GROUND LINE AT WHICH SOLID ROCK IS ENCOUNTERED																
	0'-0"	0'-6"	1'-0"	1'-6"	2'-0"	2'-6"	3'-0"	3'-6"	4'-0"	4'-6"	5'-0"	5'-6"	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"
30'	3'-8"	3'-10"	4'-2"	4'-4"	4'-6"	4'-10"	5'-0"	5'-4"	5'-6"	5'-6"	5'-6"	5'-6"					
35'	4'-0"	4'-2"	4'-6"	4'-8"	5'-0"	5'-2"	5'-4"	5'-8"	5'-10"	6'-0"	6'-0"	6'-0"	6'-0"				
40'	4'-0"	4'-2"	4'-6"	4'-8"	5'-0"	5'-2"	5'-4"	5'-8"	5'-10"	6'-0"	6'-0"	6'-0"	6'-0"				
45'	4'-4"	4'-8"	4'-10"	5'-0"	5'-4"	5'-6"	5'-8"	6'-0"	6'-2"	6'-4"	6'-6"	6'-6"	6'-6"	6'-6"			
50'	4'-8"	4'-10"	5'-2"	5'-4"	5'-8"	5'-10"	6'-0"	6'-4"	6'-6"	6'-8"	6'-10"	7'-0"	7'-0"	7'-0"	7'-0"		
55'	4'-10"	5'-0"	5'-4"	5'-6"	5'-10"	6'-0"	6'-2"	6'-6"	6'-8"	6'-10"	7'-0"	7'-2"	7'-6"	7'-6"	7'-6"	7'-6"	
60'	5'-0"	5'-2"	5'-6"	5'-8"	6'-0"	6'-2"	6'-4"	6'-8"	6'-10"	7'-0"	7'-2"	7'-6"	7'-8"	8'-0"	8'-0"	8'-0"	8'-0"
	BACKFILL SOLID ROCK HOLES WITH POLE SETTING FOAM																

NOTES:

1. SEE DWG. 36.02-107 FOR GUIDELINES FOR EXCAVATION AND TRENCHING BESIDE DISTRIBUTION POWER POLES.

DUKE ENERGY.

3				
2				
1	2/8/17	LOOSIER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLES - WOOD -

AVERAGE WEIGHTS AND SETTING DEPTHS

DEC	DEM	DEP	DEF
X	X	X	X

02.02-112

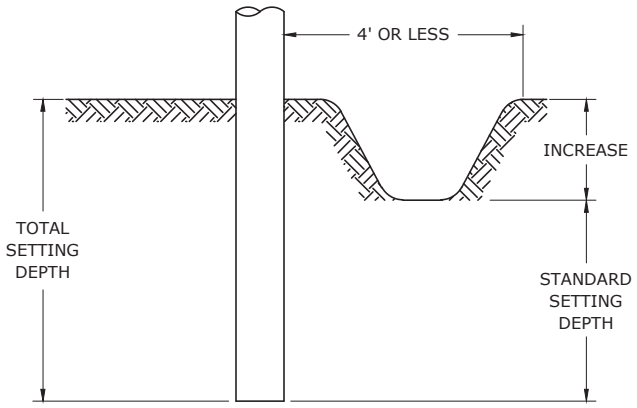


FIGURE 1

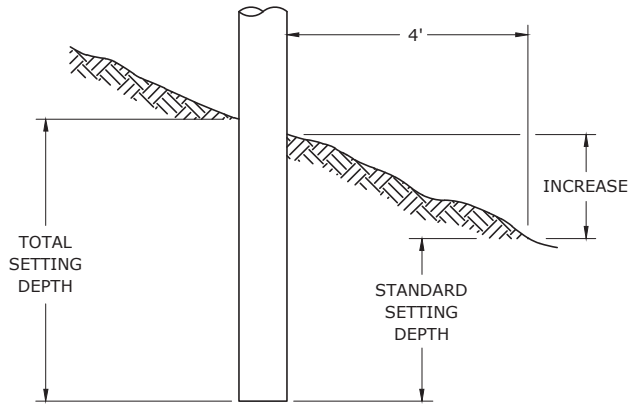


FIGURE 2

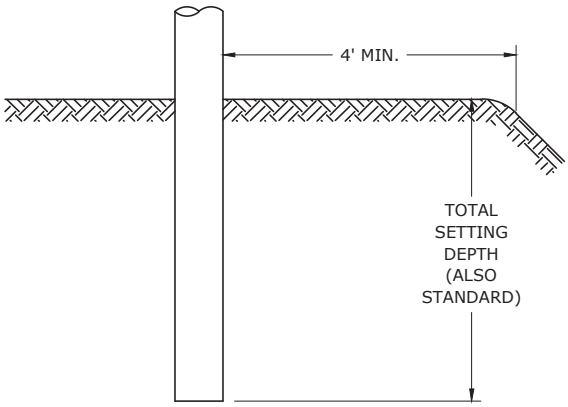


FIGURE 3

TOTAL SETTING DEPTH = STANDARD SETTING DEPTH PLUS INCREASE.

NOTES:

1. IF GROUND SLOPE IS 1 FT. IN 5 FT. OR LESS (FIGURE 2), POLE MAY BE SET TO STANDARD DEPTH WITH NO INCREASED DEPTH DUE TO SLOPE (DEPTH MEASURED FROM UPPER GROUND LEVEL).

2. IF DITCH IS LESS THAN 12" DEEP (FIGURE 1), POLE MAY BE SET TO STANDARD DEPTH WITH NO INCREASED DEPTH.

3. IF LEVEL GROUND EXTENDS 4' FROM NEAR EDGE OF POLE, POLE MAY BE SET STANDARD DEPTH (FIGURE 3).

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

STANDARD SETTING
DEPTH INCREASES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.02-113

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

FOR LIST OF COMMON STOCKED AND AVAILABLE SIZES, SEE DWG. 02.02-105B. NON-COMMON STOCKED POLE CLASSES MUST BE SPECIAL ORDERED. CONTACT STORES AS SOON AS REQUIREMENTS FOR NON-COMMON POLES ARE KNOWN 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. 02.02-112.

DUKE ENERGY.

3					
2					
1	10/13/16	BURLISON	WHITE	ADCOCK	
0	6/30/16	BURLISON	WHITE	ADCOCK	
REVISED		BY	CK'D	APPR.	

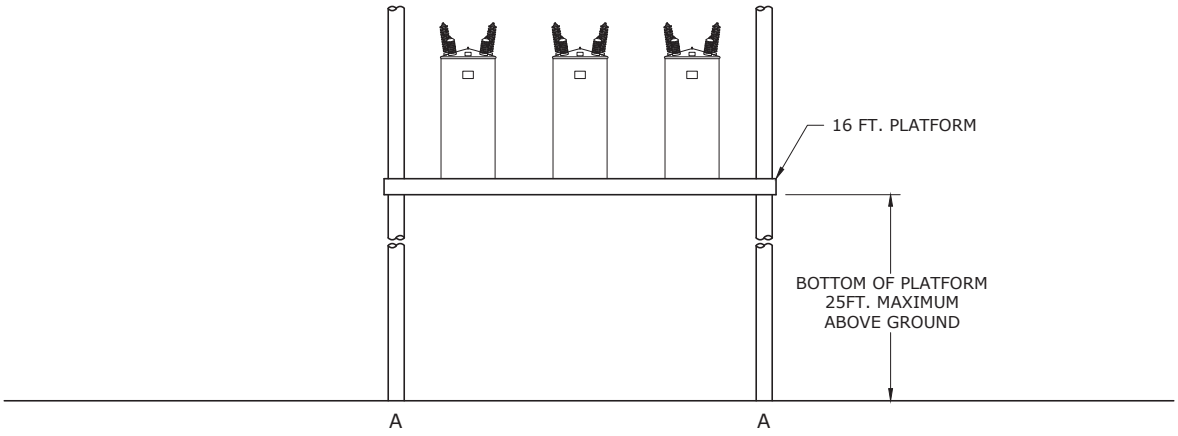
POLES - WOOD -

ALLOWABLE EQUIPMENT WEIGHT

DEC	DEM	DEP	DEF
X	X	X	X

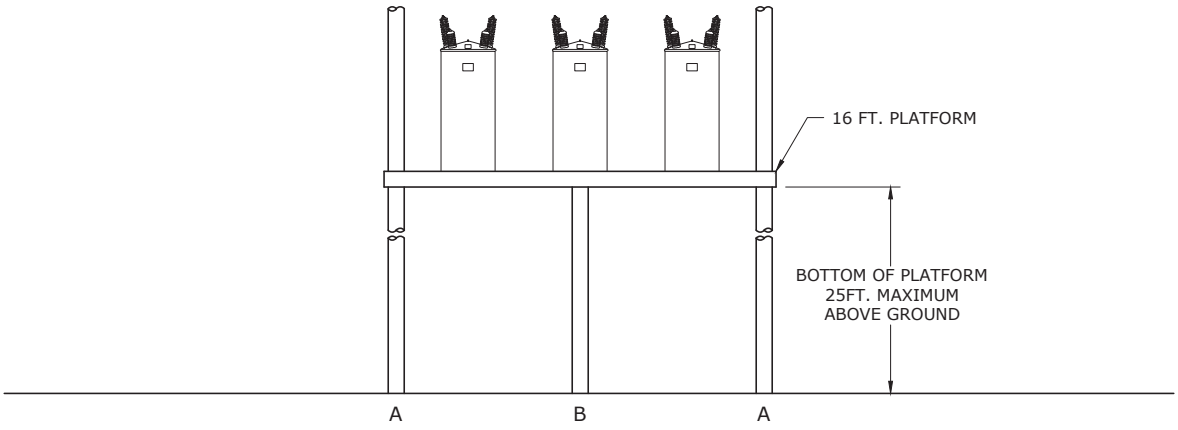
02.02-114

2 POLE PLATFORM WITH 795 DOUBLE CIRCUIT, 200 FT MAX SPAN
AND MAXIMUM EQUIPMENT LOAD OF 13,500 LBS.



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

3 POLE PLATFORM WITH 795 DOUBLE CIRCUIT, 200 FT MAX SPAN
AND MAXIMUM EQUIPMENT LOAD OF 18,000 LBS.



3 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 45C2
<15'	45C2	45C2

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 AND EMBEDMENT ONLY. SEE SPECIFIC EQUIPMENT (REGULATORS, TRANSFORMERS) INSTALLATION DRAWINGS FOR ADDITIONAL DETAILS.
4. FOR REGULATOR INSTALLATIONS, SEE SECTION 07 FOR SPECIFIC REGULATOR WEIGHTS.
5. FOR TRANSFORMER INSTALLATIONS, SEE SECTION 06 FOR SPECIFIC TRANSFORMER WEIGHTS.

DUKE ENERGY.

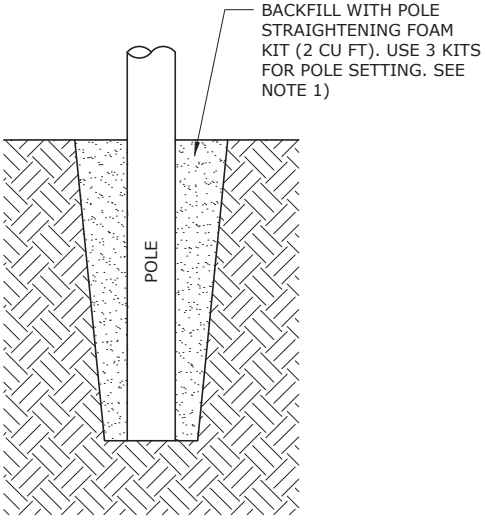
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

LOADING CRITERIA FOR
EQUIPMENT PLATFORMS

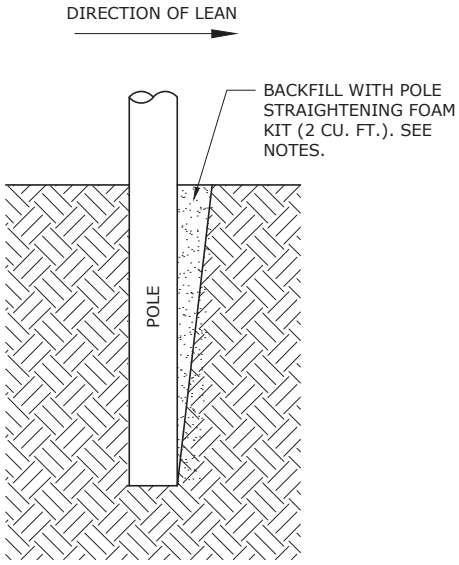
DEC	DEM	DEP	DEF
			X

02.02-116

POLE SETTING FOAM KIT
CU POLE-FOAM-F
USE 3 KITS FOR POLE SETTING



POLE STRAIGHTENING FOAM KIT
CU POLE-FOAM-F
ITEM # 1539695

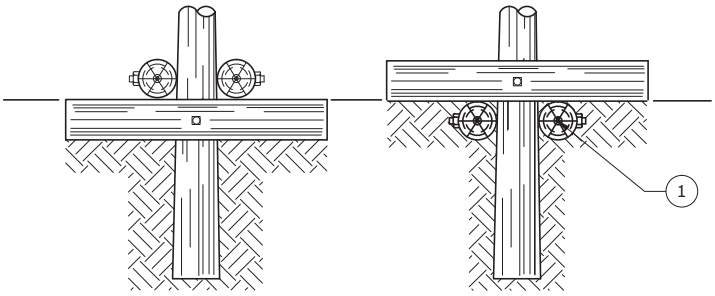


NOTES:

1. POLE STRAIGHTENING KITS (CU POLE-FOAM-F) MAY BE USED IN PLACE OF CONCRETE FOR ADDED STABILITY IN UNDESIRABLE SOIL CONDITIONS TO PREVENT THE POLE FROM LEANING. USE 1 KIT FOR POLE STRAIGHTENING AND 3 KITS FOR POLE SETTING.

2. TO INSTALL, MIX COMPOUNDS TOGETHER IN BUCKET USING THE PROVIDED MIXER FOR THE AMOUNT OF TIME SPEFIFIED 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 CCA TREATED WOOD POLES SECURELY FASTENED TO THE POLE AS SHOWN. POLE MUST BE GUYED AS SPEFIFIED BY ENGINEER.

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	ANCH-BOG-F	2	4001679	4	WASHER, FLAT, 7/8" NOM, 2.25" OD, GALV STL, 2", RND, F/ 7/8" BOLT 15/16" HOLE
			4001629	2	BOLT, DOUBLE ARMING, 7/8" DIA, 26" LG, GALV ASTM A325 GR B7, W/ (4) SQ NUTS
			4001675	4	WASHER, LOCK, SGL COIL, 7/8" NOM, GALV STL, F/ A 7/8" BOLT

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	11/13/17	LOOSIER	BURLISON	ADCOCK
1	8/22/16	KATIGBAK	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

POLE BRACING

DEC	DEM	DEP	DEF
			X

02.02-118

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 IF THEY ARE TO REMAIN IN SERVICE.

POLE PAINTING

PAINTING OF DISTRIBUTION LINE POLES IS NOT PERMITTED.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLES - WOOD -
APPLICATION GUIDE FOR REUSE
OF WOOD DISTRIBUTION POLES

DEC	DEM	DEP	DEF
X	X	X	X

02.02-120

CONCRETE DISTRIBUTION POLES

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 PILASTER/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. 02.02-135 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 CONCRETE 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.

5. WHEN INSTALLING STANDOFF BRACKETS, USE 2-1/4" FLAT WASHERS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

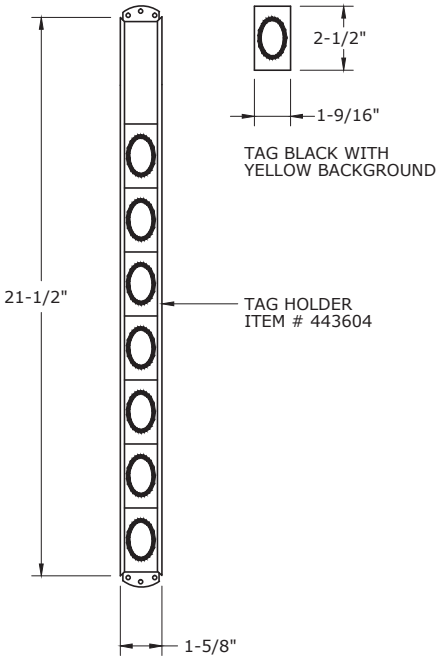
PILASTER AND CONCRETE POLE CONSTRUCTION

DEC	DEM	DEP	DEF
			X

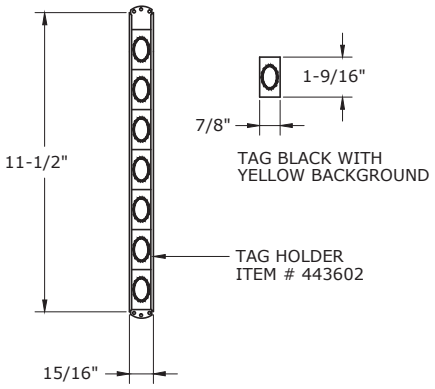
02.02-130

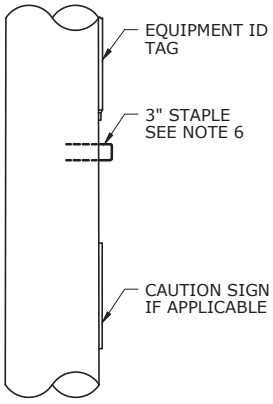
POLES WITH SWITCHES

(DISCONNECTS, SOLID BLADE CUTOUTS)



POLES WITHOUT SWITCHES

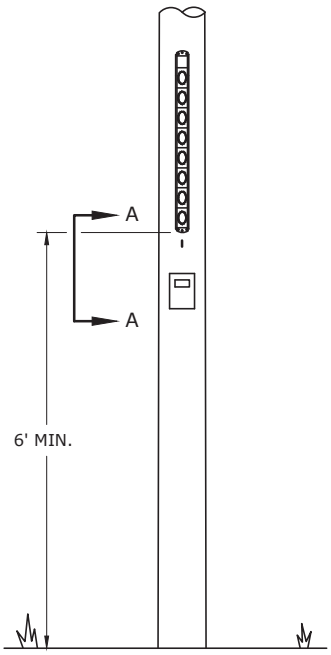




SECTION A-A

NOTES:

1. IDENTIFY POLE WITH ONE 7 DIGIT EQUIPMENT ID NUMBER ASSIGNED BY GIS.
2. SOLID BLADE SWITCH POLES - ALPHA PREFIX IS NO LONGER REQUIRED ON NEW INSTALLATIONS. IDENTIFY WITH 7 DIGIT EQUIPMENT ID NUMBER ASSIGNED BY GIS.
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/STEEL 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.



FRONT VIEW

TYPE	DESCRIPTION
WOOD	USE TWO ROOFING TYPE NAILS ITEM # 4001713
CONCRETE / STEEL	APPLY ADHESIVE ITEM # 4002997
FIBERGLASS	ATTACH WITH ADHESIVE ITEM # 4002997
* 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				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

POLE NUMBERS AND LABELS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

02.02-150A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	-	-	4006357	1	TAG, "0" 1 9/16H X 7/8W
-	-	-	4006358	1	TAG, "1" 1 9/16 "H X 7/8"W
-	-	-	4006359	1	TAG, "2",1 9/16"H X 7/8"W
-	-	-	4006360	1	TAG, "3" 1 9/16"H X 7/8"W
-	-	-	4006361	1	TAG, "4" 1 9/16"H X 7/8"W
-	-	-	4006362	1	TAG, "5" 1 9/16"H X 7/8"W
-	-	-	4006363	1	TAG, "6" OR "9" 1 9/16"H X 7/8"W
-	-	-	4006364	1	TAG, "7" 1 9/16"H X 7/8"W
-	-	-	4006365	1	TAG, "8" 1 9/16"H X 7/8"W
-	-	-	4006353	1	HOLDER, TAG 13 X 15/16
-	-	-	4006374	1	TAG, "0" 2 1/2"H X 1 9/16"W
-	-	-	4006375	1	TAG, "1" 2 1/2"H X 1 9/16"W
-	-	-	4006376	1	TAG, "2" 2 1/2"H X 1 9/16"W
-	-	-	4006377	1	TAG, "3" 2 1/2"H X 1 9/16"W
-	-	-	4006378	1	TAG, "4" 2 1/2"H X 1 9/16"W
-	-	-	4006379	1	TAG, "5" 2 1/2"H X 1 9/16"W
-	-	-	4006380	1	TAG, "6" OR "9" 2 1/2"H X 1
-	-	-	4006381	1	TAG, "7" 2 1/2"H X 1 9/16"W
-	-	-	4006382	1	TAG, "8" 2 1/2"H X 1 9/16"W
-	-	-	4006355	1	HOLDER, TAG 22 X 1 5/8
-	-	-	4006352	1	KIT, TAGGING

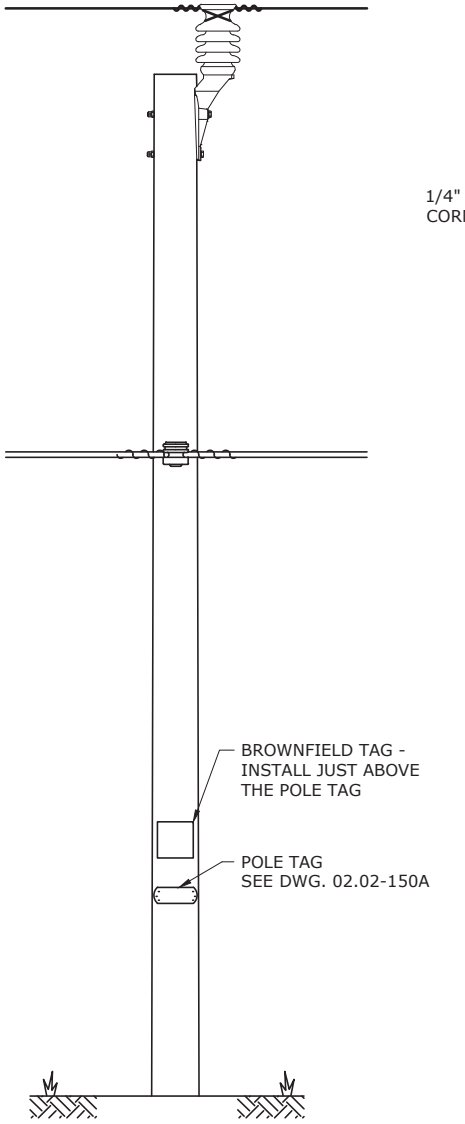
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

POLE NUMBERS AND LABELS

DEC	DEM	DEP	DEF
			X

02.02-150B



REGION	COMPATIBLE UNIT	ITEM NUMBER
DEC	MISC-SIGN-BROWNFIELD-OH-C	1542559
DEM	MISC-SIGN-BROWNFIELD-OH-M	1542559
DEP	MISC-SIGN-BROWNFIELD-OH-P	1542559
DEF	MISC-SIGN-BROWNFIELD-OH-F	1542559

NOTES:

1. A 'BROWNFIELD' IS A PROPERTY THAT HAS KNOWN PAST OR CURRENT ENVIRONMENTAL IMPACTS AND WHICH MAY HAVE ACCESS OR USE RESTRICTIONS ON SOME OR ALL OF THE PARCEL(S).
2. ALL FACILITIES LOCATED WITHIN A BROWNFIELD SITE AS IDENTIFIED BY EH&S SHALL HAVE THIS TAG APPLIED.
3. FOR POLES, THIS BROWNFIELD TAG SHALL BE PLACED JUST ABOVE AND ON THE SAME SIDE OF THE POLE AS THE LOCID TAG OR FUSE SIZE TAG. SEE DWG. 02.02-150A FOR DETAILS RELATED TO THE LOCID OR FUSE SIZE TAG.
4. DO NOT COVER POLE BRAND
5. FOR WOOD POLES - USE FOUR NAILS
6. FOR NON-WOOD POLES, SEE DWG. 02.02-150A FOR APPROVED MOUNTING METHODS.
7. REFER TO LIGHTING STANDARDS FOR APPRORIATE POLE NUMBERING GUIDELINES FOR ALL LIGHTING POLES, INCLUDING DECORATIVE, STEEL AND COMPOSITE STRUCTURES.
8. WHEN A POLE OR PIECE OF EQUIPMENT WITH THE BROWNFIELD TAG IS ENCOUNTERED IN THE FIELD, CONTACT THE LOCAL DUKE ENERGY ENVIRONMENTAL SERVICES RESOURCE FOR INSTRUCTIONS BEFORE DIGGING.

3				
2				
1				
0	8/7/17	BURLISON	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

BROWNFIELD SIGNAGE

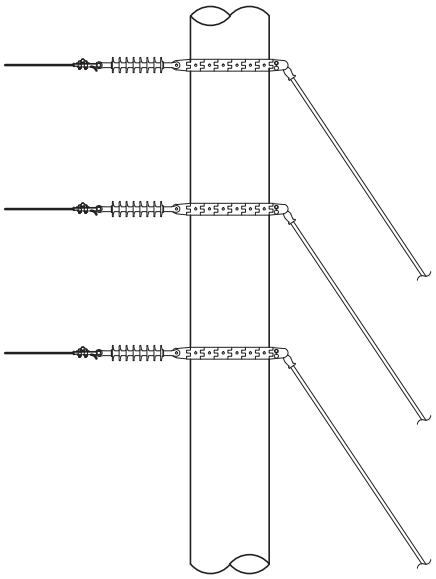
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

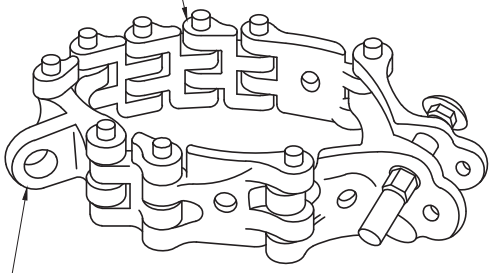
02.02-151

CHAIN FOR 30" DIA. POLE WITH 2 EYES

RATED 15,000 LBS.



CHAIN LINK
CU POLE-BAND-CHAIN-2EYE-STL-F
ITEM # 4154893



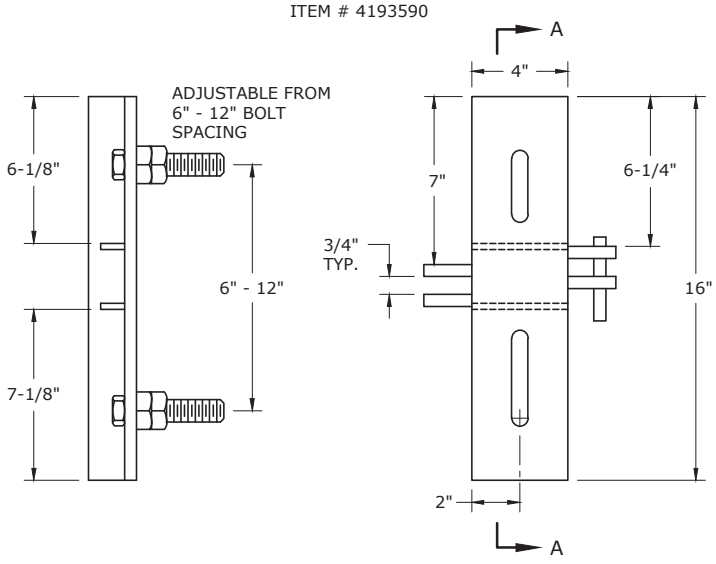
EYE LINK
ITEM # 86805

NOTE: CHAIN LINK COMES WITH TWO EYE LINKS. FOR ADDITIONAL EYE LINKS, CALL FOR CU POLE-BAND-CHAIN-EYE-LINK-STL-F

IF BINDING OF THE INSULATOR AT THE EYE LINK IS AN ISSUE, UTILIZE A CLEVIS-CLEVIS 90 - ITEM # 4002532 AND A TWISTED CHAIN LINK - ITEM # 4002553.

NEW MACLEAN BRACKET FOR CHAIN FOR EQUIPMENT AND INSULATOR BRACKETS

CU BKT-EM/INSL-CHAIN-STL-F
ITEM # 4193590

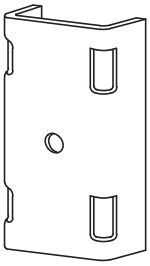


SECTION 'A-A'

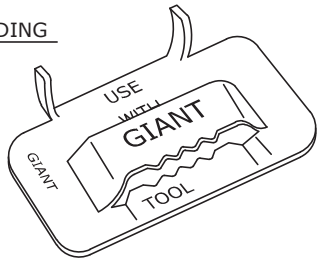
FRONT VIEW

FOR MOUNTING LIGHTNING ARRESTER

CU BKT-EM/INSL-STRAP-STL-F
ITEM # 4002344



BUCKLE AND BANDING



BANDING:
3/4" - CU POLE-BAND-STRAP-SM-STL-F
ITEM # 1490605
1-1/4" - CU POLE-BAND-STRAP-LG-STL-F
ITEM # 4005911

BUCKLE:
3/4" - CU POLE-BAND-STRAP-BUCKLE-SM-STL-F
ITEM # 1490606
1-1/4" - CU POLE-BAND-STRAP-BUCKLE-LG-STL-F
ITEM # 4030075

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 USED.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

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

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

02.02-160

GROUNDING ELECTRODES FOR DISTRIBUTION LINES

THE OVERHEAD DISTRIBUTION LINE DESIGN FOR MOST DUKE CIRCUITS IS CONSIDERED TO BE A MULTI-GROUNDED SYSTEM PER THE NESC (THE EXCEPTION WOULD BE A DELTA LINE). 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.

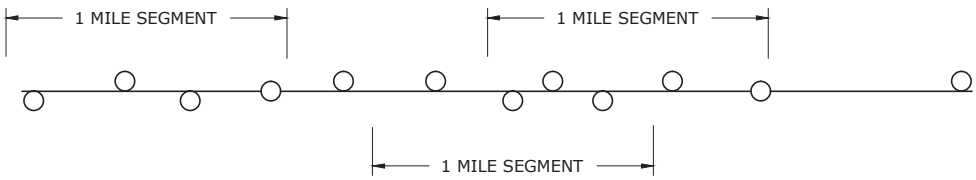


ILLUSTRATION OF 4 GROUND RODS IN EACH RANDOMLY SELECTED MILE OF LINE

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GROUNDING ELECTRODES FOR OVERHEAD DISTRIBUTION LINES

DEC	DEM	DEP	DEF
X	X	X	X

02.03-101

POLE GROUNDS

SOIL CONDITION IS A MAJOR FACTOR IN GROUNDING. SOIL CONDITIONS ACROSS THE DUKE ENERGY SYSTEM VARY FROM ROCKY TO SANDY AND MARSHY; THEREFORE, THE LENGTH AND STYLE OF GROUND RODS USED WILL VARY FROM LOCATION TO LOCATION. PLANNERS SHOULD FAMILIARIZE THEMSELVES WITH THE GROUND RODS USED IN THE AREA WHERE THEY ARE PLANNING WORK.

THE NESC DEFINES THE BASIC REQUIREMENTS FOR POLE GROUNDS. A MINIMUM OF 8FT DRIVEN DEPTH WITH THE UPPER END FLUSH OR BELOW GRADE IS REQUIRED. DUKE ENERGY HAS USED BOTH STEEL AND COPPER-CLAD RODS IN THE PAST. GOING FORWARD, DUKE WILL ONLY USE COPPER-CLAD RODS FOR DISTRIBUTION. EXPERIENCE ON THE DUKE ENERGY SYSTEM HAS SHOWN THAT IN AREAS OF CLAY, ONE EIGHT FOOT ROD IS SUFFICIENT AND IN AREAS OF SAND AND MARSH, FOUR - FIVE FOOT RODS STACKED ON TOP OF EACH OTHER FOR A TOTAL OF TWENTY FOOT IS BEST. THIS HOLDS TRUE FOR ALL POLES WITH LIGHTNING ARRESTERS. IN NO CASE IS A GROUND EVER TO BE LESS THAN EIGHT FOOT DEEP.

IN GENERAL, OPERATION CENTERS FROM RALEIGH TO THE EAST IN NORTH CAROLINA, FLORENCE TO THE EAST IN SOUTH CAROLINA AND ALL OF FLORIDA WILL DRIVE FOUR-FIVE FOOT RODS STACKED TO MAKE THEIR GROUND ROD AND ALL AREAS WEST OF THESE WILL DRIVE ONE EIGHT FOOT ROD. AREAS SHOULD ONLY STOCK ONE SIZE ROD AND SHOULD NOT CHANGE THEIR PRACTICE WITHOUT CONSULTING DISTRIBUTION STANDARDS.

IN AREAS USING FIVE FOOT RODS, IF FOUR STACKED RODS ARE ATTEMPTED AND FAIL BECAUSE ROCK IS ENCOUNTERED, TWO OR THREE - FIVE FOOT RODS ARE ACCEPTABLE. THE NESC REQUIRES A MINIMUM OF EIGHT FOOT; SO, TWO -FIVE FOOT RODS SHALL BE THE MINIMUM.

WHERE THE NEUTRAL IS 336 AAC OR SMALLER, THE GROUNDING CONDUCTOR SHALL BE #6 SOLID BARE COPPER. FOR 556 AAC NEUTRALS, USE A #4 BARE COPPER GROUNDING CONDUCTOR.

FOR ALL DISTRIBUTION GROUNDS, USE COPPER WIRE AND BRONZE CLAMPS. THE AREA OF THE ROD AT THE CLAMP SHALL BE WIRE BRUSHED BEFORE THE CONNECTION IS MADE.

RODS SHALL NOT BE DRIVEN CLOSE TO KNOWN STEEL PIPES OR CONDUIT

RUN GROUND FROM ROD TO NEUTRAL POSITION AND CONNECT TO THE SYSTEM NEUTRAL

THE DISTANCE OF THE GROUND ROD FROM THE POLE SHOULD BE 24” WHERE PRACTICAL. WHERE 24” IS IMPRACTICAL, THE GROUND ROD MAY BE DRIVEN 4” FROM THE POLE OR AT A DIAGONAL SLANT NEXT TO THE POLE.

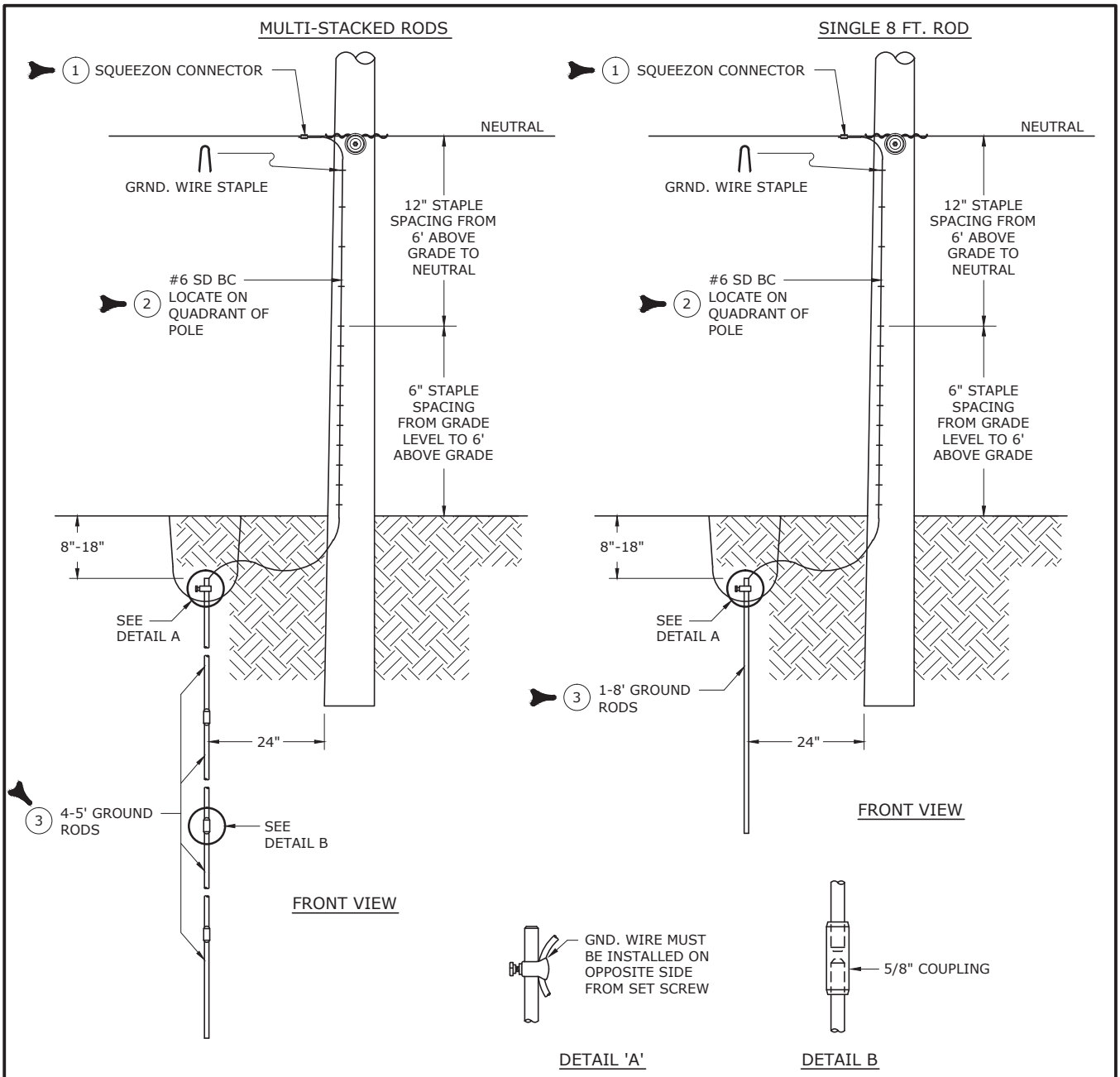
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GROUNDING

DEC	DEM	DEP	DEF
X	X	X	X

02.03-102A



REVISED	BY	CHK'D	APPR.
3			
2			
1 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	BURLISON	WHITE	ADCOCK

EQUIPMENT POLE GROUNDING DETAIL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.03-102B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
2	GND-POLE-6-F	1	1490676	40	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA
			4022334	40	WIRE, TIE, 6 AWG, SOFT DRAWN CU, 12" SPOOL
3	GND-ROD-OH-F	1	4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
			932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GND ROD
3	GND-ROD-ADD-VRT-OH-F	3	4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
			50129890	1	COUPLING, THREADLESS, 5/8", CU

DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

EQUIPMENT POLE GROUNDING DETAIL

DEC	DEM	DEP	DEF
			X

02.03-102C

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. 02.03-102A.

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 04

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 ALWAYS PERMITTED. CHECK WITH TRANSMISSION BEFORE DRILLING. THEREFORE, IF DISTRIBUTION IS UNDERBUILT AND NEEDS A GROUND AND TRANSMISSION POLE CANNOT BE DRILLED, 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.

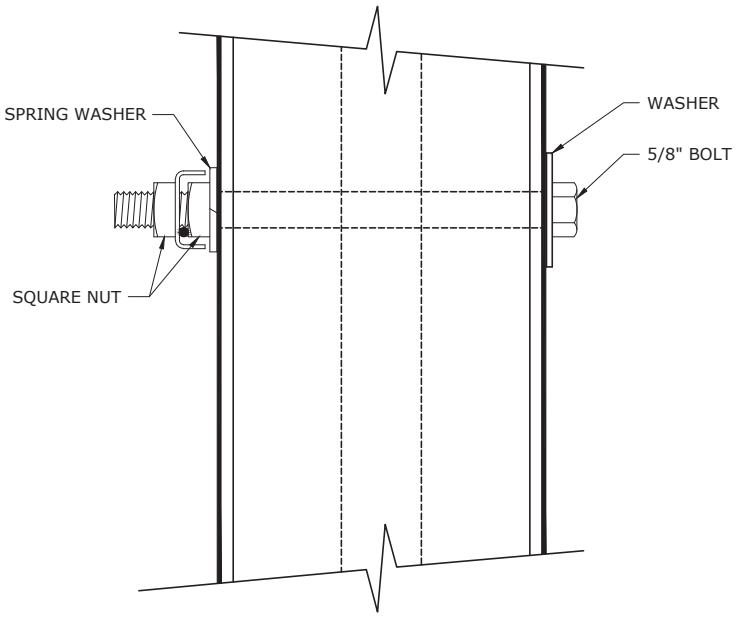
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK

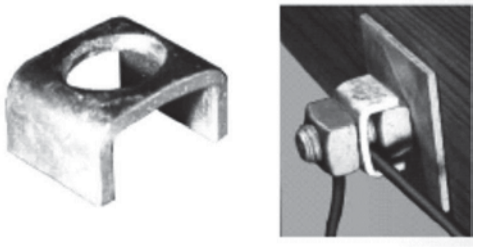
EQUIPMENT GROUNDING/BONDING

DEC	DEM	DEP	DEF
X	X	X	X

02.03-110



EQUIPMENT HARDWARE GROUND
(ALL HARDWARE)



BONDING CLIP
ITEM # 50121452

NOTES:

1. BONDING CLIP DOES NOT INCLUDE NUT.

3				
2				
1				
0	8/7/17	BURLISON	LOOSIER	ADCOCK
REVISED		BY	CHK'D	APPR.

EQUIPMENT HARDWARE GROUNDS

DEC	DEM	DEP	DEF
X	X	X	X

02.03-112

GUYING

PROCEDURES:

1. GUYING SHOULD BE DONE IN ACCORDANCE WITH THE WORK ORDER INSTRUCTIONS TO ASSURE COMPLIANCE WITH STRENGTH REQUIREMENTS AND CONSTRUCTION STANDARDS.

2. REFER TO SECTION 03, OVERHEAD PRIMARY CONSTRUCTION, TO SEE THE EXACT NUMBER AND POSITION GUY WIRES. USE POLEFOREMAN 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 SHALL BE BONDED TO THE SYSTEM NEUTRAL.

3. 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.

4. 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.

5. WHEN PERFORMING WORK AT A LOCATION WITH A GUY OR MULTIPLE GUYS, EACH GUY ANCHOR AND GUY PREFORMED WRAP SHOULD BE CAREFULLY EXAMINED AND REPLACED IF SHOWING SIGNS OF CORROSION THAT COULD LEAD TO FAILURE. WHEN REPLACING POLES THAT ARE 30 YEARS OLD OR OLDER, ALL ANCHORS OF THE SAME VINTAGE SHALL BE REPLACED.

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.

4. BONDING CONDUCTOR SHALL BE #6 SD BC.

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

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

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

8. GUY INSULATORS MUST BE LOCATED TO ENSURE A MINIMUM OF 8" CLEARANCE EXISTS FOR 12 KV, 12" CLEARANCE EXISTS FOR 25 KV, AND 14" CLEARANCE EXISTS FOR 35KV FROM THE GUY INSULATOR TO THE PRIMARY VOLTAGE ENERGIZED CONDUCTOR OR PART.

9. WHEN UNDERBUILD IS ADDED TO A TRANSMISSION LINE, TRANSMISSION GUYS MUST BE INSULATED TO PREVENT TRANSMISSION VOLTAGE FROM TRANSFERRING TO THE DISTRIBUTION LINE AND TO KEEP DISTRIBUTION VOLTAGE FROM TRANSFERRING TO THE BOTTOM OF THE GUY SHOULD THE TRANSMISSION GUY BECOME SLACK OR BROKE.

10. AN ADDITIONAL INSULATOR IS USED IN COASTAL AND HIGH CONTAMINATED AREAS. SEE SECTION 12 FOR DETAILS.

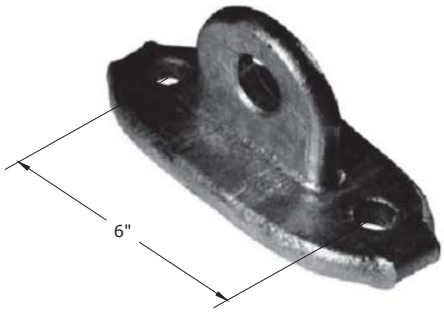
DUKE ENERGY.

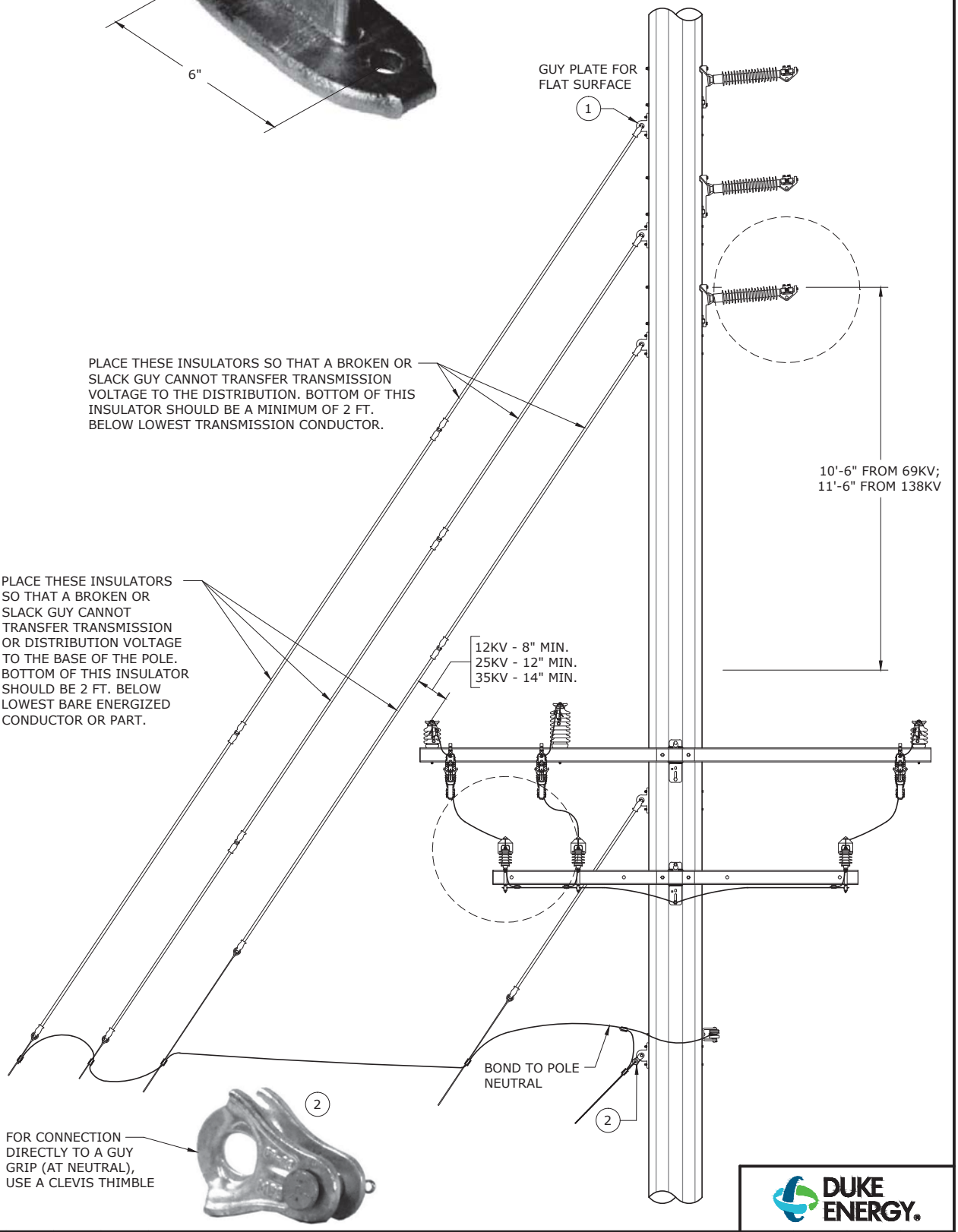
REVISED		BY	CK'D	APPR.
3				
2				
1	11/11/16	ROBESON	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GUYING - GENERAL CONSTRUCTION NOTES

DEC	DEM	DEP	DEF
X	X	X	X

02.04-100





3				
2				
1				
0	8/7/17	BENDER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

LOCATION OF GUY INSULATORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.04-101A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GUY- PLATE-GALV-EYE-UB-F	1	50124576	1	PLATE, DEADEND TEE, 3-1/2" WD X 8-1/4" LG X 3-5/8" HT, STL, HOT DIP GALV
2	GUY-CLEVIS-THMB-F	1	4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN

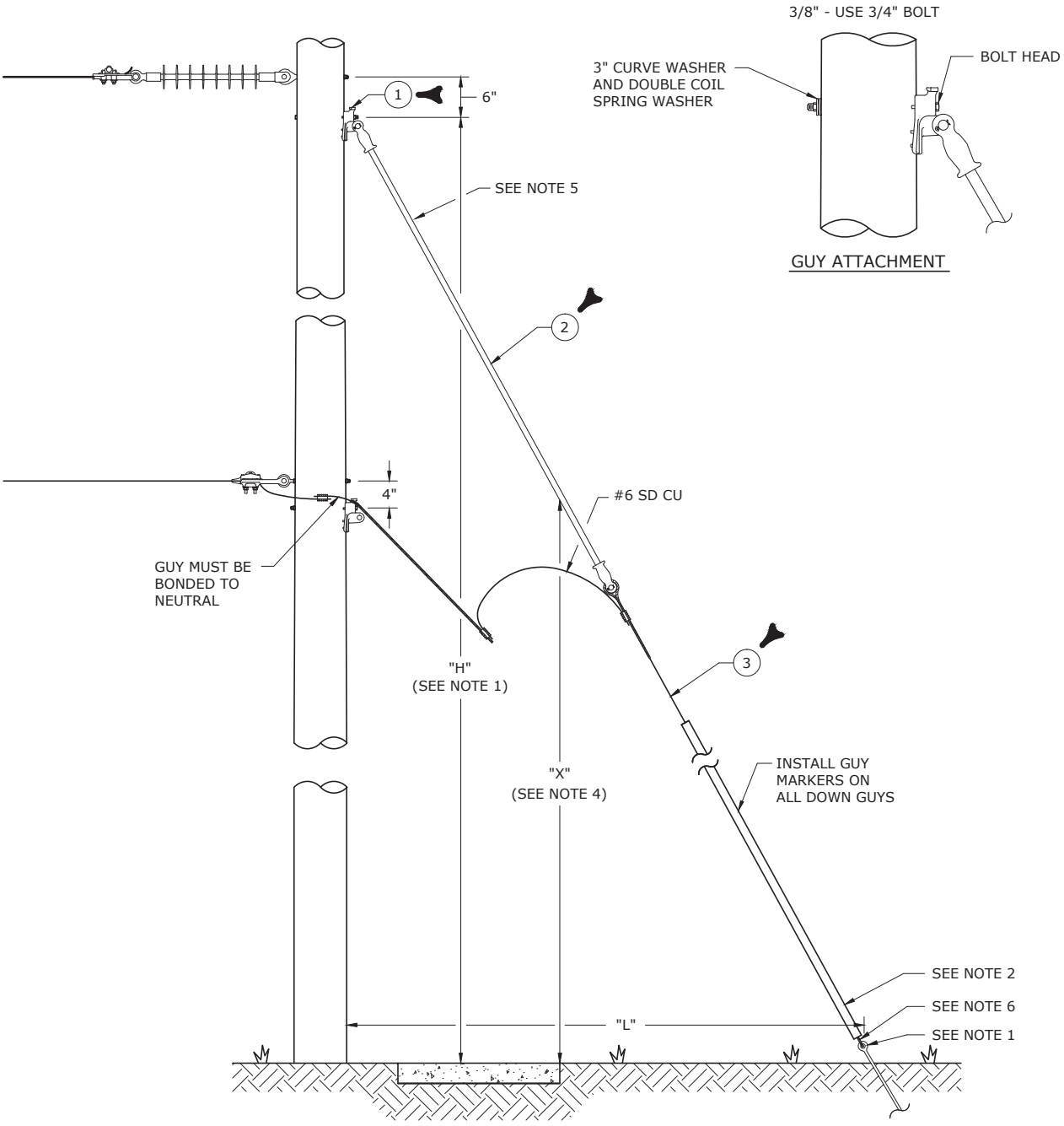
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

LOCATION OF GUY INSULATORS

DEC	DEM	DEP	DEF
			X

02.04-101B



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. INSTALL GUY MARKERS ON ALL DOWN GUYS REGARDLESS OF LOCATION.
3. IF GUYS ARE INSTALLED DIFFERENTLY THAN ABOVE, MAINTAIN A MINIMUM OF 4" BETWEEN WIRE ATTACHMENT POINT AND GUY ATTACHMENT POINT.
4. IF GUY CROSSES SIDEWALK, 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.
5. ALL GUYS ABOVE NEUTRAL POSITION MUST HAVE A GUY INSULATOR (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST BARE ENERGIZED COMPONENT BY 24".
6. GUY END (TAIL) MUST BE CUT SO IT DOES NOT STICK OUT OF THE GRIP. THE GUY MARKER SHOULD BE ABLE TO BE PULLED DOWN OVER THE GUY END (TAIL) SO IT IS NOT EXPOSED.

REVISED		BY	CHK'D	APPR.
3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GUYING - CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.04-102A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GUY-HOOK-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930031	1	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			1536043	1	HOOK, GUY, EYE COMBINATION, 13/16" DIA CLEVIS, GALV STL
1	HDWR-MACH-LG-12IN-GALV-F	1	931667	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 12" LG, SQ HEAD, HOT DIP GALV
2	GUY-INSL-7FT-FG-F	1	114045	1	INSULATOR, GUY STRAIN, 78" LG, FIBERGLASS, W/ UV INHIBITOR
	GUY-INSL-10FT-FG-F	1	4140590	1	INSULATOR, GUY STRAIN, 120" LG, FIBERGLASS, THIMBLE-EYE
3	GUY-DOWN-3/8IN-GALV-SGL-F	1	235057	1	WIRE, GUY, 3/8" DIA, 7 STR, EHS, CLASS A GALFAN, 500' PER COIL
			933366	2	CONNECTOR, ELECTRICAL, WIDE RANGE, 1/0 AWG 6 X 1 STR ACSR
			4021368	2	DEADEND, TWISTED LOOP GUY GRIP, 0.337"-0.394" CONDUCTOR
			79520	1	MARKER, GUY, YELLOW, 8', PLASTIC, ULTRA VIOLET STABILIZED
			4022334	12	WIRE, TIE, 6 AWG, 315' LG, SOL BARE, SOFT DRAWN CU, 12" SPOOL

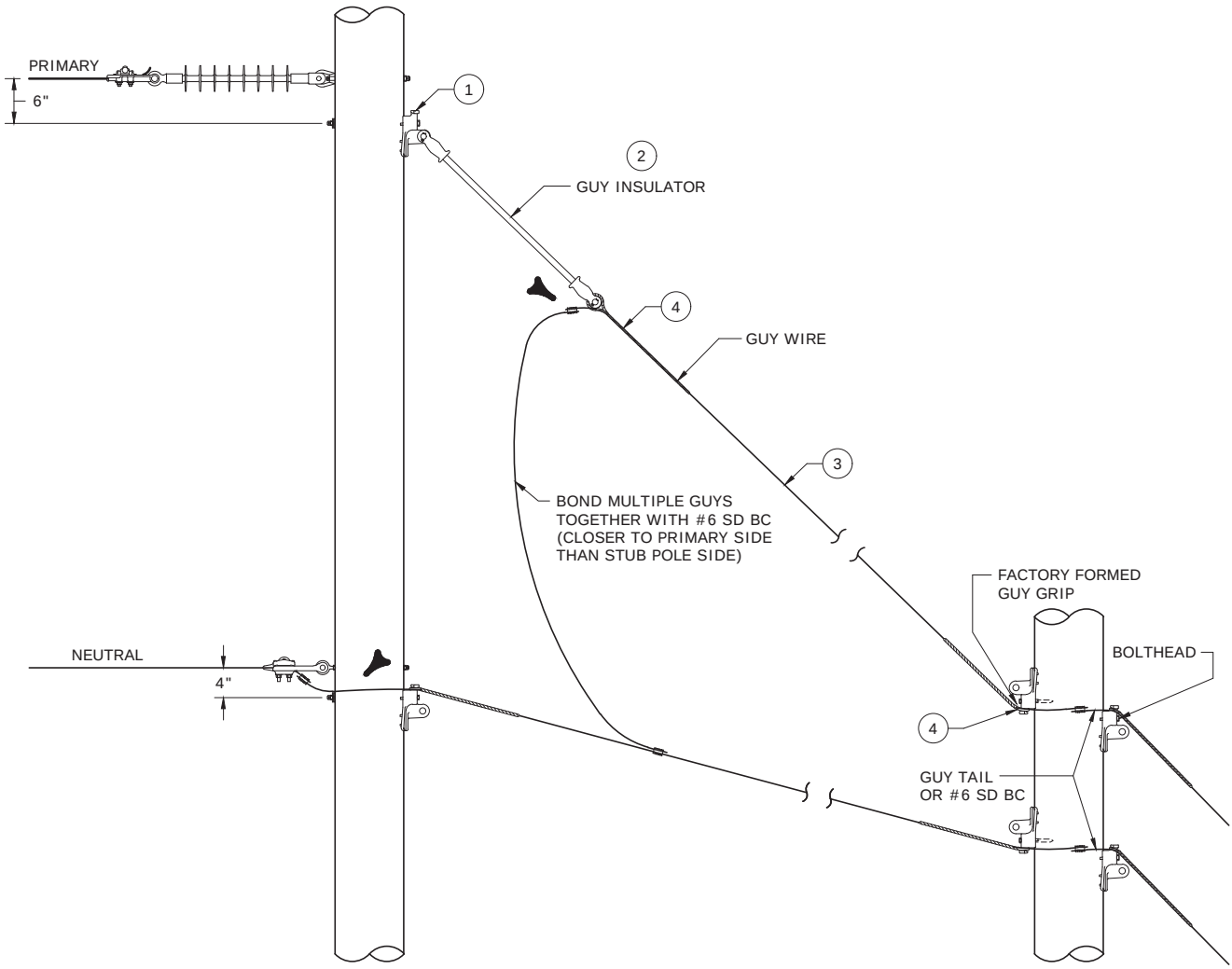
DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

GUYING - CONSTRUCTION

DEC	DEM	DEP	DEF
			X

02.04-102B



SPAN GUY

NOTES:

1. THE PRIMARY POLE NEUTRAL POSITION SHOULD BE BONDED TO THE SYSTEM NEUTRAL.

REVISED	BY	CHK'D	APPR.
3			
2	9/30/18	BURLISON	BENDER	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

SPAN GUYING ATTACHMENTS

DEC	DEM	DEP	DEF
X	X	X	X

02.04-104A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GUY-HOOK-F	2	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930031	1	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			1536043	1	HOOK, GUY, EYE COMBINATION, 13/16" DIA CLEVIS, GALV STL
1	HDWR-MACH-LG-12IN-GALV-F	2	931667	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 12" LG, SQ HEAD, HOT DIP GALV
2	GUY-INSL-7FT-FG-F	1	114045	1	INSULATOR, GUY STRAIN, 78" LG, FIBERGLASS, W/ UV INHIBITOR
	GUY-INSL-10FT-FG-F	1	4140590	1	INSULATOR, GUY STRAIN, 120" LG, FIBERGLASS, THIMBLE-EYE
3	GUY-SPAN-3/8IN-GALV-WIRE-F	# OF FT	235057	1	WIRE, GUY, 3/8" DIA, 7 STR, EHS, CLASS A GALFAN, 500' PER COIL
4	GUY-SPAN-3/8IN-GALV-ATTACH-F	1	933366	2	CONNECTOR, ELECTRICAL, WIDE RANGE, 1/0 AWG 6 X 1 STR ACSR
			936448	1	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, GALV STL
			4022334	12	WIRE, TIE, 6 AWG, 315' LG, SOL BARE, SOFT DRAWN CU, 12" SPOOL
			4021368	2	DEADEND, TWISTED LOOP GUY GRIP, 0.337"-0.394" CONDUCTOR

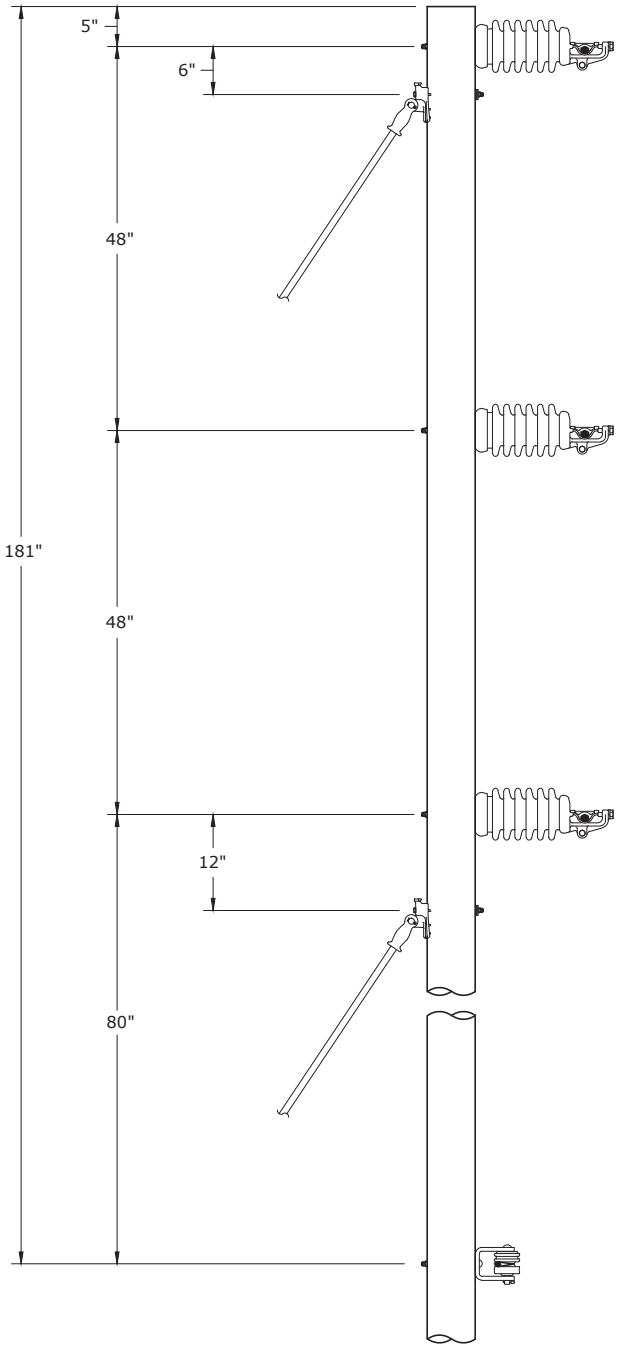
DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SPAN GUYING ATTACHMENTS

DEC	DEM	DEP	DEF
			X

02.04-104B



FRONT VIEW

NOTES:

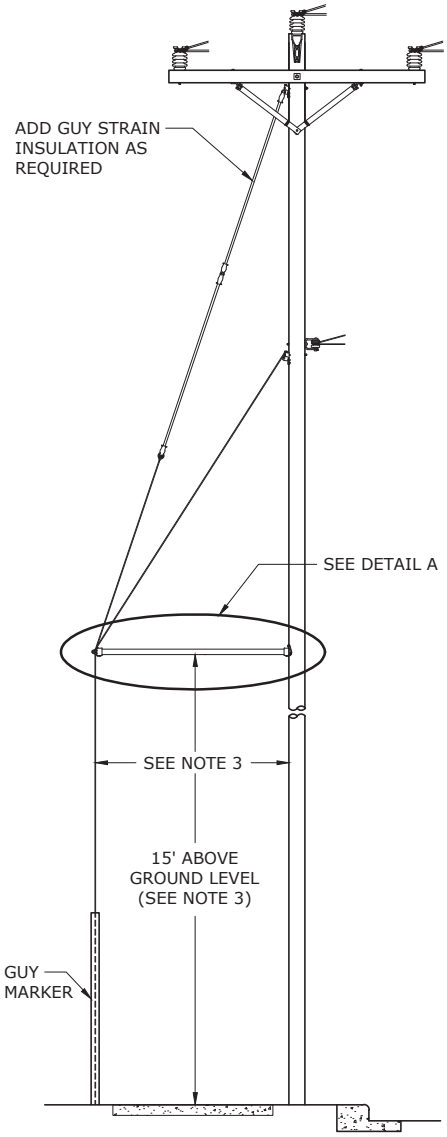
1. SPLIT GUYING AS SHOWN ABOVE MAY BE USED ON SMALL ANGLES AND SMALL WIRE DEADENDS. POLE AND GUY STRENGTHS MUST BE CHECKED IN POLEFOREMAN FOR ALL SPLIT GUY APPLICATIONS.

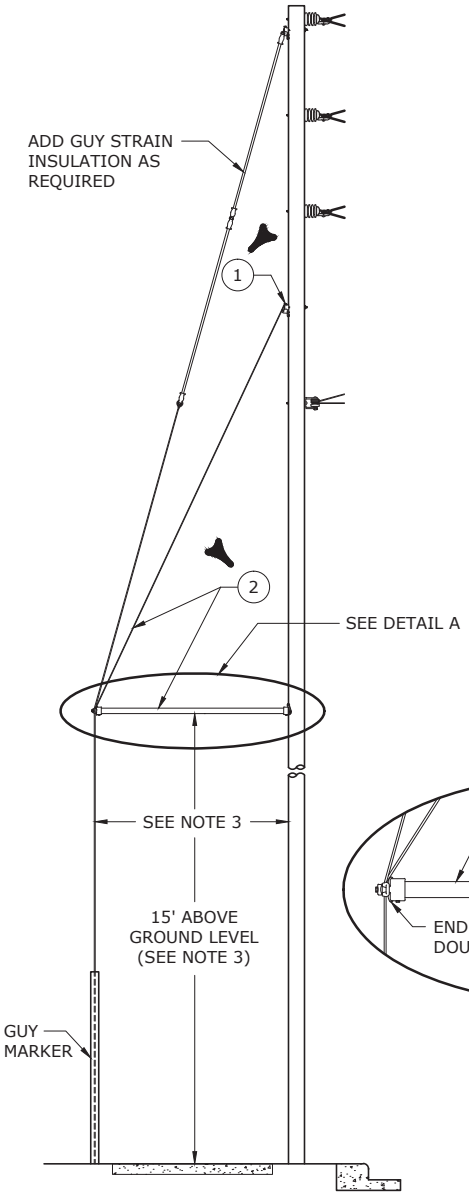
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

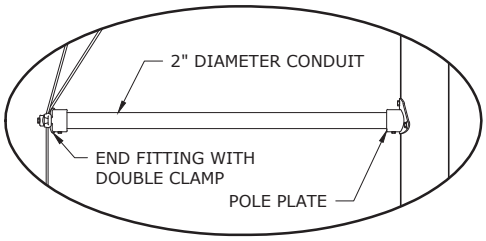
SPLIT GUY

DEC	DEM	DEP	DEF
X	X	X	X

02.04-105







DETAIL A

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

NOTES:

1. FOR USE ONLY WHEN REGULAR GUYING IS IMPRACTICAL. POLEFOREMAN ANALYSIS IS REQUIRED FOR ALL INSTALLATIONS.
2. THE PRIMARY GUY WIRES SHOULD BE LOCATED AS SHOWN.
3. THE LENGTH OF THE STEEL CONDUIT STRUT SHOULD BE LIMITED TO 12'. HOWEVER, 6' TO 8' IS PREFERRED. THE STRUT SHOULD BE LOCATED 15' ABOVE GROUND LINE.
4. THE END FITTING CLAMP ACCEPTS TWO GUY WIRES UP TO 3/8" IN SIZE. IT MAY ALSO BE USED FOR SINGLE GUY WIRE APPLICATIONS.
5. SIDEWALK GUY COMPATIBLE UNIT CONTAINS GUY STRUT AND MATERIAL/LABOR FOR SINGLE GUY. ADDITIONAL DOWN GUY AND ANY INSULATORS SHOULD BE ADDED WHEN NEEDED.

3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CHK'D	APPR.

HORIZONTAL CONSTRUCTION - SIDEWALK GUY

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

02.04-106A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GUY-HOOK-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930031	1	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			1536043	1	HOOK, GUY, EYE COMBINATION, 13/16" DIA CLEVIS, GALV STL
1	HDWR-MACH-LG-12IN-GALV-F	1	931667	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 12" LG, SQ HEAD, HOT DIP GALV
2	GUY-SWLK-3/8IN-GALV-F	1	235057	1	WIRE, GUY, 3/8" DIA, 7 STR, EHS, CLASS A GALFAN, 500' PER COIL
			933366	2	CONNECTOR, ELECTRICAL, WIDE RANGE, 1/0 AWG 6 X 1 STR ACSR
			4021368	2	DEADEND, TWISTED LOOP GUY GRIP, 0.337"-0.394" CONDUCTOR
			79520	1	MARKER, GUY, YELLOW, 8', PLASTIC, ULTRA VIOLET STABILIZED
			4022334	12	WIRE, TIE, 6 AWG, 315' LG, SOL BARE, SOFT DRAWN CU, 12" SPOOL
			936448	2	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, GALV STL
			87360	1	FLANGE, SIDEWALK GUY, GALV CS, POLE MOUNTING BOLT HOLES
			55923	1	CLAMP, SIDEWALK GUY, 1/4",3/8", 1/2", GALV STL
			61252	10	CONDUIT, RIGID, 2", 10' LG, GALV STL, THD BOTH ENDS
2	HDWR-MACH-SM-12IN-GALV-F	1	4021294	1	BOLT, MACHINE, 5/8" DIA, 11 THD, 12" LG, SQ HEAD, GALV STL

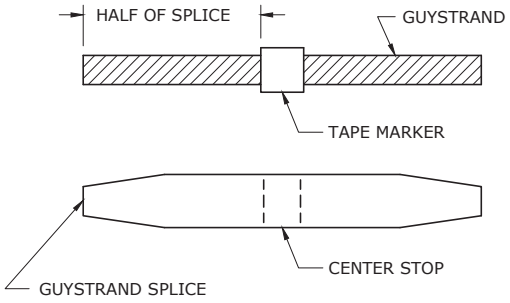
DUKE ENERGY.

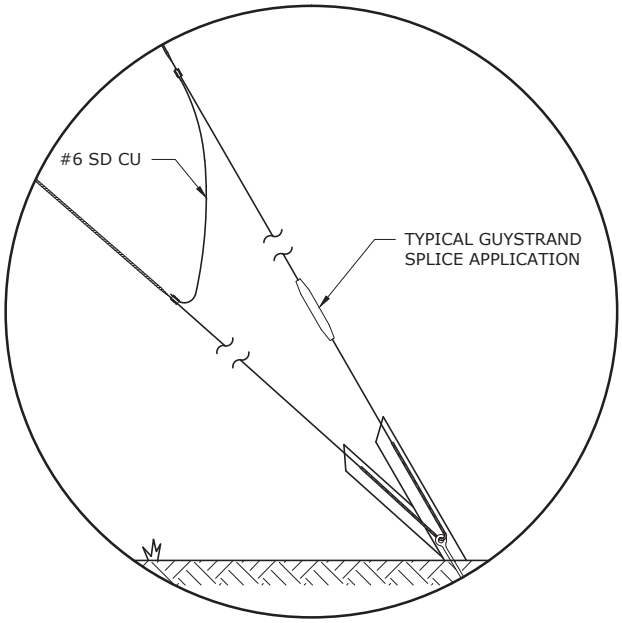
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

HORIZONTAL CONSTRUCTION - SIDEWALK GUY

DEC	DEM	DEP	DEF
			X

02.04-106B





BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	-	-	275057	1	SPLICE, CONDUCTOR, AUTOMATIC, FULL TENSION, 3/8" EHS
-	-	-	4021382	1	SPLICE, AUTO, 5/16, 7STR SPLICE, 5/16" GUYSTRAND FULL TENSION
-	-	-	4021384	1	SPLICE, AUTO, 7/16, 7STR SPLICE, 7/16" GUYSTRAND FULL TENSION
-	-	-	1538976	1	SPLICE, AUTO, FULL TENSION, 3/8" EHS X 5/16"
-	-	-	1542554	1	SPLICE, AUTO, FULL TENSION, 3/8" EHS X 7/16"

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.

REVISED		BY	CHK'D	APPR.
3	11/13/17	LOOSIER	BURLISON	ADCOCK
2	11/30/16	LOOSIER	BURLISON	ADCOCK
1	9/7/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GUYSTRAND SPLICE INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

02.04-113

ANCHOR RATED HOLDING POWER- POUNDS (MANUFACTURER'S FULL RATING)								
	SOIL CLASS							
	CLASS 0	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5	CLASS 6	CLASS 7
	SOIL DESCRIPTION							
	SOUND HARD ROCK	VERY DENSE AND/OR CEMENTED SANDS; COARSE GRAVEL AND COBBLES	DENSE FINE SANDS; VERY HARD SILTS AND CLAYS (MAY BE PRELOADED)	DENSE SANDS AND GRAVEL; HARD SILTS AND CLAYS	MEDIUM DENSE SAND AND GRAVEL; VERY STIFF TO HARD SILTS AND CLAY	MEDIUM DENSE COARSE SANDS AND SANDY GRAVELS; STIFF TO VERY STIFF SILTS AND CLAY	LOOSE TO MEDIUM DENSE FINE TO COARSE SANDS TO STIFF CLAYS AND SILTS	LOOSE FINE SANDS; ALLUVIUM LOESS; MEDIUM; STIFF AND VARIED CLAYS; FILL
ROCK ANCHORS								
3/4" BY 60" DEC, DEM, DEP	23,000							
3/4" BY 84" DEC, DEM, DEP	23,000							
EXPANDING ANCHORS								
8", WITH 3/4" X 7' TWIN EYE ROD DEC, DEM, DEP		26,500	26,500	26,500	22,000	18,000	15,000	10,000
12", WITH 1"X 8' TRIPLE EYE ROD DEC, DEM, DEP		36,000	36,000	36,000	34,000	26,500	21,500	16,000
POWER INSTALLED SCREW ANCHORS								
8", WITH 3/4" X 7' TWIN EYE ROD DEC, DEM, DEP					15,500	12,000	9000	6000
8" TOUGH ONE WITH 3/4"X7' TWIN EYE ROD DEC, DEM, DEP				23,000	15,500	12,000	9000	6000
14" TOUGH ONE WITH 1"X7' TRIPLE EYE ROD DEC, DEM, DEP				36,000	34,000	27,500	24,000	20,000
NO WRENCH SCREW ANCHORS								
8"WITH 1" X 66" TRIPLE EYE ROD DEP, DEF						11,000	9000	6000
10"WITH 1.25" X 96" TRIPLE EYE ROD DEP, DEF						13,000	10,000	7000
SQUARE SHAFT SCREW ANCHORS								
2 HELIX - 8" AND 10" WITH 1.5" TRIPLE EYE ROD DEP, DEF			41,000	36,000	32,000	27,000	23,000	19,000
3 HELIX - 8", 10" & 11-5/8" WITH 1.5" TRIPLE EYE ROD DEP, DEF			58,000	51,000	46,000	39,000	32,000	26,000

NOTES:

1. ALL ANCHORS ARE NOT APPRORIATE FOR ALL AREAS. SOIL TYPE IS THE MAJOR DETERMING FACTOR. PLANNERS AND CREWS SHOULD BE FAMILIAR WITH THE ANCHORS STOCKED AND USED IN THEIR AREA.
2. WHEN SELECTING ANCHORS, IT IS MORE ECONOMICAL TO USE ONE ANCHOR RATHER THAN MULTIPLE ANCHOR WHERE POSSIBLE.
3. FOR PISA AND SCREW ANCHORS WITH EXTENSION OPTIONS, INSTALL ANCHORS DEEP ENOUGH, BY USE OF EXTENSIONS, TO PENETRATE CLASS 5 SOIL UNDERLYING MUSHY SILT OR QUICKSAND. IF CLASS 5 SOIL CANNOT BE PENETRATED, CONSULT PLANNER TO BE SURE CLASS 6 OR CLASS 7 IS ADEQUATE.
4. ANCHORS SHALL BE INSTALLED IN LINE WITH THE GUYS.
5. ANCHOR RODS MEET OR EXCEED ANCHOR RATINGS SHOWN HERE.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

ANCHOR RATING

DEC	DEM	DEP	DEF
X	X	X	X

02.04-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
NO WRENCH ANCHORS					
1	ANCH-ROUND-SM-F	1	4021179	1	ANCHOR, EARTH, SCREW, 8", 1" X 66" ROD, TRIPLEYE GUY ATTACHMENT
1	ANCH-ROUND-MD-F	1	4021181	1	ANCHOR, EARTH, SCREW, 10", 1-1/4" X 96" ROD, TRIPLEYE GUY ATTACHMENT
1	ANCH-EXT-LG-6-F	1	4002039	1	ROD - EXTENSION, ANCHOR 1-1/4 IN. X 6'
1	ANCH-EXT-BURIED-MD-2-F	1	1536089	1	EXTENSION, ANCHOR, ROD, 1" DIA X 24" LG, GALV STL
SQUARE SHAFT SCREW ANCHORS					
1	ANCH-SQ-DBL-LG-F	1	4002034	1	ANCHOR, TPL-EYE, 2, HLX
			405849	1	ROD, EXTENSION, ANCHOR, TYPE-SS, 5 FEET EXTENSION
1	ANCH-SQ-TPL-LG-F	1	4002036	1	ANCHOR, HELIX, WITH, TRIPLE, EYE, 3, TYPE-SS
			405849	1	ROD, EXTENSION, ANCHOR, TYPE-SS, 5 FEET EXTENSION
1	ANCH-EXT-LG-3-SQ-F	1	73221	1	ROD, EXTENSION, ANCHOR, TYPE-SS, 3.5, FEET
1	ANCH-EXT-LG-5-SQ-F	1	405849	1	ROD, EXTENSION, ANCHOR, TYPE-SS, 5 FEET EXTENSION

DUKE ENERGY.

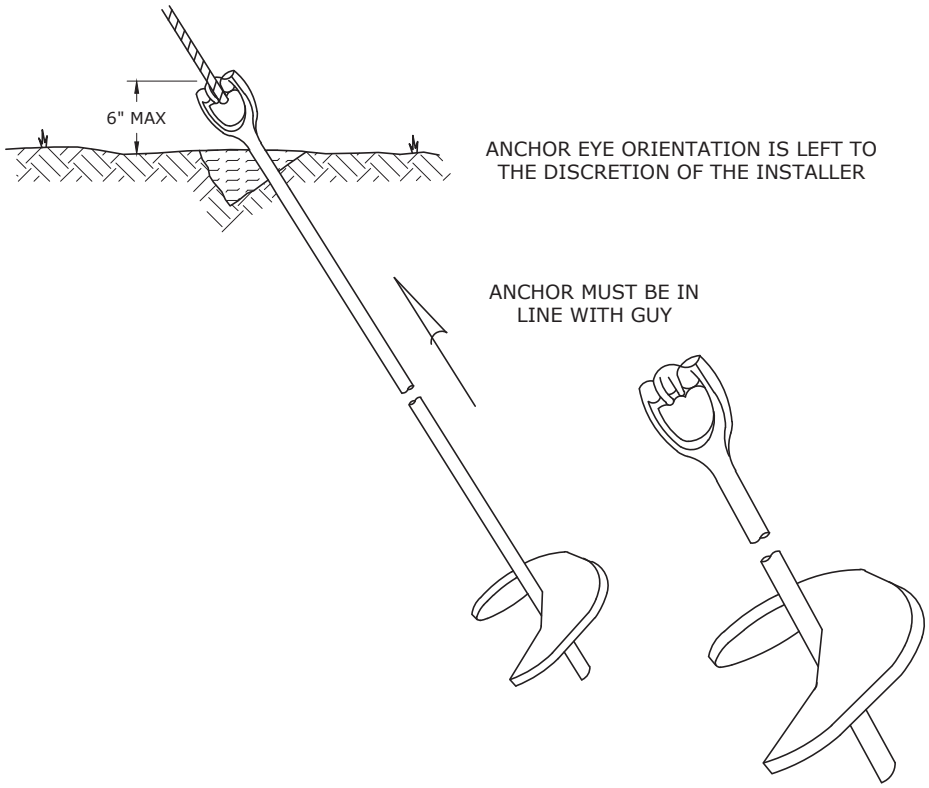
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

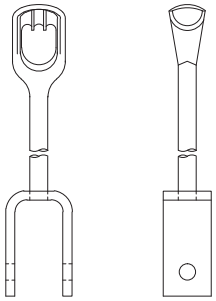
ANCHOR RATING

DEC	DEM	DEP	DEF
			X

02.04-120B

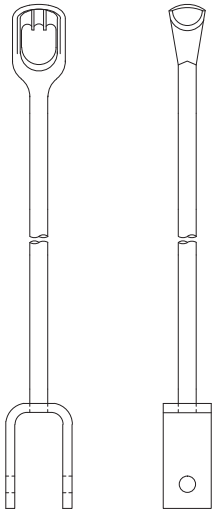
SCREW ANCHOR





24" EXTENSION

SINGLE HELIX SCREW ANCHOR



6' EXTENSION

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.

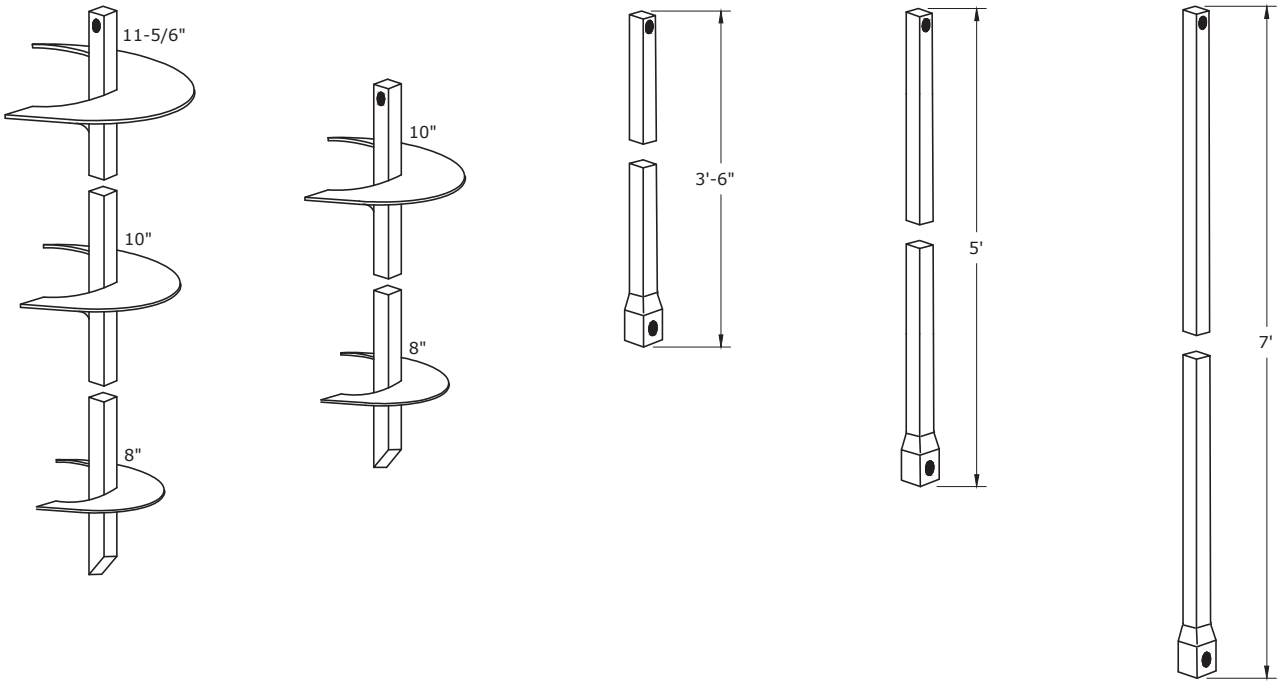
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

SCREW ANCHORS (NO WRENCH) - CONSTRUCTION DETAILS

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

02.04-128



STANDARD EXTENSION

DOUBLE AND TRIPLE HELIX SQUARE SHAFT ANCHORS

DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

DOUBLE AND TRIPLE HELIX SQUARE SHAFT ANCHORS - CONSTRUCTION DETAILS

DEC	DEM	DEP	DEF
		X	X

02.04-130

HEIGHT (FT)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
50	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3
49	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
48	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
47	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
46	PF	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
45	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
44	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
43	PF	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
42	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
41	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3
40	PF	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1
39	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1
38	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1
37	PF	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1
36	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1
35	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1
34	PF	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1
33	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
32	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
31	PF	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
30	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
29	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
28	PF	PF	PF	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
27	PF	PF	PF	1/3	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
26	PF	PF	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25	PF	PF	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
24	PF	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
23	PF	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
22	PF	PF	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
21	PF	1/3	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
20	PF	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
19	PF	1/3	1/3	1/3	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
18	1/3	1/3	1/3	1/2	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
17	1/3	1/3	1/3	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
16	1/3	1/3	1/2	1/2	1/2	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
15	1/3	1/3	1/2	1/2	2/3	2/3	2/3	2/3	2/3	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
(FT)	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40

LEAD (FT)

NOTES:

1. DETERMINE LEAD TO HEIGHT RATIO TO BE USED WITH GUYING TABLES.
2. PF = POLEFOREMAN, THESE RATIOS REQUIRE ANALYSIS IN POLEFOREMAN.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 1/31/17	BURLISON	WHITE	ADCOCK

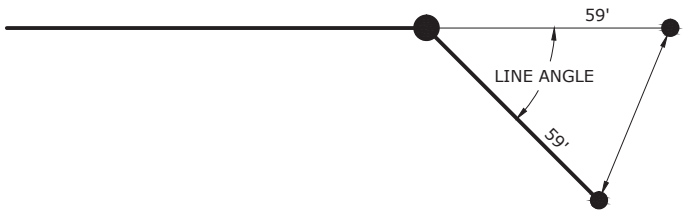
GUYING LEAD TO HEIGHT RATIOS

DUKE ENERGY

DEC	DEM	DEP	DEF
X	X	X	X

02.05-102

DETERMINING LINE ANGLE



1. MEASURE OUT 59' ALONG BOTH DIRECTIONS OF THE LINE AS SHOWN AND PLACE A MARKER.
2. MEASURE THE DISTANCE BETWEEN THE TWO MARKERS.
3. THE LINE ANGLE IN DEGREES IS APPROXIMATELY EQUAL TO THE DISTANCE IN FEET BETWEEN THE MARKERS.
4. IF YOU ARE UNABLE TO MEASURE OUT 59', MEASURE OUT 30' AND MULTIPLY BY 2.

USING THE GUY TABLES

1. DETERMINE THE LINE ANGLE IF NOT A DEADEND.
2. ESTIMATE HOW MANY GUYS AND ANCHORS ARE GOING TO BE USED AND WHICH CONDUCTORS EACH WILL SUPPORT.
3. DETERMINE THE LEAD TO HEIGHT RATIO FROM TABLE ON DWG. 02.05-102 FOR EACH GUY/ANCHOR COMBO.
4. DETERMINE THE CONTRIBUTION FROM EACH WIRE TO GUY TENSION FOR A GIVEN GRADE OF CONSTRUCTION, LOADING ZONE, CONDUCTOR AND LINE ANGLE OR DEADEND.
5. FOR EACH GUY, SUM THE CONTRIBUTION TO GUY TENSION FROM EACH CONDUCTOR BEING SUPPORTED BY THE GUY.
6. THE RESULTING TOTAL GUY TENSION MUST BE LESS THAN THE 90% RATING VALUE OF THE GUY WIRE. FOR 3/8" EHS WITH A RATED BREAKING STRENGTH OF 15,400 LBS, THE ALLOWED LOAD ON THE GUY IS 90% OF 15,400 LBS OR 13,860 LBS.
7. THE TOTAL LOAD ON THE ANCHOR MUST BE LESS THAN THE ANCHOR'S RATING FOR THE SOIL IT WILL BE INSTALLED IN PER DWG. 02.04-120A.

GUY WIRE	RATED BREAKING STRENGTH (LBS)	ALLOWABLE LOAD (LBS)
1/4 EHS	6650	5985
5/16 HS	8000	7200
3/8 EHS	15,400	13,860
7/16 UG	18,000	15,000*
6M	6000	5400
10M	10,000	9000

*LIMITED BY GUY LINK

NOTES:

1. 3/8 EHS IS THE STANDARD SIZE FOR ALL NEW GUYS AND IT IS TO BE USED WHEN REPLACING EXISTING GUYS. OTHER SIZES ARE LISTED HERE FOR REFERENCE WHEN EVALUATING EXISTING GUYS.
2. POLEFOREMAN IS THE PREFERRED METHOD OF DETERMINING GUYING. GUY TABLES MUST TAKE INTO ACCOUNT THE EXTREMES OF EACH SENARIO. USING POLEFOREMAN WILL GENERALLY INDICATE LESS TENSION IN GUYS AND ANCHORS.
3. POLEFOREMAN MUST BE USED FOR GRADE B.

DUKE ENERGY.

3				
2				
1				
0	1/31/17	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

USING THE GUY TABLES

DEC	DEM	DEP	DEF
X	X	X	X

02.05-103

EXAMPLE 1

STEP 1: THE MEASUREMENT OF THE LINE ANGLE AT A CERTAIN POLE IS DETERMINED TO BE 20 DEGREES.

STEP 2: THE LINE IS THREE-PHASE VERTICAL AND WILL UTILIZE 1/0 AAAC AND A 1/0 NEUTRAL ON A 45' POLE. IT WILL BE CONSTRUCTED TO DWG. 03.12-107A. IT IS IN THE LIGHT LOADING DISTRICT AND IS TO BE BUILT TO GRADE C. A 280' RULING SPAN IS USED. A SPLIT GUY CONFIGURATION WILL BE USED WITH THE TOP GUY SUPPORTING THE TOP TWO CONDUCTORS AND THE BOTTOM GUY SUPPORTING THE BOTTOM TWO CONDUCTORS.

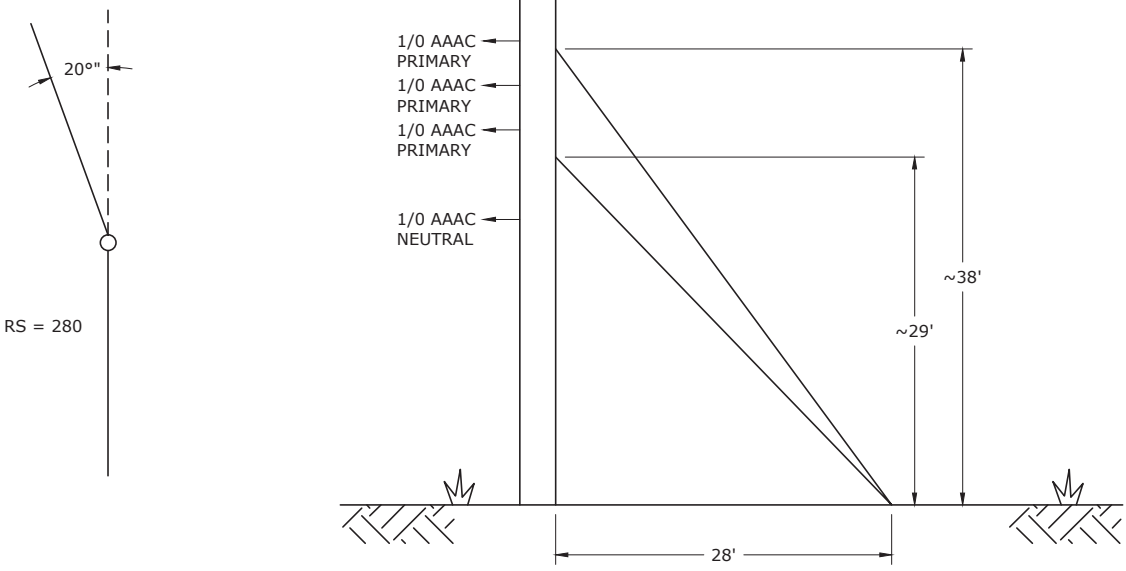
STEP 3: PER SPEC, THE HEIGHT OF THE PRIMARY GUY FOR A 45' POLE IS APPROXIMATELY 38' AND THE HEIGHT OF THE NEUTRAL GUY IS APPROXIMATELY 29'. A SINGLE ANCHOR IS DESIRED AT 28'. THE HEIGHT TO LEAD RATIO FOR EACH FROM DWG. 02.05-102 INDICATES A 2/3 SHOULD BE USED.

STEP 4: FROM THE TABLE FOR GRADE C, LIGHT LOADING DISTRICT AND 280' RULING SPAN, THE CONTRIBUTION OF TENSION IN THE GUY FOR EACH CONDUCTOR IS 1800 LBS.

STEP 5: THE TOP GUY WILL SUPPORT 2 TIMES 1800 LBS OR 3600 LBS AND THE NEUTRAL GUY WILL SEE 2 TIMES 1800 OR 3600 LBS.

STEP 6: BOTH OF THESE GUYS CAN UTILIZE 3/8" EHS GUY WIRE.

STEP 7: THE ANCHOR MUST SUPPORT THE SUM OF 3600 LBS AND 3600 LBS OR A TOTAL OF 7200 LBS.

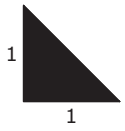


3				
2				
1				
0	1/31/17	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GUY TABLE EXAMPLE

DEC	DEM	DEP	DEF
			X

02.05-106

LINE ANGLE	#2 AAAC (LLT=800)	1/0 AAAC FEEDER NEUTRAL (LLT=642)	1/0 AAAC (LLT=1000)	336 AAC (LLT=2243)	795 AAC (LLT=4500)	LEAD TO HEIGHT
LEVEL SPAN GUY						
10	420	400	490	840	1440	SPAN GUY
20	600	550	710	1350	2460	
30	780	690	930	1840	3450	
40	950	830	1150	2330	4430	
50	1120	960	1360	2800	5370	
60	1280	1090	1560	3250	6270	
DE	1190	990	1450	3070	6000	
LEAD TO HEIGHT = 1 TO 1						
10	590	570	690	1190	2040	
20	850	770	1000	1900	3470	
30	1100	980	1320	2610	4880	
40	1340	1170	1620	3290	6260	
50	1580	1360	1920	3960	7590	
60	1810	1550	2200	4600	8870	
DE	1690	1400	2060	4340	8490	
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)						
10	750	730	870	1520	2600	
20	1080	990	1280	2430	4420	
30	1400	1240	1680	3320	6220	
40	1710	1490	2070	4200	7980	
50	2010	1740	2440	5040	9680	
60	2300	1970	2810	5860	11,310	
DE	2150	1780	2620	5530	10,820	
LEAD TO HEIGHT = 1 TO 2						
10	930	900	1080	1880	3220	
20	1330	1220	1580	3010	5490	
30	1730	1540	2080	4120	7710	
40	2120	1850	2560	5200	9890	
50	2490	2150	3030	6250	12,000	
60	2850	2440	3480	7260	14,020	
DE	2670	2210	3250	6860	13,420	
LEAD TO HEIGHT = 1 TO 3						
10	1310	1270	1530	2660	4560	
20	1880	1730	2240	4250	7760	
30	2440	2180	2940	5820	10,910	
40	2990	2620	3620	7360	13,990	
50	3520	3040	4280	8840	16,970	
60	4030	3450	4920	10,270	19,830	
DE	3770	3120	4590	9700	18,980	

NOTES:

1. CONTRIBUTION TO GUY TENSION FROM EACH CONDUCTOR (LBS).

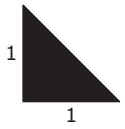
3				
2				
1				
0	1/31/17	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GUY TABLE FOR GRADE C,
LIGHT LOADING ZONE -
150' RULING SPAN AND MAX SPAN 200'

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

02.05-131

LINE ANGLE	#2 AAAC (LLT=1015)	1/0 AAAC FEEDER NEUTRAL (LLT=720)	1/0 AAAC (LLT=1483)	336 AAC (LLT=2301)	795 AAC (LLT=5005)	LEAD TO HEIGHT
LEVEL SPAN GUY						
10	530	450	670	900	1630	SPAN GUY
20	750	610	1000	1420	2750	
30	980	770	1330	1930	3860	
40	1200	930	1650	2430	4940	
50	1410	1080	1960	2910	5990	
60	1620	1220	2260	3370	7000	
DE	1470	1090	2080	3150	6660	
LEAD TO HEIGHT = 1 TO 1						
10	740	630	940	1270	2300	
20	1060	860	1420	2000	3890	
30	1380	1090	1880	2720	5460	
40	1690	1310	2330	3430	6990	
50	1990	1520	2770	4110	8470	
60	2280	1730	3190	4770	9890	
DE	2080	1540	2940	4450	9420	
LEAD TO HEIGHT = 2 TO 3 (PREFERRED)						
10	940	800	1200	1620	2930	
20	1360	1100	1800	2550	4960	
30	1760	1380	2390	3470	6950	
40	2160	1670	2970	4370	8910	
50	2540	1940	3530	5240	10,800	
60	2910	2200	4070	6070	12,610	
DE	2650	1960	3750	5670	12,010	
LEAD TO HEIGHT = 1 TO 2						
10	1170	1000	1490	2010	3630	
20	1680	1360	2230	3170	6150	
30	2180	1720	2970	4310	8620	
40	2670	2060	3690	5420	11,050	
50	3150	2400	4380	6500	13,390	
60	3610	2730	5050	7530	15,640	
DE	3290	2430	4650	7030	14,890	
LEAD TO HEIGHT = 1 TO 3						
10	1650	1410	2100	2840	5130	
20	2370	1920	3160	4480	8690	
30	3090	2420	4200	6090	12,190	
40	3780	2920	5210	7660	15,620	
50	4450	3390	6190	9190	18,930	
60	5100	3850	7140	10,650	22,120	
DE	4650	3440	6580	9940	21,050	

NOTES:

1. CONTRIBUTION TO GUY TENSION FROM EACH CONDUCTOR (LBS).

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	1/31/17	BURLISON	WHITE	ADCOCK

GUY TABLE FOR GRADE C, LIGHT LOADING ZONE -
FOR 336 AAC AND 795 AAC -
200' RULING SPAN AND MAX SPAN 250'
FOR #2 AAAC AND #1/0 AAAC -
280' RULING SPAN AND MAX SPAN 340'

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

02.05-132

03.00 GENERAL CONSTRUCTION NOTES

03.01 DISTRIBUTION PHASING

03.02 SECONDARY AND SERVICES

03.03 DEADEND, TRUNION AND SUSPENSION CLAMPS

03.04 HAND TIES/PREFORMED TIES/ARMOR RODS

03.06 INSULATORS

DUKE ENERGY.

3				
2				
1	3/31/17	KATIGBAK	BURLISON	ADCOCK
0	6/30/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 3 - PRIMARY CONSTRUCTION OVERHEAD

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

03.07 CROSSARMS

03.08 SINGLE-PHASE CONSTRUCTION

03.11 HORIZONTAL CONSTRUCTION

DUKE ENERGY.

3				
2	9/30/18	KATIGBAK	BURLISON	ADCOCK
1	3/31/17	KATIGBAK	BURLISON	ADCOCK
0	6/30/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 3 - PRIMARY CONSTRUCTION OVERHEAD

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

03.11 HORIZONTAL CONSTRUCTION (CONT.)

03.12 VERTICAL CONSTRUCTION

03.12 VERTICAL CONSTRUCTION (CONT.)

03.13 HORIZONTAL DOUBLE CIRCUIT CONSTRUCTION

03.14 VERTICAL DOUBLE CIRCUIT CONSTRUCTION

03.18 MIDSPAN TAPS

03.20 LIMITED ACCESS OR RAILROAD CROSSING - GRADE B CONSTRUCTION

DUKE ENERGY.

3				
2				
1	5/9/17	KATIGBAK	BURLISON	ADCOCK
0	9/30/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 3 - PRIMARY CONSTRUCTION OVERHEAD

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

03.23 SINGLE-PHASE ELECTRIC DISTRIBUTION ON STEEL AND CONCRETE TRANSMISSION POLES

03.24 HORIZONTAL UNDERBUILD ON STEEL TRANSMISSION POLES

DUKE ENERGY.

3				
2				
1	3/31/18	KATIGBAK	BURLISON	ADCOCK
0	12/31/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

03.25 VERTICAL UNDERBUILD ON STEEL TRANSMISSION POLES

03.25 VERTICAL UNDERBUILD ON STEEL TRANSMISSION POLES (CONT.)

03.26 WILDLIFE/AVIAN PROTECTION

03.28 SUBSTATION EXIT TERMINATION/GROUNDING

STANDARD PRIMARY CONSTRUCTION

SPECIFICATIONS AS OUTLINED IN THIS SECTION ARE CONSIDERED TO BE THE PREFERRED CONSTRUCTION. THE LOCATION OF HARDWARE AND PHASE SPACING IS POSITIONED TO BE THE BEST FOR OVERALL SAFETY, OPERATION, MAINTENANCE AND RELIABILITY. IT SHALL BE FOLLOWED ON ALL NEW LINES AND EXISTING LINES UNLESS EXTENUATING CIRCUMSTANCES REQUIRE USE OF LEGACY CONFIGURATION. ALTERATIONS SHALL BE APPROVED BY THE LOCAL ENGINEERING MANAGEMENT.

IN GENERAL, TWO TYPES OF CONSTRUCTION ARE AVAILABLE; HORIZONTAL AND VERTICAL. HORIZONTAL CAN BE CONSTRUCTED WHERE RIGHT-OF-WAY PERMITS. VERTICAL IS AVAILABLE WHERE LIMITED BY RIGHT-OF-WAY OR CLEARANCE ISSUES EXIST. LOCAL ENGINEERING SHALL DETERMINE THE TYPE OF CONSTRUCTION.

THE PRIMARY TO NEUTRAL SPACING SHOWN IN THE CONSTRUCTION STANDARDS ARE THE MINIMUM REQUIRED TO MEET THE MID-SPAN SPACING REQUIREMENT FOR ALL CONDUCTORS FOR ALL SPANS UP TO 340' IN A 280' RULING SPAN (EXCEPTION 250' IN A 200' RULING SPAN FOR 795AAC PRIMARY)

TO UTILIZE A 40' POLE FOR HORIZONTAL CONSTRUCTION IN THE CINCINNATI BELL CURRENT JOINT USE AGREEMENT AREA, THE MAXIMUM SPAN IS 300 FT. AND THE NEUTRAL IS INSTALLED 84” FROM THE POLE TOP. OTHERWISE A 45' POLE IS REQUIRED.

THE BILL OF MATERIAL AND CU'S WILL FOLLOW THE FRAMING SPECIFICATION IN THIS SECTION.

PRIMARY CONDUCTORS

SPAN LENGTH LIMITS AND CONDUCTOR SPACING

SPAN LENGTH LIMITS AND CONDUCTOR SPACING ARE SELECTED BASED ON THE FOLLOWING

1. SAFETY COMPLIANCE TO THE SAFETY FACTORS OF THE NATIONAL ELECTRICAL SAFETY CODE. THIS ENSURES ADEQUATE CLEARANCE IS MAINTAINED DURING ALL EXTREME CONDITIONS WHICH OUR LINES WILL EXPERIENCE.
2. RELIABILITY - PREVENT ADDITIONAL MIDSPAN FAULTS FROM OCCURRING DURING EVENTS. CONDUCTORS MOVE SIGNIFICANTLY DURING DOWNSTREAM FAULTS. PROPER CLEARANCES PREVENT THESE MOVING CONDUCTORS FROM CONTACTING EACH OTHER AND WORSENING THE EVENT.
3. EASE OF CONSTRUCTION, OPERATION AND MAINTENANCE - CONSIDERATION IS GIVEN TO THE SPACING REQUIRED TO SAFELY AND EFFICIENTLY CONSTRUCT NEW LINES AS WELL AS TYPICAL MAINTENANCE AND ADDITIONS THAT WILL OCCUR OVER THE LIFE OF THE LINE.

ALL OF THESE FACTORS ARE EXTREMELY DEPENDENT ON PROPERLY SAGGED AND TENSIONED CONDUCTORS. FAILURE TO TAKE THE STEPS TO PROPERLY SAG AND TENSION CONDUCTORS AT INSTALLATION AS DEFINED IN SECTION 05 CAN SIGNIFICANTLY REDUCE SAFETY AND/OR RELIABILITY. SEVERAL ACCEPTABLE WORK METHODS EXIST FOR MEASURING SAG AND TENSION SO THAT IT CAN BE PROPERLY ADJUSTED DURING INSTALLATION OR MAINTENANCE. CREWS SHOULD FAMILIARIZE THEMSELVES WITH THESE AND EMPLOY ONE ON EVERY JOB.

ALL NEW OVERHEAD PRIMARY LINE CONDUCTORS WILL BE BARE ALUMINUM OR ALUMINUM ALLOY ON ALL CIRCUITS UNLESS SPECIFIED BY ENGINEERING FOR SPECIAL PURPOSES

FOR TIE TYPE INSULATORS, PLACE CONDUCTORS ON THE INSULATOR SO THAT THE WIRE TENSION HOLDS IT AGAINST THE INSULATOR. FACTORY FORM TIES SHALL BE USED WHERE POSSIBLE. RUBBER GROMMETS SUPPLIED WITH THE FORM TIE SHALL BE USED.

EQUIPMENT RISERS/JUMPERS SHALL BE COVERED FOR ANIMAL PROTECTION. WHEN COVERED RISER WIRE IS SUPPORTED BY A PORCELAIN INSULATOR, COMPOSITE TIES SHALL BE USED.

NEUTRALS

NEUTRALS SHALL BE MULTI-GROUNDED AND IN A POSITION ON THE POLE COMMON TO BOTH PRIMARY AND SECONDARY SYSTEMS, EXCEPT FOR WHEN THE EXISTING NEUTRAL IS IN THE TOP (SHIELD WIRE) POSITION ON THE POLE.

MULTI-GROUNDED MEANS THERE ARE AT LEAST 4 POLE GROUNDS IN EACH MILE OF LINE.

RULING SPANS

SPAN LENGTHS ARE DEFINED IN THIS SECTION AS TYPICAL, MEDIUM, INTERMEDITATE AND LONG SPANS. WHEN FIELD CONDITIONS PERMIT, TYPICAL SPAN LENGTHS (AS DEFINED BELOW) SHOULD BE USED. ALTERNATE FRAMING CONFIGURATIONS ARE REQUIRED FOR MEDIUM, INTERMEDIATE AND LONG SPANS (AS DEFINED BELOW) TO REDUCE THE LIKELIHOOD OF MAGNETICALLY INDUCED MID-SPAN FAULTS.

FOR SPACING, FOLLOW THE GUIDELINES BELOW:

FOR SINGLE CIRCUIT HORIZONTAL CONSTRUCTION:

1. TYPICAL SPANS: FOR SPANS LESS THAN OR EQUAL TO 250 FT., USE SPACING AS SHOWN ON DWG. 03.11-103A.
2. INTERMEDIATE SPANS (EXCEPT 795AAC): FOR 250 FT. UP TO 340 FT., USE A 10 FT. ARM LOWERED 24" BELOW THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 24". SEE DWG. 03.11-160.
3. LONG SPANS: - FOR 340 FT. UP TO 500 FT. (250 TO 500 FOR 795AAC), USE A 10 FT. ARM WHICH IS FRAMED 36 INCHES BELOW THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 36". SEE DWG. 03.11-170.
4. SEE SECTION 03.15 FOR SPANS IN EXCESS OF 500 FT.

DOUBLE CIRCUIT SPANS (SIDE BY SIDE HORIZONTAL FRAMING)

1. TYPICAL SPANS: FOR SPANS LESS THAN OR EQUAL TO 175 FT. USE THE CURRENT 10-OVER-8 FRAMING AS SHOWN ON DWG. 03.13-100A.
2. MEDIUM SPANS: FOR SPANS 175 FT TO 250 FT, USE A 14'-4" ARM MOUNTED 10" FROM THE POLE TOP, USE AN 8 FT ARM SPACED 60" BELOW THE TOP ARM, INSTALL NEUTRAL 80" BELOW THE LOWER ARM. SEE DWG. 03.13-145A.
3. INTERMEDIATE SPANS: FOR SPANS 250 FT. TO 340 FT. (175 FT. TO 250 FT. FOR 795 AAC), USE THREE CROSSARMS (8'-10'-8' CONFIGURATION) SPACED 60" APART. INSTALL NEUTRAL 80" BELOW THE LOWER ARM. SEE DWG. 03.13-146A.
4. LONG SPANS: 340 FT. TO 500 FT. (250 FT. TO 500 FT. FOR 795AAC) - BUILD TWO SINGLE CIRCUIT LONG SPANS POLES LINES (SEE DWG. 03.11-170). USE A 10 FT. ARM WHICH IS FRAMED 36 INCHES BELOW THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 36".
5. CONTACT DISTRIBUTION STANDARDS FOR SPANS IN EXCESS OF 500 FT.

DOUBLE CIRCUIT SPANS (OVER AND UNDER HORIZONTAL FRAMING)

1. TYPICAL SPANS: FOR SPANS LESS THAN OR EQUAL TO 175 FT. USE THE CURRENT 8 FT. TOP CIRCUIT AND 10 FT. BOTTOM CIRCUIT FRAMING AS SHOWN ON DWG. 03.13-150A.
2. MEDIUM SPANS: FOR SPANS 175 FT. TO 250 FT., USE A 8 FT. CROSSARM FOR TOP CIRCUIT. FOR THE BOTTOM CIRCUIT, MOUNT THE CENTER PHASE ON A HORIZONTALLY MOUNTED 35KV INSULATOR. LOWER THE BOTTOM CIRCUIT CROSSARM 24" FROM THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 24". SEE DWG. 03.13-195.
3. INTERMEDIATE SPANS (EXCEPT 795AAC): FOR 250 FT. UP TO 340 FT.: FOR THE UPPER CIRCUIT USE A 10 FT. ARM LOWERED 24 INCHES BELOW THE CURRENT CROSSARM POSITION IN TYPICAL SPANS. FOR THE BOTTOM CIRCUIT, MOUNT THE CENTER PHASE ON A HORIZONTALLY MOUNTED 35KV INSULATOR. LOWER THE BOTTOM CIRCUIT CROSSARM 24" FROM THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 24". SEE DWG. 03.13-196.
4. LONG SPANS: 340 FT. TO 500 FT. (250 FT. TO 500 FT. FOR 795AAC) - BUILD TWO SINGLE CIRCUIT LONG SPANS POLES LINES (SEE DWG. 03.11-170). USE A 10 FT. ARM WHICH IS FRAMED 36 INCHES BELOW THE CURRENT CROSSARM POSITION IN TYPICAL SPANS AND LOWER THE NEUTRAL 36".
5. CONTACT DISTRIBUTION STANDARDS FOR SPANS IN EXCESS OF 500 FT.

SINGLE AND DOUBLE CIRCUIT VERTICAL CONSTRUCTION

1. TYPICAL SPANS: FOR SPANS UP TO 340' (250 FOR 795AAC), USE THE SPACING PROVIDED IN SUB-SECTION 03.12 AND SUB-SECTION 03.14

2. LONG SPANS: (340 TO 500) (250 TO 500 FOR 795AAC) CONSULT WITH DISTRIBUTION STANDARDS FOR REQUIRED INCREASES FOR PHASE AND NEUTRAL SPACING.

3. CONTACT DISTRIBUTION STANDARDS FOR SPANS IN EXCESS OF 500 FT.

CROSSARMS

THE USE OF DOUBLE ARMING BOLTS IS ACCEPTABLE WHEN INSTALLING SINGLE WOOD CROSSARMS. HOWEVER, NO MORE THAN 4" MAXIMUM SHALL BE LEFT EXTRUDING FROM THE BACK SIDE OF THE POLE. STANDARDS CONSTRUCTION DRAWINGS AND BILL OF MATERIALS WILL CONTINUE TO SHOW THE USE OF MACHINE BOLTS FOR THIS APPLICATION.

POLES

40' IS TYPICAL POLE SIZE FOR HORIZONTAL THREE-PHASE CONSTRUCTION. 45' POLES ARE TYPICAL FOR VERTICAL THREE-PHASE CONSTRUCTION. THERE ARE THREE BASIC REASONS FOR INSTALLING TALLER POLES:

1. REQUIRED ADDITIONAL NEUTRAL TO PRIMARY SPACING - FUTURE DOUBLE CIRCUIT OR EQUIPMENT NEEDS.

2. REQUIRED ADDITIONAL GROUND CLEARANCE - MAINTAIN STANDARD NEUTRAL TO PRIMARY SPACING.

3. CONTRACTS WITH CERTAIN JOINT USE COMPANIES - SEE SECTION 10.07.

ENGINEERING IS RESPONSIBLE FOR COMMUNICATING THE REASON FOR TALLER POLES AND ANY CHANGE TO PRIMARY TO NEUTRAL SPACING.

GUYING

ALL GUYS EXCEPT THE ONE INSTALLED AT THE NEUTRAL MUST HAVE A FIBERGLASS GUY LINK(S) INSTALLED OF SUFFICIENT LENGTH SO THAT THE LINK EXTENDS BEYOND THE LOWEST ENERGIZED COMPONENT BY 24 INCHES. ALL GUYS SHALL BE BONDED TO THE NEUTRAL.

GRADES OF CONSTRUCTION AND LOADINGS

THESE CONSTRUCTION SPECIFICATIONS ARE APPLICABLE FOR NESC GRADE C AND NESC RULE 250A LOADINGS UNLESS SPECIFICALLY NOTED. GRADE C AND NESC RULE 250A ARE DUKE ENERGY'S NORMAL GRADE AND LOADING LINE DESIGN. GRADE B IS REQUIRED WHERE DISTRIBUTION LINES CROSS OVER LIMITED ACCESS HIGHWAYS, RAILROAD TRACKS OR SPECIFIED BY ENGINEERING FOR SPECIAL PURPOSES. LOADING REQUIREMENT OF NESC RULE 250B OR 250C SHALL BE USED IF POLES ARE GREATER THAN 60' ABOVE GROUND OR THE LINE BETWEEN POLES IS MORE THAN 60' ABOVE GROUND. NESC RULE 250B OR 250C MAY ALSO BE SPECIFIED BY ENGINEERING FOR SPECIAL DESIGNS SUCH AS STORM HARDENING.

GENERALLY, STANDARD SPECIFICATIONS FOR POLES, CROSSARMS, INSULATORS, GUYS AND HARDWARE MAY BE USED FOR GRADE B AND/OR RULE 250B AND 250C LOADINGS PROVIDED THE FOLLOWING MODIFICATION AND EVALUATIONS ARE MADE.

1. ALL STRUCTURES SHOULD BE EVALUATED IN POLEFOREMAN FOR PROPER STRENGTH REQUIREMENT OF THE POLE, ARMS, INSULATORS AND GUYS.

2. THE STRUCTURES AND SUPPORTS ON EACH END OF THE GRADE B SECTION WHERE TRANSITION FROM GRADE B TO GRADE C IS MADE MUST BE ABLE TO WITHSTAND BREAKAGE OF A CONDUCTOR ON THE GRADE C SIDE WHEN THERE ARE 8 OR LESS CONDUCTORS. THE CONDUCTOR SELECTED FOR THIS ANALYSIS SHOULD BE THE ONE THAT CAUSES THE MAXIMUM STRESS ON THE STRUCTURE.

TRANSMISSION ENCROACHMENTS AND UNDERBUILD

DISTRIBUTION UNDERBUILD ON TRANSMISSION LINES MUST BE APPROVED BY TRANSMISSION. THIS 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.

THE PRIMARY CONCERN OF UNDERBUILD DISTRIBUTION IS SUFFICIENT BIL. TRANSMISSION PREDOMINATELY USES STEEL AND CONCRETE POLES FOR NEW OR UPGRADED CONSTRUCTION. TO OBTAIN PROPER BIL ON THESE STRUCTURES, REFER TO THE UNDERBUILD SECTIONS 03.24 AND 03.25.

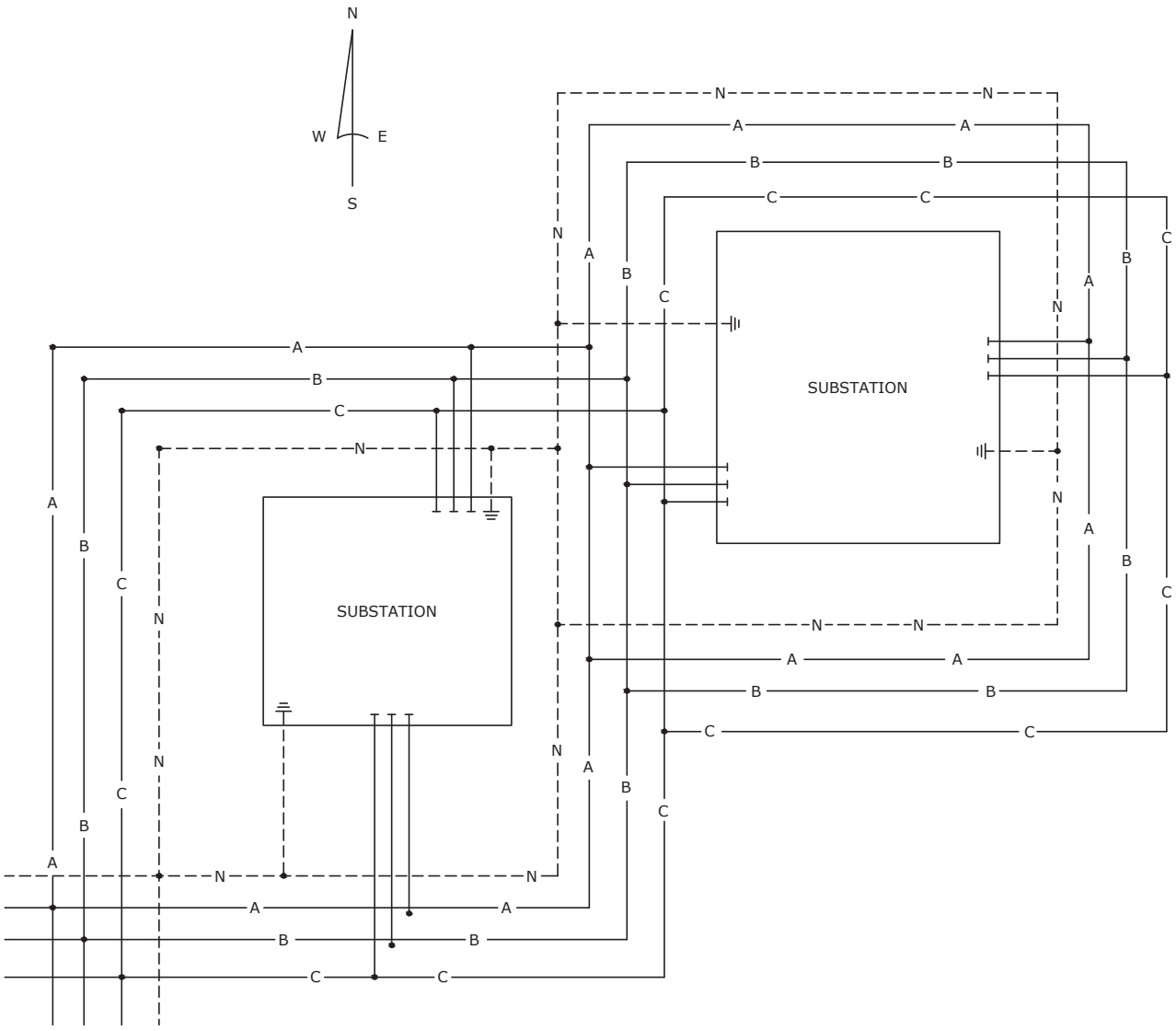
LOCKWASHERS

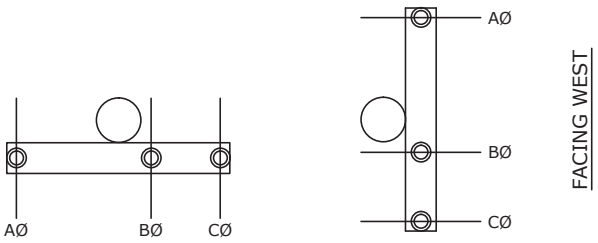
EYEBOLTS SUPPORTING DEADEND INSULATORS REQUIRE NO LOCKWASHER.

ALL OTHER BOLTS, INCLUDING GUYS ATTACHMENTS REQUIRE USE OF A DOUBLE COIL LOCKWASHER.

COASTAL CONSTRUCTION

USED IN AREAS OF HIGH AIRBORNE CONTAMINATION SUCH AS BEACHES, PAPER PLANTS, PHOSPHATE PROCESSING PLANTS, ETC. AS DEFINED BY ENGINEERING. SEE SECTION 12 FOR CONSTRUCTION SPECIFICATION AND MATERIAL SELECTION.





FACING NORTH

HORIZONTAL CONSTRUCTION
TOP VIEWS

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

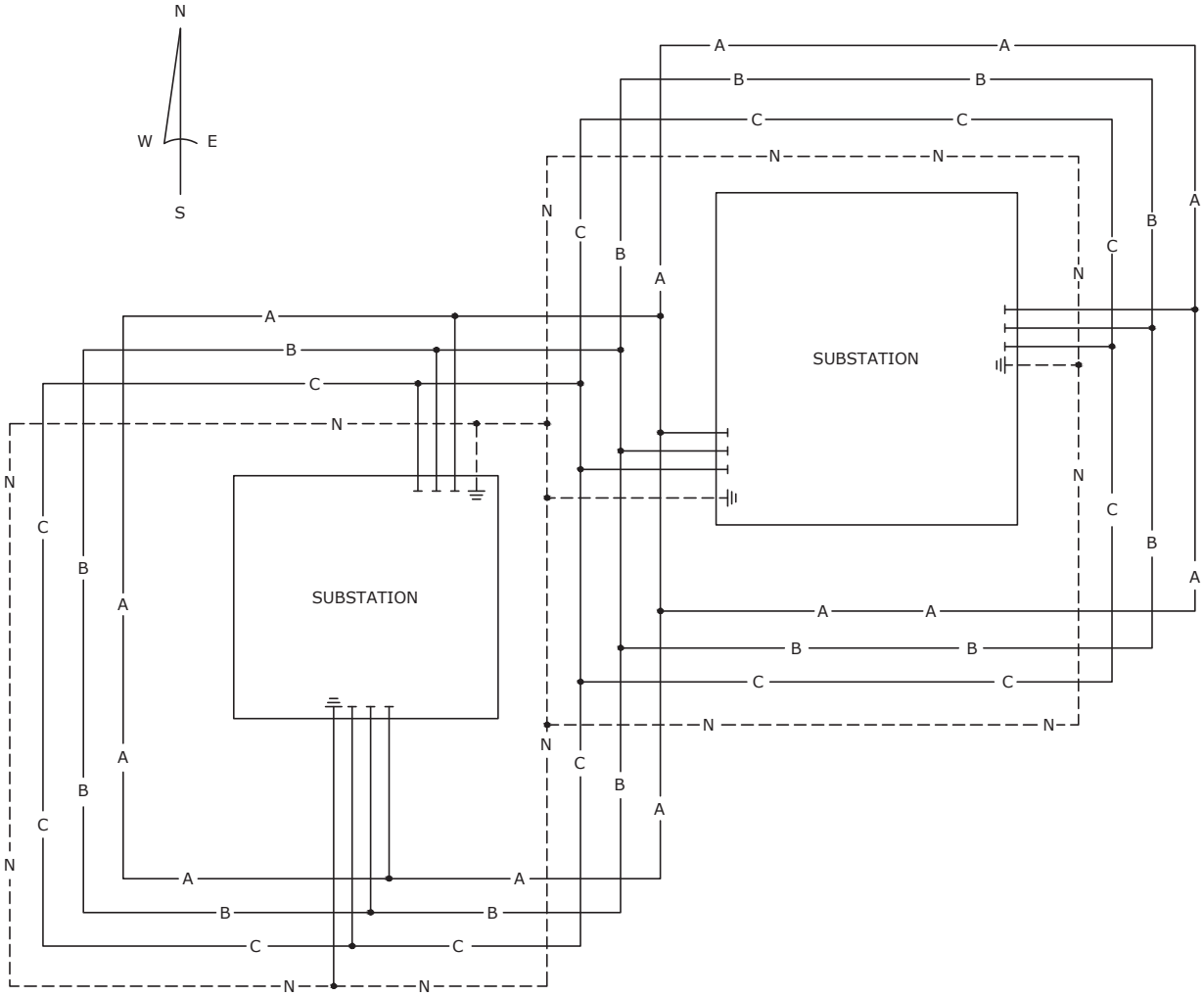
STANDARD DISTRIBUTION PHASING
FOR ALL AREAS EXCEPT ST. PETERSBURG

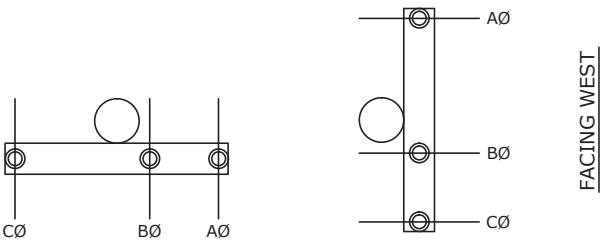
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.01-100

ST. PETERSBURG AREA





FACING NORTH

FACING WEST

HORIZONTAL CONSTRUCTION
TOP VIEWS

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

STANDARD DISTRIBUTION PHASING
FOR ST. PETERSBURG AREA ONLY

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.01-102

NOTES:

1. THE NEUTRAL SHALL BE COMMON TO BOTH PRIMARY AND SECONDARY CIRCUITS ON WYE SYSTEMS. THE NEUTRAL SHALL BE MULTI-GROUNDED.

2. MULTIPLEX CONDUCTOR IS THE PREFERRED SECONDARY CONDUCTOR. WHEN MAJOR WORK IS DONE IN AN AREA, OPEN SECONDARY SHOULD BE REPLACE WITH MULTIPLEX WHERE PRACTICAL.

3. WHEN OPEN SECONDARY IS MAINTAINED, IT IS PREFERRED TO HAVE THE NEUTRAL ON TOP. HOWEVER, THERE ARE AREAS WHERE THE NEUTRAL IS IN THE MIDDLE. CONFIRMATION OF CONFIGURATION SHOULD BE MADE PRIOR TO PERFORMING ANY WORK ON A POLE WITH OPEN SECONDARY.

4. ALL ENERGIZED SERVICE CONDUCTORS WILL BE COVERED ALUMINUM SUPPORTED BY A BARE NEUTRAL. THE REQUIRED SIZE SHALL BE SPECIFIED BY THE PLANNER.

5. FOR THREE PHASE, FOUR WIRE DELTA SECONDARY CABLE AND SERVICES, THE PHASE CONDUCTOR WITH THE MOST NUMBER OF RAISED RIBS WILL BE THE HIGH (208 VOLT) PHASE.

6. REFER TO THE LOCAL REQUIREMENTS OF SERVICE DOCUMENT FOR DETERMING SERVICE ENTRANCE LOCATION.

7. USE INSULINKS OR INSTALL INSULATING COVERS OVER SECONDARY CABLE OR SERVICE CABLE CONNECTORS.

8. STREETLIGHT CIRCUITS ARE TO BE CONSIDERED AS SECONDARY FOR CONSTRUCTION RULES.

9. BEFORE CUTTING THE LACING WIRE ON EXISTING AERIAL SECONDARY CABLE, BIND THE LACING WITH SEVERAL TURNS OF SCRAP LACING WIRE.

10. TO DEADEND THE PHASE CONDUCTORS OF EXISTING AERIAL SECONDARY CABLE, WHILE ALLOWING THE NEUTRAL TO CONTINUE ON, FIRST TAPE THE ENDS OF THE PHASE CONDUCTOR, THEN BEND THEM BACK AND SECURE WITH SEVERAL WRAPS OF THE BINDING WIRE. COVER ENDS IF NOT IN USE

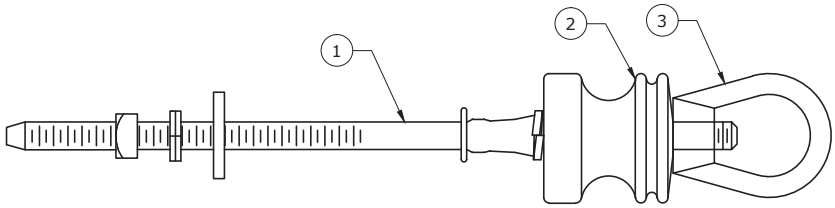
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARIES AND SERVICES

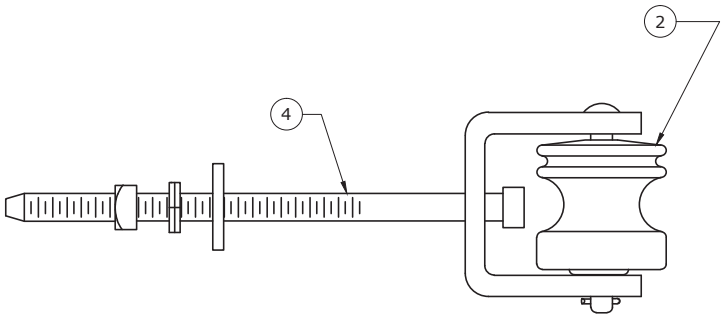
DEC	DEM	DEP	DEF
X	X	X	X

03.02-100



FOR TANGENT POLE
NEUTRAL SUPPORT
AND OPEN-WIRE
SECONDARY SUPPORT

INSULATOR, SECONDARY RACK



FOR ANGLE POLE
NEUTRAL SUPPORT
AND OPEN-WIRE
SECONDARY DEAD ENDS

NOTES:

1. SEE DWG. 03.02-102B FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

POLE ATTACHMENT DEVICES

DEC	DEM	DEP	DEF
X	X	X	X

03.02-102A

BILL OF MATERIALS - SPOOL BOLT					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	HDWR-SP-SM-10IN-GALV-F	1	39424	1	BOLT, SPOOL, 5/8" DIA, 10" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
2	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
3	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL

BILL OF MATERIALS - INSULATOR, SECONDARY RACK					
CU/CN ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
2	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
4	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
4	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, GALV STL

NOTES:

1. FOR FACTORY FORMED TIE INFORMATION, SEE DWGS. 03.04-102A THROUGH 03.04-102H.

2. SEE DWG. 03.02-102A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	10/13/17	LOOSIER	BURLISON	ADCOCK

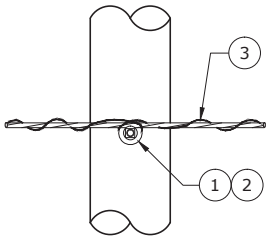
POLE ATTACHMENT DEVICES

DUKE ENERGY.

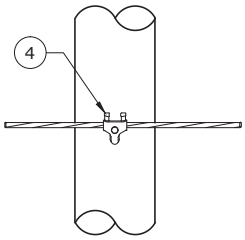
DEC	DEM	DEP	DEF
			X

03.02-102B

TANGENT, SPOOL

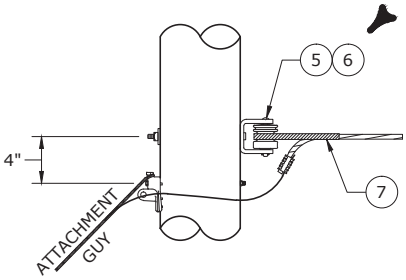


TANGENT, MESSENGER CLAMP

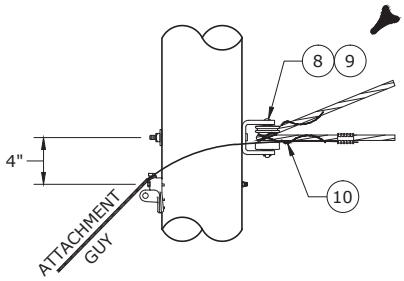


AERIAL CABLE ONLY

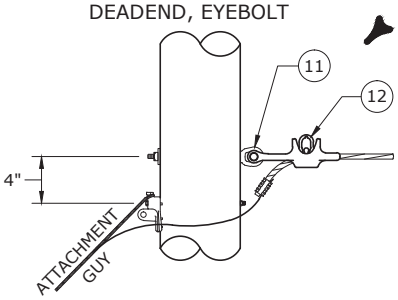
SECONDARY
DEADEND, RACK



ANGLE, RACK

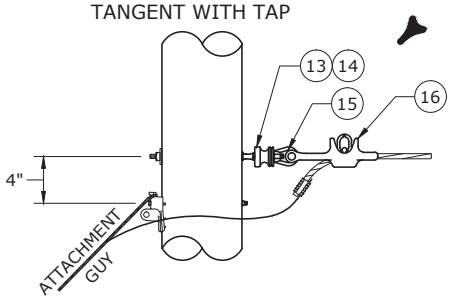


DEADEND, EYEBOLT



AERIAL CABLE OR BARE CONDUCTOR.
GUYED FULL TENSION OR
UNGUYED SLACK SPAN

TANGENT WITH TAP



AERIAL CABLE OR BARE CONDUCTOR.
GUYED FULL TENSION OR
UNGUYED SLACK SPAN

NOTES:

1. SEE DWG. 03.02-104B FOR BILL OF MATERIALS AND NOTES.

DUKE ENERGY.

3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CHK'D	APPR.

NEUTRAL POLE ATTACHMENTS

DEC	DEM	DEP	DEF
X	X	X	X

03.02-104A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
2	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV, DUI WASHER
3	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE DWG. 03.04-102L FOR WIRE TIE DETAILS
4	CLAMP-AER-CABLE-MD-F	-	4002389	-	CLAMP, CABLE, MES CBL 4 TO 4/0
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER,FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, GALV STL
7	TIE-DE GRIP-(WIRE)-AL-F	1	-	1	SEE DWG. 03.02-110B (SIZE VARIES)
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
9	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV
10	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE DWG. 03.04-102L FOR WIRE TIE DETAILS
11	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (SIZE VARIES)
13	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
14	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV, DUI WASHER
15	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
16	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (SIZE VARIES)

NOTES:

1. FOR FACTORY FORMED TIE INFORMATION, SEE DWGS. 03.04-102A THROUGH 03.04-102H.

2. SEE DWG. 03.02-104A FOR DESIGN SPECIFICATIONS.

DUKE ENERGY.

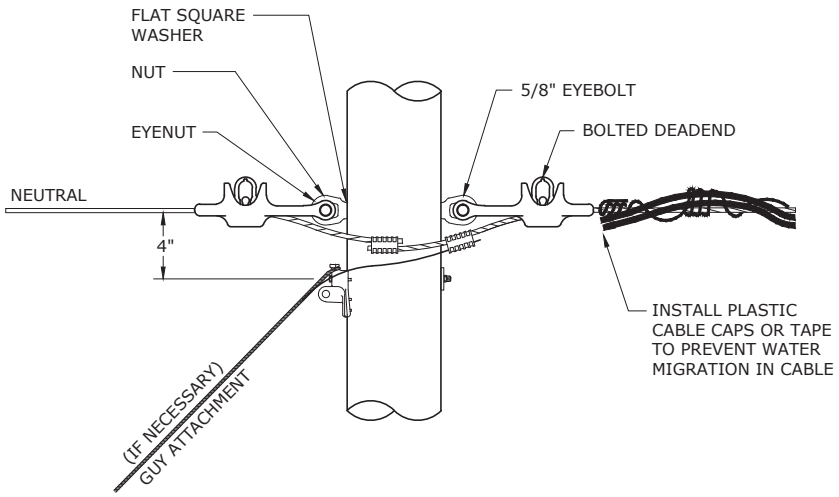
3				
2				
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

NEUTRAL POLE ATTACHMENTS

DEC	DEM	DEP	DEF
			X

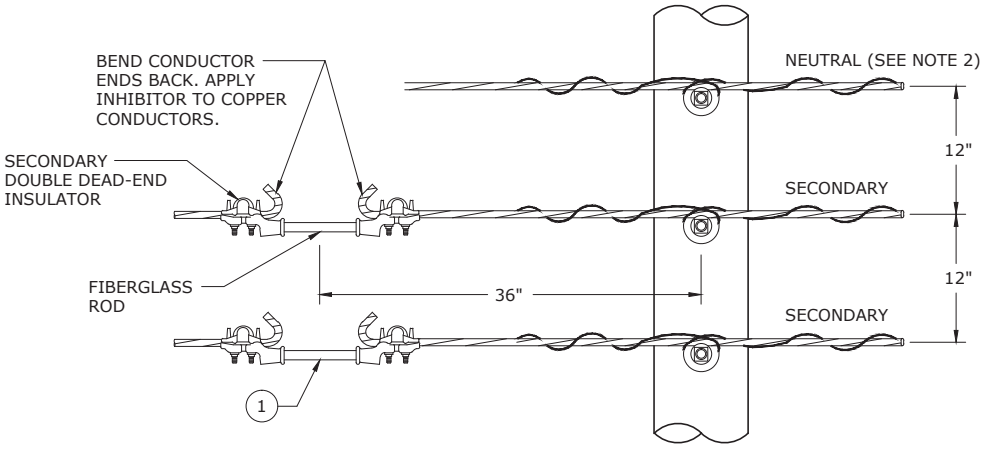
03.02-104B

SECONDARY CABLE DOUBLE DEAD-END



OPEN WIRE DOUBLE DEADEND

FOR WIRE SIZES #4 THROUGH 1/0



NOTES:

1. SEE DWG. 03.02-105B FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY ATTACHMENTS

DEC	DEM	DEP	DEF
X	X		X

03.02-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-SEC-BREAK-AL-F	1	4002517	1	CLAMP, C, 4-1/0 AWG, FIBERGLASS, DEADEND DBL ASSY SECONDARY BREAKER

NOTES:

1. FOR MAINTENANCE ONLY - OPEN WIRE SECONDARY IS A NON-PREFERRED CONSTRUCTION METHOD AND SHOULD NOT BE USED FOR NEW CONSTRUCTION.

2. NEUTRAL IN CENTER POSITION IN SOME DUKE AREAS.

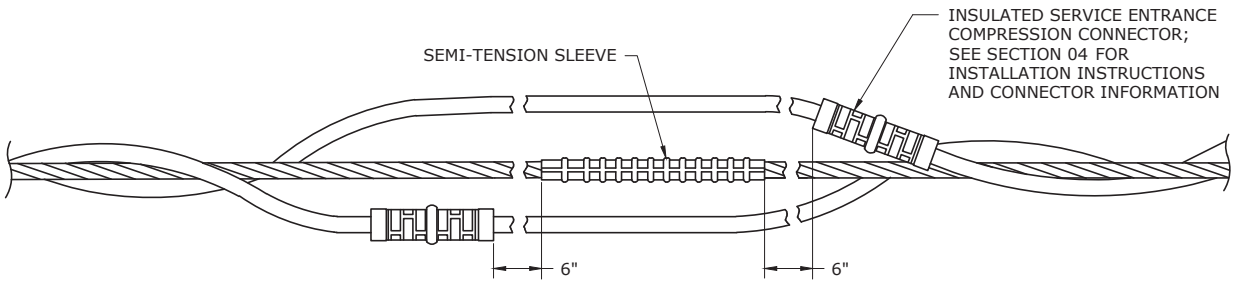
3. SEE DWG. 03.02-105A FOR DESIGN SPECIFICATIONS AND NOTES.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SECONDARY ATTACHMENTS

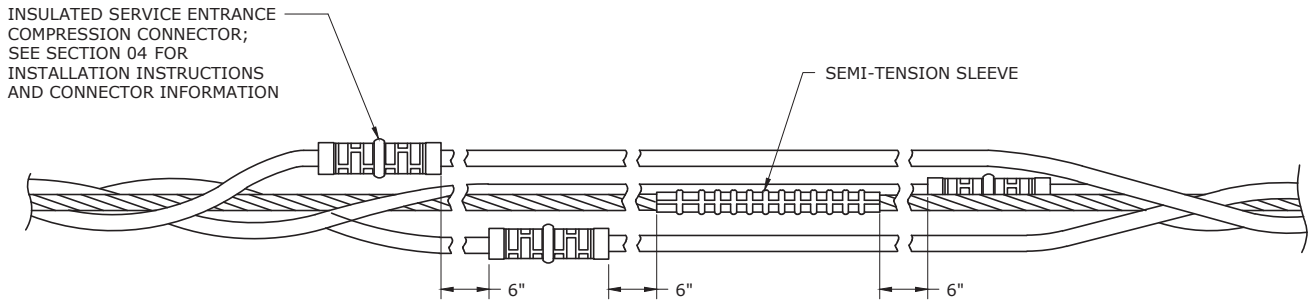
DEC	DEM	DEP	DEF
			X

03.02-105B



TRIPLEX CABLE SPLICE

SEMI-TENSION SLEEVES FOR SERVICE NEUTRALS	
ITEM NUMBER	CONDUCTOR SIZE
291049	#6 ACSR OR ALLOY
937105	#4 ACSR OR ALLOY
50062554	#2 ACSR OR ALLOY
119525	#1/0 ACSR OR ALLOY



QUADRUPLEX CABLE SPLICE

NOTES:

1. WHEN SPLICING NEUTRAL, CUT OFF ENOUGH CONDUCTOR TO ASSURE A LOOSE WRAP OF PHASE CONDUCTORS AT SPLICE.
2. USE "BG" GROOVE OF BURNDY TOOL, OR EQUIVALENT TOOL WITH DIE FOR 5/8" SLEEVES. USE 840 DIE ON 4/0 SLEEVE.
3. CLEAN CONDUCTORS BY WIRE BRUSHING.
4. SEE SECTION 04 FOR DETAILS OF INSULATED COMPRESSION CONNECTOR INSTALLATION.
5. "NEW" TRIPLEX OR QUADRUPLEX SECONDARIES AND SERVICES MAY CONTAIN A MAXIMUM OF ONE SPLICE PER SPAN. "REPAIR" TRIPLEX OR QUADRUPLEX SECONDARIES AND SERVICES MAY CONTAIN A MAXIMUM OF TWO SPLICES PER SPAN.
6. PHASE CONDUCTORS SHALL BE POSITIONED SUCH THAT CONTACT WITH THE NEUTRAL SLEEVE WILL NOT OCCUR.

DUKE ENERGY.

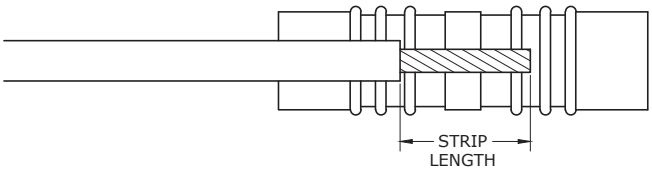
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	10/10/17	LOOSIER	BURLISON	ADCOCK

SECONDARY AND SERVICE CABLE SPLICES

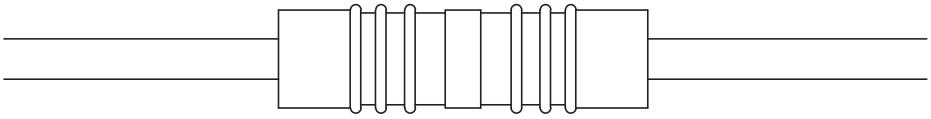
DEC	DEM	DEP	DEF
			X

03.02-107A

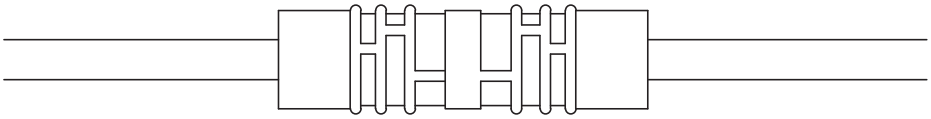
NOTE 1



NOTE 2



NOTE 3



INSULATED COMPRESSION CONNECTOR SIZE TABLE				
ITEM NUMBER	END MARKINGS			
	CONDUCTOR SIZE	END COLOR	CONDUCTOR SIZE	END COLOR
193145	6	BLUE	6	BLUE
193142	4	ORANGE	6	BLUE
193144	4	ORANGE	4	ORANGE
4022805	2	RED	6	BLUE
193140	2	RED	4	ORANGE
193139	2	RED	2	RED
193138	1/0	YELLOW	4	ORANGE
193137	1/0	YELLOW	2	RED
4022806	1/0	YELLOW	1/0	YELLOW
4162289	1/0	YELLOW	2/0	GRAY

NOTES:

1. STRIP INSULATION ON EACH CONDUCTOR FOR LENGTH SHOWN BY ARROWS ON SIDE OF CONNECTOR, CLEAN CONDUCTOR BY WIRE BRUSHING.

2. INSERT CONDUCTORS THROUGH CAPS ON EACH END UNTIL THEY HIT THE CENTER STOP.

3. MAKE THREE COMPRESSIONS ON EACH END. ROTATE TOOL SO THAT CRIMPS DO NOT LINE UP. USE "BG" GROOVE OF BURNDY TOOL, OR EQUIVALENT TOOL WITH DIE FOR 5/8" SLEEVES. REMOVE END CAPS WHEN INSTALLED ON BARE NEUTRAL.

4. INSULATED COMPRESSION CONNECTOR IS TO BE USED FOR NON-TENSION JOINTS ONLY. NO TAPING OR ADDITIONAL INHIBITOR IS REQUIRED.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

INSULATED SERVICE ENTRANCE
COMPRESSION CONNECTORS

DEC	DEM	DEP	DEF
		X	X

03.02-107B

COMPATIBLE UNIT	ITEM NUMBER	DIE	HEIGHT	LENGTH	WIDTH
CONN-COVER-H-SM-F	69391	O	2-1/4	4-1/2	1-5/8
CONN-COVER-H-MD-F	69392	D	2-3/8	5-5/8	1-1/4

NOTES:

1. FAST, POSITIVE MEANS FOR PROTECTING TAP CONNECTIONS. THE COVER MUST COMPLETELY COVER THE INSULATION ON CONDUCTORS, NO BARE CONDUCTORS.
2. PROVIDES A CLOSE FITTING TOP AND BOTTOM SEAL- SECURE DOUBLE LOCKING LATCHES ON BOTH THE HINGE AND LOCKING SIDE OF THE COVER.
3. HIGHLY RELIABLE END ENCLOSURE - THIN STRIPS OF THE "GRASS SKIRT" MOLD AROUND THE CONDUCTORS.
4. TAPERED DRAINS IN BOTH COVER HALVES PREVENT ACCUMULATION OF WATER WITHIN THE COVER, REGARDLESS OF WHICH HALF OF THE COVER IS DOWN.
5. FABRICATED FROM BLACK POLYPROPYLENE, COVERS ARE HIGHLY RESISTANT TO WEATHER, COMMON CONTAMINATING ELEMENTS, AND THE ULTRA-VIOLET RAYS OF THE SUN.

DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

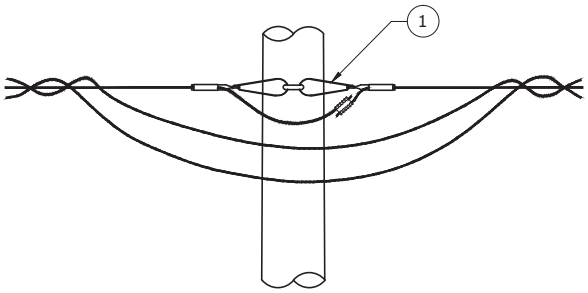
SQUEEZON CONNECTOR COVERS

FOR INSULATED CONDUCTORS

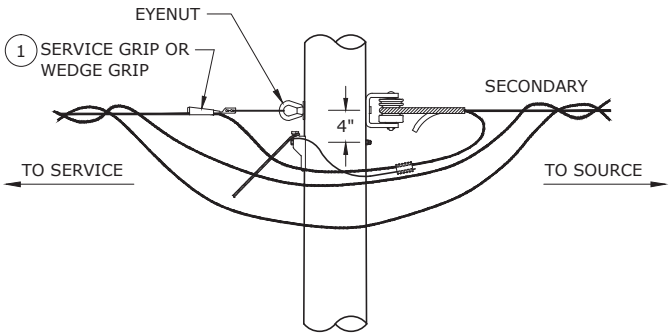
DEC	DEM	DEP	DEF
			X

03.02-107C

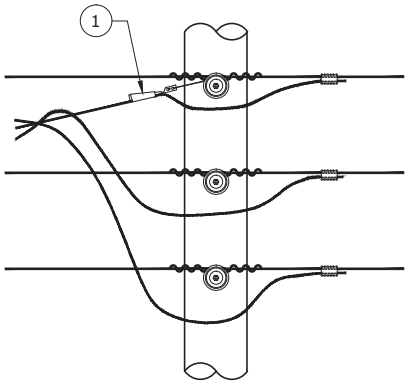
NEW CONSTRUCTION

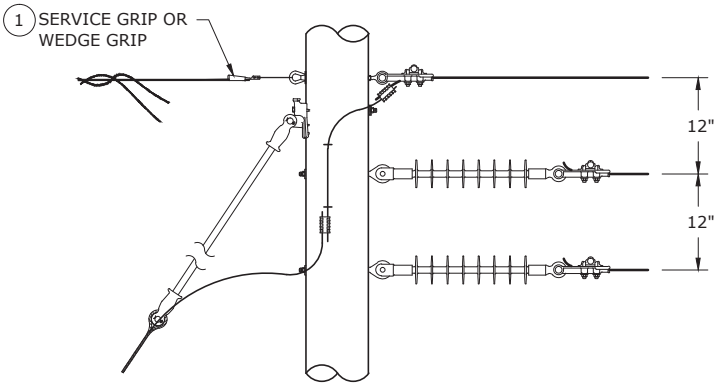


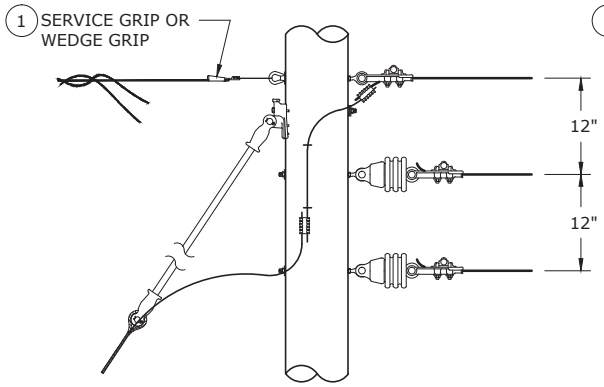
SERVICE LIFT POLE

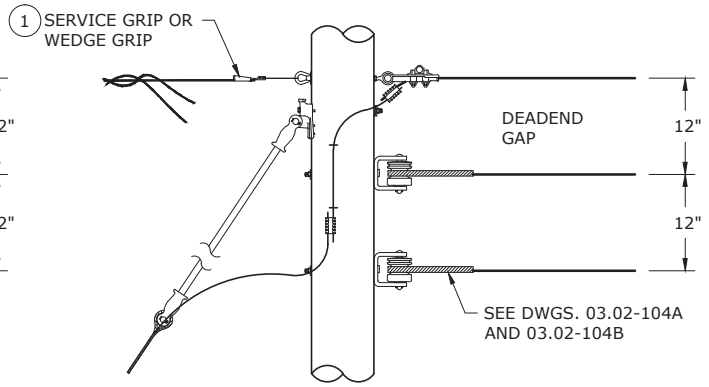


SECONDARY TO SERVICE









NOTES:

1. SEE DWG. 03.02-110B FOR GRIPS AND NOTES.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

SERVICE ATTACHMENTS

DEC	DEM	DEP	DEF
X	X	X	X

03.02-110A

BILL OF MATERIALS - SECONDARY CABLE CLAMPS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DE GRIP-4-AL-F	1	4002482	1	GRIP, DEADEND, DE, #4 ACSR/AAAC/AAC
	TIE-DE GRIP-2-AL-F	1	4161024	1	GRIP, DEADEND, DE, #2 ACSR/AAAC/AAC
	TIE-DE GRIP-1/0-AL-F	1	937840	1	GRIP, DEADEND, DE, #1/0,ACSR/AAAC/AAC
	TIE-DE GRIP-4/0-AL-F	1	83361	1	GRIP, DEADEND, DE, #4/0 ACSR/AAAC/AAC

BILL OF MATERIALS - SECONDARY CABLE CLAMPS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-DE-WDG-SM-F	1	4003495	1	CLAMP, CABLE, 6-2 AWG TRIPLEX ALUM, SERVICE
	CLAMP-DE-WDG-MD-F	1	4022393	1	CLAMP, WEDGE GRIP, 4/0 AWG ACSR, ALUM, SERVICE NEUTRAL

NOTES:

1. FOR MAINTENANCE ONLY - OPEN WIRE SECONDARY IS A NON-PREFERRED CONSTRUCTION METHOD AND SHOULD NOT BE USED FOR NEW CONSTRUCTION.
2. SALVAGED 4" STRAIN INSULATORS (BELLS) ARE ACCEPTABLE OR USE CLEVIS.
3. USE EYE NUT IF SERVICE MUST COME OFF BACK SIDE OF POLE.
4. NEUTRAL IN CENTER POSITION IN SOME DUKE AREAS.
5. SEE DWG. 03.02-110A FOR DESIGN SPECIFICATIONS.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

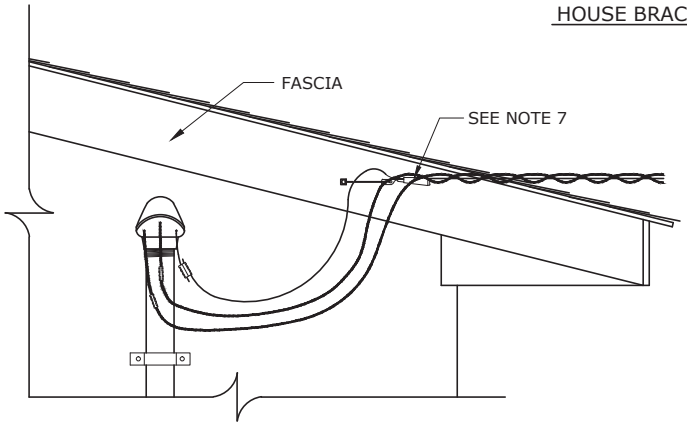
SERVICE ATTACHMENTS

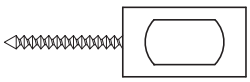
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.02-110B

HOUSE BRACKETS



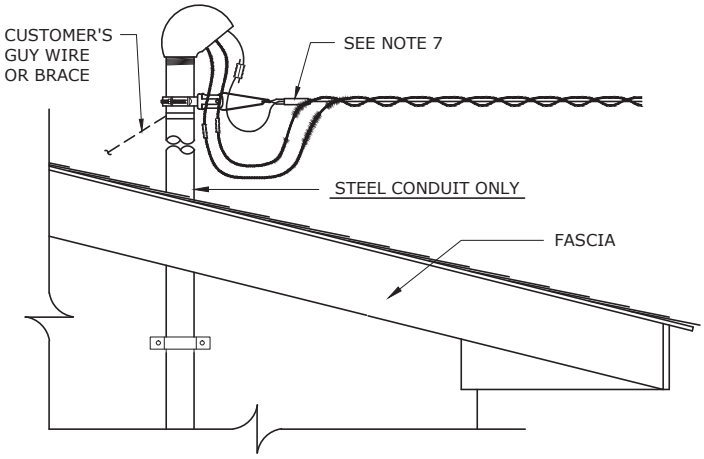


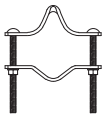
HOUSE BRACKET
CU INSL-HOLDER-SCREW-F
ITEM # 4003500

NOTES:

1. HOUSE BRACKETS MUST BE INSTALLED IN STUDS (2" X 4") OR EQUIVALENT SUPPORT.

SERVICE MAST





MAST BRACKET

1-1/4" - 2-1/2"
CU INSL-HOLDER-PIPE-SM-F
ITEM # 4022392

3" - 4"
CU INSUL-HOLDER-PIPE-LG-F
ITEM # 4003493

NOTES:

1. SERVICE MAST SHALL BE OF ADEQUATE STRENGTH OR BE SUPPORTED BY A GUY OR BRACE TO WITHSTAND A MAXMIUM TENSION FORCE OF 200 LBS. IMPOSED BY SERVICE DROP.
2. 2" RIGID STEEL CONDUIT IS REQUIRED FOR MASTS UP TO 4'. LONGER MAST HEIGHTS REQUIRE GUYING, BRACING, LARGER MAST SIZE OR SPECIAL SAG.

NOTES:

1. DRIP LOOPS SHALL BE FORMED ON SERVICE DROP SERVICE ENTRANCE CONDUCTORS.
2. THE CONNECTIONS OF THE SERVICE DROP CONDUCTORS TO THE SERVICE ENTRANCE CONDUCTORS SHALL BE MADE BELOW THE LEVEL OF THE SERVICE WEATHERHEAD.
3. SEE DWGS. 10.02-01 AND 10.02-03 FOR SERVICE GROUND CLEARANCES AND DWGS. 10.04-09A AND 10.04-09B FOR SERVICE CLEARANCES AT BUILDINGS.
4. SERVICE ENTRANCE CONNECTORS SHALL BE COVERED PER NEC RULE 230-22.
5. THE SERVICE POINT OF ATTACHMENT SHOULD BE LOCATED BELOW THE LEVEL OF THE WEATHERHEAD OR GOOSENECK. IF THIS IS IMPRACTICAL, THE POINT OF ATTACHMENT MUST BE LOCATED WITHIN 24" OF THE WEATHERHEAD OR GOOSENECK (REF. NEC 230-54C).
6. CUSTOMER IS RESPONSIBLE FOR PROVIDING AN ATTACHMENT POINT FOR MASONRY AND STEEL BUILDINGS.
7. SEE DWG. 03.02-110B FOR SERVICE CLAMP COMPATIBLE UNITS.

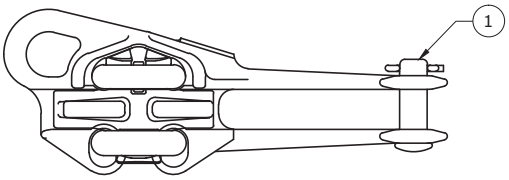
DUKE ENERGY.

3					
2					
1					
0	11/13/17	LOOSIER	BURLISON	ADCOCK	
REVISED		BY	CHK'D	APPR.	

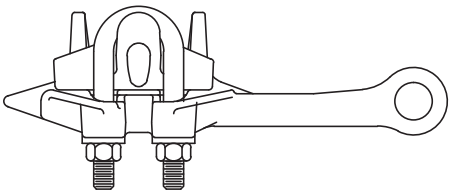
SERVICE ATTACHMENT METHODS

DEC	DEM	DEP	DEF
			X

03.02-112

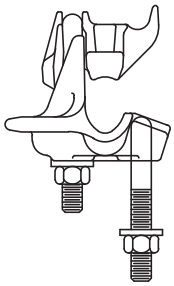


CONDUCTOR RANGE (0.680-1.160)
556.5AAC, 556.5ACSR (18/1)
795AAC, 795ACSR

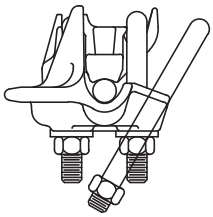


NOTES:

1. FOR USE ON 556.5 AND 795 CONDUCTORS.
2. TORQUE TO 45 FT. LBS.

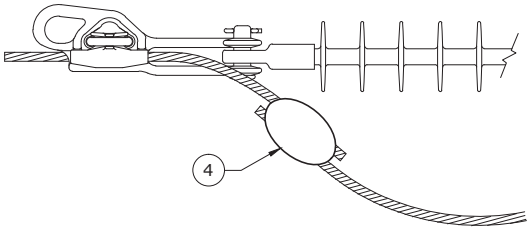


OPEN POSITION



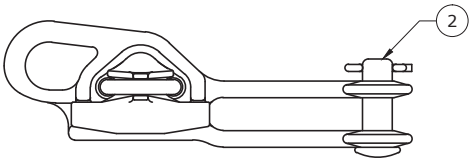
CLOSED POSITION

PREFERRED LOCATION FOR JUMPER CONNECTIONS

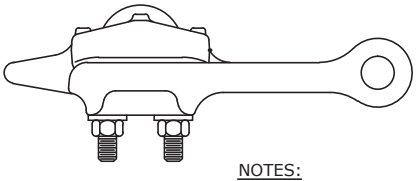


CONNECT JUMPER TO TAIL OF PRIMARY ON BACK SIDE OF DEADEND CLAMP

SEE SECTION 04 FOR CONNECTOR DETAILS.

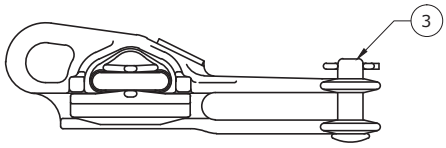


CONDUCTOR RANGE (0.410-0.880)
336.4AAC, 336.4ACSR (30/7)
477AAC, 477ACSR (26/7)

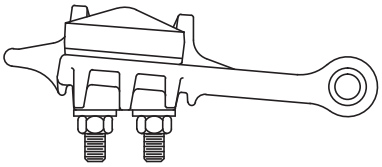


NOTES:

1. FOR USE ON 336 AND 477 CONDUCTORS.
2. TORQUE TO 45 FT. LBS.



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



NOTES:

1. FOR USE ON CONDUCTORS #6 TO 4/0.
2. CLAMP IS TIN PLATED.
3. TORQUE TO 45 FT. LBS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

PRIMARY AND NEUTRAL DEAD END ASSEMBLIES

DEC	DEM	DEP	DEF
X	X	X	X

03.03-110A

BILL OF MATERIALS - SECONDARY CABLE CLAMPS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-DE-LG-F	1	4002479	1	CLAMP, DEADEND, 0.68"- 1.16" DIA, ALUM, (18/1) 556.5-795 AAC/ACSR CONDUCTOR
2	CLAMP-DE-MD-F	1	4022409	1	CLAMP, DEADEND, 0.41" - 0.88" DIA, ALUM, (30/7) 336.8 KCMIL - (26/7) 477 KCMIL AAC/ACS
3	CLAMP-DE-SM-F	1	4002478	1	CLAMP, DEADEND, 0.16"-0.57", 6-4/0 TO 4-4/0 AWG SOL AL COND
4	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS

DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

PRIMARY AND NEUTRAL

DEAD END ASSEMBLIES

DEC	DEM	DEP	DEF
			X

03.03-110B

SINGLE U-BOLT CLAMPS: THE NUTS ON THE U-BOLT SHALL BE TIGHTENED EVENLY TO THE RECOMMENDED TORQUE LISTED IN TABLE 1 BELOW.

TWIN PARALLEL U-BOLTS: THE NUTS ON EACH U-BOLT SHALL BE TIGHTENED EVENLY TO THE RECOMMENDED TORQUE LISTED BELOW IN TABLE 1, MOVING IN AN "X" PATTERN AS SHOWN IN FIGURE 1. NOTE THAT BOTH U-BOLTS MUST BE TORQUED TO THE RECOMMENDED RATING IN ORDER TO PROPERLY SECURE THE CONDUCTOR.

HAND TOOLS, TORQUE WRENCHES, SPEEDY WRENCHES OR BATTERY POWERED IMPACT WRENCHES SHALL BE THE TOOLS USED TO TIGHTEN NUTS ON ALL DEADEND CLAMPS.

HYDRAULIC IMPACT WRENCHES SHALL NOT BE USED BECAUSE OF THEIR EXCESSIVE POWER.

TABLE 1 - TORQUE RATINGS		
U-BOLT DIAMETER	TORQUE RATING	MAXIMUM TORQUE
1/2"	45 FOOT-LBS	60 FOOT-LBS

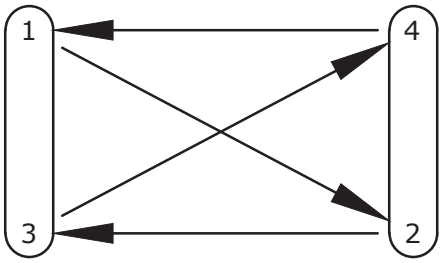


FIGURE 1 - U-BOLT TORQUE PATTERNS

EXCESSIVE TORQUE CAN RESULT IN DAMAGE TO THE CONDUCTOR OR CLAMP, RESULTING IN SHORTENED SERVICE LIFE OR FAILURE.

EXCESSIVE TORQUE RESULTS IN CUPPED FLAT WASHERS AND SPLAYED U-BOLTS.

THE PRACTICE OF TORQUING ONE NUT ALL THE WAY UP BEFORE RUNNING THE OTHER NUT UP DEFORMS THE U-BOLT AND PUTS STRESS ON THE CLAMP BODY. WHEN ATTEMPTING TO TORQUE THE OTHER NUT, FAILURE OFTEN OCCURS. IF FAILURE DOES NOT OCCUR, THE WEDGE HOLDING THE CONDUCTOR IS NOT PROPERLY SEATED RESULTING IN CONDUCTOR PULL OUT.

RUNNING UP BOTH NUTS ON THE U-BOLT EQUALLY KEEPS THE U-BOLT CENTERED ELIMINATING STRESS ON THE CLAMP BODY RESULTING IN THE PROPER PRESSURE ON THE CONDUCTOR.

DUKE ENERGY.

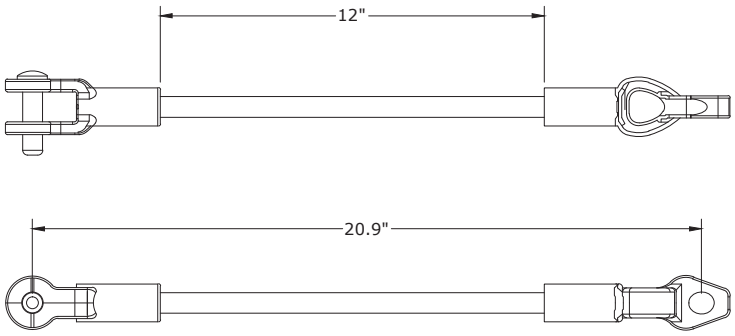
REVISED		BY	CK'D	APPR.
3				
2				
1	9/30/16	WHITE	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DEAD END CLAMP

U-BOLT TORQUE INSTRUCTIONS

DEC	DEM	DEP	DEF
X	X	X	X

03.03-112



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-EXT-LINK-F	1	50126703	1	LINK,EXTENSION, CLEVIS-EYE, 20-5/8" CENTER TO CENTER LG, 15000 LB, FIBERGLASS, GUY STRAIN, 11/16" EYE X 5/8"

NOTES:

1. A FIBERGLASS EXTENSION LINK MAY ONLY BE USED IN EXTREME SITUATIONS, WHERE THE CLEARANCE REQUIRED EXCEEDS THE LENGTH OF THE 35 KV SUSPENSION INSULATOR (22”), FOR APPLICATIONS WHERE A PRIMARY CONDUCTOR IS DEADENDING TO THE POLE.

2. EXAMPLES INCLUDE:

   A. REAR PROPERTY CONSTRUCTION ON EQUIPMENT POLES WHERE RIGGING EQUIPMENT IS USED.
   B. INSTALLATIONS THAT ARE NOT BUCKET TRUCK ACCESSIBLE WHERE CLIMBING IS REQUIRED.

DUKE ENERGY.

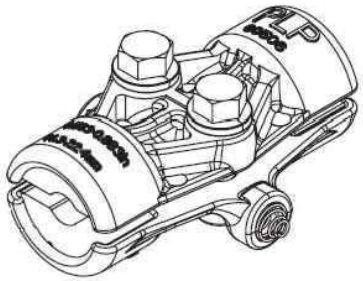
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

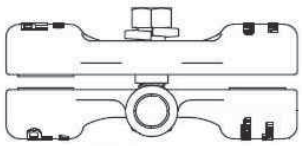
FIBERGLASS EXTENSION LINK

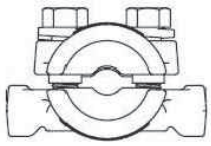
DEC	DEM	DEP	DEF
			X

03.03-130

CUSHION GRIP TRUNNION CLAMP



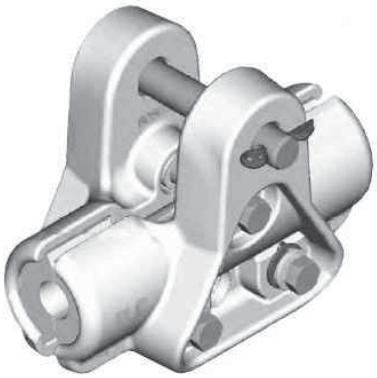


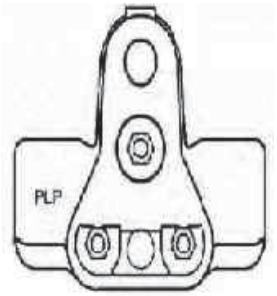


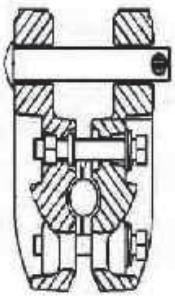
BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-SM-F	1	4179337	1	CLAMP, GRIP, CUSHION, TRUNNION, #2-4/0
1	CLAMP-TR-CUSHGRP-MD-F	1	4179335	1	CLAMP, GRIP, CUSHION, TRUNNION, 266-477
1	CLAMP-TR-CUSHGRP-LG-F	1	4002524	1	CLAMP, GRIP, CUSHION, TRUNNION, 556-954

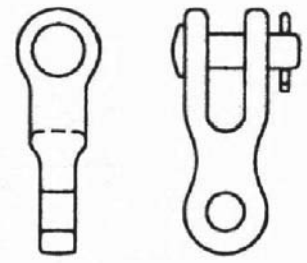
TIGHTEN ALL BOLTS WITH A RACHET WRENCH TO THE VALUES BELOW	
CLAMP RANGE (INCHES)	BOLT TORQUE
#2-4/0	25 FT-LBS
266-477	40 FT-LBS
556-954	40 FT-LBS

CUSHION GRIP SUSPENSION CLAMP









BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	CLAMP-SUS-CUSHGRP-SM-F	1	4198067	1	CLAMP, GRIP, CUSHION, SUSP, #2-4/0
			4002536	1	CLEVIS, CLEVIS-EYE, 90 DEG
1	CLAMP-SUS-CUSHGRP-MD-F	1	4198030	1	CLAMP, GRIP, CUSHION, SUSP, 266-477
			4002536	1	CLEVIS, CLEVIS-EYE, 90 DEG
1	CLAMP-SUS-CUSHGRP-LG-F	1	4181715	1	CLAMP, GRIP, CUSHION, SUSP, 556-954
			4002536	1	CLEVIS, CLEVIS-EYE, 90 DEG

TIGHTEN ALL THREE BOLTS WITH A RACHET WRENCH TO THE VALUES BELOW	
CLAMP RANGE (INCHES)	BOLT TORQUE
#2-4/0	15 FT-LBS
266-477	25 FT-LBS
556-954	40 FT-LBS

NOTES:

1. CUSHION GRIPS DO NOT REQUIRE ARMOR RODS.
2. ANGLES ARE LIMITED TO 30 DEGREES WITH CUSHION GRIPS. FOR ANGLES LARGER THAN 30 DEGREES, DOUBLE DEAD END CONDUCTORS AND USE JUMPERS.
3. CUSHION GRIPS ARE FOR USE WITH ALUMINUM CONDUCTORS ONLY.
4. 90 DEGREE CLEVIS EYE IS REQUIRED FOR USE WITH CUSHION GRIPS ON POLYMER SUSPENSION.

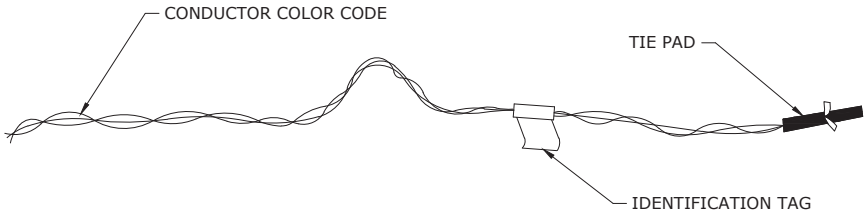
DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

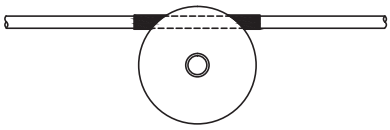
CUSHION GRIPS

DEC	DEM	DEP	DEF
			X

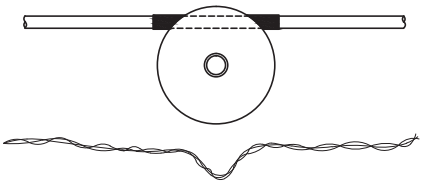
03.03-134



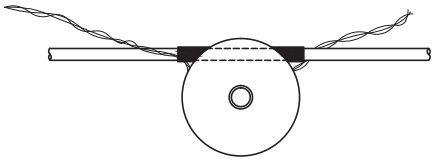
EZ-WRAP SPOOL TIE AS RECEIVED IN THE FIELD
HORIZONTAL POSITION INSTALLATION



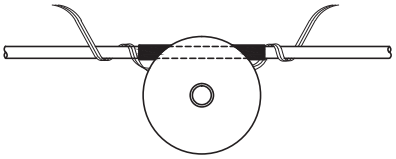
STEP 1: APPLY TIE PAD ON THE CONDUCTOR AND POSITION IT BETWEEN THE CONDUCTOR AND INSULATOR, MAKING SURE THE SLIT DOES NOT FACE THE INSULATOR.



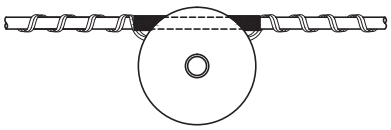
STEP 2: POSITION THE TIE LOOP UNDER THE INSULATOR SO THE LEGS ARE PARALLEL TO THE CONDUCTOR AS SHOWN.



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

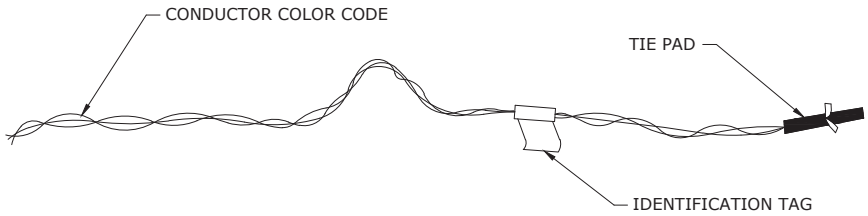
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

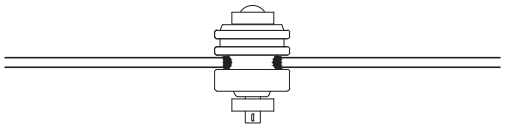
EZ-WRAP SPOOL TIE

DEC	DEM	DEP	DEF
X	X	X	X

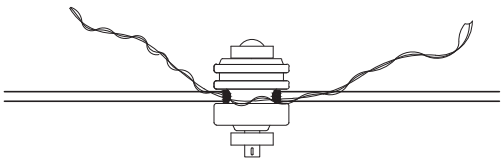
03.04-102A



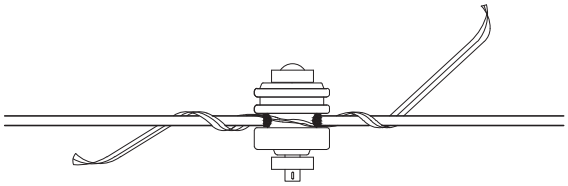
EZ-WRAP SPOOL TIE AS RECEIVED IN THE FIELD
VERTICAL POSITION INSTALLATION



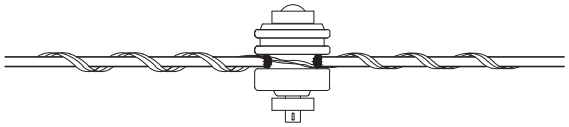
STEP 1: IN MOST CASES THE CONDUCTOR SHOULD BE PLACED BETWEEN THE INSULATOR AND THE STRUCTURE SO IT IS INSIDE THE CLEVIS, AS SHOWN. APPLY THE TIE PAD ON THE CONDUCTOR AND POSITION IT BETWEEN THE CONDUCTOR AND INSULATOR, MAKING SURE THE SLIT DOES NOT FACE THE INSULATOR.



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.

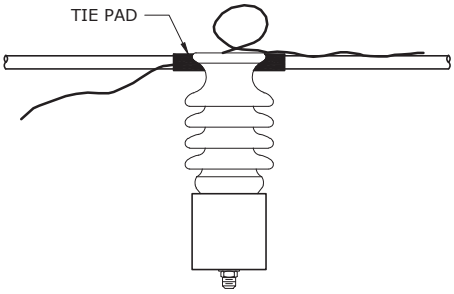
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

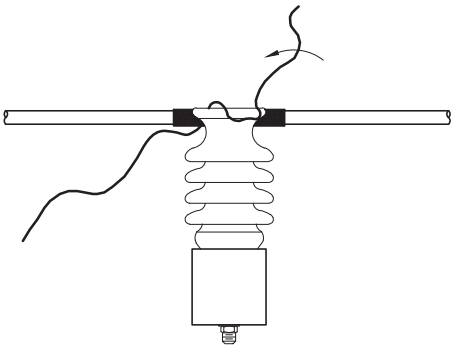
EZ-WRAP SPOOL TIE

DEC	DEM	DEP	DEF
X	X	X	X

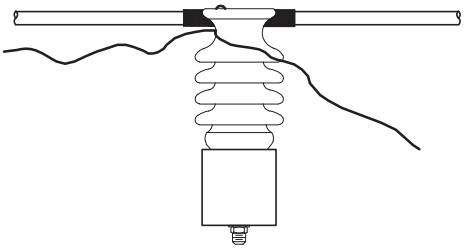
03.04-102B



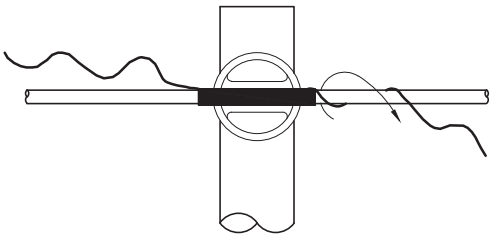
1. POSITION DISTRIBUTION TIE ON INSULATOR AS SHOWN, WITH BOTH LEGS PARALLEL TO THE CONDUCTOR.



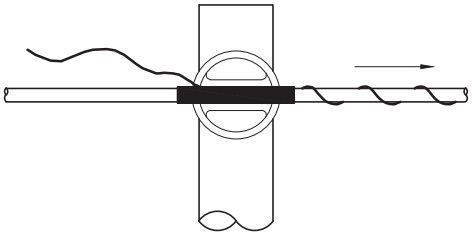
2. ROTATE THE DISTRIBUTION TIE IN A COUNTER-CLOCKWISE DIRECTION, MAKING CERTAIN THAT BOTH LEGS GO UNDER THE CONDUCTOR AS SHOWN.



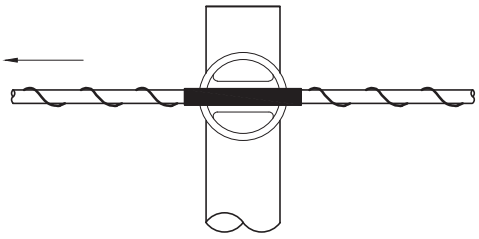
3. CONTINUE TO ROTATE THE LEGS AND THE DISTRIBUTION TIE WILL SEAT ITSELF AS SHOWN.



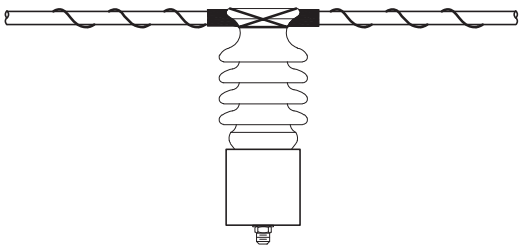
4. START TO WRAP ON ONE LEG OF THE DISTRIBUTION TIE AS SHOWN.



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.

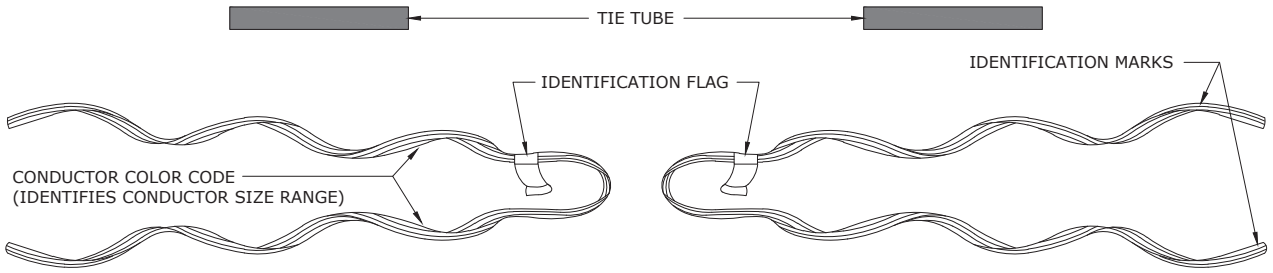
3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SINGLE TOP TIE

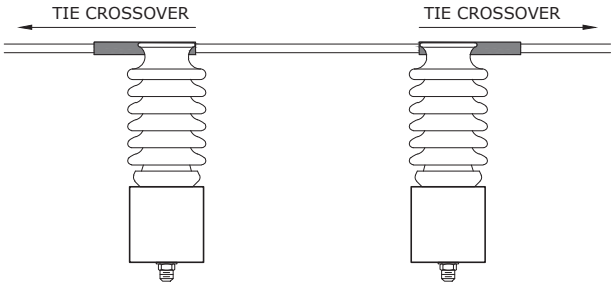
DEC	DEM	DEP	DEF
X	X	X	X

03.04-102C

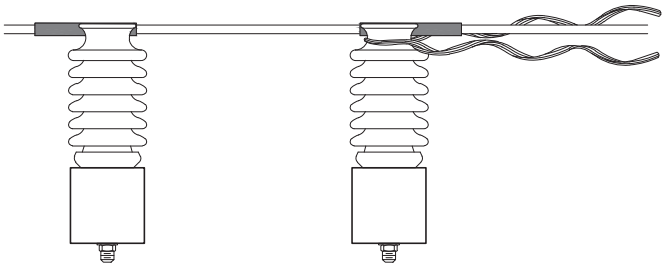
HAND APPLICATION



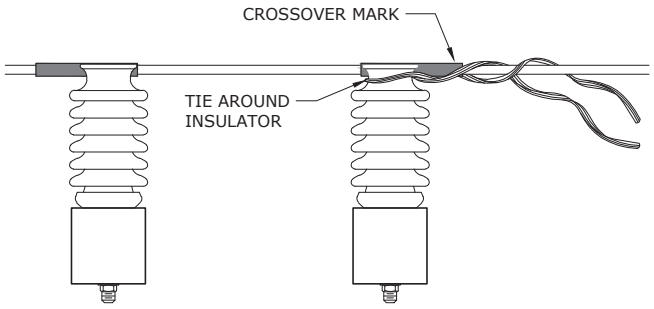
PREFORMED TIES AND TIE TUBES



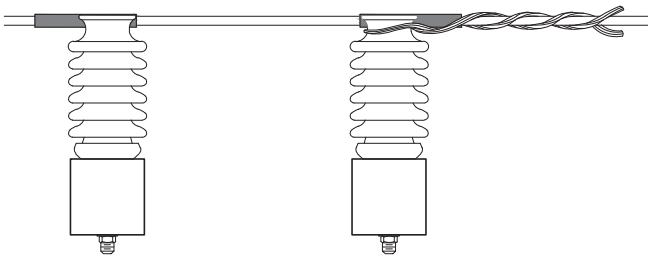
STEP 1: APPLY THE TIE TUBE TO THE CONDUCTOR, SLIT FACING AWAY FROM THE INSULATOR, SO THAT THE INSULATOR DOESN'T HAVE DIRECT CONTACT WITH THE CONDUCTOR. MAKE SURE THAT THE TIE TUBE EXTENDS OUT TOWARDS THE CROSSOVER OF THE TIE.



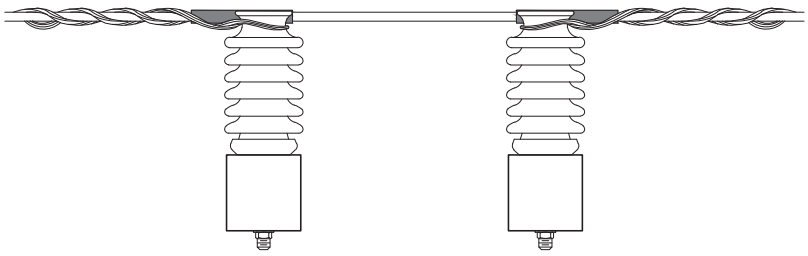
STEP 2: PLACE THE FIRST HALF OF THE DOUBLE-SUPPORT TIE AROUND THE HEAD OF THE FIRST INSULATOR WITH THE LEGS EXTENDING AWAY FROM THE SECOND INSULATOR.



STEP 3: MAKE SURE THAT THE TIE IS TIGHT AROUND THE INSULATOR NECK AND BEGIN WRAPPING THE LEGS ONTO THE CONDUCTOR AT THE CROSSOVER MARK, CAPTURING THE TIE TUBE. WRAP AROUND THE CONDUCTOR FOLLOWING THE CONDUCTOR LAY DIRECTION.



STEP 3: CONTINUE TO WRAP THE LEGS ONTO THE CONDUCTOR. SNAP THE LEG ENDS INTO PLACE WITH A SLIGHT THUMB PRESSURE.



STEP 5: USING THESE SAME INSTRUCTIONS, INSTALL THE SECOND HALF OF THE DOUBLE-SUPPORT TIE ONTO THE SECOND INSULATOR. NOTE THAT THE TWO TIE HALVES ARE IDENTICAL.

DUKE ENERGY.

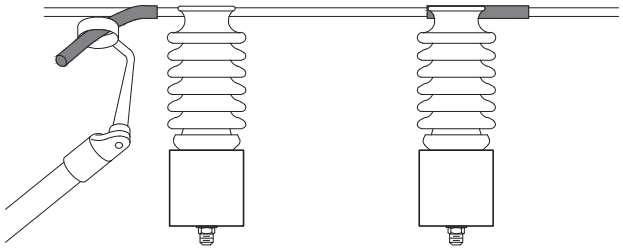
3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DOUBLE TOP TIE

DEC	DEM	DEP	DEF
X	X	X	X

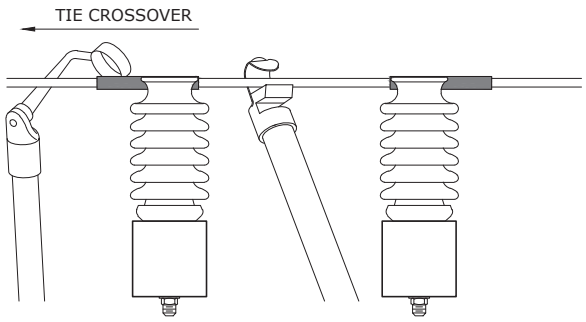
03.04-102D

HOT STICK APPLICATION

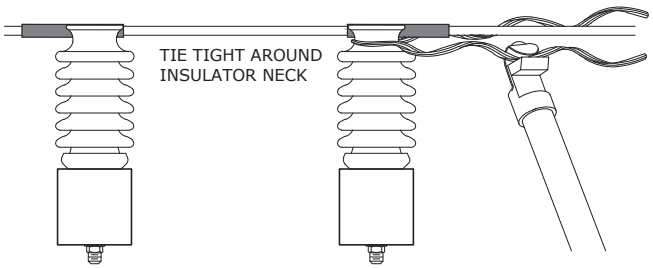


STEP 1: APPLY THE TIE TUBE ONTO THE CONDUCTOR USING THE APPLICATOR RING TOOL OR OTHER HOT STICK TOOL. THE SLIT SHOULD BE FACING UP SO THAT THE CONDUCTOR DOES NOT COME INTO DIRECT CONTACT WITH THE INSULATOR.

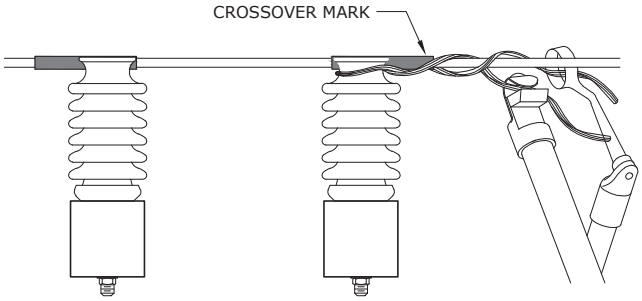
TIP: FLEX TUBE BEFORE INSTALLATION.



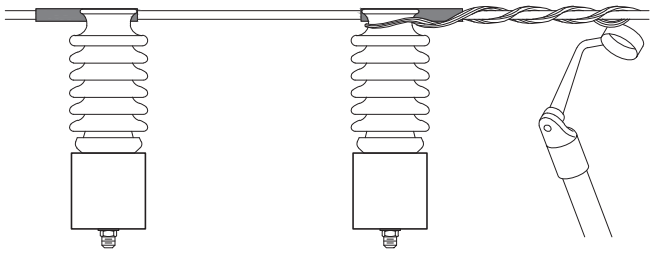
STEP 2: AFTER APPLYING THE TIE TUBE TO THE CONDUCTOR, USE THE APPLICATOR RING TOOL OR OTHER HOT STICK TOOL TO SLIDE THE TUBE OVER THE INSULATOR GROOVE. IT MAY BE NECESSARY TO USE A 2ND HOT STICK TO LIFT THE CONDUCTOR SLIGHTLY TO SLIDE THE TUBE INTO PLACE. THE TUBE SHOULD EXTEND OUT AWAY FROM THE INSULATOR TOWARD THE TIE CROSSOVER MARK.



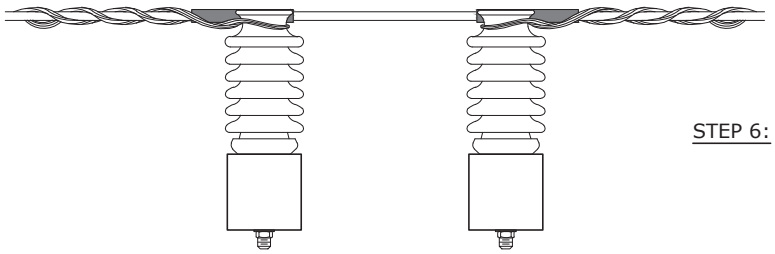
STEP 3: GRASP ONE LEG OF THE FIRST HALF OF THE DOUBLE-SUPPORT TIE WITH THE JUMPER HOLDING STICK AND POSITION AROUND THE HEAD OF THE FIRST INSULATOR WITH LEGS EXTENDING AWAY FROM THE SECOND INSULATOR.
NOTE: MAKE SURE THAT THE TIE LOOP IS TIGHT ON THE INSULATOR NECK.



STEP 4: BEGIN WRAPPING THE LEGS AT THE CROSSOVER MARK, CAPTURING THE TIE TUBE IN THE FIRST WRAP.



STEP 5: CONTINUE WRAPPING THE LEGS AROUND THE CONDUCTOR. MAKE SURE TO SNAP THE LEG ENDS INTO PLACE WITH THE APPLICATOR RING TOOL OR OTHER HOT STICK TOOL, AS SHOWN BELOW.



STEP 6: FOLLOW THESE SAME INSTRUCTIONS FOR THE SECOND HALF OF THE TIE. NOTE THAT THE TWO TIE HALVES ARE IDENTICAL. MAKE SURE THAT THE TIE LOOP IS TIGHT ON THE INSULATOR NECK.

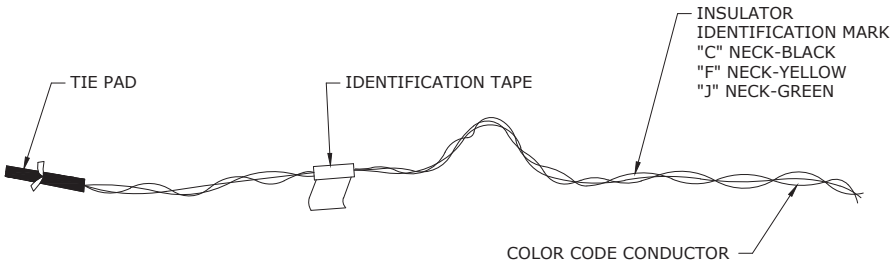
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

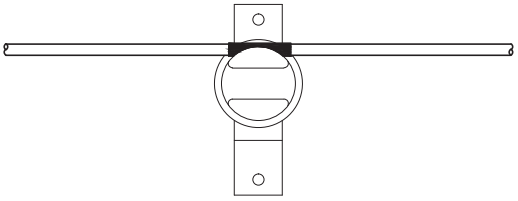
DOUBLE TOP TIE

DEC	DEM	DEP	DEF
X	X	X	X

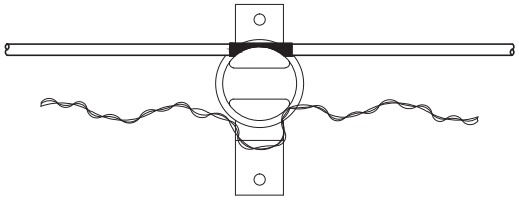
03.04-102E



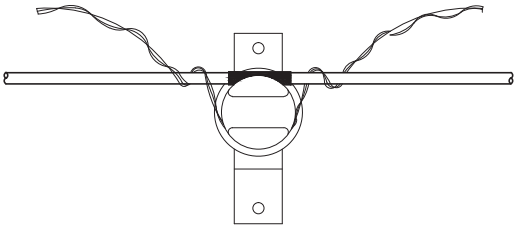
EZ-WRAP SIDE TIE AS RECEIVED IN THE FIELD



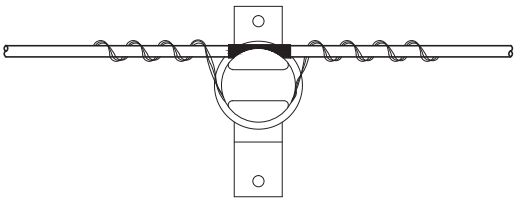
STEP 1: APPLY TIE PAD ON TO CONDUCTOR, SLIT FACING UP SO THAT CONDUCTOR DOES NOT COME INTO DIRECT CONTACT WITH THE INSULATOR.



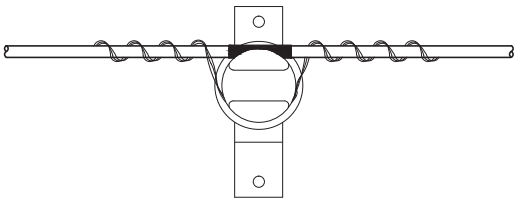
STEP 2: ALIGN THE EZ-WRAP SIDE TIE WITH THE CONDUCTOR. MAKE SURE THE TIE LOOP OF THE EZ-WRAP SIDE TIE IS FACING AWAY FROM THE CONDUCTOR AS SHOWN.



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

DUKE ENERGY.

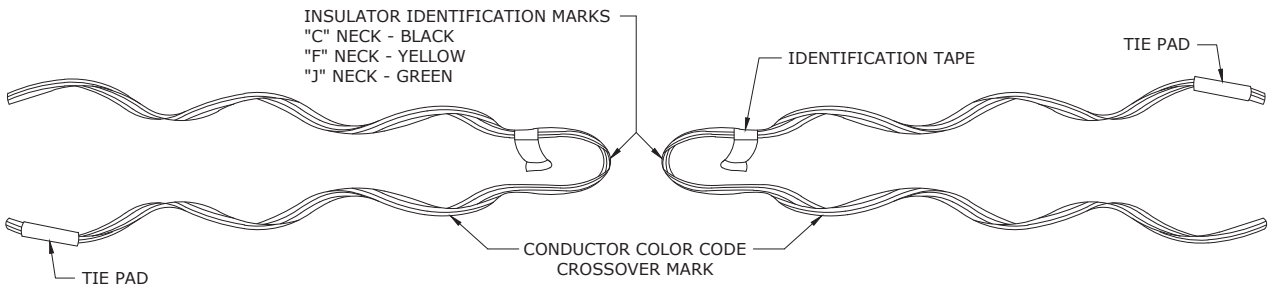
3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SINGLE SIDE TIE (EZ-WRAP)

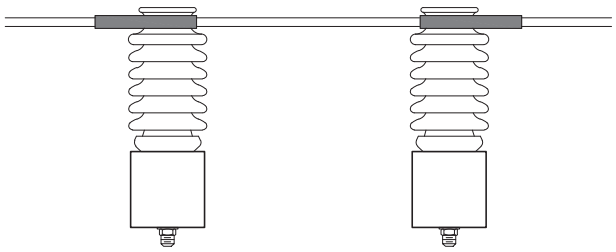
DEC	DEM	DEP	DEF
X	X	X	X

03.04-102F

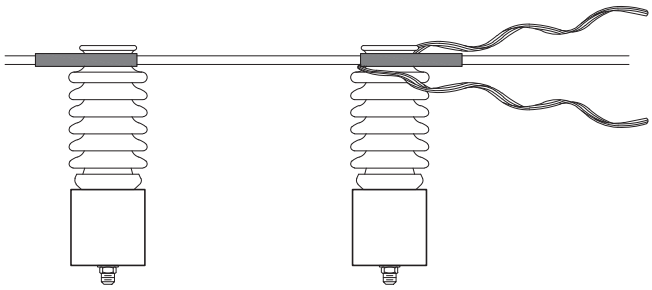
HAND APPLICATION



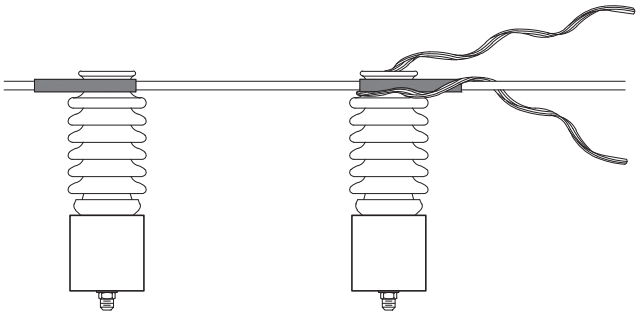
DOUBLE SIDE TIE



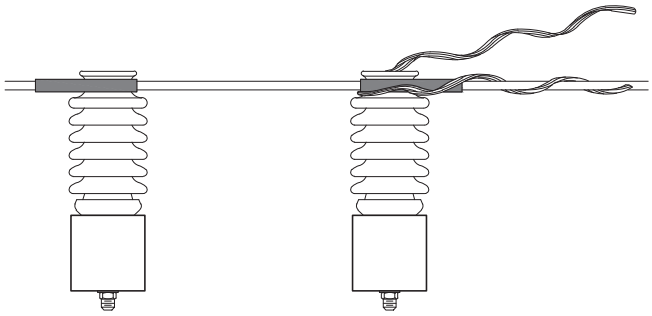
STEP 1: APPLY TIE PADS TO CONDUCTOR, SLIT FACING OUT, SO THE CONDUCTOR DOES NOT COME INTO DIRECT CONTACT WITH THE INSULATOR.



STEP 2: PULL THE TIE SNUGLY AGAINST THE INSULATOR NECK SO THAT IT WILL BE PROPERLY SEATED. THIS MUST BE DONE TO ENSURE PROPER INSTALLATION.



STEP 3: WRAP THE FIRST LEG AROUND THE TIE PAD.



STEP 4: CONTINUE WRAPPING THE LEG OF THE TIE AROUND THE CONDUCTOR AND THEN SNAP THE LEG INTO PLACE WITH SLIGHT THUMB PRESSURE.

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

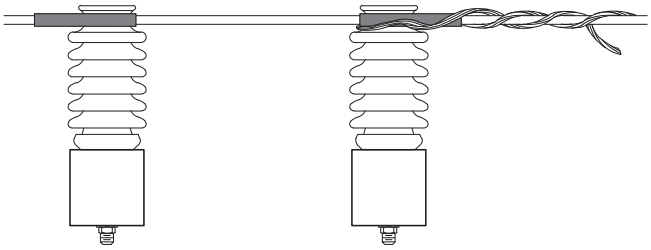
DUKE ENERGY.

DOUBLE SIDE TIE

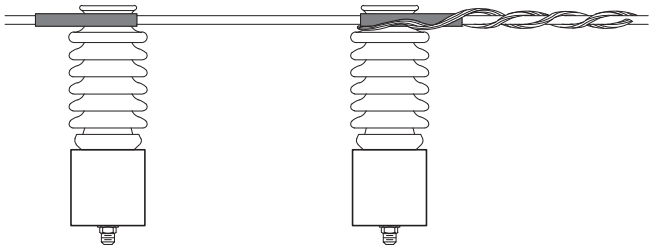
DEC	DEM	DEP	DEF
X	X	X	X

03.04-102G

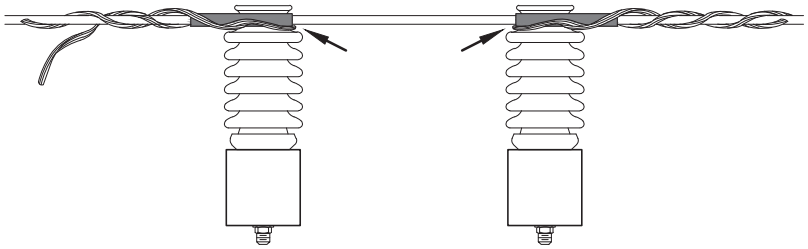
HAND APPLICATION



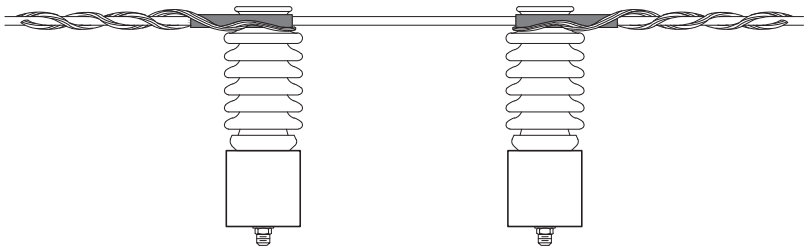
STEP 5: PULL THE SECOND LEG AROUND THE INSULATOR AND WRAP AROUND THE CONDUCTOR NEAR THE CROSSOVER MARK.



STEP 6: MAKE SURE TO SNAP THE END OF THE LEG INTO PLACE WITH SLIGHT THUMB PRESSURE. **MAKE SURE TIE LOOP IS TIGHT ON INSULATOR NECK AND UNDER INSULATOR HEAD.**



STEP 7: FOLLOW THESE SAME INSTRUCTIONS FOR THE OTHER INSULATOR. **MAKE SURE TIE LOOP IS TIGHT ON INSULATOR NECK AND UNDER INSULATOR HEAD.** NOTICE THE APPLICATION OF THE TIES AS THEY LEAVE THE INSULATOR NECKS AND WRAP AROUND THE PADS (SEE ARROWS). ONE WILL ALWAYS START UNDER THE PAD, AND THE OTHER WILL ALWAYS START OVER THE PAD.



STEP 8: COMPLETED APPLICATION OF PERFORMED™ DOUBLE SIDE TIE.

DUKE ENERGY.

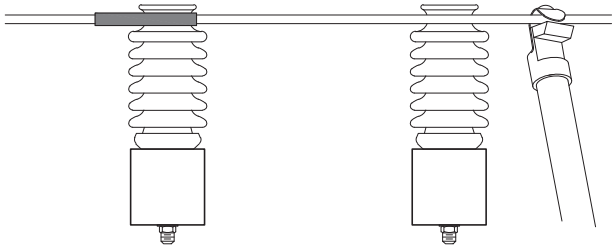
3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DOUBLE SIDE TIE

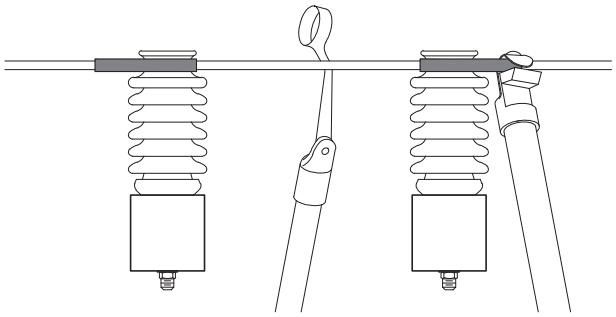
DEC	DEM	DEP	DEF
X	X	X	X

03.04-102H

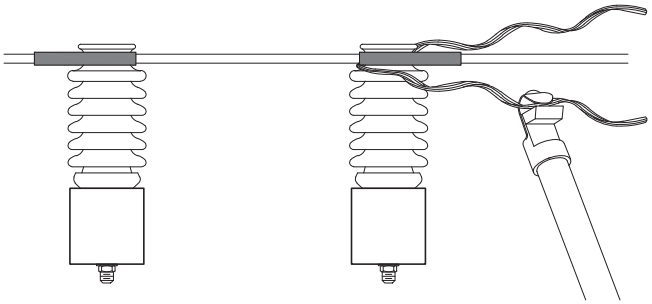
HOT STICK APPLICATION



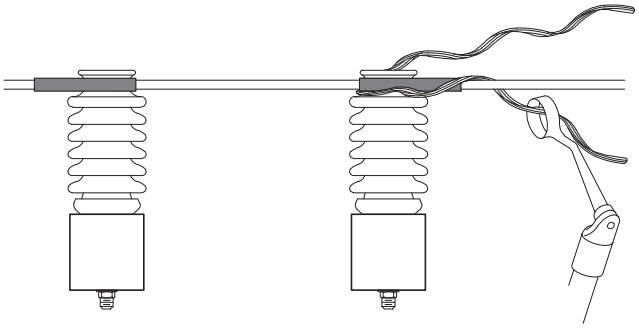
STEP 1: ONE METHOD OF SECURING THE DOUBLE SIDE TIE PADS ONTO THE CONDUCTOR PRIOR TO APPLYING DOUBLE SIDE TIE: APPLY THE TIE PAD TO CONDUCTOR, SLIT FACING OUT, SO THE CONDUCTOR DOES NOT COME INTO DIRECT CONTACT WITH THE INSULATOR.



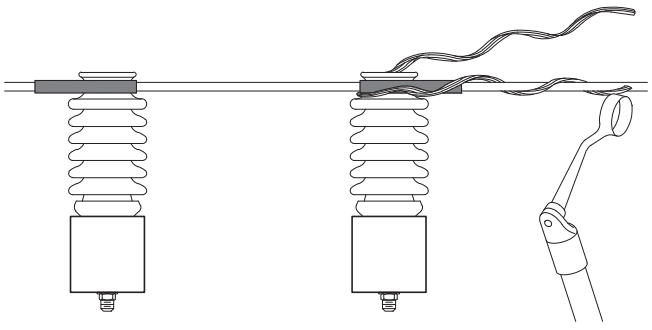
STEP 2: AFTER APPLYING THE PAD WITH A HOT STICK, SLIDE THE PAD OVER UNTIL IT RESTS IN THE INSULATOR GROOVE AS DESCRIBED IN STEP 1. YOU MAY NEED TO LIFT THE CONDUCTOR WITH THE AID OF ANOTHER HOT STICK. MAKE SURE THE SLIT IN THE TIE PAD FACES AWAY FROM THE INSULATOR GROOVE.



STEP 3: GRASP ONE LEG OF THE DOUBLE SIDE TIE WITH THE HOT STICK AND PULL THE TIE DOWN AROUND THE NECK OF THE INSULATOR. BE SURE THE TIE IS SNUG AGAINST THE INSULATOR NECK SO THAT IT WILL BE PROPERLY SEATED. THIS MUST BE DONE TO ENSURE PROPER INSTALLATION.



STEP 4: START TO WRAP THE LEG OF THE TIE AROUND AND OVER THE TOP OF THE TIE PAD AS SHOWN.



STEP 5: USING THE APPLICATOR RING TOOL, LIFT THE TIE UP AND OVER THE CONDUCTOR AND WRAP PLACE. MAKE SURE TO SNAP THE LEG INTO PLACE.

DUKE ENERGY.

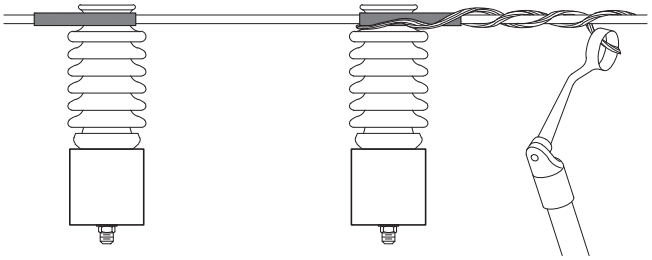
3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DOUBLE SIDE TIE

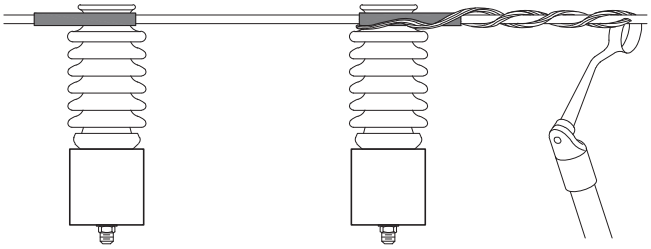
DEC	DEM	DEP	DEF
X	X	X	X

03.04-102I

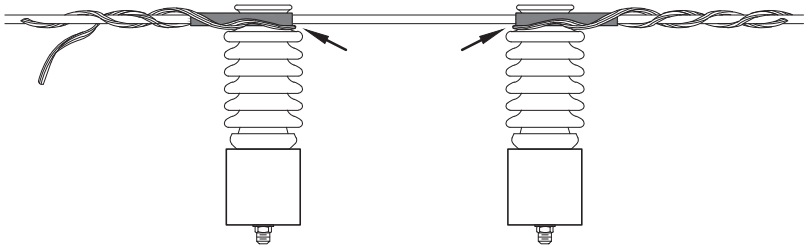
HOT STICK APPLICATION



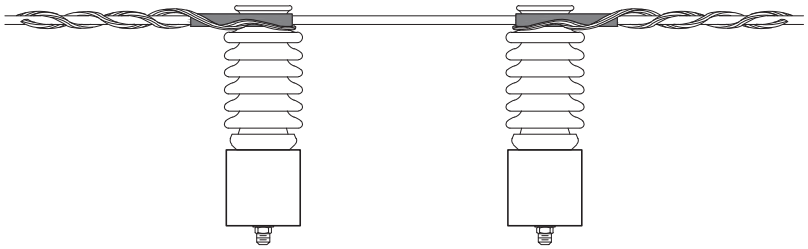
STEP 6: POSITION THE APPLICATOR RING TOOL ON THE REMAINING LEG. PULL THIS LEG AROUND THE INSULATOR AND WRAP THE LEG AROUND THE CONDUCTOR NEAR THE CROSSOVER MARK.



STEP 7: CONTINUE WRAPPING THE LEGS AROUND THE CONDUCTOR. **MAKE SURE TIE LOOP IS TIGHT ON INSULATOR NECK AND UNDER INSULATOR HEAD.** MAKE SURE TO SNAP THE END OF THE LEG INTO PLACE WITH THE APPLICATOR RING TOOL AS SHOWN.



STEP 7: FOLLOW THESE SAME INSTRUCTIONS FOR THE OTHER INSULATOR. **MAKE SURE TIE LOOP IS TIGHT ON INSULATOR NECK AND UNDER INSULATOR HEAD.** NOTICE THE APPLICATION OF THE TIES AS THEY LEAVE THE INSULATOR NECKS AND WRAP AROUND THE PADS (SEE ARROWS). ONE WILL ALWAYS START UNDER THE PAD, AND THE OTHER WILL ALWAYS START OVER THE PAD.



STEP 8: COMPLETED APPLICATION OF PERFORMED™ DOUBLE SIDE TIE.

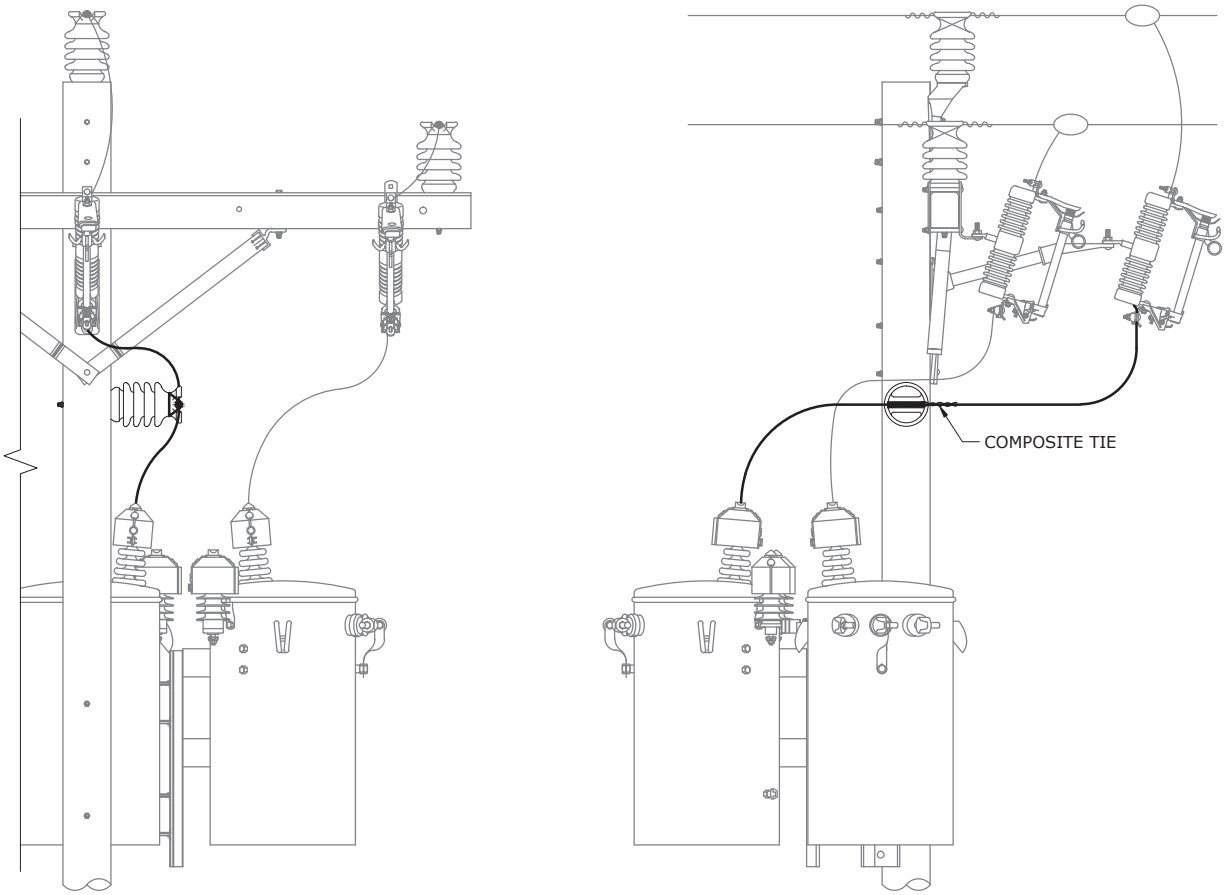
DUKE ENERGY.

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DOUBLE SIDE TIE

DEC	DEM	DEP	DEF
X	X	X	X

03.04-102J



COMPOSITE TIE

INSTALLATION INSTRUCTIONS:

1. MOUNT COMPOSITE TIE AS SHOWN ABOVE WITH THE OPENED WRAPPED END POINTING TOWARD THE CUTOUT (OR SOURCE)

2. TRAIN COVERED COPPER CONDUCTOR IN ONE CONTINUOUS SECTION FROM EQUIPMENT BUSHING THROUGH THE CENTER OF THE WRAP ON THE STANDOFF POST INSULATOR TO THE BOTTOM OF THE CUTOUT (OR SOURCE).

NOTES:

1. DO NOT INSTALL METAL PREFORM TIES OR COVERED CONDUCTORS: **ALWAYS** USE A COMPOSITE TIE. HAND TIES OF ANY TYPE WIRE ARE ALSO UNACCEPTABLE.

2. COMPOSITE TIES PERFORMANCE:
   A. PREVENT "CONDUCTOR BURN DOWN"
   B. PREVENTS RADIO AND TELEVISION INTERFERENCE
   C. REDUCES CONDUCTOR VIBRATION
   D. INSTALLED DIRECTLY ON COVERED CONDUCTOR, ELIMINATING THE NEED FOR SKINNING
   E. INSTALLED SIMILAR TO FACTORY FORMED TIES

3				
2				
1				
0	6/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

COMPOSITE TIE FOR COVERED CONDUCTORS

03.04-102K

EZ-WRAP SPOOL TIE			
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	COLOR CODE
TIE-SPOOL-4-AL-F	4002616	TIE, INSULATOR, SPOOL INS, 4 AWG ACSR, 4 AWG AAAC CONDUCTOR	ORANGE
TIE-SPOOL-2-AL-F	504843	TIE, INSULATOR, SPOOL INS, 1-3/4" INS DIA, 2 AWG 6/1 STR ACSR	RED
TIE-SPOOL-1/0-AL-F	938412	TIE, INSULATOR, EZ WRAP SPOOL INS,1 /0 AAAC, 7 STR, 1/0 ACSR 6/1	YELLOW

SINGLE TOP TIE			
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	COLOR CODE
TIE-TOP-4-AL-FNECK-F	4002605	TIE, INSULATOR, F NECK INSULATOR, 4 AWG ACSR, 4 AWG AAAC	ORANGE
TIE-TOP-2-AL-FNECK-F	214556	TIE, INSULATOR, F NECK INSULATOR, 2 AWG 6/1 STR ACSR	RED
TIE-TOP-1/0-AL-FNECK-F	4002609	TIE, INSULATOR, F NECK INSULATOR, 1/0 AWG ACSR, 1/0 AWG AAAC	YELLOW
TIE-TOP-336-AL-FNECK-F	4002610	TIE, INSULATOR, F NECK INSULATOR, 336.4 MCM ALUM	BROWN
TIE-TOP-795-AL-FNECK-F	4002611	TIE, INSULATOR, F NECK INSULATOR, 795 MCM AAC, 795 MCM ACSR	GREEN

SINGLE SIDE TIE (EZ-WRAP)			
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	COLOR CODE
TIE-SIDE-4-AL-FNECK-F	4002612	TIE,INSULATOR, F NECK INSULATOR, 4 AWG ACSR	ORANGE
TIE-SIDE-2-AL-FNECK-F	214558	TIE, INSULATOR, F NECK INSULATOR, 2 AWG 6/1 STR ACSR	RED
TIE-SIDE-1/0-AL-FNECK-F	936177	TIE, INSULATOR, F NECK INSULATOR, 1/0 7 STR AAAC/1/0 6/1 ACSR	YELLOW
TIE-SIDE-336-AL-FNECK-F	938304	TIE, INSULATOR, F NECK INSULATOR, 336.4 MCM ALUM	BROWN
TIE-SIDE-795-AL-FNECK-F	4002615	TIE, INSULATOR, F NECK INSULATOR, 795 MCM AAC, 795 MCM ACSR	GREEN

DOUBLE SIDE TIE			
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	COLOR CODE
TIE-DSIDE-2-AL-FNECK-F	214559	TIE, INSULATOR, F NECK INSULATOR, 2 AWG 6/1 STR ACSR	RED
TIE-DSIDE-1/0-AL-FNECK-F	214549	TIE, INSULATOR, F NECK INSULATOR, 1/0 AWG ACSR (6/1)	YELLOW
TIE-DSIDE-336-AL-FNECK-F	214550	TIE, INSULATOR, F NECK INSULATOR, 336.4MCM ACSR/AAC	BROWN
TIE-DSIDE-795-AL-FNECK-F	1528436	TIE, INSULATOR, F NECK INSULATOR, 636 ACSR 26/7 STR	GREEN

COMPOSITE TIE			
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	COLOR CODE
TIE-COMP-SM-COV-FNECK-F	214569	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG	WHITE
TIE-COMP-MD-COV-FNECK-F	214565	TIE, INSULATOR, F NECK INSULATOR, 2/0 AWG TO 4/0 AWG	BLUE
TIE-COMP-LG-COV-FNECK-F	301747	TIE, INSULATOR, F NECK INSULATOR, 336-500 MCM	RED

DUKE ENERGY.

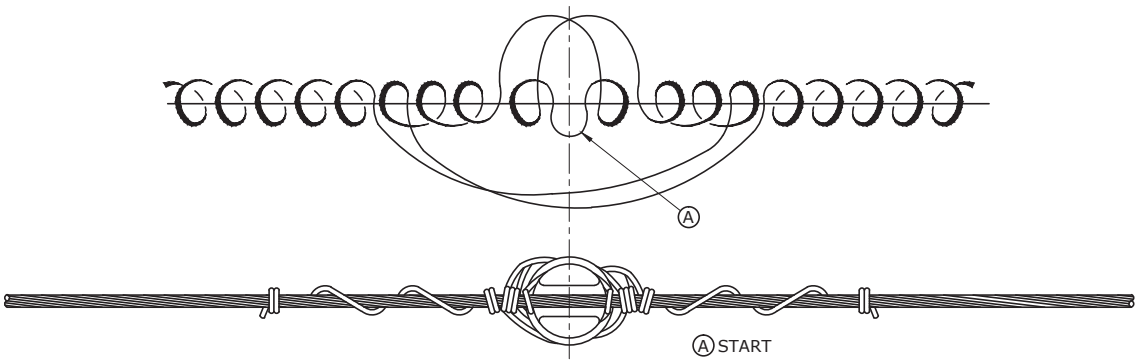
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

FACTORY FORMED CONDUCTOR TIES

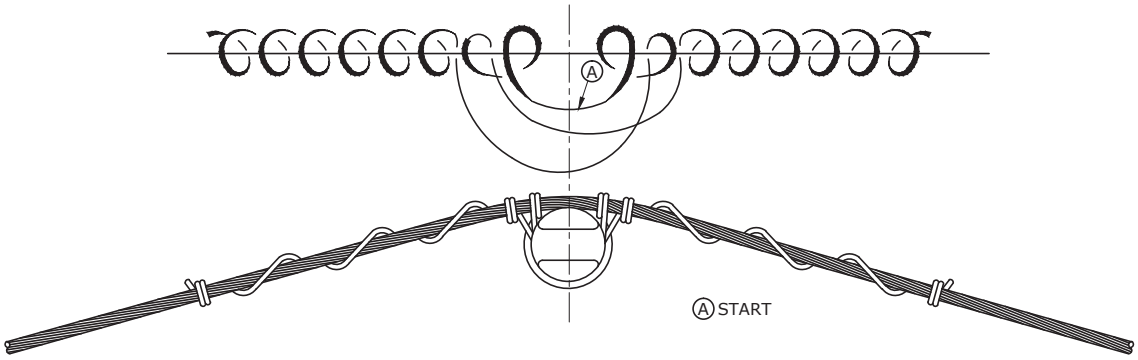
DEC	DEM	DEP	DEF
			X

03.04-102L

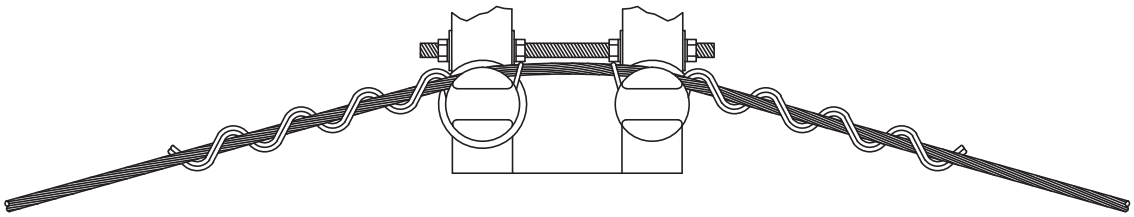
TOP GROOVE TIE



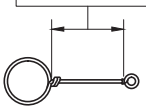
SIDE GROOVE TIE



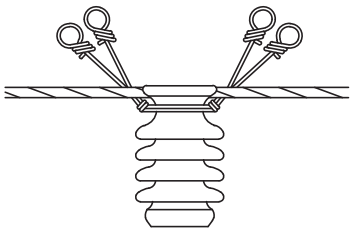
SIDE OR TOP GROOVE - TWO INSULATORS



18" COPPER
30" ALUMINUM



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	ITEM NUMBER	DESCRIPTION
TIE-HAND-4-AL-F	4022333	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
TIE-HAND-6-CU-F	4022334	WIRE, TIE, 6 AWG, 315' LG, SOL BARE, SOFT DRAWN CU

DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

CONDUCTOR HAND TIES

DEC	DEM	DEP	DEF
			X

03.04-104

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	TIE-ARMROD-2-AL-F	1	4022676	1	ROD, ARMOR, 0.136" DIA, 44" LG, ALUM ALLOY, COLOR CODE RED
2	TIE-ARMROD-1/0-AL-F	1	4002602	1	ROD, ARMOR, 1/0 AWG AAAC COND, 0.167" DIA, 52" LG, AL ALLOY, COLOR YELLOW
3	TIE-ARMROD-336-AL-F	1	4002603	1	ROD, ARMOR, 336.4 MCM AAC CONDUCTOR, 0.666" DIA, 66" LG, ALUM ALLOY, COLOR CODE BROWN
4	TIE-ARMROD-795-AL-F	1	4002604	1	ROD, ARMOR, 795 MCM AAC CONDUCTOR, 1.026" DIA, 94" LG, ALUM ALLOY, COLOR CODE BROWN

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.

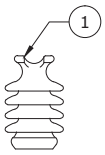
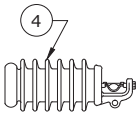
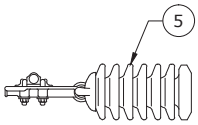
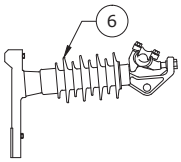
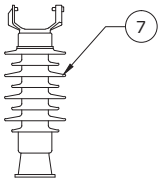
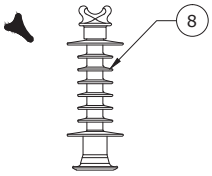
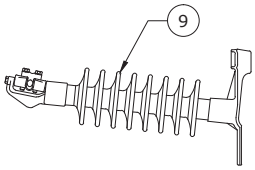
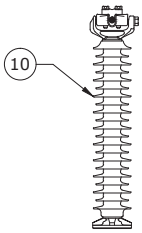
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

ARMOR RODS

DEC	DEM	DEP	DEF
			X

03.04-118

 25KV POST	 35KV POST	 45KV POST	 35KV CLAMP HORIZONTAL CONSTRUCTION
GENERAL USE	GENERAL USE	GENERAL USE	GENERAL USE
 35KV CLAMP VERTICAL CONSTRUCTION	 45 KV HORIZONTAL GAIN BASE	 45 KV ROUND BASE	 45 KV POLY POST
SLACK SPAN	COASTLINE AND OVERINSULATED	COASTLINE AND OVERINSULATED	COASTLINE AND OVERINSULATED
 69 KV HORIZONTAL GAIN BASE	 69 KV POST TRUNION		
UNDERBUILD	SELF SUPPORTING STRUCTURE		

NOTES:

1. ITEMS 6 AND 7 ARE USED FOR COASTAL APPLICATIONS.
2. ITEM 9 IS USED ON STEEL TRANSMISSION UNDERBUILD WHEN TRANSMISSION HAS SUPPLIED THE INSULATOR MOUNT OR PRE-DRILLED HOLES.

REVISED		BY	CK'D	APPR.
3				
2	7/11/17	LOOSIER	BURLISON	ADCOCK
1	2/3/17	LOOSIER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

POST INSULATORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.06-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
3	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-POST-35KV-PORC-HC-F	1	4002398	1	INSULATOR, LINE POST, 35KV, HOR CLAMP
5	INSL-POST-35KV-PORC-VC-F	1	4022893	1	INSULATOR, CLAMP TOP VERT LINE POST, 35KV, ANSI 57-12
6	INSL-POST-45KV-POLY-HC-GB-F	1	938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4001673	2	WASHER, LOCK, SPLIT, 5/8" NOM, GALV STL, F/ 5/8 BOLT
			4022898	1	INSULATOR, HORZ LINE POST, 45KV, 10" BOLT HOLE SPACING
7	INSL-POST-45KV-POLY-VC-F	1	4022910	1	INSULATOR, VERT LINE POST, 45KV, SILICONE, VRT-MT, RND BASE
8	INSL-POST-45KV-POLY-TT-F	1	1545900	1	INSULATOR, LINE POST, 46KV, 19.5" LG, SILICONE, TIE TOP, F-NECK
9	INSL-POST-69KV-POLY-HC-GB-F	1	938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
10	NA	-	-	-	-

REVISED		BY	CHK'D	APPR.
3				
2				
1	5/17/18	ROBBINS	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

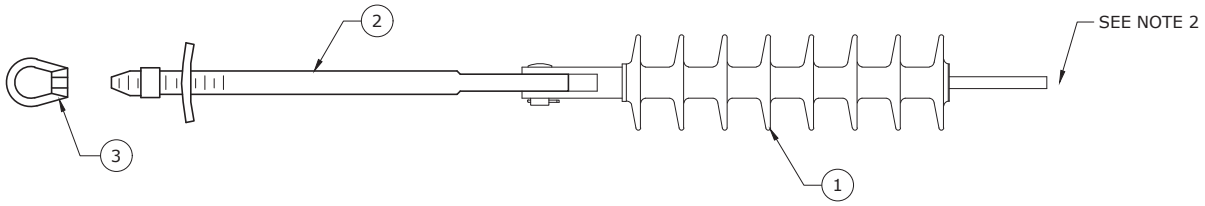
POST INSULATORS

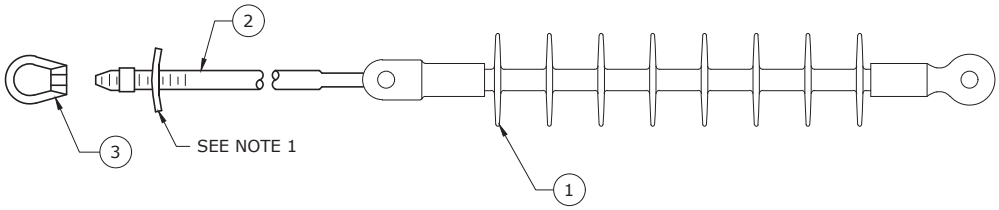
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.06-110B

35KV POLYMER SUSPENSION INSULATOR





BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL,5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-EYEBOLT-SM-14IN-GALV-F	1	931138	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 14" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-EYEBOLT-SM-16IN-GALV-F	1	931146	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 16" LG, 6" MIN THD LG, GALV
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
3	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
SEE NOTE 3	HDWR-LWASH-SM-GALV-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-SWASH-SM-GALV-CURVE-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG

NOTES:

1. USE ROUND WASHERS ON ROUND POLES, SQUARE WASHERS ON FLAT SURFACES.
2. DEADEND CLAMPS NOT SHOWN (REFER TO SECTION 03.03).
3. FOR SLACK SPANS, USE TWO CURVED WASHERS AND DOUBLE COIL SPRING WASHER ON EYEBOLT.

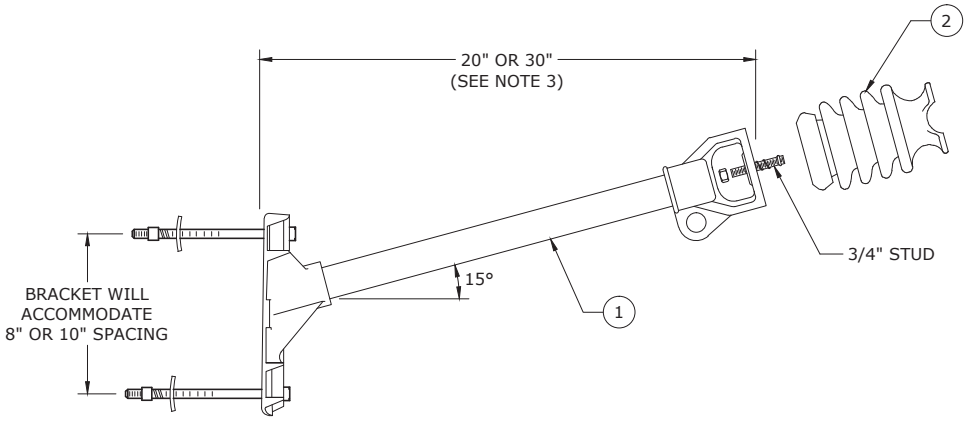
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3			
2			
1 3/31/18	BENDER	BURLISON	ADCOCK
0 11/13/17	LOOSIER	BURLISON	ADCOCK

POLYMER DEADEND ASSEMBLY

DEC	DEM	DEP	DEF
			X

03.06-120



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	BKT-INSL-POST-POLE-MD-FG-F	1	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002346	1	BRACKET, STANDOFF, 20", FIBERGLASS, W/ 8" & 10" BOLT SPACING
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	BKT-INSL-POST-POLE-LG-FG-F	1	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
1	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN

NOTES:

1. STANDOFF HORIZONTAL POST INSULATOR BRACKET IS FOR USE ON TANGENT FLAT CONSTRUCTION WHERE RIGHT OF WAY IS AN ISSUE AND POLE MUST BE SET OUT OF LINE, OR WHERE ADDITIONAL PHASE SPACING IS REQUIRED. DO NOT INSTALL WHERE A DIFFERENCE IN ELEVATION BETWEEN STRUCTURES WILL CREATE AN EXCESSIVE DOWNWARD FORCE ON THE BRACKET.

2. SEE SECTION 03.04 FOR FACTORY FORMED CONDUCTOR TIES.

3. STANDOFF HORIZONTAL POST INSULATOR BRACKETS ARE AVAILABLE IN 20" AND 30" LENGTHS.

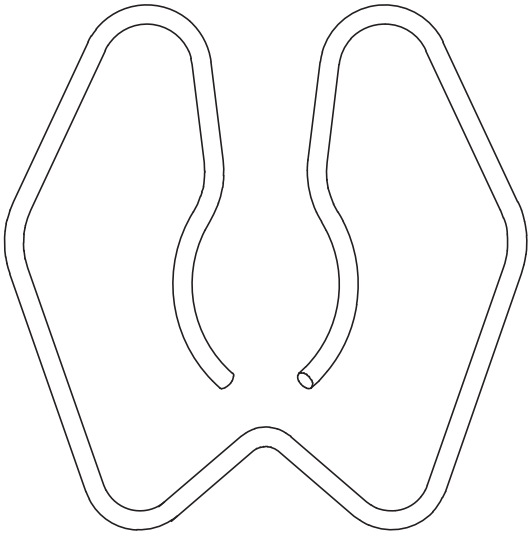
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

STANDOFF HORIZONTAL POST INSULATOR BRACKETS

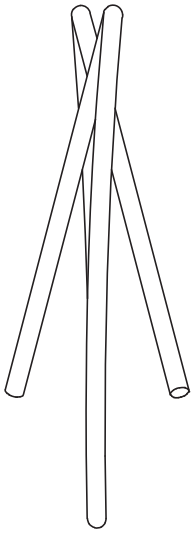
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.06-130



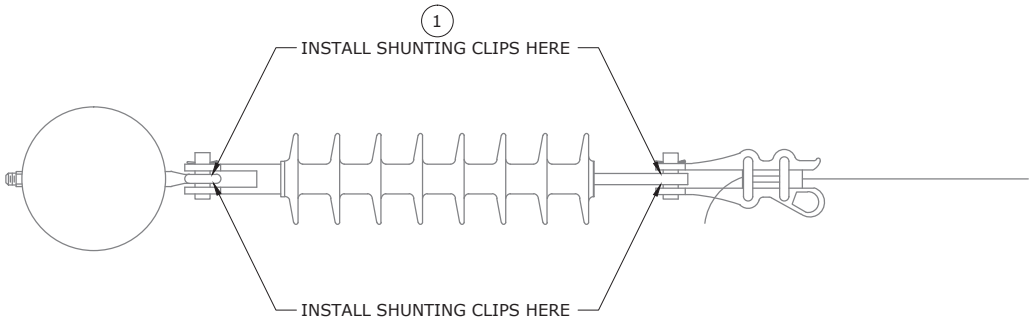
FRONT VIEW



SIDE VIEW

NOTES:

1. TO INSTALL THE SHUNTING CLIPS, SIMPLY PUSH THEM OVER THE CLEVIS PIN IN THE GAP BETWEEN THE INSIDE SURFACE OF THE CLEVIS AND THE EYE FITTING WHICH IS HELD BY THE CLEVIS. TWO CLIPS ARE TO BE INSTALLED, ONE ON EACH SIDE OF THE CLEVIS.



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-CLIP-SHUNT-F	1	57785	4	CLIP SPRING STL SUSPENSION INSULATOR SHUNT

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

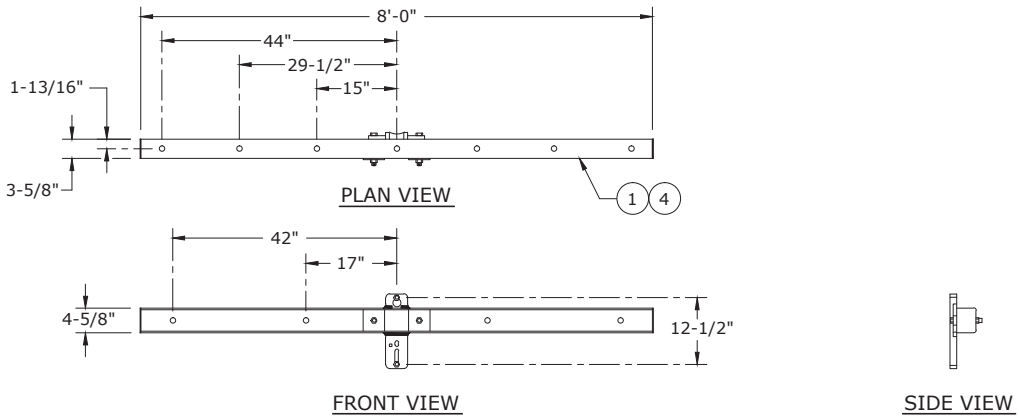
SLACK SPAN DEADEND WITH SHUNTING CLIPS

DUKE ENERGY.

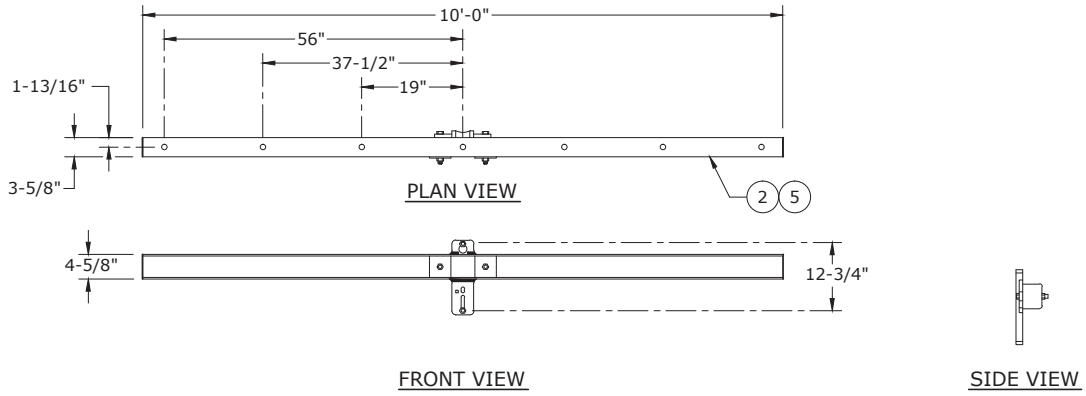
DEC	DEM	DEP	DEF
			X

03.06-140

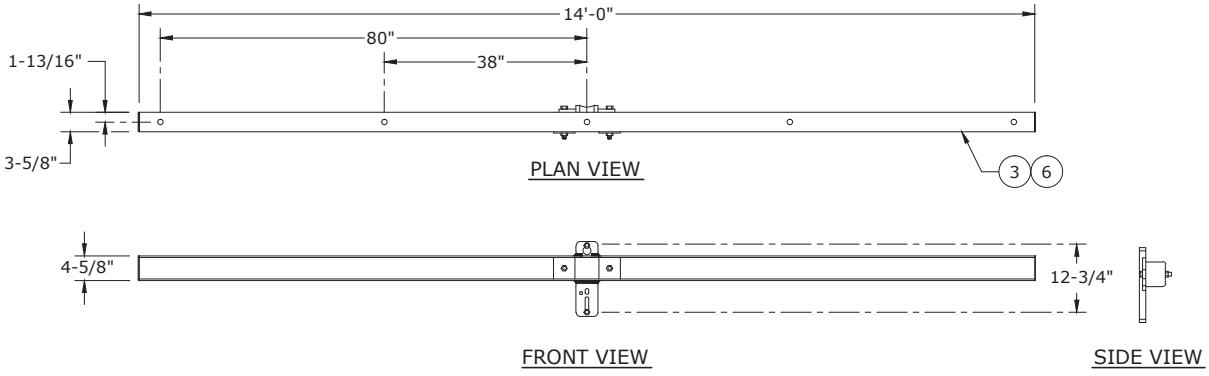
8' FIBERGLASS TANGENT CROSSARM



10' FIBERGLASS TANGENT CROSSARM



14' FIBERGLASS TANGENT CROSSARM



NOTES:

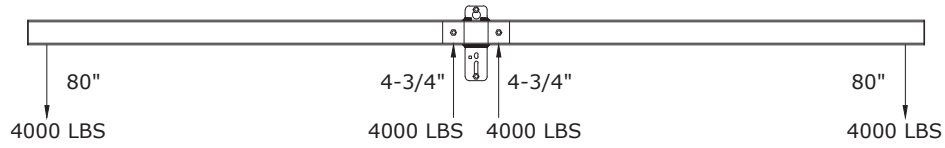
1. SEE DWG. 03.07-102C FOR BILL OF MATERIALS.
2. WOOD ARMS ARE TO BE USED FOR STANDARD TANGENT CONSTRUCTION. FIBERGLASS TANGENT ARMS ARE FOR COASTAL USE AND APPLICATIONS WHERE ADDITIONAL STRENGTH OR OTHER SPECIAL NEEDS EXIST.

3				
2				
1				
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

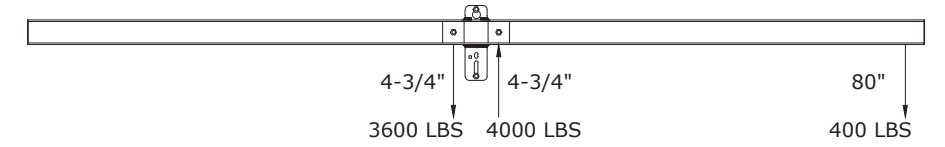
TANGENT FIBERGLASS CROSSARMS

DEC	DEM	DEP	DEF
X	X	X	X

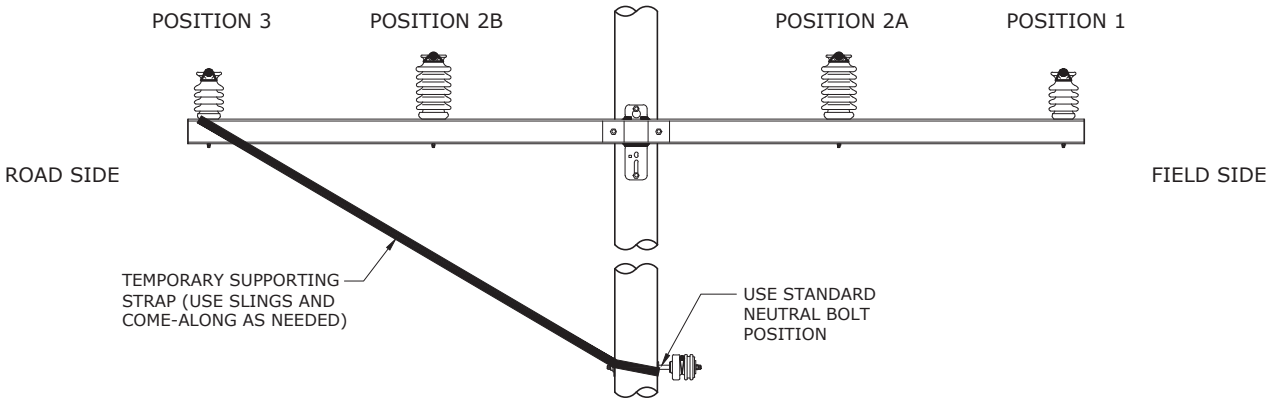
03.07-102A



THE 14" TANGENT FIBERGLASS CROSSARM IS RATED FOR 4000 LBS **BALANCED LOADING**.



WHEN YOU PLACE UNBALANCED LOADING ON THE CROSSARM, ITS WEIGHT BEARING CAPABILITY IS GREATLY COMPROMISED. A LOADING OF ONLY 400 LBS ON ONE SIDE ALREADY PUTS MAXIMUM LOADING AT THE CENTER BRACKET.



WHEN INSTALLING OR TRANSFERRING CONDUCTOR TO A FIBERGLASS CROSSARM, IT'S IMPERATIVE TO COUNTER THE UNBALANCED LOADING THAT WILL OCCUR. THIS IS ESPECIALLY CRITICAL WHEN INSTALLING CONDUCTOR ONTO LAYOUT ARMS. BEFORE SETTING CONDUCTOR IN POSITION 1 OR 2A, INSTALL A STRAP FROM THE OPPOSITE END OF THE CROSSARM DOWN TO THE POLE AS SHOWN ABOVE. ANY FORCE PLACED ON THE FIELD SIDE OF THE CROSSARM WILL BE COUNTERED BY THE STRAP THUS BALANCING THE FORCES ON THE CROSSARM. THE STRAP MAY BE REMOVED AFTER THE CONDUCTOR IS SET AT POSITION 3.

USE THE TABLE BELOW TO DETERMINE WHEN YOU NEED TO USE A TEMPORARY SUPPORTING STRAP.

NOTE THAT IF YOU ARE NOT INSTALLING CONDUCTOR ONTO LAYOUT ARMS ONLY 795 CONSTRUCTION NEEDS STRAPS.

WHEN TO USE TEMPORARY SUPPORTING STRAPS						
COND. SIZE	8' FIBERGLASS		10' FIBERGLASS		14' FIBERGLASS	
	NO LAYOUT	LAYOUT	NO LAYOUT	LAYOUT	NO LAYOUT	LAYOUT
795	YES	YES	YES	YES	YES	YES
556		YES		YES		YES
477		YES		YES		YES
336				YES		
CONDUCTORS 4/0 AND SMALLER DO NOT REQUIRE TEMPORARY SUPPORTING STRAPS						

DUKE ENERGY.

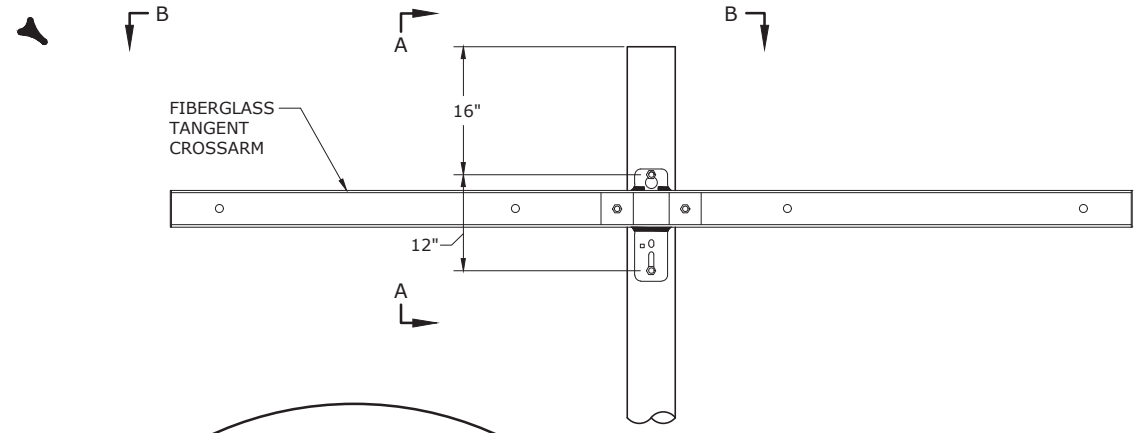
3					
2					
1					
0	9/30/18	BRUINS	BURLISON	ADCOCK	
REVISED		BY	CHK'D	APPR.	

TANGENT FIBERGLASS CROSSARMS

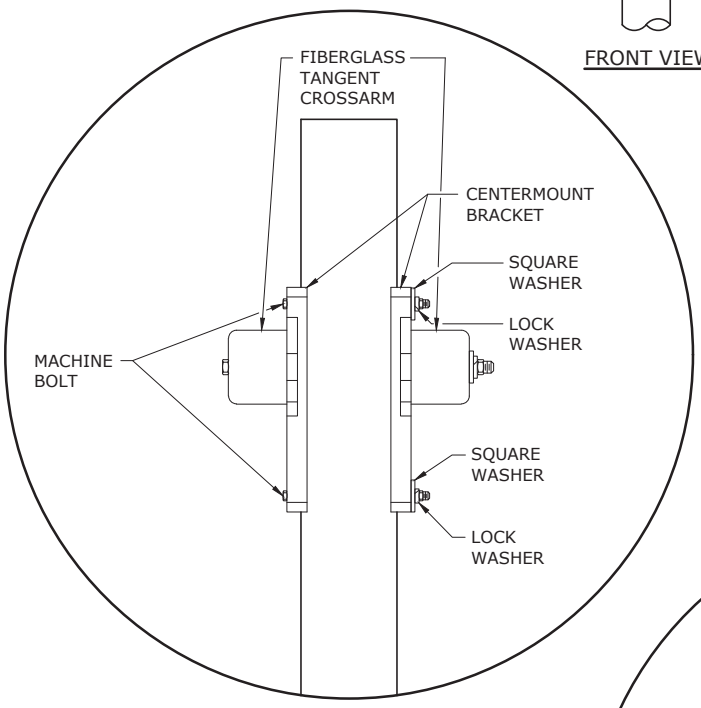
UNBALANCED LOADING

DEC	DEM	DEP	DEF
X	X	X	X

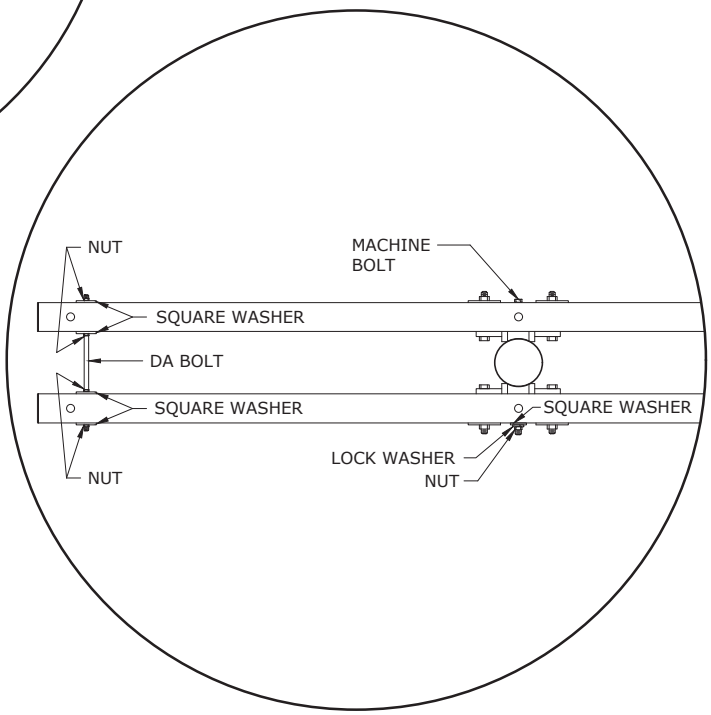
03.07-102B



FRONT VIEW



SECTION A-A



SECTION B-B

NOTES:

1. LOCK WASHERS SHALL BE INSTALLED.

3				
2				
1				
0	9/30/18	BRUINS	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE TANGENT FIBERGLASS CROSSARM
MOUNTING DETAILS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.07-102C

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
2	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER,LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	ARM-SGL-14-FBG-NB-F	1	1517219	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 14' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	ARM-DBL-8-FBG-NB-F	1	4001743	2	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL,
5	ARM-DBL-10-FBG-NB-F	1	1519861	2	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	ARM-DBL-14-FBG-NB-F	1	1517219	2	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 14' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL

DUKE ENERGY.

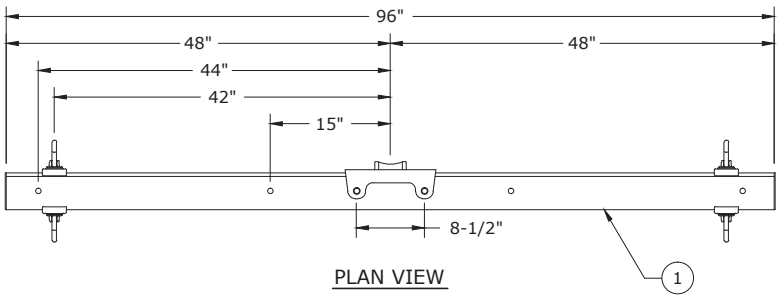
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	9/30/18	BRUINS	BURLISON	ADCOCK

TANGENT AND DOUBLE TANGENT
FIBERGLASS CROSSARMS

DEC	DEM	DEP	DEF
			X

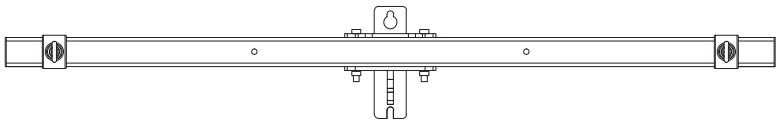
03.07-102D

8' FT. DEADEND ARM

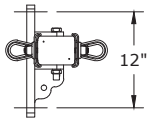


PLAN VIEW

MAXIMUM LOAD PER SIDE (LBS)	DEFLECTION PER 1000 LBS (IN)	WEIGHT (LBS)
11,361	0.35	46



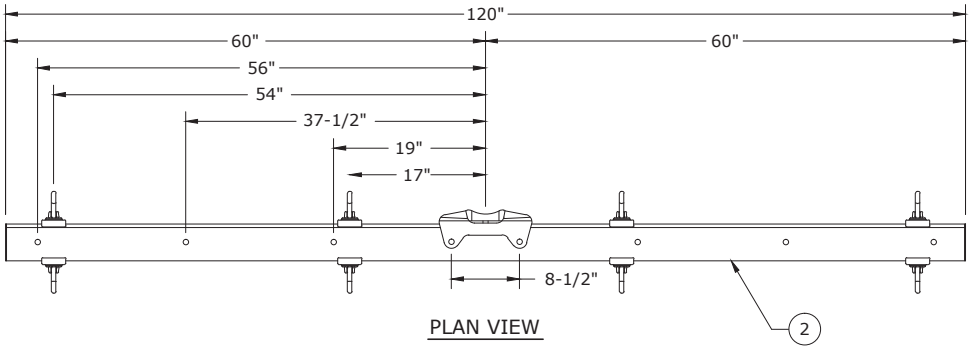
FRONT VIEW



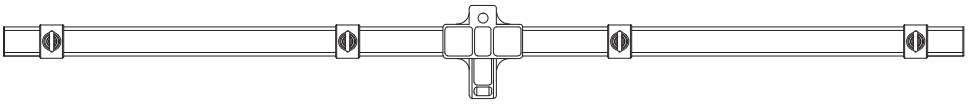
SIDE VIEW

10' FT. DEADEND ARM

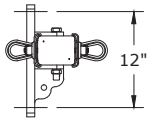
MAXIMUM LOAD PER SIDE (LBS)	DEFLECTION PER 1000 LBS (IN)	WEIGHT (LBS)
11,000	0.42	86



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE 03.07-104C FOR BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

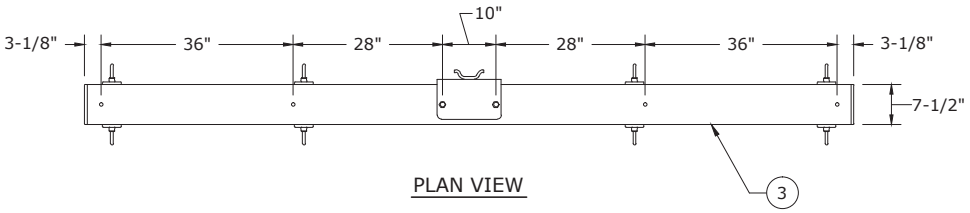
8' AND 10' FIBERGLASS DEADEND CROSSARMS

DEC	DEM	DEP	DEF
X	X	X	X

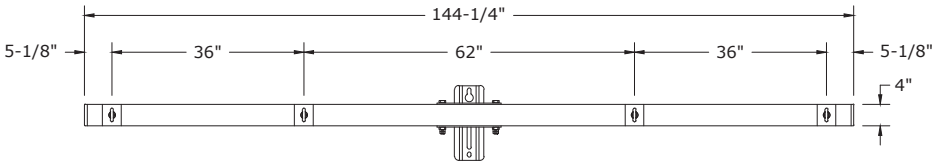
03.07-104A

12 FT. DEADEND ARM

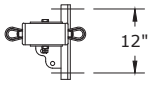
MAXIMUM LOAD PER SIDE (LBS)	DEFLECTION PER 1000 LBS (IN)	WEIGHT (LBS)
10,000	0.73	130



PLAN VIEW



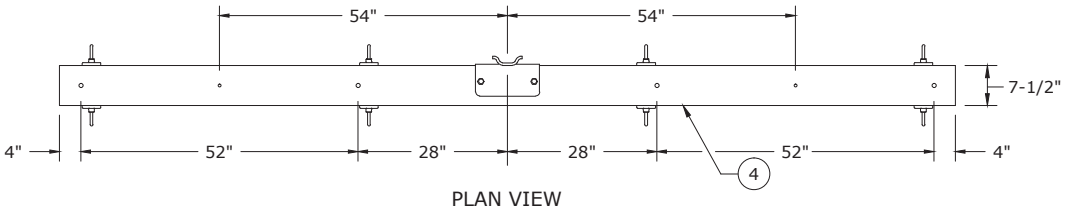
FRONT VIEW



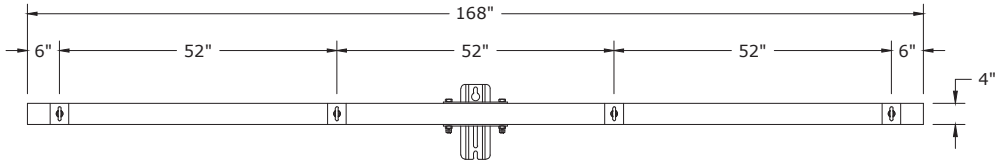
SIDE VIEW

14 FT. DEADEND ARM

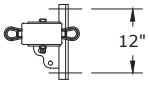
MAXIMUM LOAD PER SIDE (LBS)	DEFLECTION PER 1000 LBS (IN)	WEIGHT (LBS)
8000	0.89	130



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE 03.07-104C FOR BILL OF MATERIALS.

3				
2				
1				
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

12' AND 14' FIBERGLASS DEADEND CROSSARMS

DEC	DEM	DEP	DEF
X	X	X	X

03.07-104B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	ARM-SDE-8-FBG-NB-F	1	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
2	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	NA	-	-	-	-
4	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL

NOTES:

1. FOR DEAD-END CONSTRUCTION, USE FIBERGLASS ARMS.
2. SEE DWG. 03.07-104A AND 03.07-104B FOR CROSSARM DETAILS.

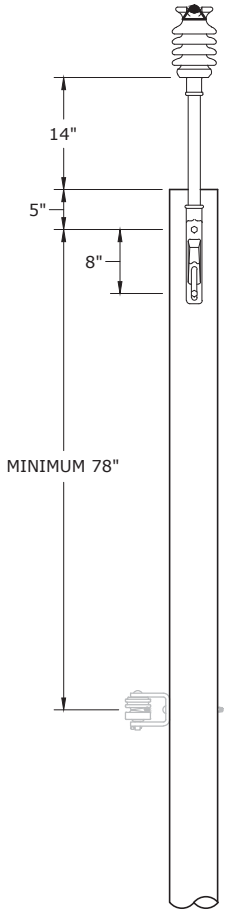
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

FIBERGLASS DEADEND CROSSARMS

DEC	DEM	DEP	DEF
			X

03.07-104C



FRONT VIEW

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	BKT-INSL-POST-PTOP-FG-F	1	490838	1	BRACKET, INSULATOR, 2" WD X 14" LG, FIBERGLASS, PTP REPAIR
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV

NOTES:

1. USE FOR POLE TOP REPAIR, CUT POLE TOP AND CAP POLE.
2. POLE TOP REPAIR EXTENSION SHALL NOT BE USED FOR NEW CONSTRUCTION.
3. THESE BRACKETS ARE TO BE USED ON TANGENT POLES ONLY. NO LINE ANGLE IS ALLOWED.

DUKE ENERGY.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

TANGENT POLE TOP REPAIR

DEC	DEM	DEP	DEF
			X

03.07-108

USE CONSIDERATIONS

1. EMERGENCIES - POLE TOP IS DAMAGED (5' OR LESS).
2. SPECIAL SITUATIONS WHERE EXTRA SPACE IS NEEDED TO ACCOMMODATE PROPER GUIDELINES AND THE EXISTING POLE IS HEALTHY (NO DECAY AT GROUNDLINE AND OVERALL POLE IS IN IN GOOD CONDITION):
   - NEW CIRCUITS
   - ELECTRONIC RECLOSERS
   - CAPACITOR BANKS
   - THREE-PHASE TRANSFORMER BANKS
3. POLE TOP EXTENSIONS SHALL NOT BE USED FOR JOINT USE MAKE READY APPLICATIONS.

DESIGN CRITERIA

1. INSTALL THE POLE TOP EXTENSION ON POLES ACCESSIBLE BY ALL-WEATHER ROADS YEAR ROUND.
2. ALWAYS ENSURE THE POLE TOP EXTENSION IS INSTALLED ON GOOD WOOD (I.E. CHECK FOR POLE DECAY, ETC.).
3. ALL PROPOSED POLE TOP EXTENSION INSTALLATIONS ARE TO BE VERIFIED BY POLEFOREMAN, WHICH WILL ACCOUNT FOR THE PRE-EXISTING LOADING ON THE POLE. AN INSTALLATION, WITHOUT POLEFOREMAN VERIFICATION, MAY BE PERMITTED IF ANOTHER INSTALLATION, WITH THE SAME OR GREATER MECHANICAL LOADS, HAS ALREADY BEEN VERIFIED BY POLEFOREMAN.
4. FOR AN EMERGENCY INSTALLATION ON A DAMAGED POLE, ENSURE THE INSTALLATION OF POLE TOP EXTENSION WILL PRESERVE THE REQUIRED VERTICAL CLEARANCE OF THE CONDUCTORS.

CONSTRUCTION NOTES

1. ENSURE THE POLE TOP EXTENSION IS CLEAN OF ANY DIRT, DEBRIS, GREASE, OIL OR ANY OTHER CONTAMINANTS WHICH WOULD REDUCE ITS INSULATING VALUE.
2. ENSURE THE WOOD POLE TOP IS FLAT BEFORE INSTALLING THE POLE TOP EXTENSION.
3. HAND-TIGHTEN HARDWARE ON THE POLE TOP EXTENSION. THE BOLT "PULL THROUGH" DESIGN ON FIBERGLASS POLE TOP EXTENSIONS IS 150 FT-LBS. MOST HYDRAULIC TOOLS DELIVER 400 FT-LBS, WHICH WILL PULL A NUT AND WASHER THROUGH THE FIBERGLASS WITH CONSTANT TIGHTENING. HAND TIGHTENING GENERALLY DOES NOT EXCEED 50 FT-LBS.
4. IF THE POLE TOP EXTENSION IS MOUNTED JUST ABOVE A CROSSARM, THE CLAMPS FOR THE POLE TOP EXTENSION MAY BE MOUNTED ABOVE AND BELOW THE CROSSARM.
5. DRILLING THROUGH THE POLE TOP EXTENSION IS THE SAME AS DRILLING THROUGH A FIBERGLASS CROSSARM. CONSIDER USING A CARBIDE TIP DRILL BIT IF NUMEROUS HOLES ARE TO BE DRILLED.
6. THE POLE TOP EXTENSION IS VERY ROBUST (RATED FOR 8,500 LBS). FULL TENSION DEADENDS MAY BE APPLIED TO THE EXTENSION.
7. POLE SHRINKAGE IS NOT A CONCERN. THE POLE TOP EXTENSION CLAMPS HAVE TEETH THAT BITE INTO THE POLE IN ORDER TO MAINTAIN CONTACT.
8. IF EXTENSION IS USED TO RAISE THE STATIC LINE ON ONE POLE, GROUNDING OF THE STATIC AT THE POLE EXTENSION IS NOT NECESSARY. (DO NOT WANT TO PLACE A GROUND WIRE ON FIBERGLASS EXTENSION.)
9. IF EXTENSION IS USE TO RAISE THE NEUTRAL (SKYLINE NEUTRAL CONSTRUCTION - INDIANA), THEN USE BOLT-A-BAND POLE BANDS AT 18" INTERVALS TO FASTEN POLE GROUND TO POLE EXTENSION.

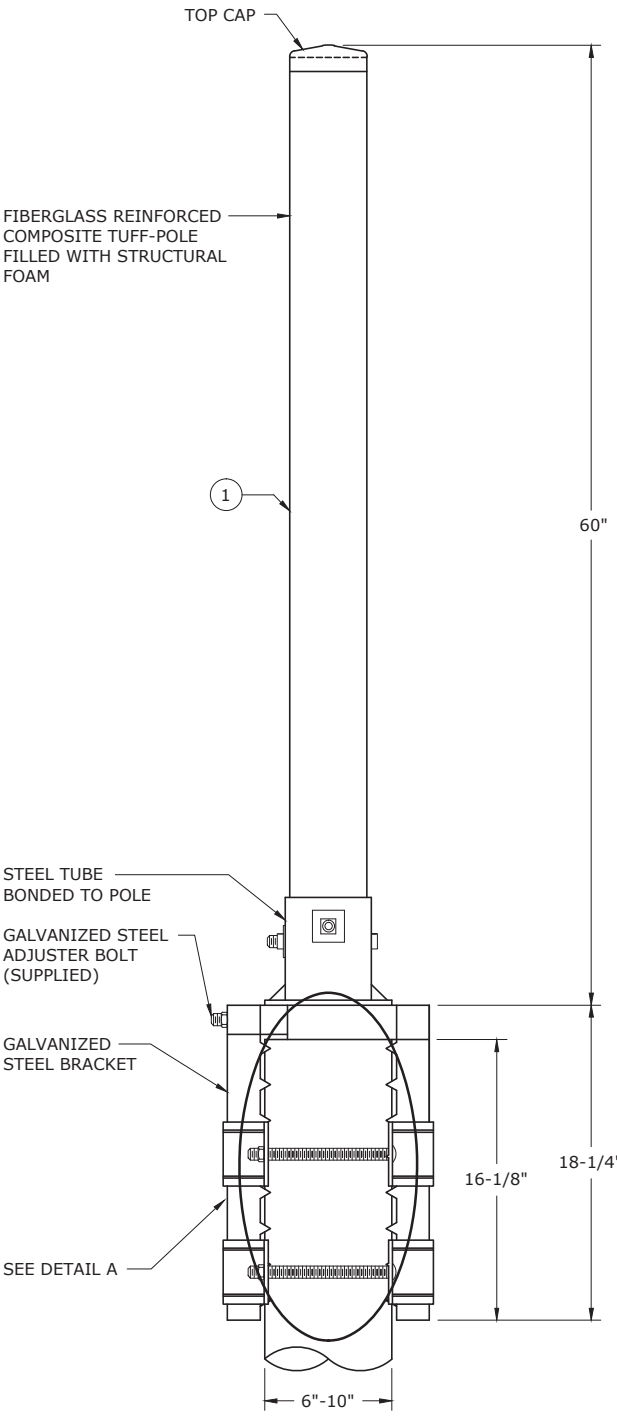
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/10/17	WHITE	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

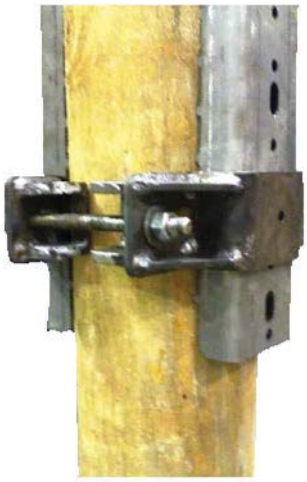
GUIDELINES ON POLE TOP EXTENSION USE

DEC	DEM	DEP	DEF
X	X	X	X

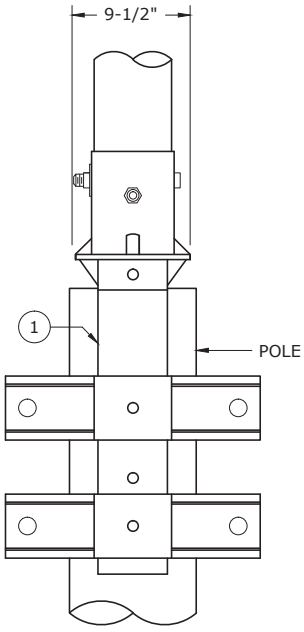
03.07-110A



FRONT VIEW



DETAIL A



SIDE VIEW

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	POLE-TOP-EXT-FG-F	1	1522562	1	EXTENSION, POLE, 5' LG, FIBERGLASS

NOTES:

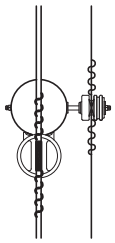
1. SEE DWG. 03.07-110A FOR INSTALLATION GUIDELINES.
2. TWO DETACHED GALVANIZED STEEL BRACKETS WITH TEETH WILL BE SUPPLIED TO FIT THE APPLICABLE POLE DIMENSION. THE UNIT THAT IS NOT NEEDED WILL BE STORED FOR LATER USE.

3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

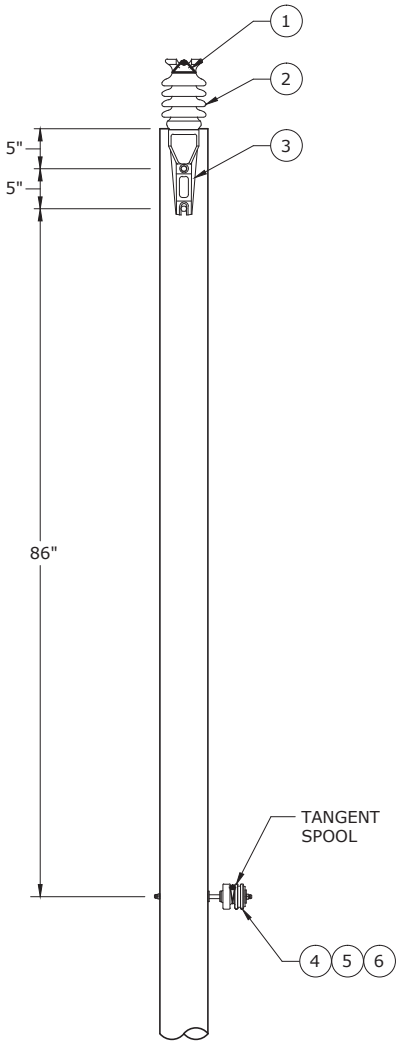
FIBERGLASS POLE TOP EXTENSION

DEC	DEM	DEP	DEF
			X

03.07-110B



PLAN VIEW



FRONT VIEW

NOTES:

1. NEUTRAL SPOOL MAY BE INSTALLED ON EITHER SIDE OF POLE.

3				
2				
1				
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SINGLE-PHASE CONSTRUCTION - TANGENT
POST TOP INSULATOR

DEC	DEM	DEP	DEF
X	X	X	X

03.08-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

DUKE ENERGY.

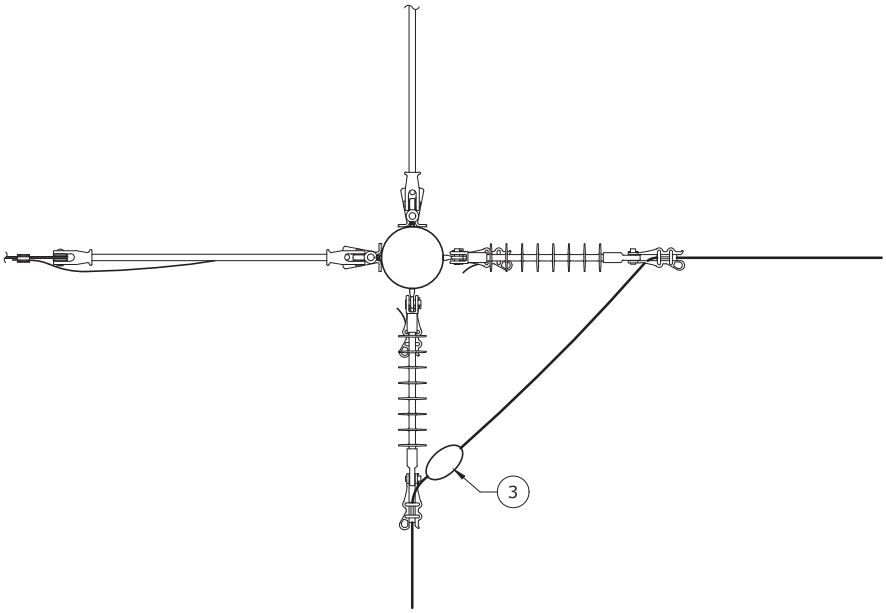
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION - TANGENT

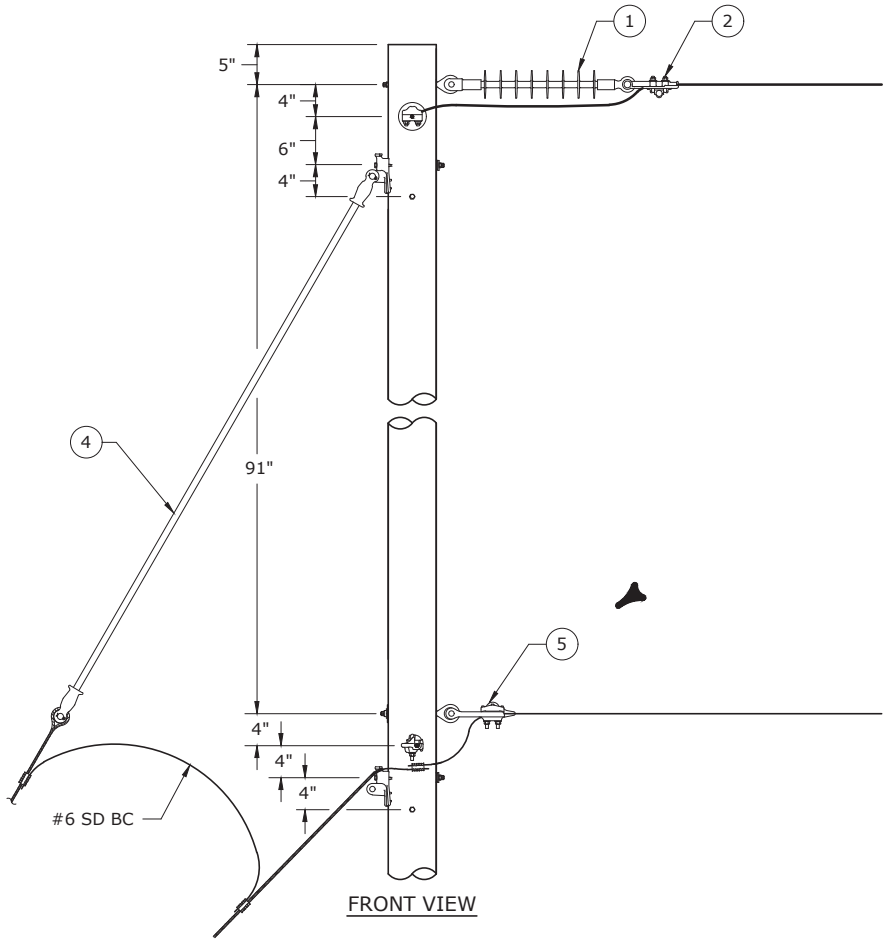
POST TOP INSULATOR

DEC	DEM	DEP	DEF
			X

03.08-100B



PLAN VIEW



FRONT VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

DUKE ENERGY.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE CONSTRUCTION -

RIGHT ANGLE

DEC	DEM	DEP	DEF
X	X	X	X

03.08-104A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	2	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE, OVAL,5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

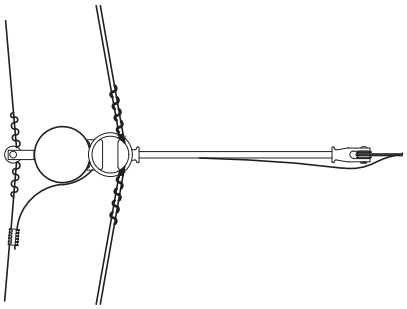
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

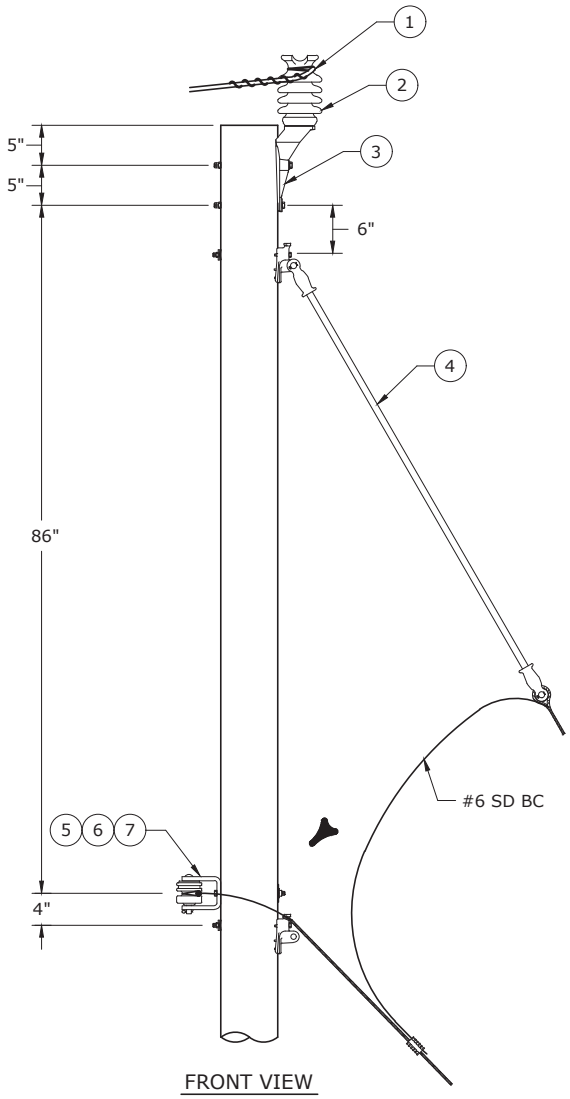
SINGLE-PHASE CONSTRUCTION - RIGHT ANGLE

DEC	DEM	DEP	DEF
			X

03.08-104B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	15°	15°	10°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	9/30/16	BURLISON	WHITE	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION - SMALL ANGLE - POST TOP INSULATOR

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

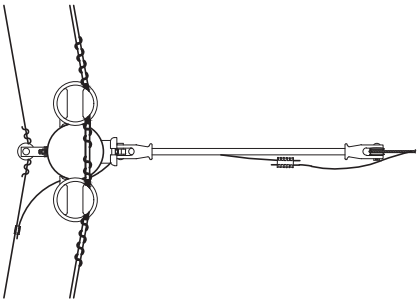
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION -
SMALL ANGLE -
POST TOP INSULATOR

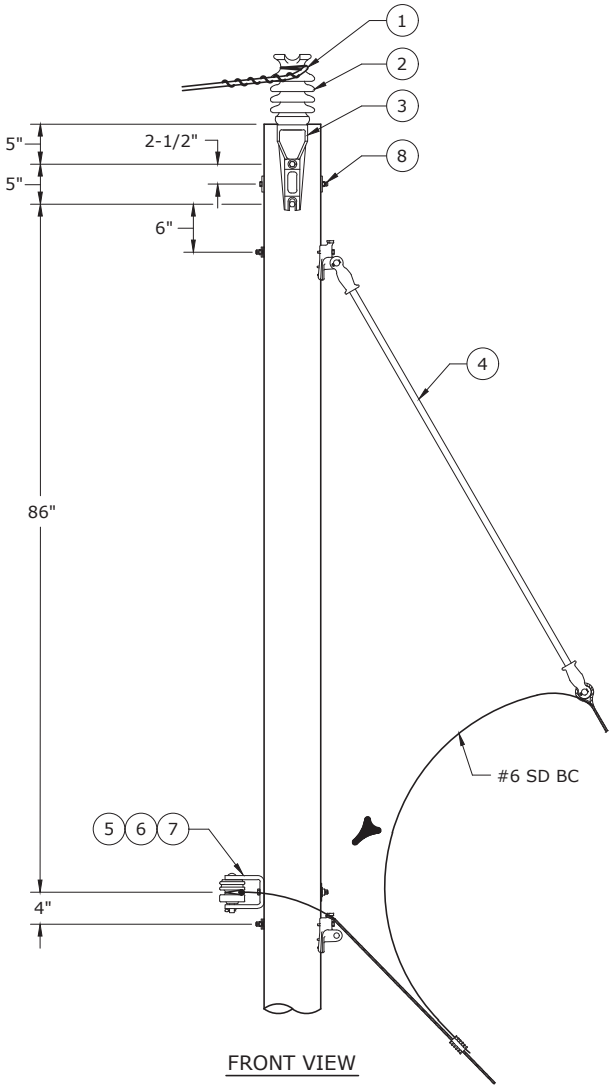
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.08-105B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	30°	30°	25°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

2. A 5/8" MACHINE BOLT SHALL BE INSTALLED AS A SPLIT-OUT BOLT ON MEDIUM ANGLE AND DOUBLE POLE TOP INSULATOR APPLICATIONS.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	WHITE	BURLISON	ADCOCK
1	9/30/16	BURLISON	WHITE	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION - MEDIUM ANGLE DOUBLE POST TOP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DSIDE-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	2	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	4	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
8	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV

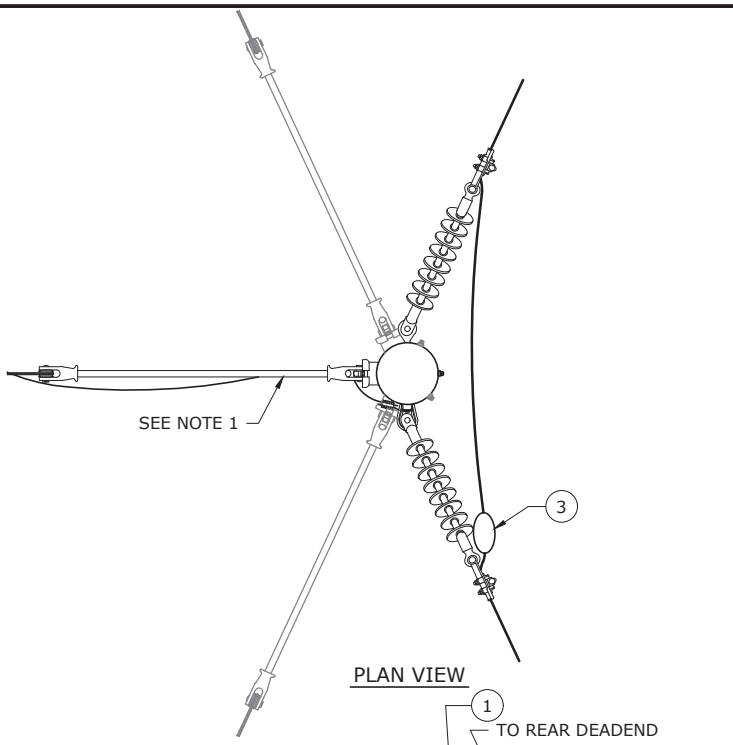
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION -
MEDIUM ANGLE DOUBLE POST TOP

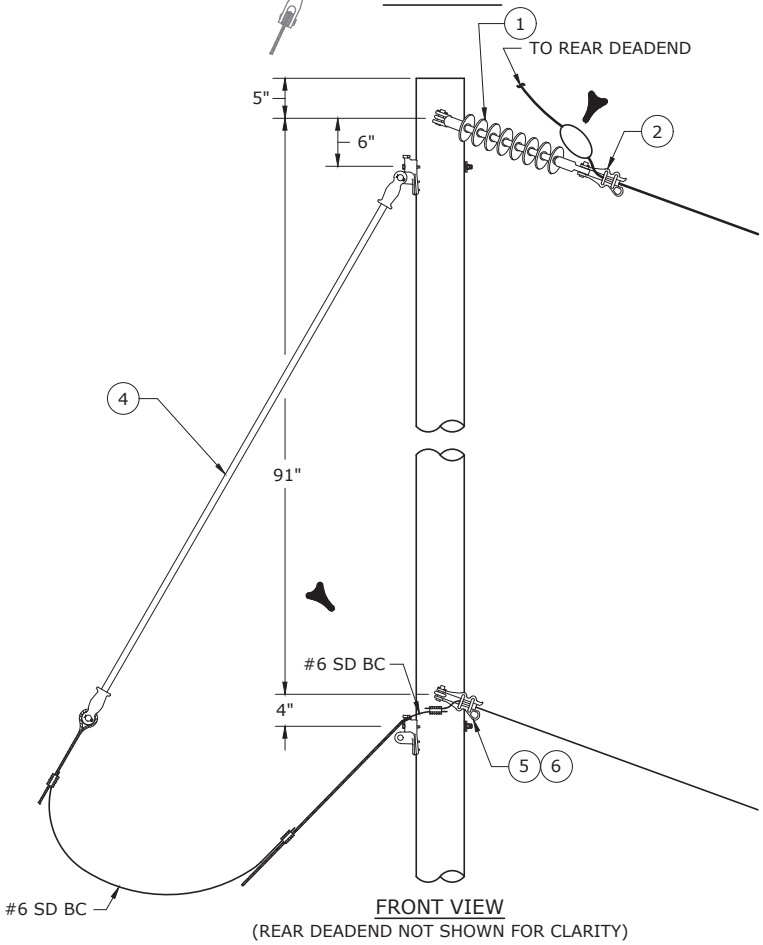
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.08-110B



PLAN VIEW



FRONT VIEW

(REAR DEADEND NOT SHOWN FOR CLARITY)

NOTES:

1. USE ONE SET OF GUYS FOR ANGLE < 60 DEGREES. USE TWO SETS OF GUYS FOR ANGLES 60-90 DEGREES. DOUBLE DOWN GUYS MAY BE REQUIRED TO BACK UP PRIMARY CONDUCTORS DEPENDING ON POLE LOADING CALCULATIONS.
2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION
DOUBLE DEADEND SIDE GUYED
LARGE ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-114A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
5	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
6	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

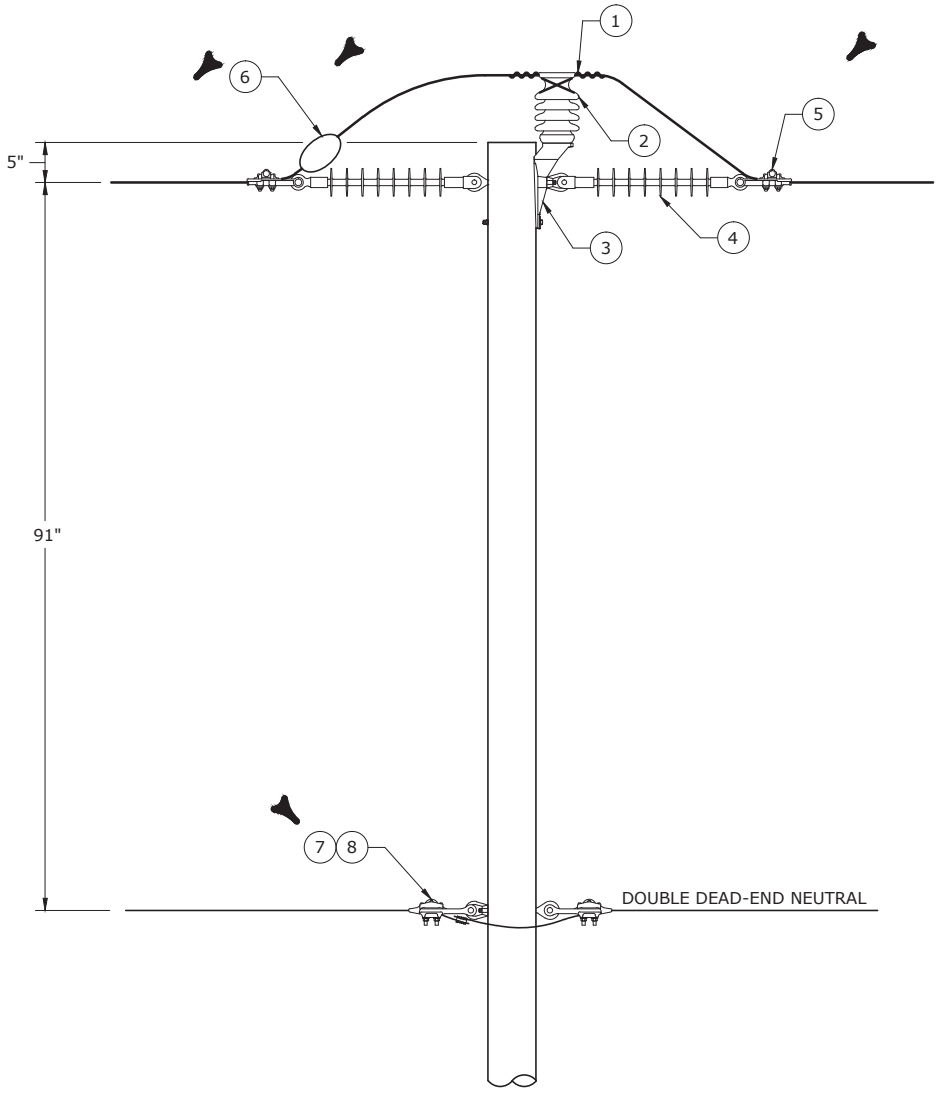
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION
DOUBLE DEADEND SIDE GUYED
LARGE ANGLE

DEC	DEM	DEP	DEF
			X

03.08-114B

PLAN VIEW



FRONT VIEW

NOTES:

1. INSTALL DOWN GUYS WHEN DIFFERENT SIZED CONDUCTORS ARE DEADENDED.

REVISED		BY	CHK'D	APPR.
3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION -
DOUBLE DEADENDS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
4	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

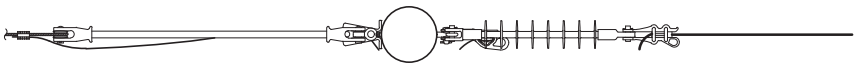
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION -
DOUBLE DEADENDS

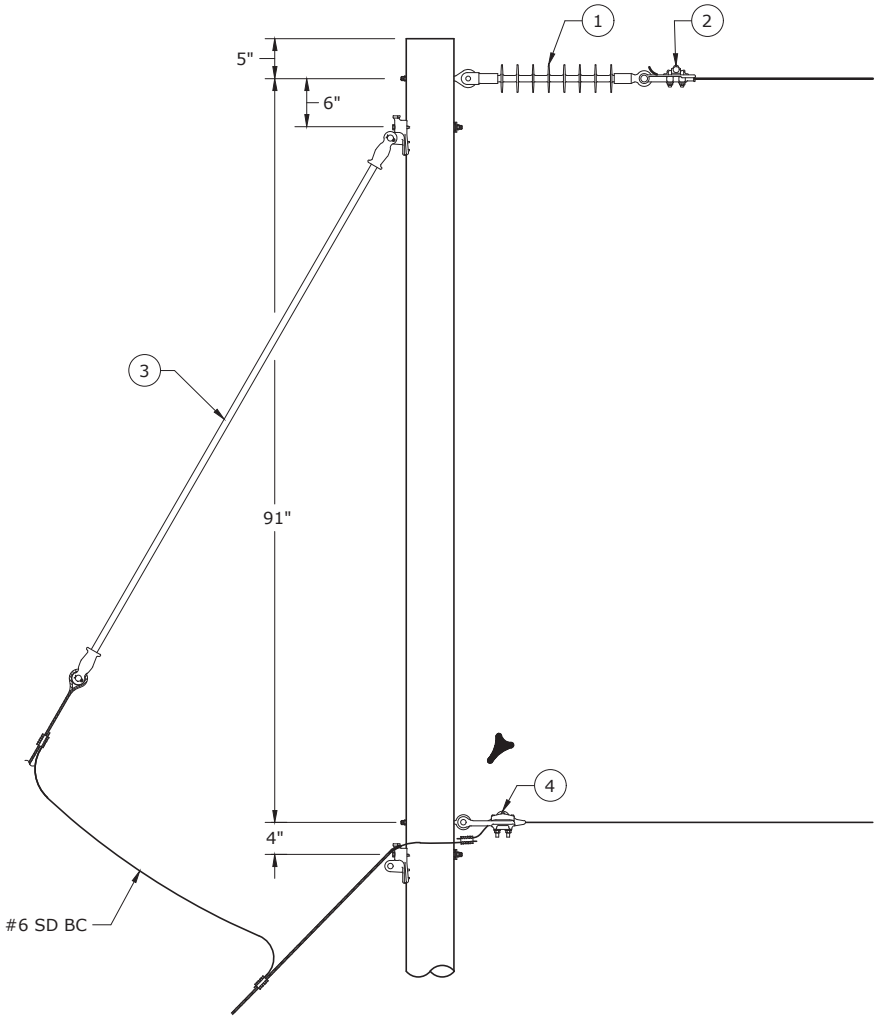
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.08-120B



PLAN VIEW



FRONT VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE CONSTRUCTION DEADEND - GUYED

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-125A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
4	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL,5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

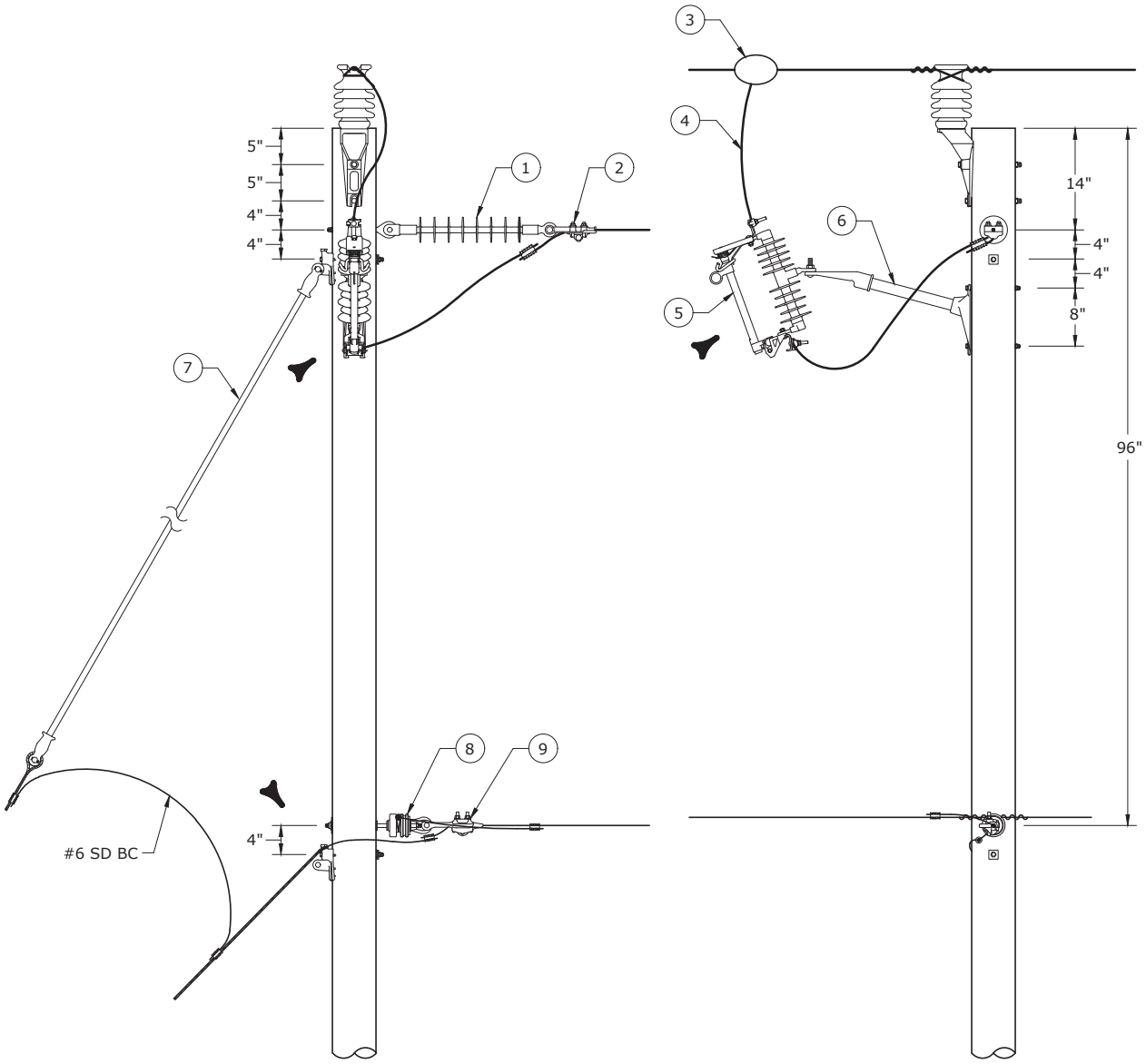
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION DEADEND - GUYED

DEC	DEM	DEP	DEF
			X

03.08-125B



FRONT VIEW

SIDE VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE CONSTRUCTION

SINGLE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.08-130A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE,ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

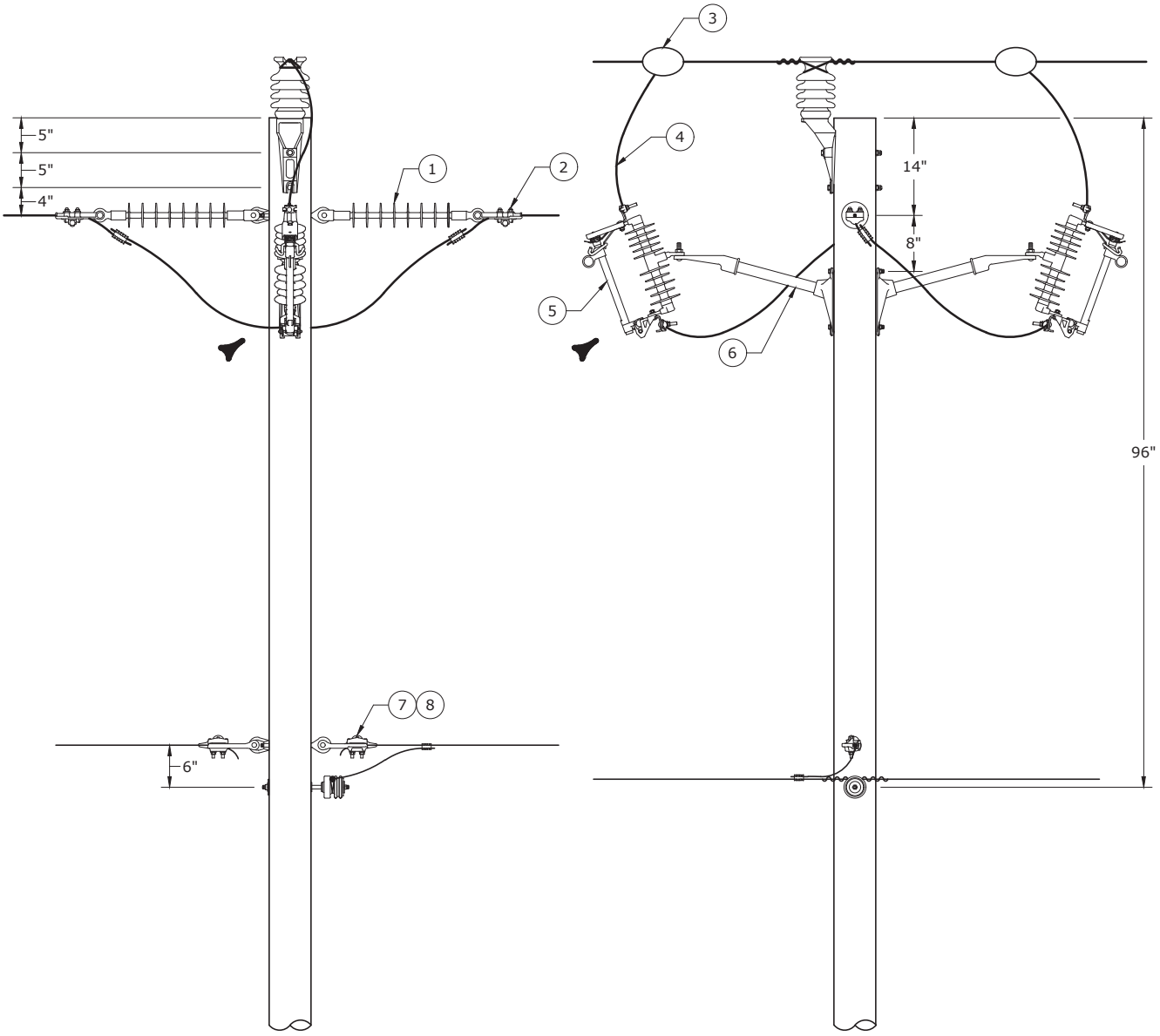
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE CONSTRUCTION

SINGLE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
			X

03.08-130B



FRONT VIEW

SIDE VIEW

NOTES:

1. USE GUYS AND ANCHORS IF TAPS ARE NOT 180° FROM EACH OTHER.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	8/7/17	BENDER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE CONSTRUCTION -
TWO SINGLE-PHASE FUSED TAPS

DEC	DEM	DEP	DEF
X	X	X	X

03.08-135A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	2	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	2	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	2	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
7	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

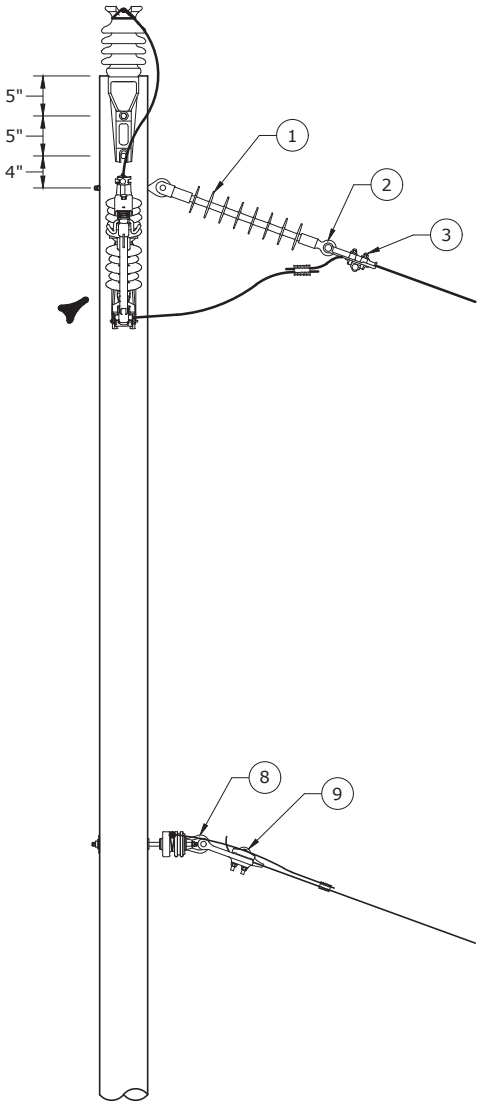
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

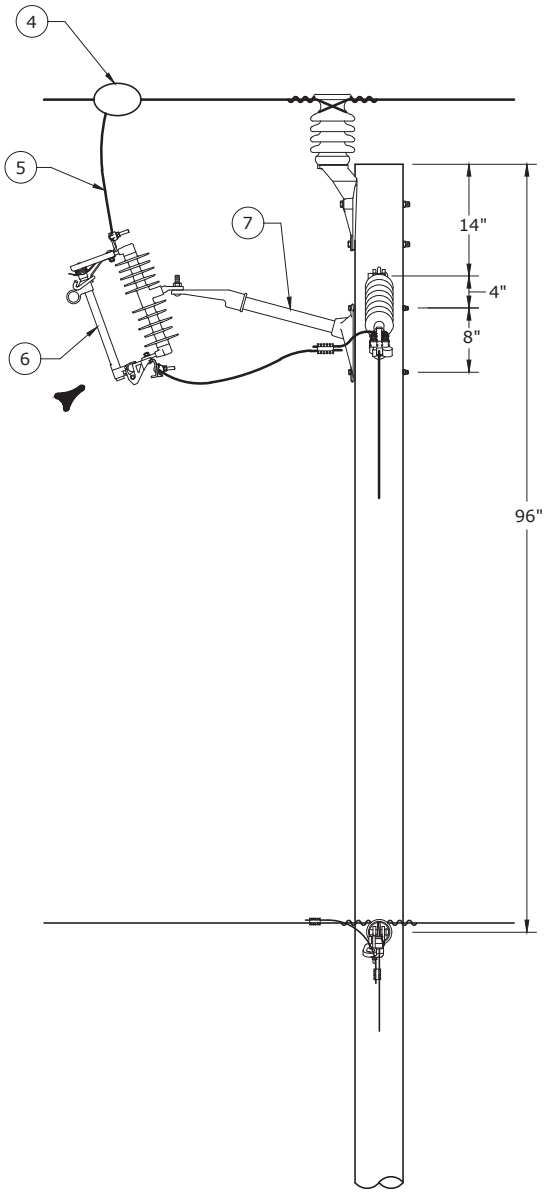
SINGLE-PHASE CONSTRUCTION -
TWO SINGLE-PHASE FUSED TAPS

DEC	DEM	DEP	DEF
			X

03.08-135B



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.06-140 FOR SHUNT CLIP INSTALLATION.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE CONSTRUCTION

SINGLE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.08-140A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	INSL-CLIP-SHUNT-F	1	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE,ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FBG, EQUIPMENT MNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

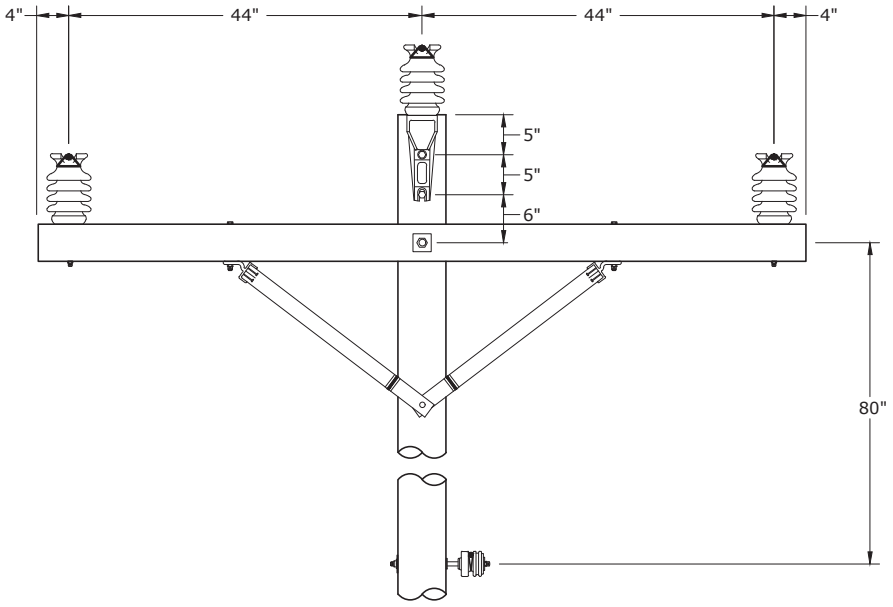
SINGLE-PHASE CONSTRUCTION

SINGLE-PHASE FUSED SLACK SPAN TAP

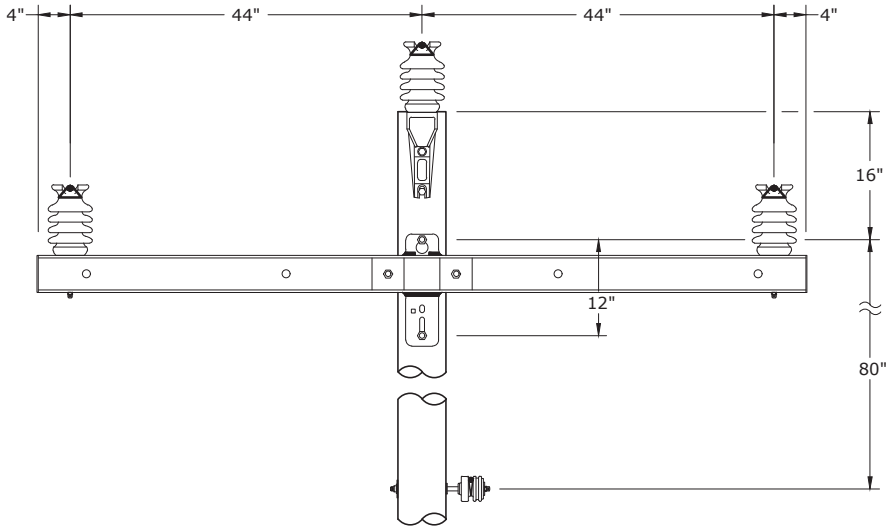
DEC	DEM	DEP	DEF
			X

03.08-140B

WOOD CROSSARM WITH BRACES



FIBERGLASS BRACELESS CROSSARM



CIRCUMSTANCES THAT MAY OVERLOAD CROSSARMS

WHEN THE CONDUCTOR MUST BE RAISED MORE THAN 2% OF THE SHORTER SPAN, ADDITIONAL CONDUCTOR MUST BE ADDED TO PREVENT EXCESSIVE TENSION. SPLICE IN CONDUCTOR FOR PROPER SAG ON THE TWO ADJACENT SPANS. (SEE SECTION 05.)

FOR TRANSMISSION REBUILD PROJECTS, PROFILE DRAWINGS MAY SHOW MAXIMUM HEIGHTS ALLOWED BY TRANSMISSION. ONLY RAISE THE PRIMARY AND NEUTRAL AS NECESSARY FOR NESC GROUND CLEARANCES AND DISTRIBUTION CONSTRUCTION STANDARDS POLE SPACING. **MEASURE UP FROM THE GROUND AND NOT DOWN FROM TRANSMISSION**.

NOTES:

1. CORROSION POTENTIAL RELATED TO HIGH DECAY ZONES EXIST IN ALL OF THE DEF AND DEP DESIGNATED COASTAL AREAS. FOR THIS REASON, WOOD CROSSARMS WILL NOT BE INSTALLED IN THESE JURISDICTIONS AND THE USE OF FIBERGLASS CROSSARMS WILL BECOME THE STANDARD. SEE SECTION 03.07 (CROSSARMS) TO FIND THE FIBERGLASS CROSSARM APPLICABLE TO YOUR DESIGN.

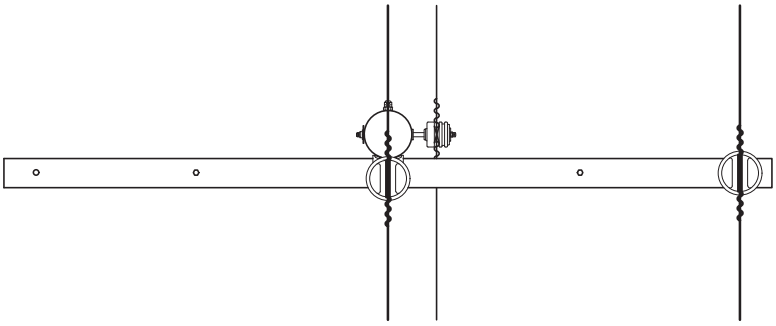
REVISED		BY	CK'D	APPR.
3				
2	9/30/18	BRUINS	BURLISON	ADCOCK
1	11/11/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DUKE ENERGY.

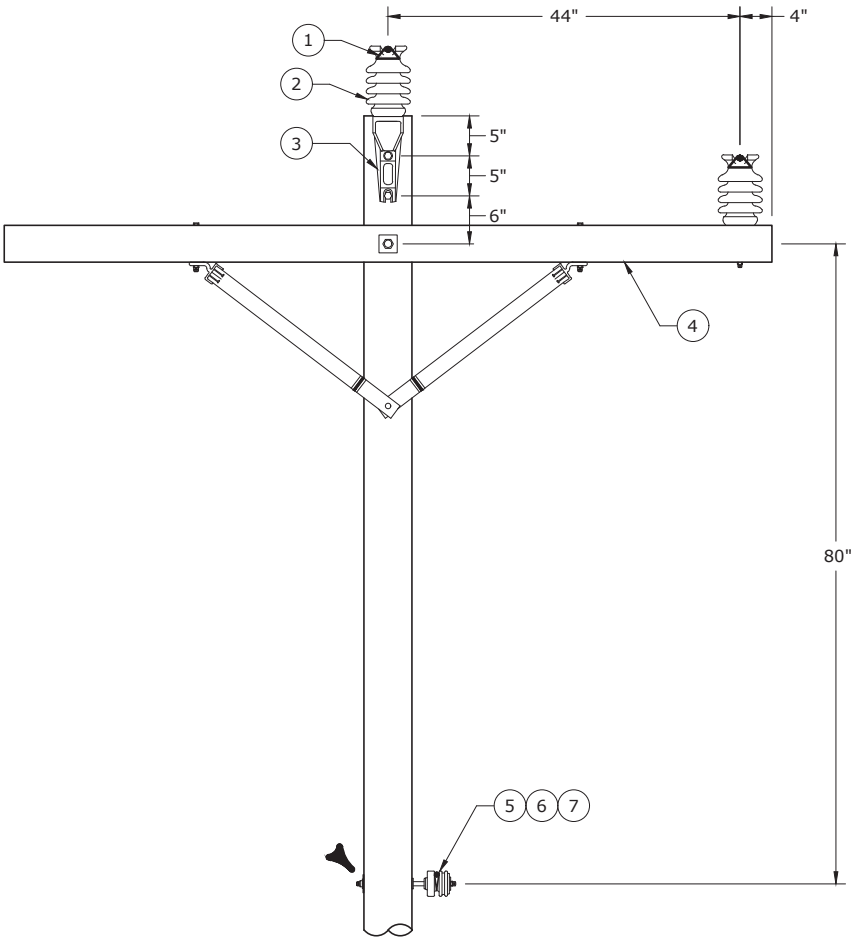
STANDARD CROSSARM INSTALLATION COMPARISON

DEC	DEM	DEP	DEF
X	X	X	X

03.11-100



PLAN VIEW



FRONT VIEW

NOTES:

1. DRAWING DEPICTS A SINGLE-PHASE LINE BEING CONVERTED TO A TWO-PHASE LINE.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM

DEC	DEM	DEP	DEF
X	X	X	X

03.11-101A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

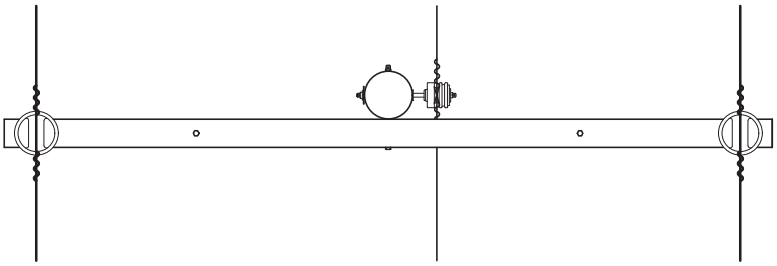
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM

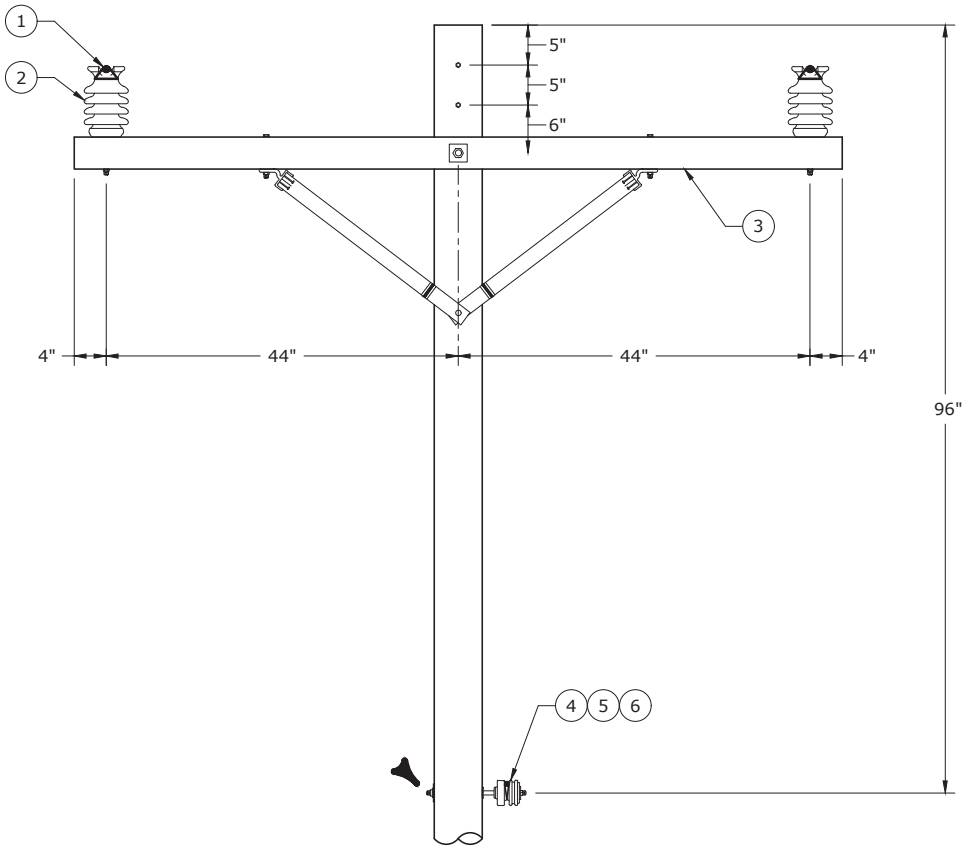
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.11-101B



PLAN VIEW



FRONT VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

TWO-PHASE HORIZONTAL CONSTRUCTION - IN-LINE CROSSARM

DEC	DEM	DEP	DEF
X	X	X	X

03.11-102A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

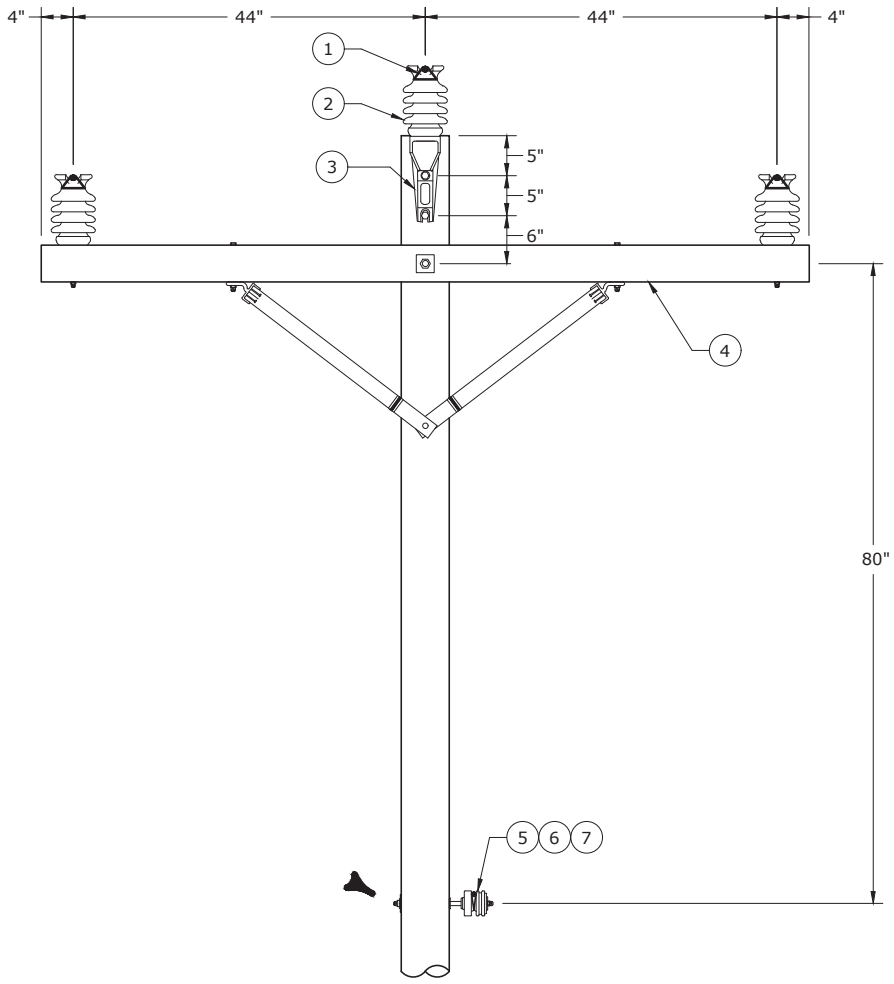
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - IN-LINE CROSSARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.11-102B



FRONT VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM

DEC	DEM	DEP	DEF
X	X	X	X

03.11-103A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

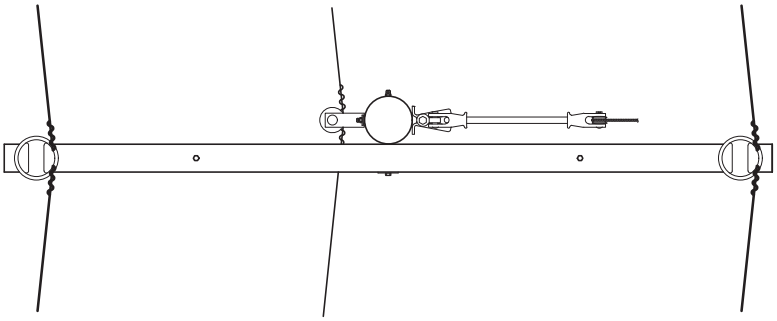
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

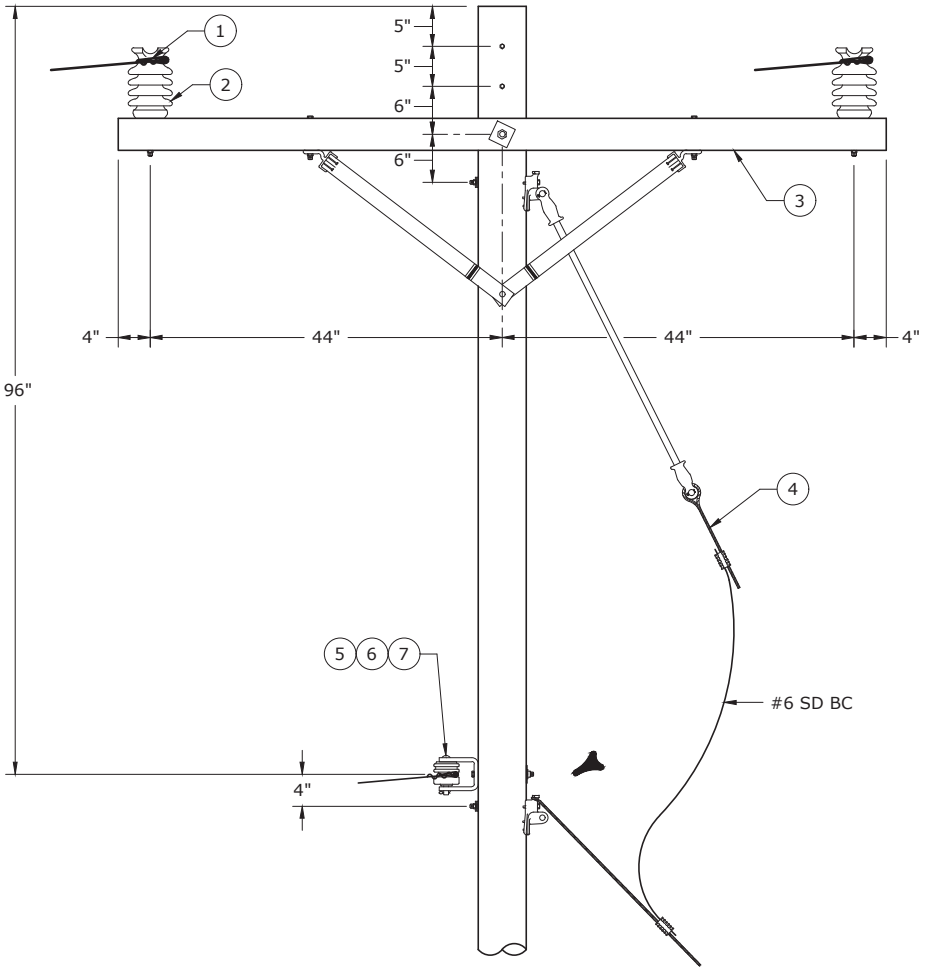
THREE-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM

DEC	DEM	DEP	DEF
			X

03.11-103B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	15°	15°	10°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - IN-LINE CROSSARM SMALL ANGLE

DEC	DEM	DEP	DEF
X	X	X	X

03.11-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

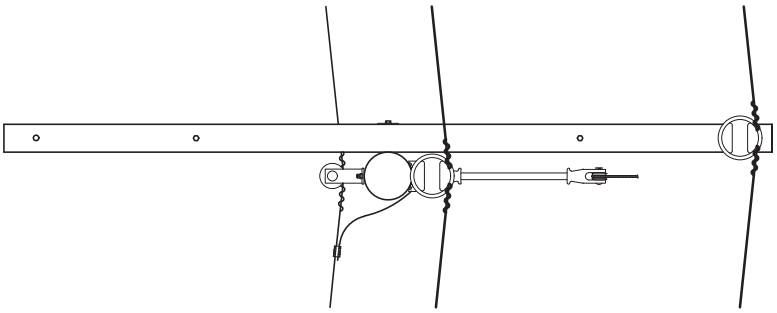
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

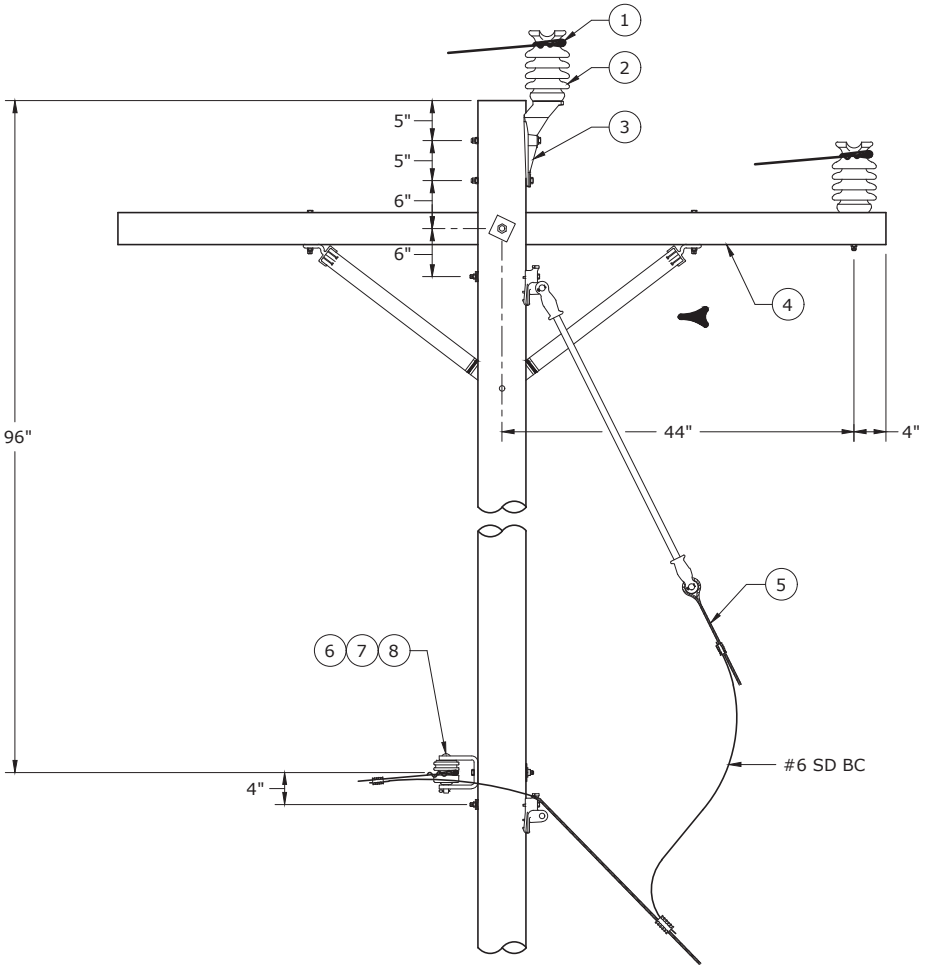
TWO-PHASE HORIZONTAL CONSTRUCTION -
IN-LINE CROSSARM SMALL ANGLE

DEC	DEM	DEP	DEF
			X

03.11-105B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AAAC AND SMALLER	15°	15°	10°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - SMALL ANGLE - CROSSARM

DEC	DEM	DEP	DEF
X	X	X	X

03.11-106A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT,MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

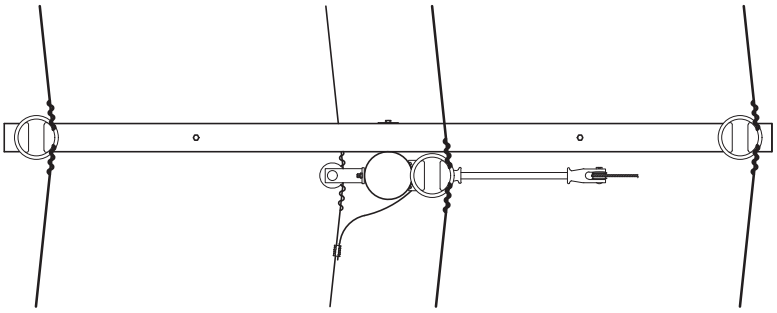
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

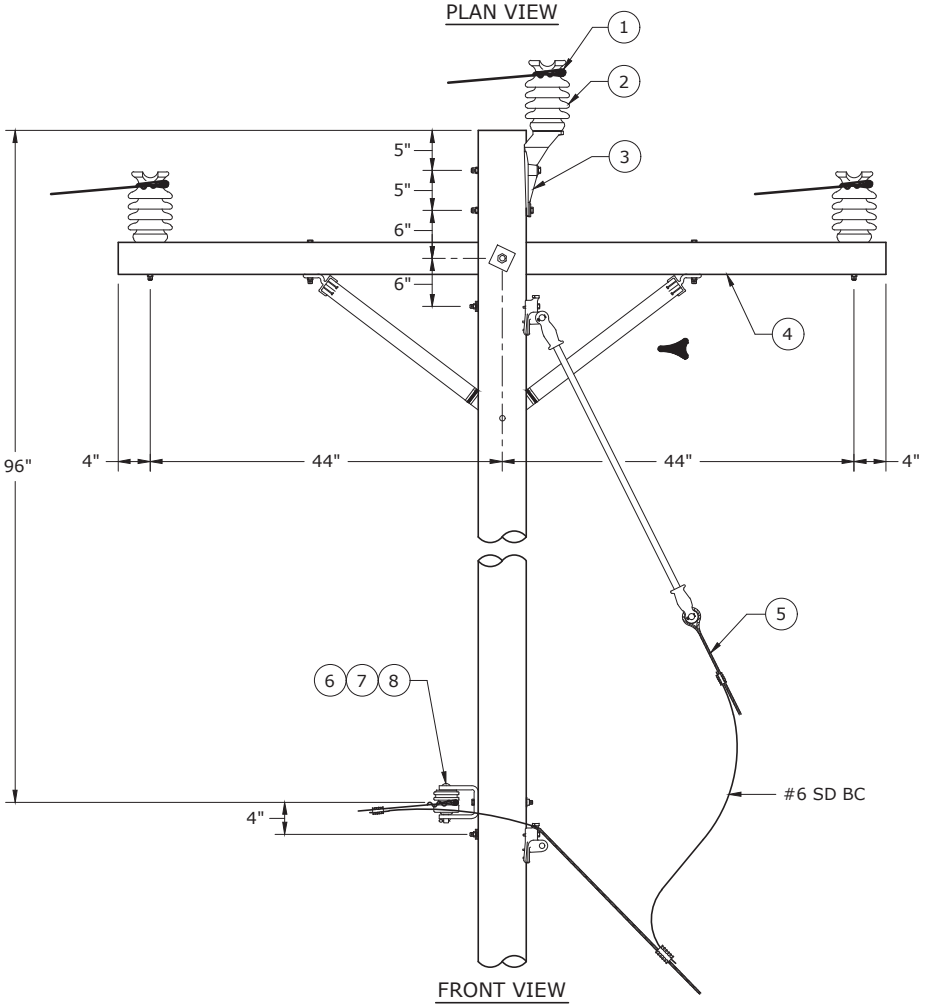
TWO-PHASE HORIZONTAL CONSTRUCTION -
SMALL ANGLE - CROSSARM

DEC	DEM	DEP	DEF
			X

03.11-106B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AAAC AND SMALLER	15°	15°	10°
4/0 AAAC	-	10°	10°
336.4 AAC	10°	10°	10°
477 AAC	-	10°	-
556.5 AAC	-	10°	5°
795 AAC	5°	-	-

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - SMALL ANGLE - CROSSARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-107A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GAL
5	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

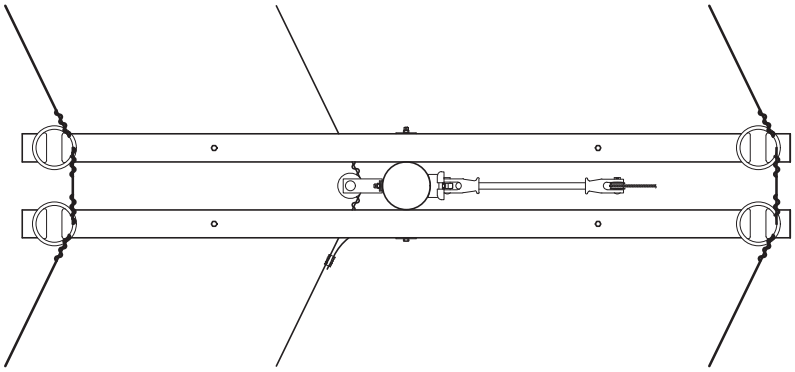
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - SMALL ANGLE - CROSSARM

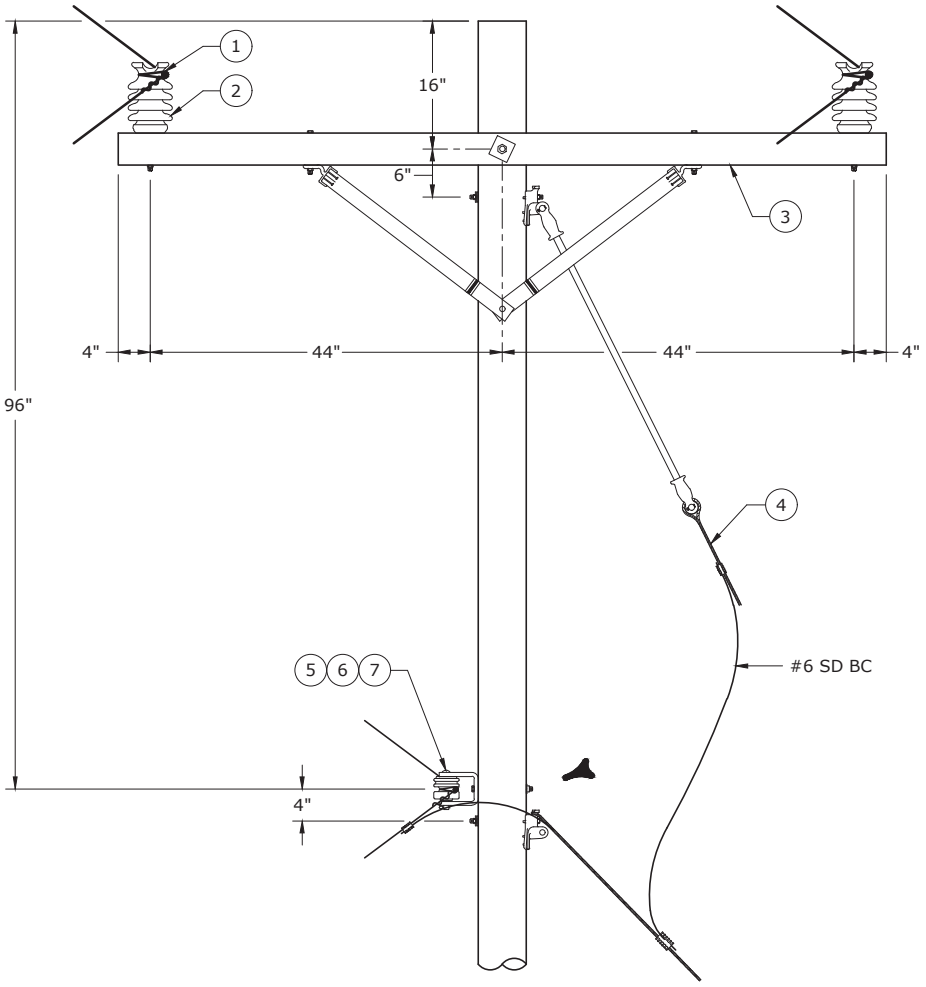
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.11-107B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	30°	30°	25°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - IN-LINE - MEDIUM ANGLE - DOUBLE CROSSARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DSIDE-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	4	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	ARM-DBL-8-FBG-NB-F	1	4001743	2	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	HDWR-DA-LG-22IN-GALV-F	2	930945	1	BOLT, DOUBLE ARMING, 3/4" DIA, 22" LG, 18350 LB, GALV STL
3	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

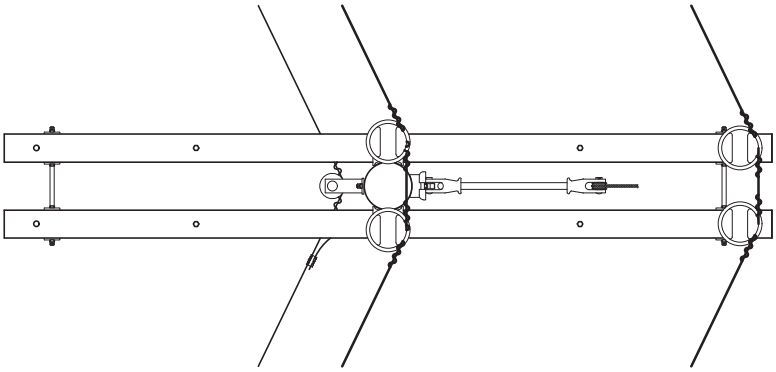
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

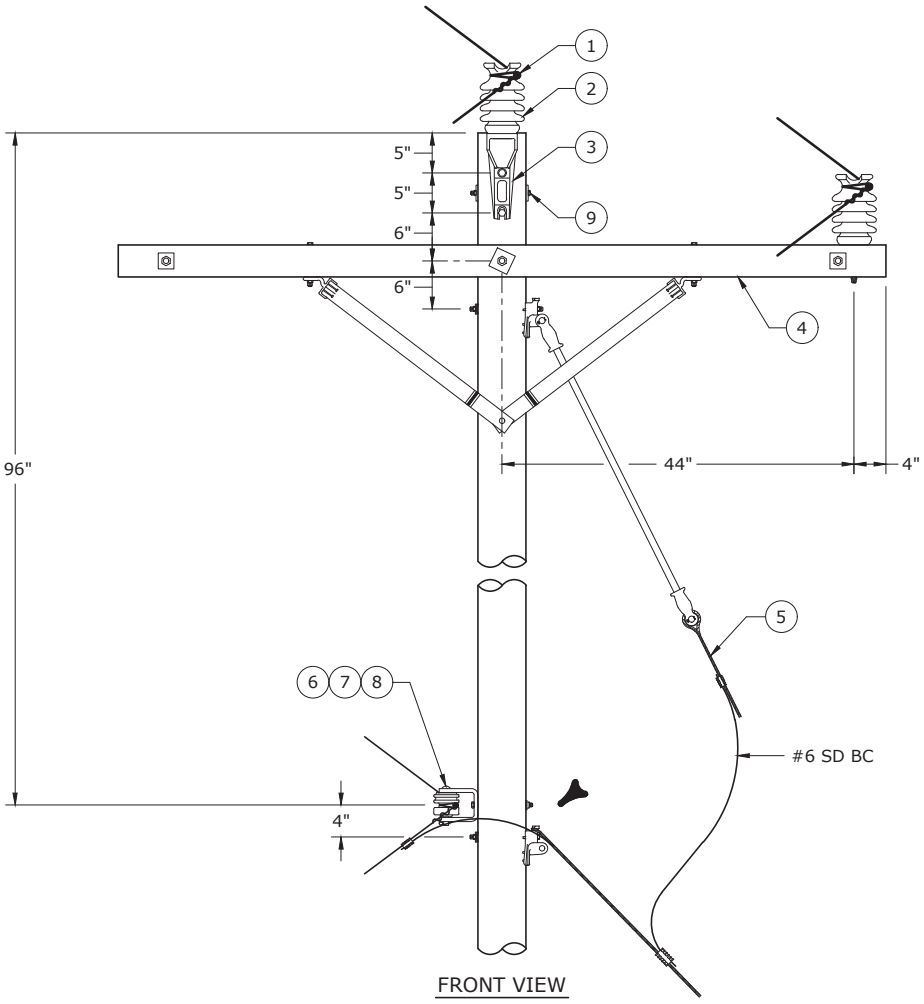
TWO-PHASE HORIZONTAL CONSTRUCTION -
IN-LINE - MEDIUM ANGLE -
DOUBLE CROSSARM

DEC	DEM	DEP	DEF
			X

03.11-110B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	30°	30°	25°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. A 5/8" MACHINE BOLT SHALL BE INSTALLED AS A SPLIT-OUT BOLT ON MEDIUM ANGLE AND DOUBLE POLE TOP INSULATOR APPLICATIONS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - MEDIUM ANGLE - DOUBLE CROSSARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-111A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DSIDE-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	4	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	2	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-DBL-8-FBG-NB-F	1	4001743	2	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-DA-LG-22IN-GALV-F	2	930945	1	BOLT, DOUBLE ARMING, 3/4" DIA, 22" LG, 18350 LB, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
9	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV

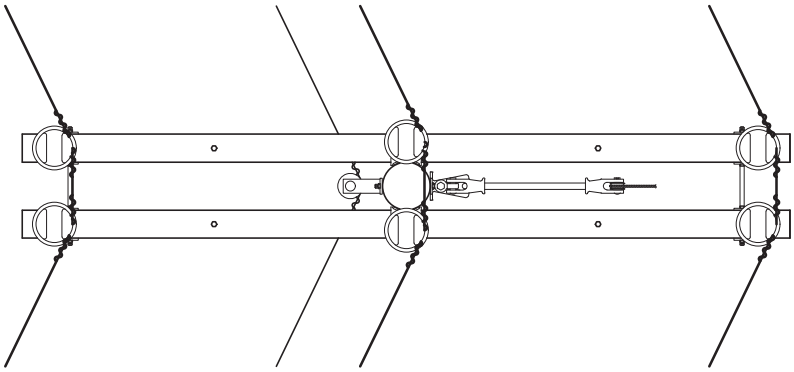
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

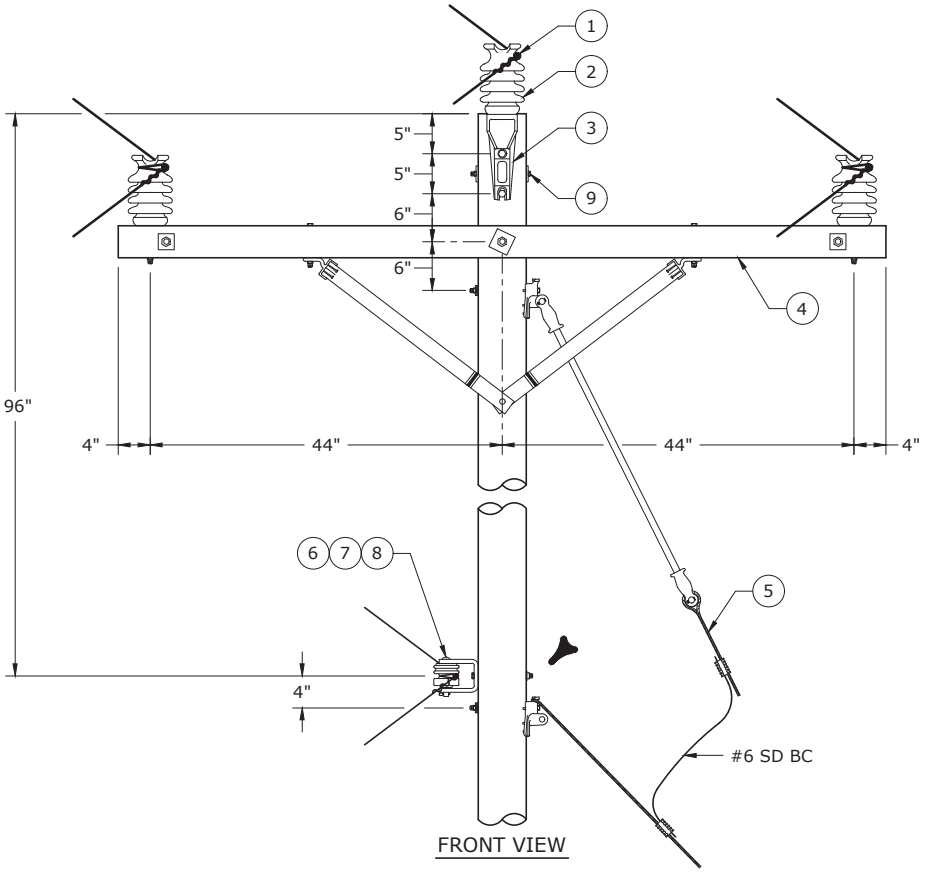
TWO-PHASE HORIZONTAL CONSTRUCTION - MEDIUM ANGLE - DOUBLE CROSSARM

DEC	DEM	DEP	DEF
			X

03.11-111B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AAAC AND SMALLER	30°	30°	25°
4/0 AAAC	-	25°	20°
336.4 AAC	25°	25°	20°
477 AAC	-	20°	-
556.5 AAC	-	20°	10°
795 AAC	10°	-	-

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. A 5/8" MACHINE BOLT SHALL BE INSTALLED AS A SPLIT-OUT BOLT ON MEDIUM ANGLE AND DOUBLE POLE TOP INSULATOR APPLICATIONS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - MEDIUM ANGLE - DOUBLE CROSSARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-112A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DSIDE-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	2	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	ARM-DBL-8-FBG-NB-F	1	4001743	2	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-DA-LG-22IN-GALV-F	2	930945	1	BOLT, DOUBLE ARMING, 3/4" DIA, 22" LG, 18350 LB, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HD, HOT DIP GALV STL
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
9	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV

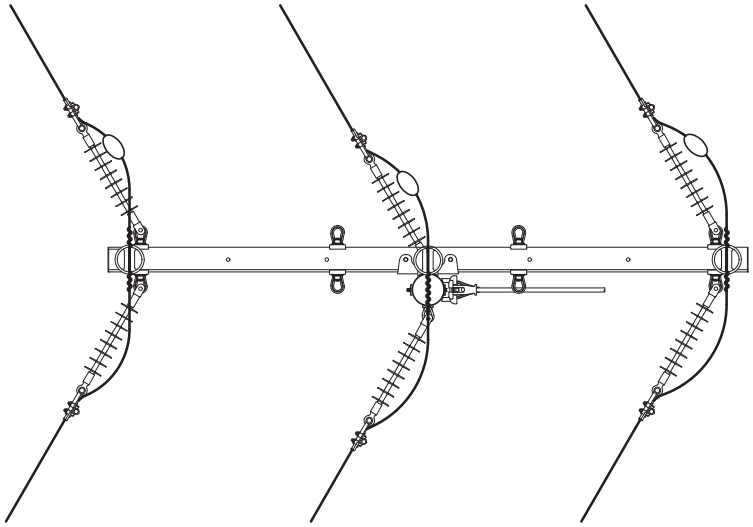
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - MEDIUM ANGLE - DOUBLE CROSSARM

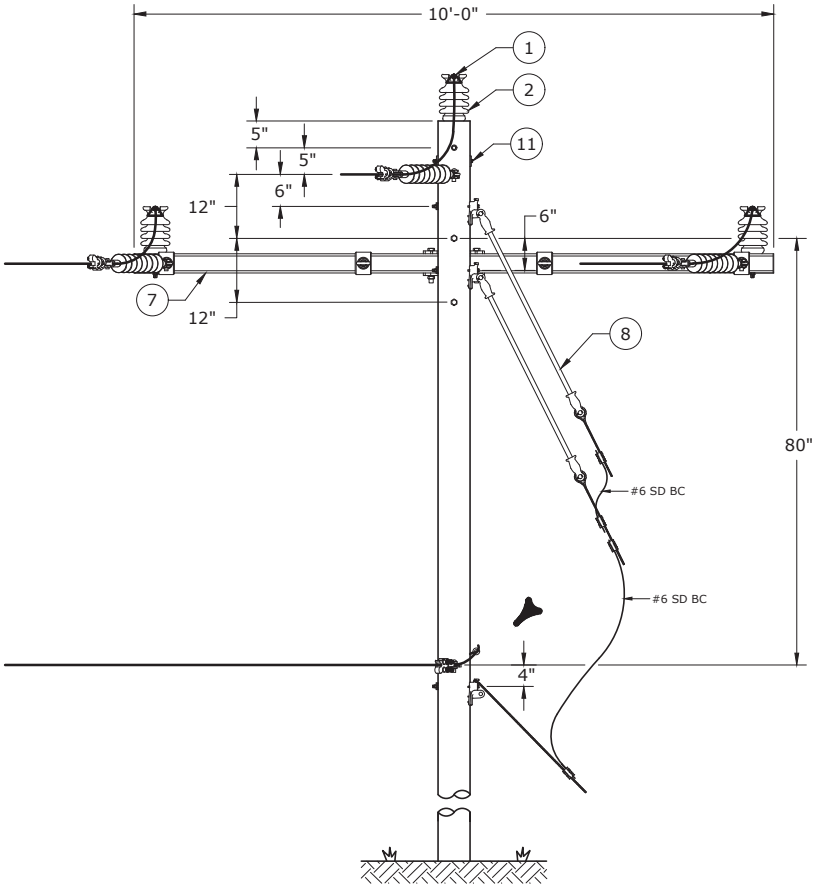
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

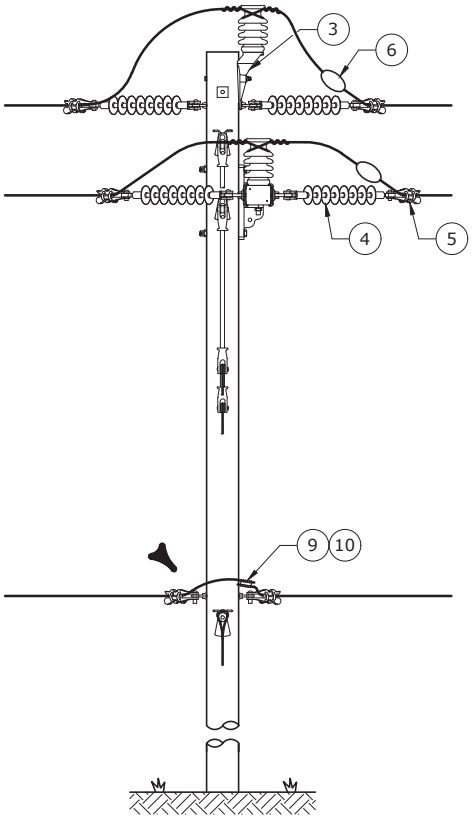
03.11-112B



PLAN VIEW



FRONT VIEW



SIDE VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795 AND SMALLER	60°	60°	50°

NOTES:

1. FOR TWO-PHASE DOUBLE DEADEND INSTALLATIONS, USE SAME DESIGN AS SHOWN ABOVE.
2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - DOUBLE DEADEND LARGE ANGLE NOT TO EXCEED 60 DEGREE ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-116A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE,OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
9	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
9	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
10	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
11	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV

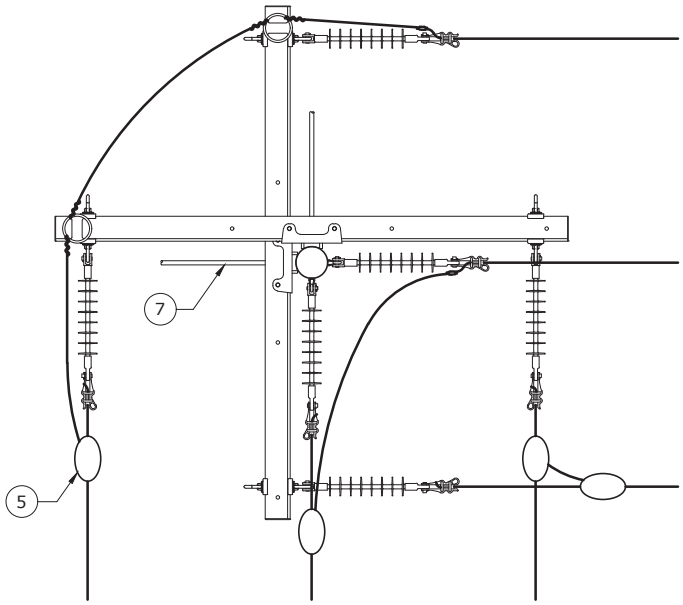
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

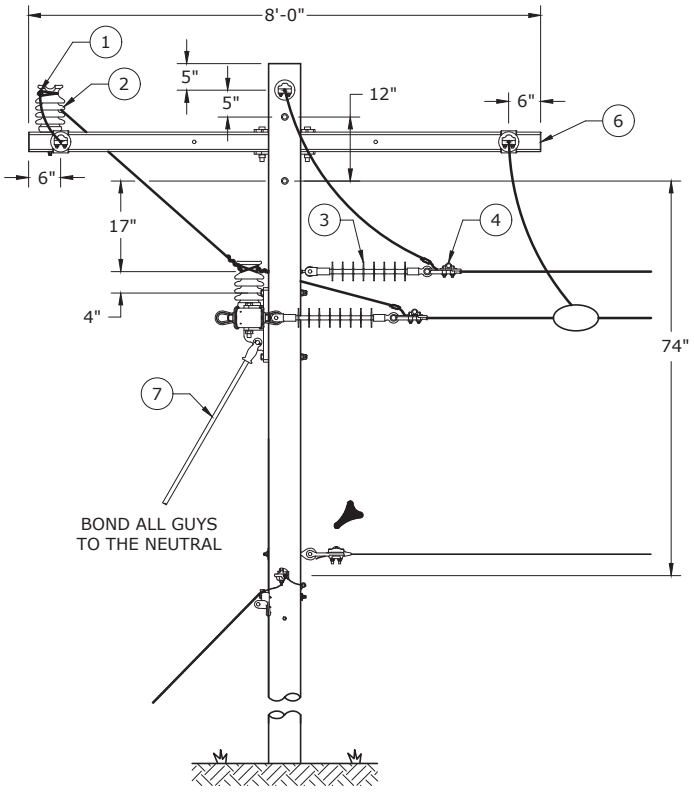
THREE-PHASE HORIZONTAL CONSTRUCTION -
DOUBLE DEADEND LARGE ANGLE
NOT TO EXCEED 60 DEGREE ANGLE

DEC	DEM	DEP	DEF
			X

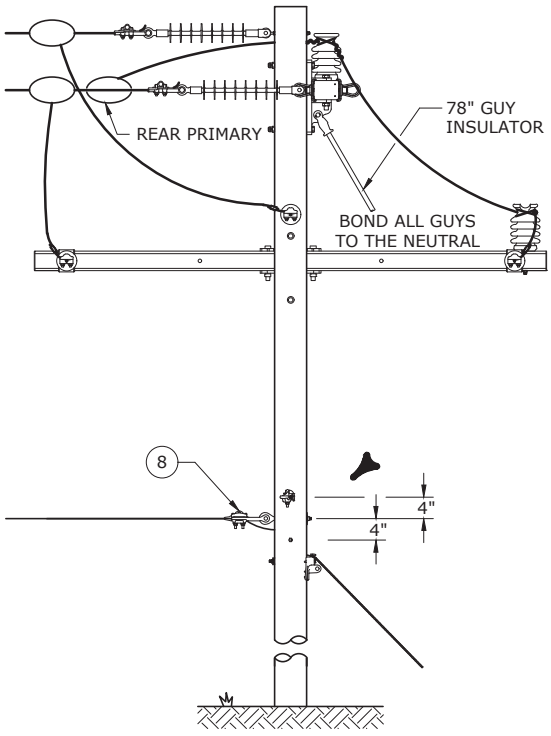
03.11-116B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. TWO DOWN GUYS SHALL BE INSTALLED WHEN 795 CONDUCTOR IS USED. DEADEND CENTERMOUNT BRACKET ON FIBERGLASS CROSSARM HAS PROVISIONS FOR TWO GUYS.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - BUCK ARM - RIGHT ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-119A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	2	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
3	HDWR-EYEBOLT-SM-10IN-GALV-F	2	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	2	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUY AND ANCHOR DETAILS
8	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

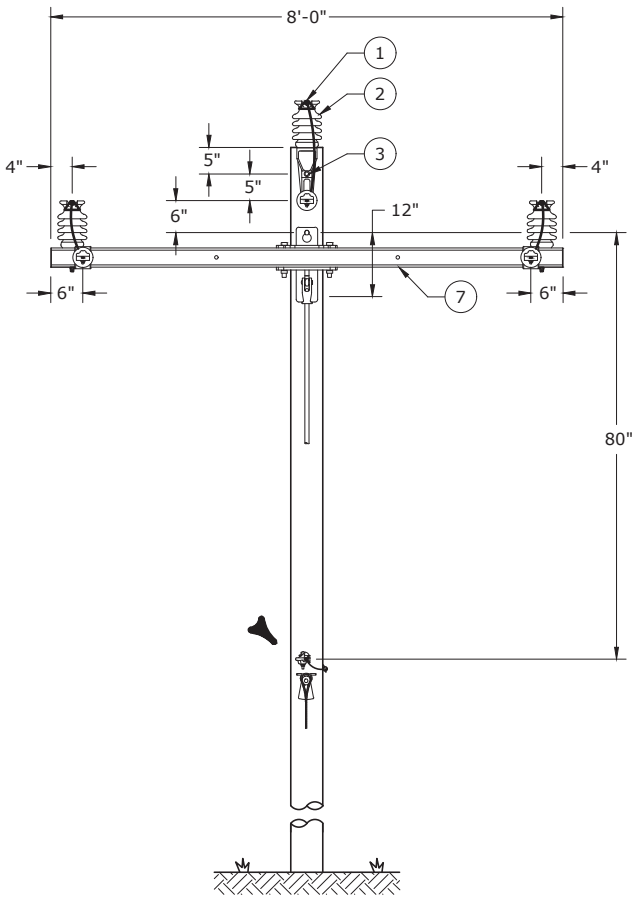
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION -

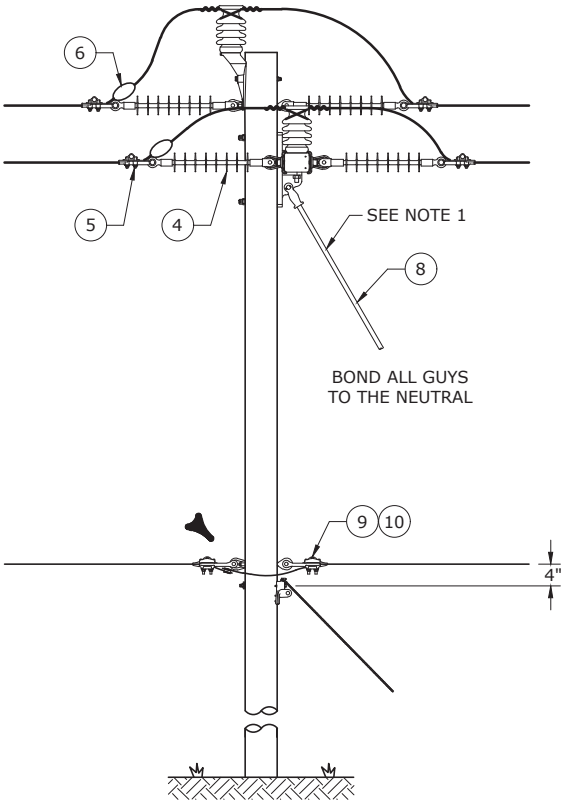
BUCK ARM - RIGHT ANGLE

DEC	DEM	DEP	DEF
			X

03.11-119B



FRONT VIEW



SIDE VIEW

NOTES:

1. USED WHEN DIFFERENT SIZE CONDUCTORS ON EACH SIDE OF POLE.
2. FOR TWO-PHASE DOUBLE DEADEND INSTALLATIONS, USE SAME DESIGN AS SHOWN ABOVE.
3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - DOUBLE DEADEND GUYED

DEC	DEM	DEP	DEF
X	X	X	X

03.11-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, POLE TOP MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HD, HOT DIP GALV STL
4	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DISTRIBUTION DEADEND, 35KV, 22" LG, POLYMER
4	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	3	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	ARM-SDE-8-FBG-NB-F	1	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUY AND ANCHOR DETAILS
9	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
9	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
10	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

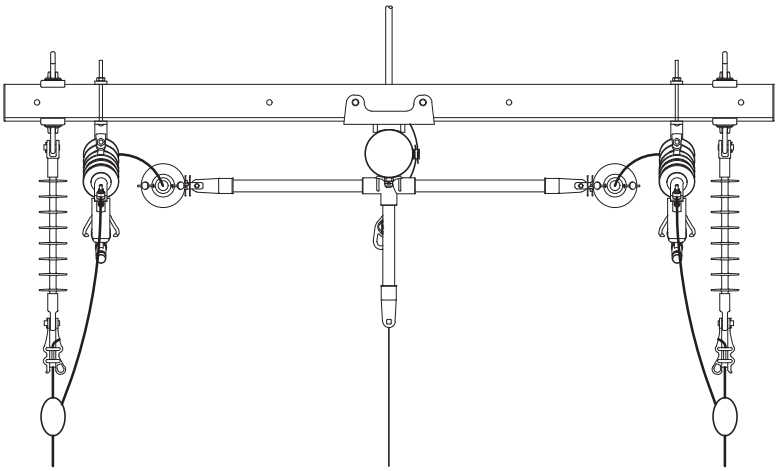
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

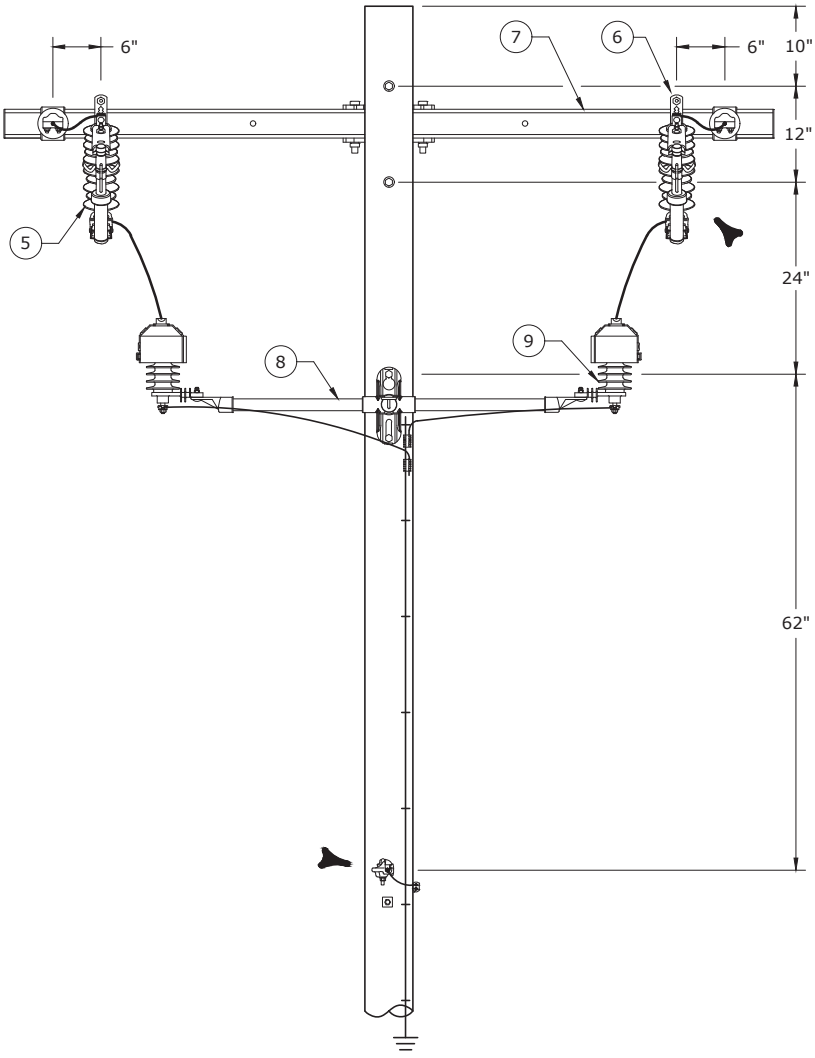
THREE-PHASE HORIZONTAL CONSTRUCTION - DOUBLE DEADEND GUYED

DEC	DEM	DEP	DEF
			X

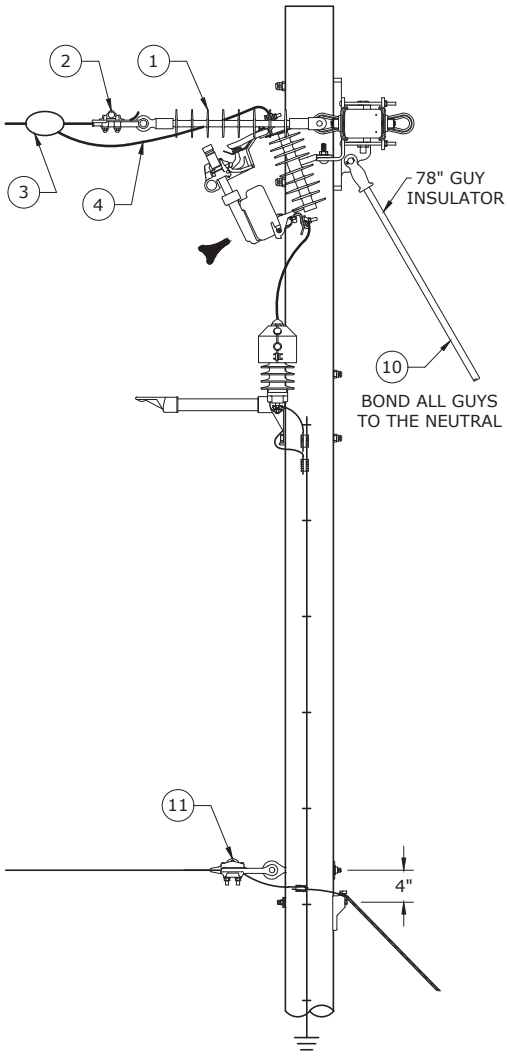
03.11-120B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 12/12/16	GORLEY	BURLISON	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

TWO-PHASE HORIZONTAL CONSTRUCTION - DEADEND CROSSARM GUYED

DEC	DEM	DEP	DEF
X	X	X	X

03.11-125A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	2	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	2	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	BKT-EM-ARM-1P-STL-MD-F	2	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-8-FBG-NB-F	1	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	BKT-EM-POLE-3P-FG-LG-F	1	4197597	1	BRACKET, SGL POSITION 3PH, 48" X 24", FIBERGLASS, 0 DEG MOUNT
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
9	ARR-LINE-10KV-F	2	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	2	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	2	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

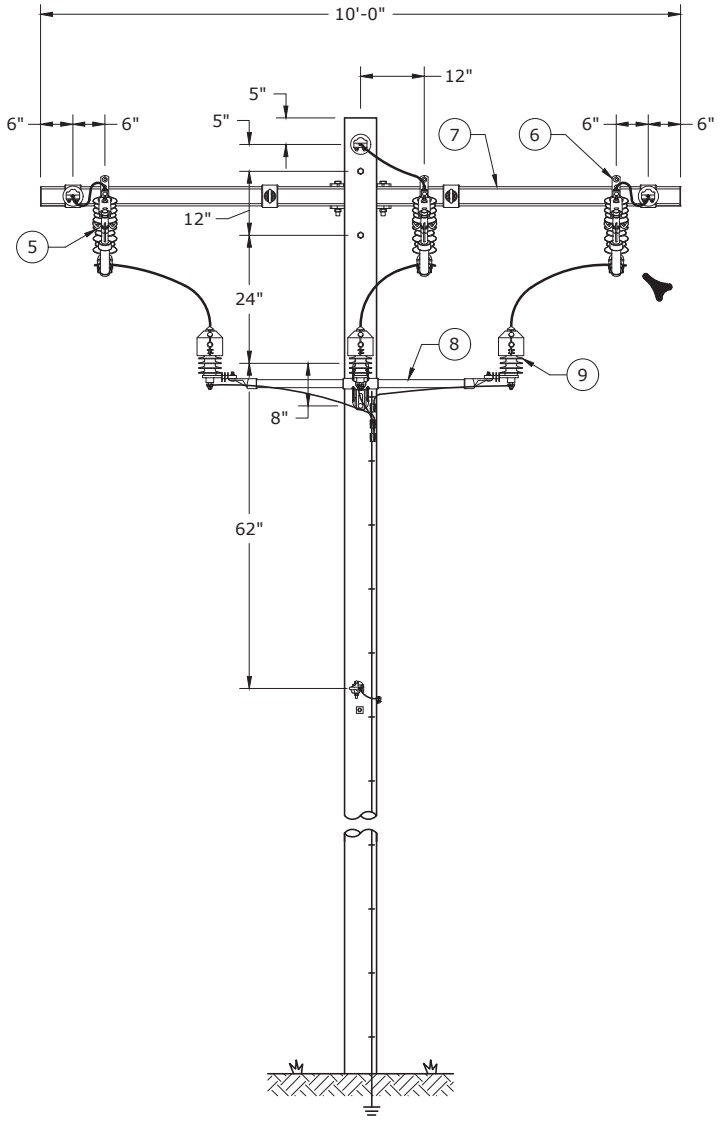
DUKE ENERGY.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

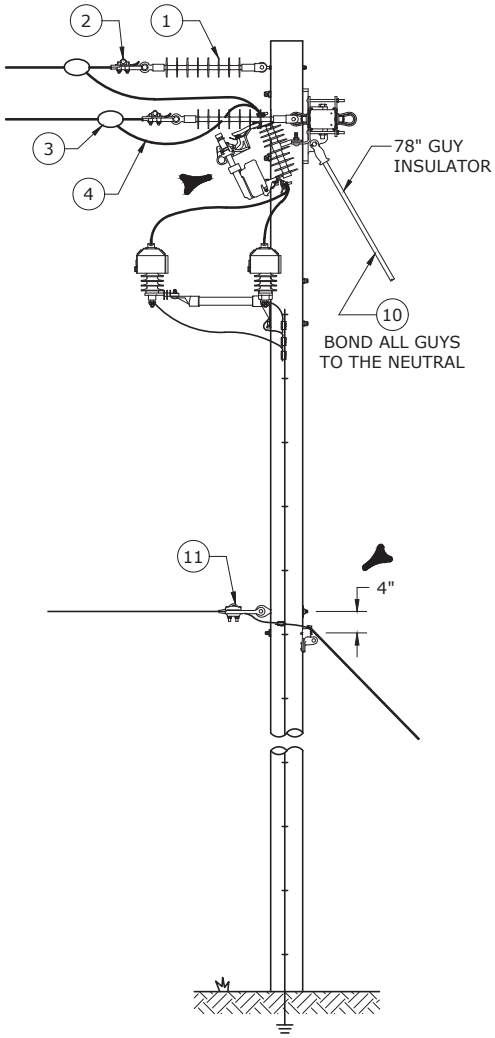
TWO-PHASE HORIZONTAL CONSTRUCTION - DEADEND CROSSARM GUYED

DEC	DEM	DEP	DEF
			X

03.11-125B



FRONT VIEW



SIDE VIEW

NOTES:

1. TWO DOWN GUYS SHALL BE INSTALLED WHEN 795 CONDUCTOR IS USED. DEADEND CENTERMOUNT BRACKET ON FIBERGLASS CROSSARM HAS PROVISIONS FOR TWO GUYS.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
4	4/30/18	BENDER	BURLISON	ADCOCK
3	8/7/17	BENDER	BURLISON	ADCOCK
2	4/5/17	LOOSIER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - DEADEND CROSSARM GUYED

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-127A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	BKT-EM-POLE-3P-FG-LG-F	1	4197597	1	BRACKET, SGL POSITION 3PH, 48" X 24", FIBERGLASS, 0 DEG MOUNT
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
9	ARR-LINE-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

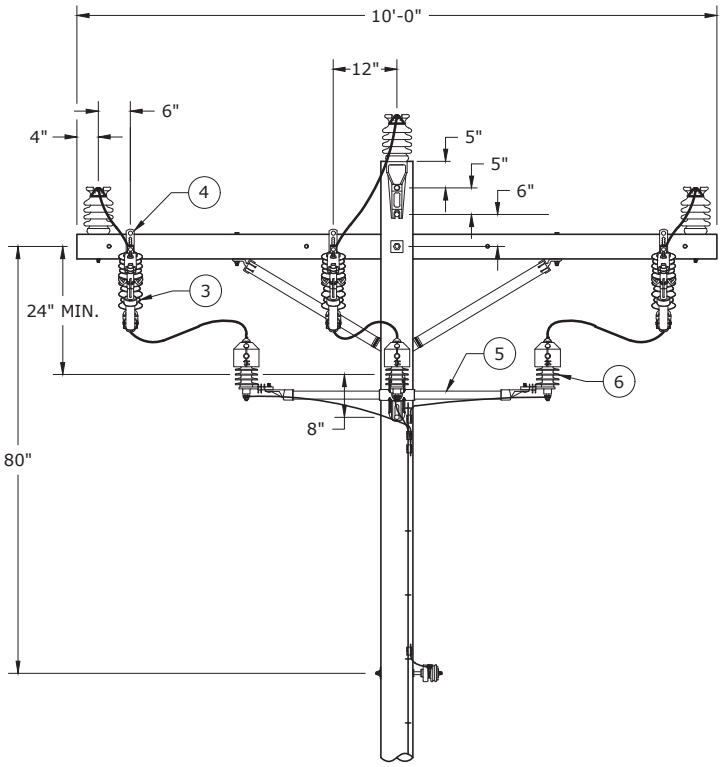
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

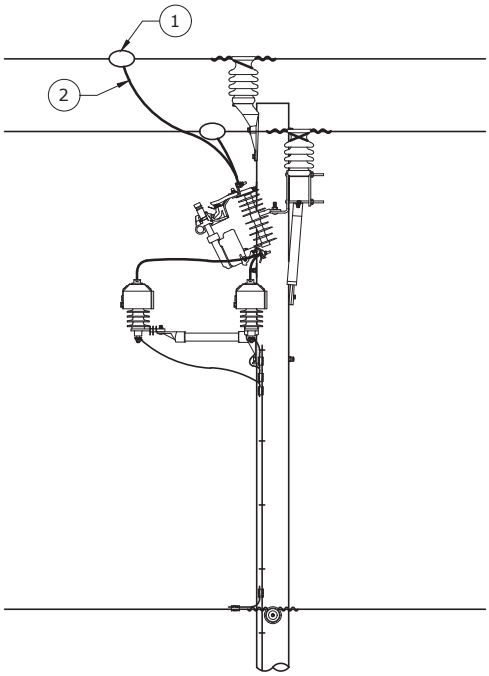
THREE-PHASE HORIZONTAL CONSTRUCTION -
DEADEND CROSSARM GUYED

DEC	DEM	DEP	DEF
			X

03.11-127B



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 08.00-104 FOR DETAILS ON WHEN ARRESTERS ARE REQUIRED.

2. 10' CROSSARM IS REQUIRED.

3				
2				
1				
0	3/31/18	BENDER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE HORIZONTAL CONSTRUCTION -
TANGENT ARRESTER ONLY STATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-128A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
2	LEAD-EQ-6-CU-COVER-F	3	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
3	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
3	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
3	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
4	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
5	BKT-EM-POLE-3P-FG-LG-F	1	4197597	1	BRACKET, SGL POSITION 3PH, 48" X 24", FIBERGLASS, 0 DEG MOUNT
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
6	ARR-LINE-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT

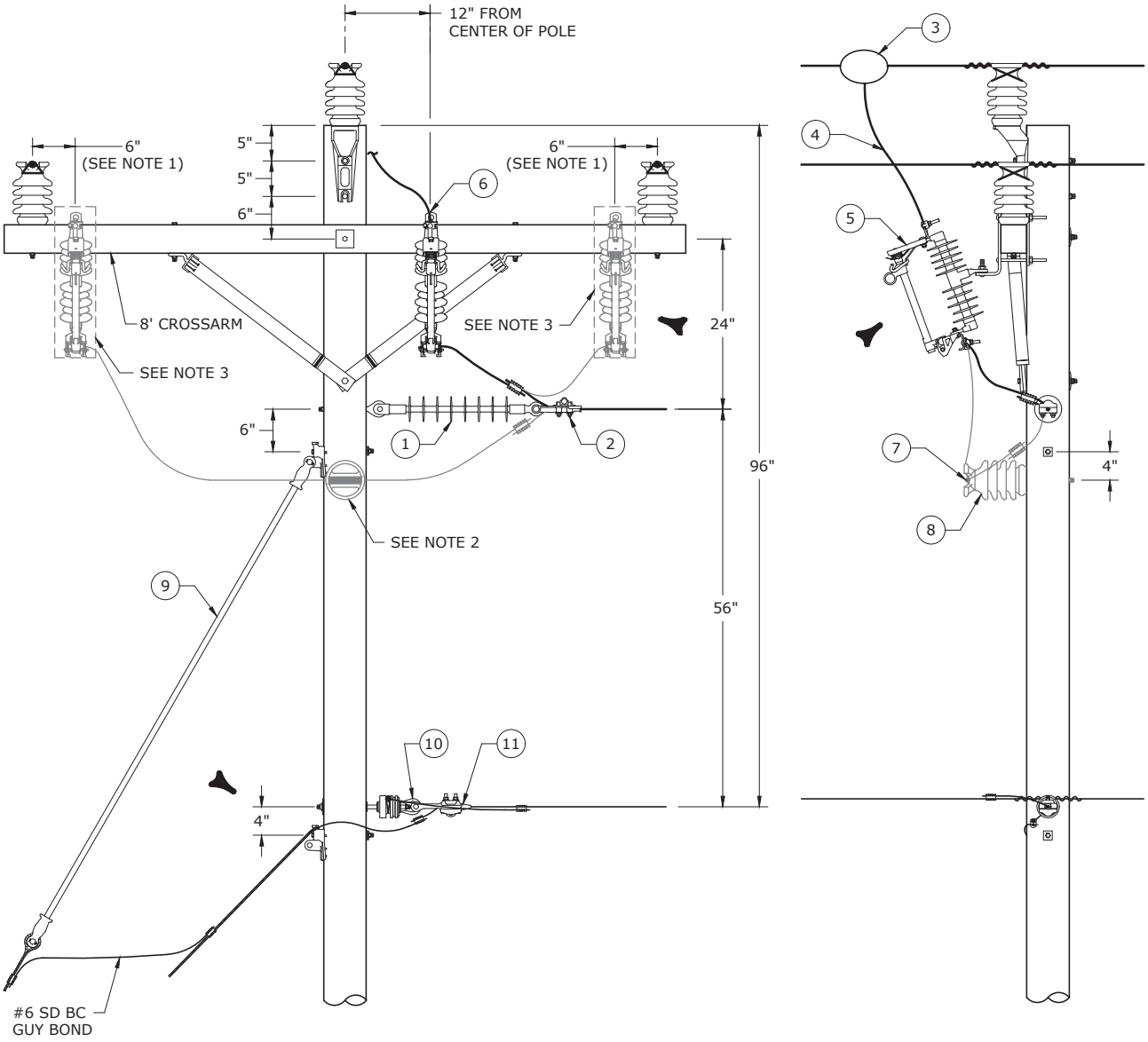
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	3/31/18	BENDER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION -
TANGENT ARRESTER ONLY STATION

DEC	DEM	DEP	DEF
			X

03.11-128B



FRONT VIEW

SIDE VIEW

NOTES:

1. POSITION OF CUTOUT IF THIS PHASE IS TAPPED.
2. USE POST INSULATOR FOR JUMPER SUPPORT IF THIS PHASE IS TAPPED.
3. BOXED CUTOUTS ARE SHOWN AS ALTERNATE FEEDS.
4. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - SINGLE-PHASE FUSED TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-130A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
8	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
8	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
9	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

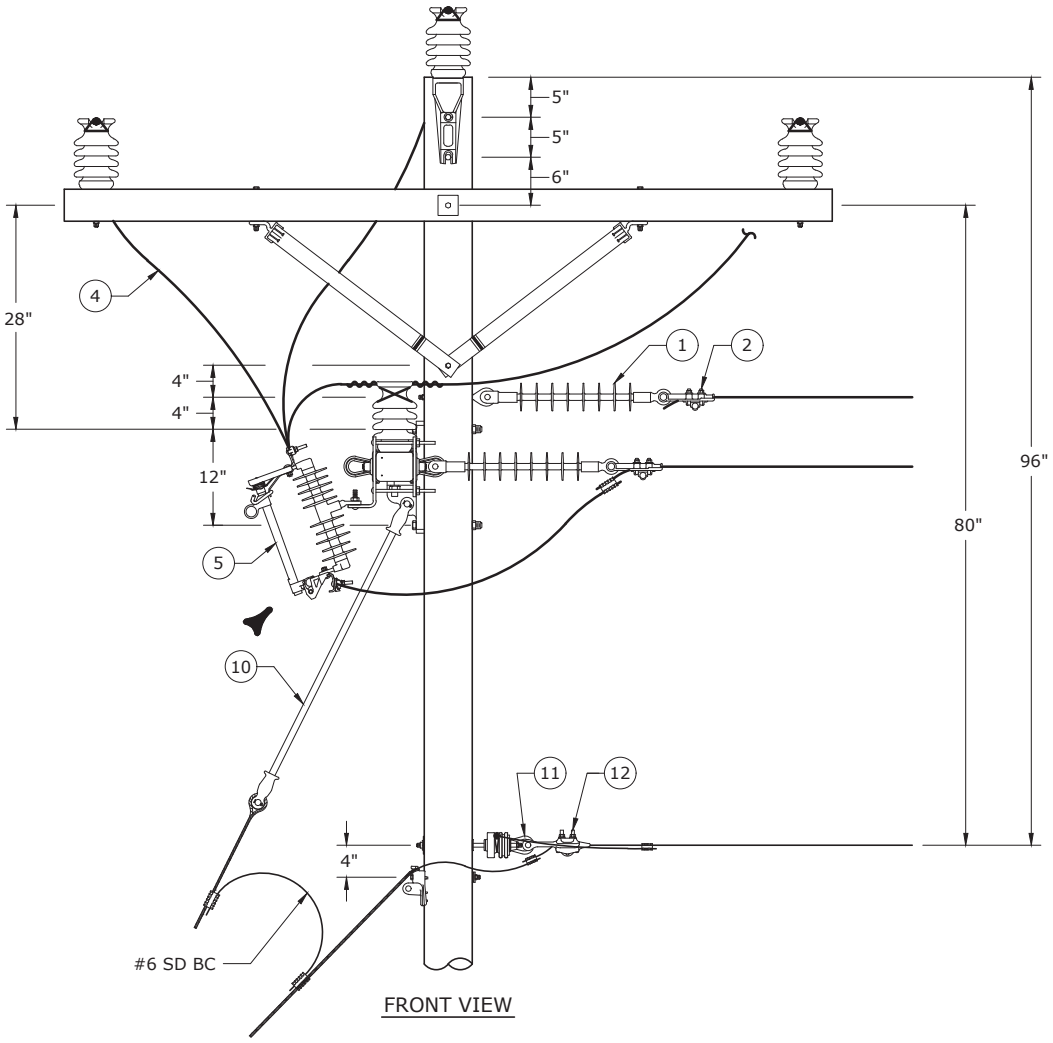
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - SINGLE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
			X

03.11-130B



FRONT VIEW

NOTES:

1. SEE DWG. 03.11-133B FOR PLAN VIEW.
2. OMIT CENTER PHASE FOR TWO-PHASE TAP AND USE 8' ARM.
3. CUTOUTS CAN BE INSTALLED ON EITHER SIDE OF CROSSARM FOR OPERATING REASONS.
4. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

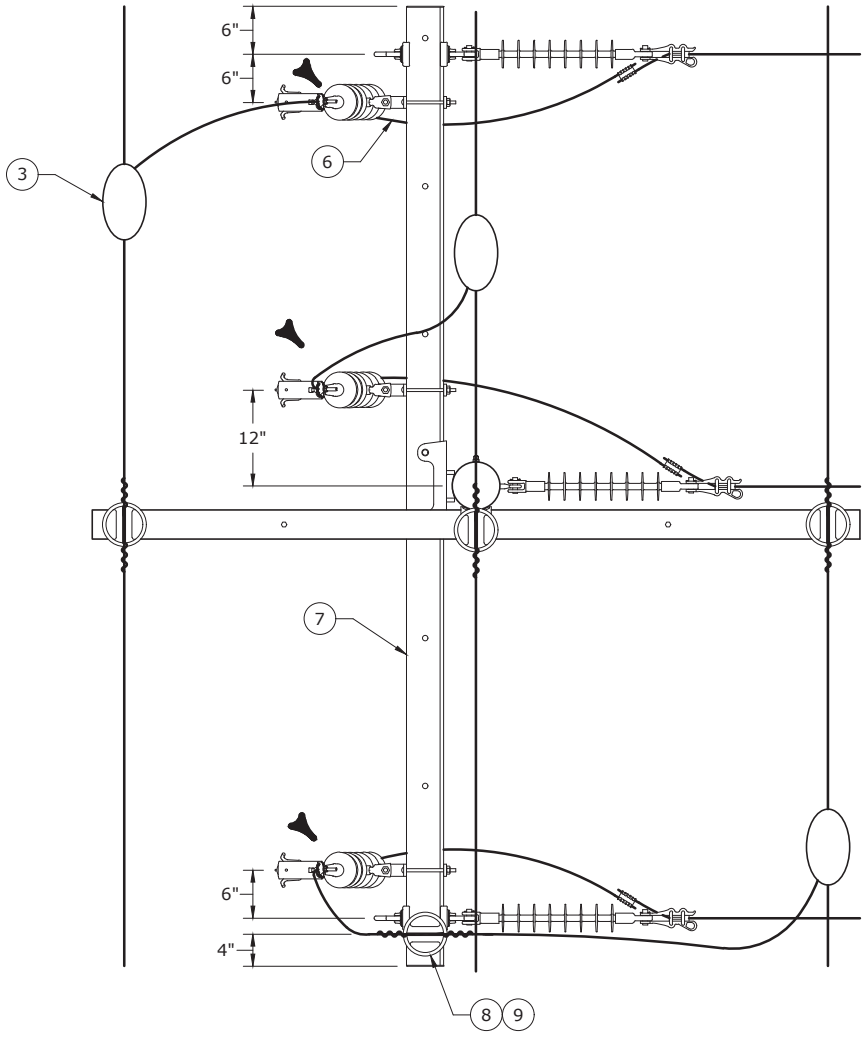
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - THREE-PHASE FUSED TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-133A



PLAN VIEW

NOTES:

1. SEE DWG. 03.11-133A FOR FRONT VIEW.
2. OMIT CENTER PHASE FOR TWO-PHASE TAP AND USE 8' ARM.
3. CUTOUTS MAY BE INSTALLED ON THE CONDUCTOR SIDE OF THE FIBERGLASS ARM IF MORE CONVENIENT TO OPERATE ON THAT SIDE.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - THREE-PHASE FUSED TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-133B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4", 10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
8	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
9	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

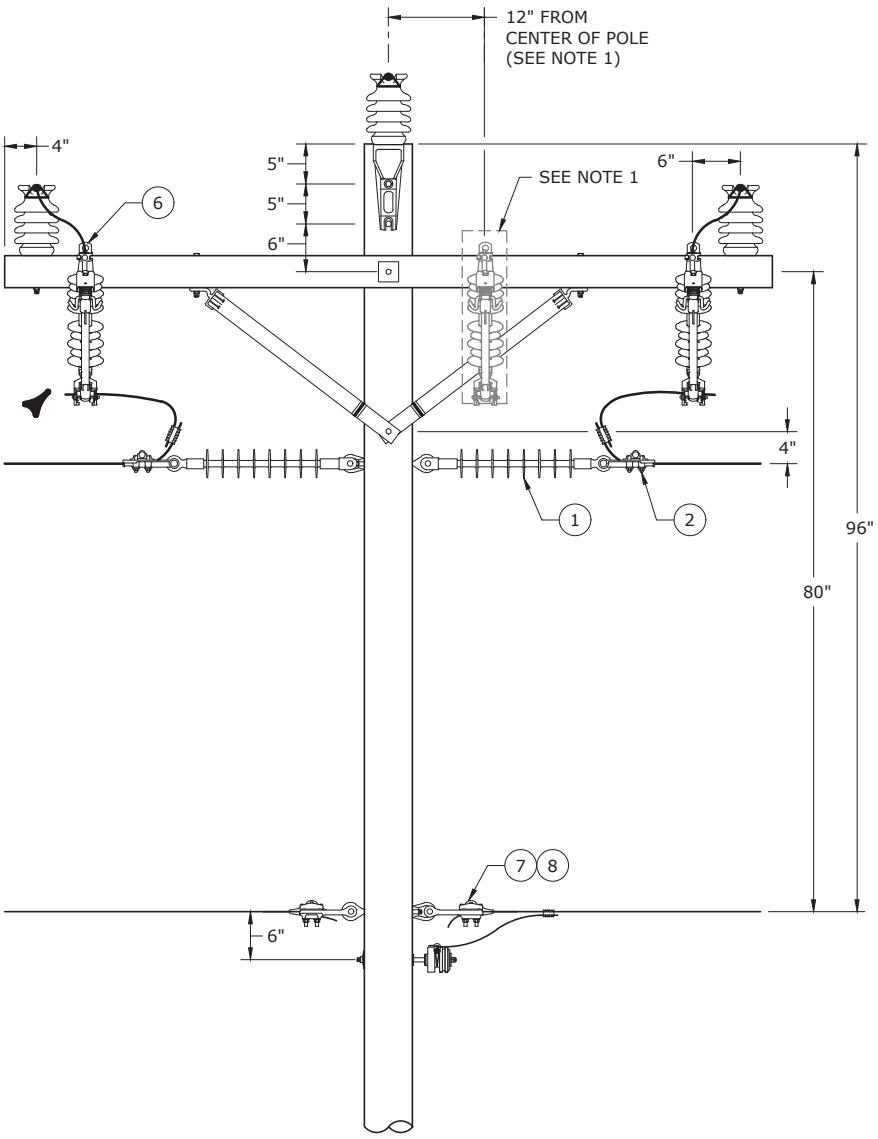
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

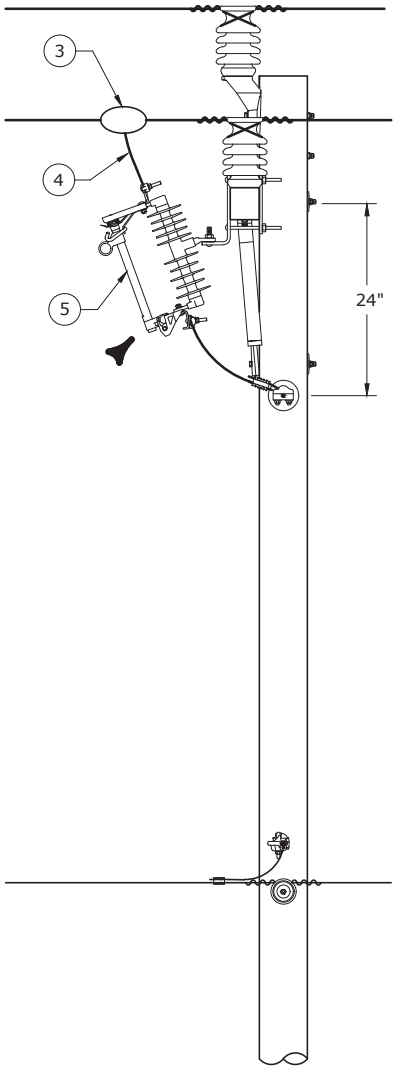
THREE-PHASE HORIZONTAL CONSTRUCTION -
THREE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
			X

03.11-133C



FRONT VIEW



SIDE VIEW

NOTES:

1. POSITION OF CUTOUT IF THIS PHASE IS TAPPED.

2. INSTALL GUY STRAIN INSULATOR AND ANCHOR IF TAPS ARE NOT DIRECTLY OPPOSITE FROM EACH OTHER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - TWO SINGLE-PHASE FUSED TAPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-135A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	2	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	2	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-SM-F	2	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK,SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

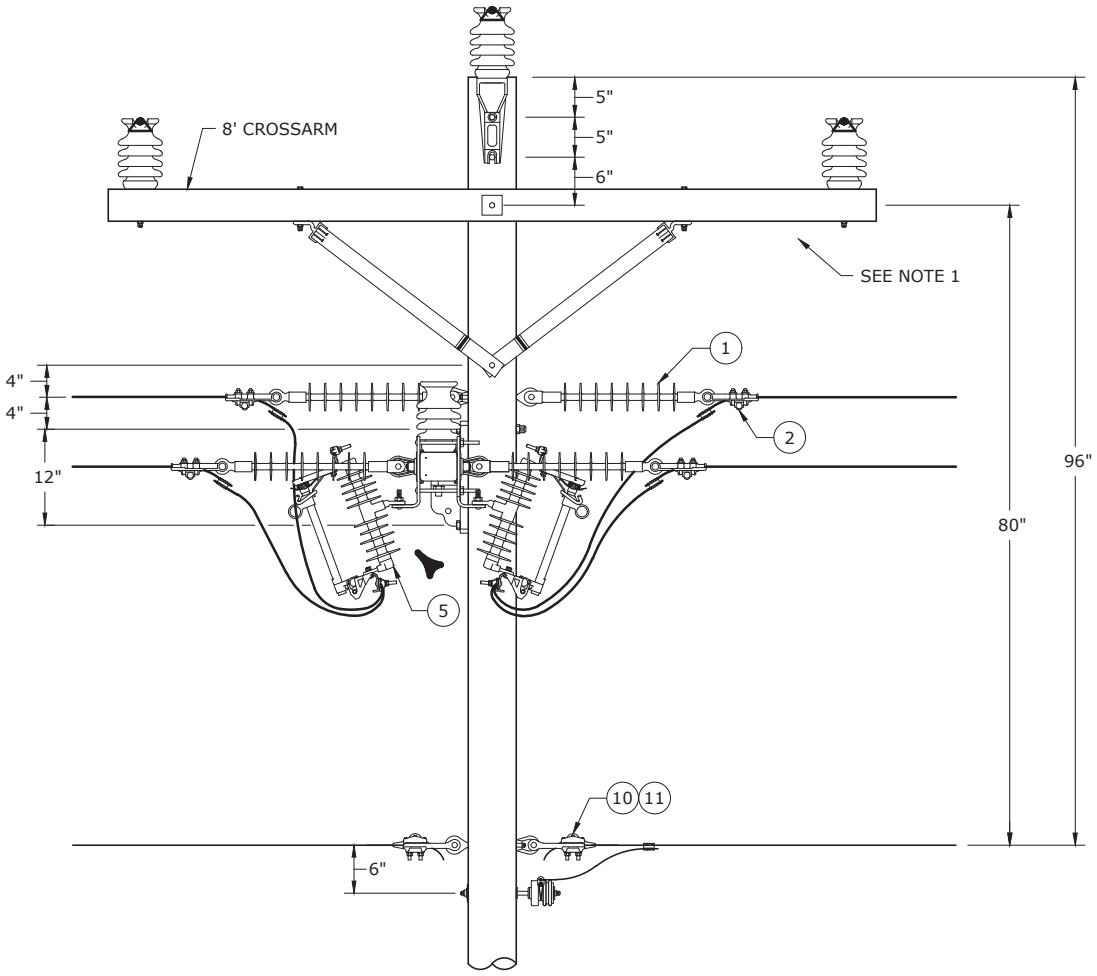
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION -
TWO SINGLE-PHASE FUSED TAPS

DEC	DEM	DEP	DEF
			X

03.11-135B



FRONT VIEW

NOTES:

1. PRIMARY JUMPERS OMITTED FOR CLARITY. SEE DWG. 03.11-137B FOR PLAN VIEW AND JUMPERS.

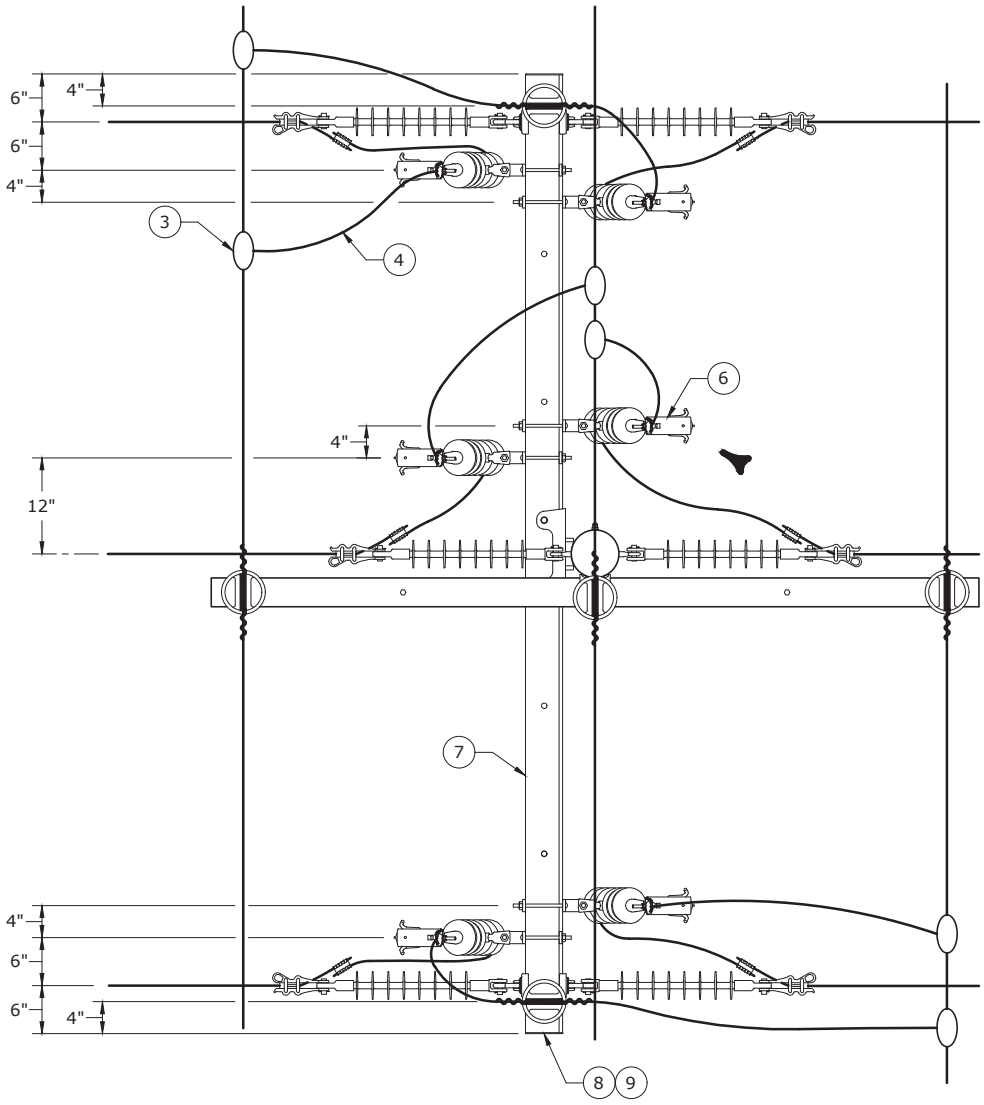
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DUKE ENERGY.

THREE-PHASE HORIZONTAL CONSTRUCTION -
TWO THREE-PHASE FUSED TAPS

DEC	DEM	DEP	DEF
X	X	X	X

03.11-137A



PLAN VIEW

NOTES:

1. SEE DWG. 03.11-137A FOR FRONT VIEW.

2. OMIT CENTER PHASE FOR TWO-PHASE TAP AND USE 8' ARM.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE HORIZONTAL CONSTRUCTION -
TWO THREE-PHASE FUSED TAPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-137B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	6	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-MD-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4", 10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
8	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
9	TIE-COMP-SM-COV-FNECK-F	2	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
10	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

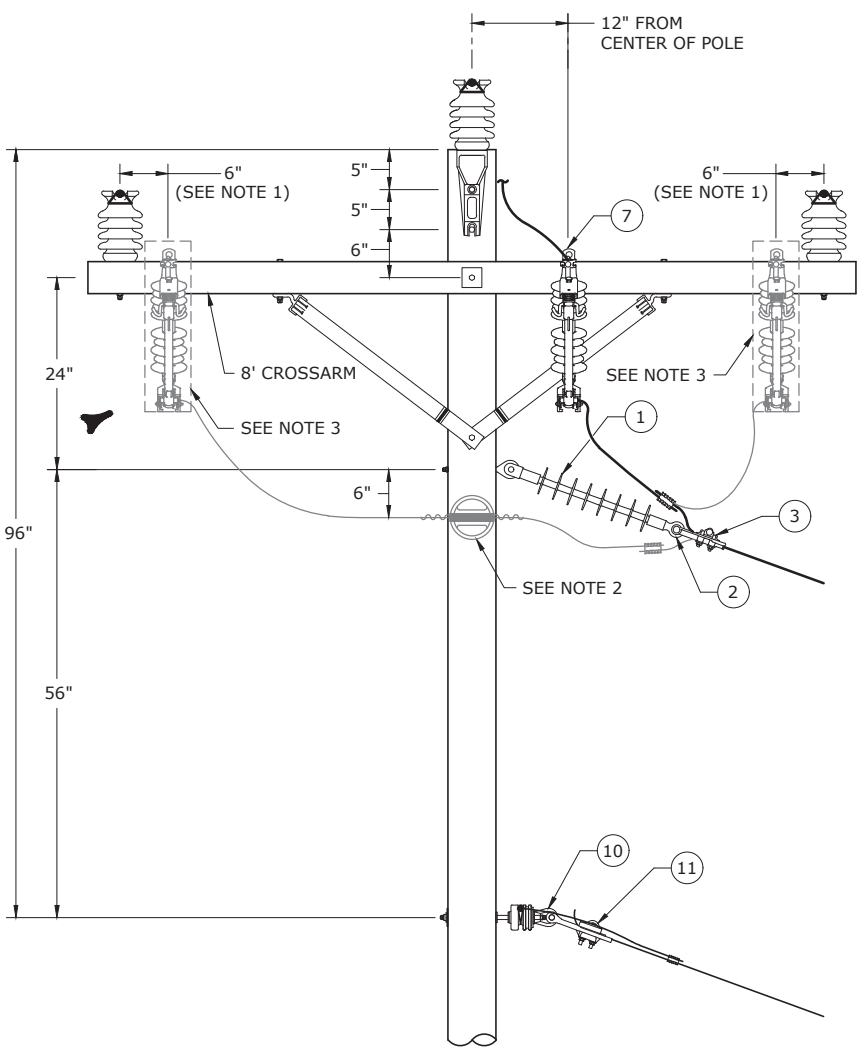
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

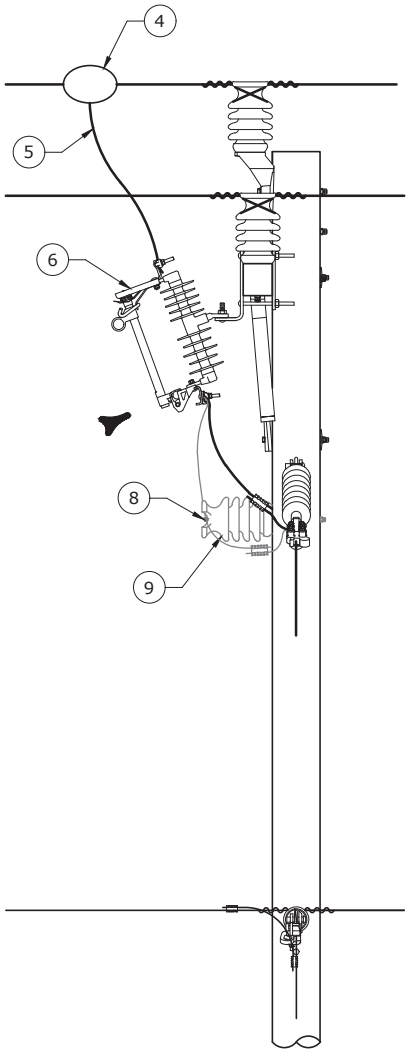
THREE-PHASE HORIZONTAL CONSTRUCTION - TWO THREE-PHASE FUSED TAPS

DEC	DEM	DEP	DEF
			X

03.11-137C



FRONT VIEW



SIDE VIEW

NOTES:

1. POSITION OF CUTOUT IF THIS PHASE IS TAPPED.
2. USE POST INSULATOR FOR JUMPER SUPPORT IF THIS PHASE IS TAPPED.
3. BOXED CUTOUTS ARE SHOWN AS ALTERNATE FEEDS.
4. SEE DWG. 03.06-140 FOR SHUNT CLIP INSTALLATION INSTRUCTIONS.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

THREE-PHASE HORIZONTAL CONSTRUCTION -
SINGLE-PHASE FUSED SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.11-140A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	INSL-CLIP-SHUNT-F	1	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
9	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
9	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

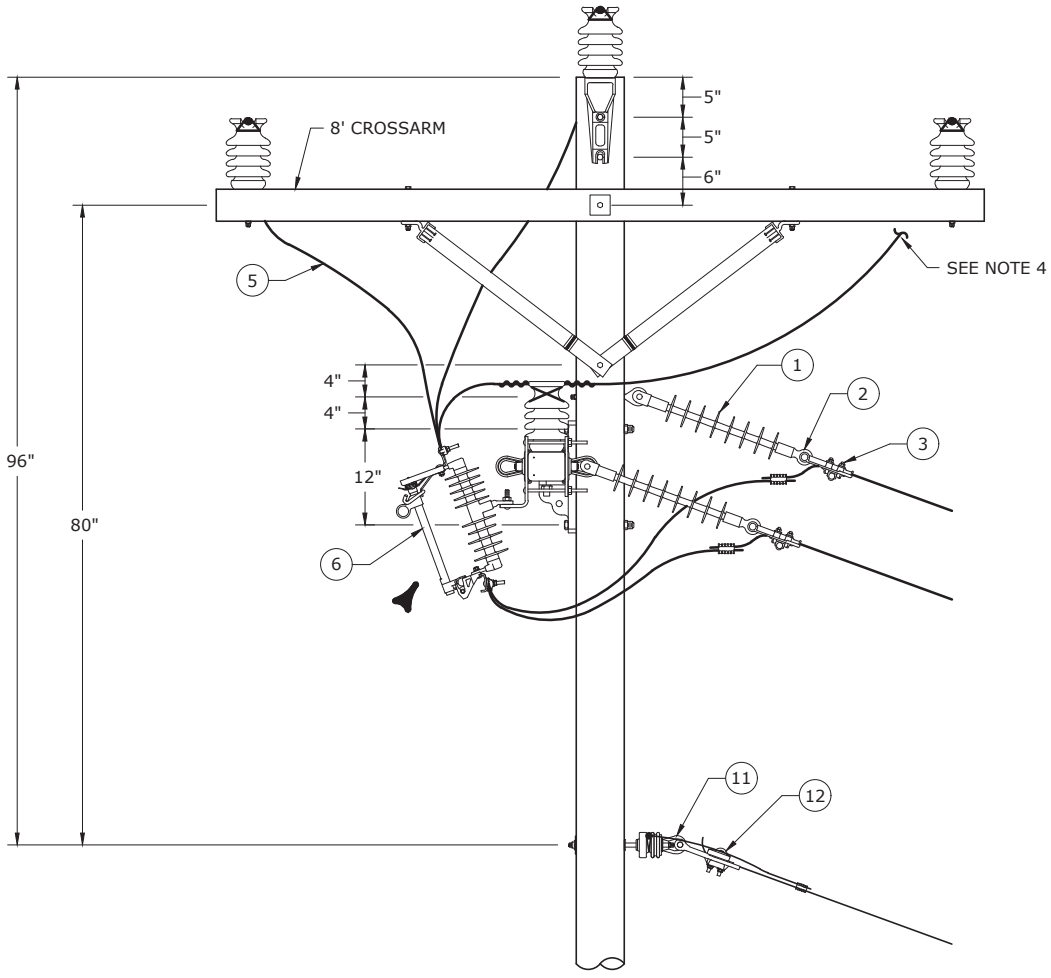
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION -
SINGLE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.11-140B



FRONT VIEW

NOTES:

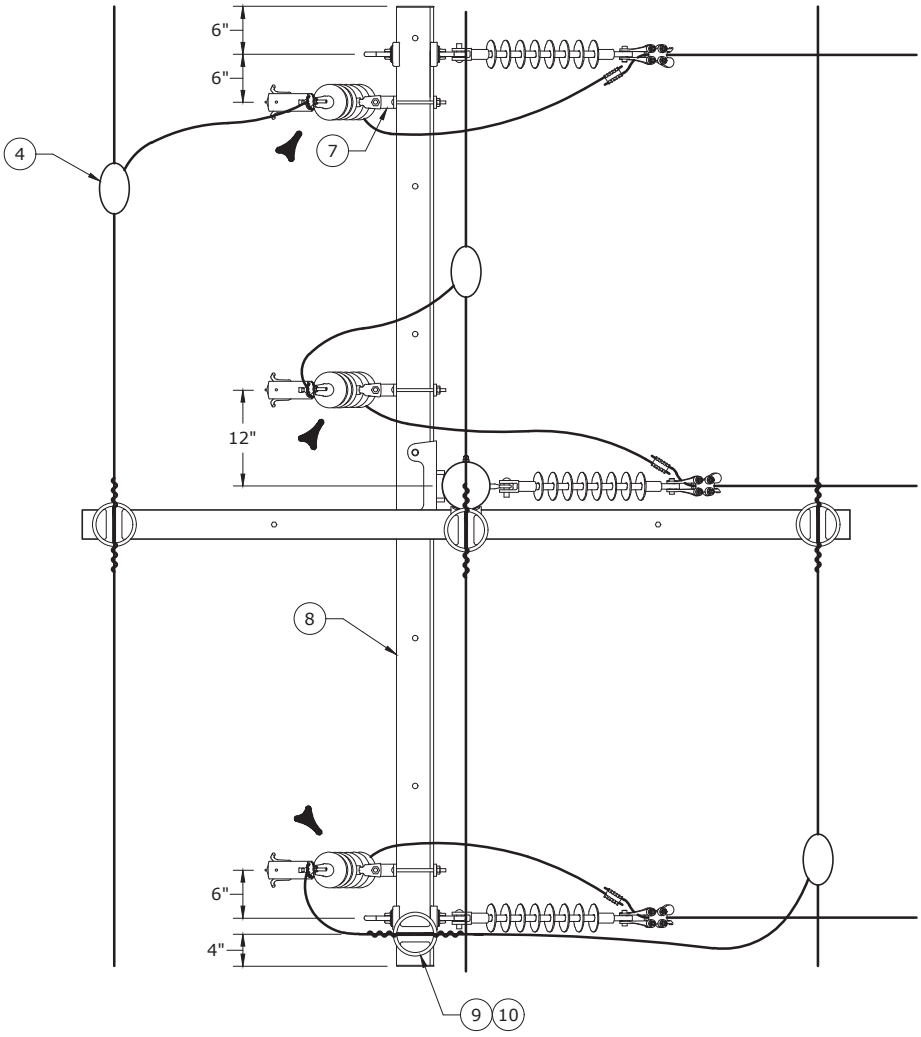
1. SEE DWG. 03.11-145B FOR PLAN VIEW.
2. OMIT CENTER PHASE FOR TWO-PHASE TAP AND USE 8' ARM.
3. CUTOUTS CAN BE INSTALLED ON EITHER SIDE OF CROSSARM FOR OPERATING REASONS.
4. SEE DWG. 03.06-140 FOR SHUNT CLIP INSTALLATION INSTRUCTIONS.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - THREE-PHASE SLACK SPAN FUSED TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.11-145A



PLAN VIEW
(NEUTRAL NOT SHOWN FOR CLARITY)

NOTES:

1. SEE DWG. 03.11-145A FOR FRONT VIEW.
2. OMIT CENTER PHASE FOR TWO-PHASE TAP AND USE 8' ARM.
3. CUTOUTS MAY BE INSTALLED ON THE CONDUCTOR SIDE OF THE FIBERGLASS ARM IF MORE CONVENIENT TO OPERATE ON THAT SIDE.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE HORIZONTAL CONSTRUCTION -
THREE-PHASE SLACK SPAN FUSED TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-145B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	INSL-CLIP-SHUNT-F	3	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4", 10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
9	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
9	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
10	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

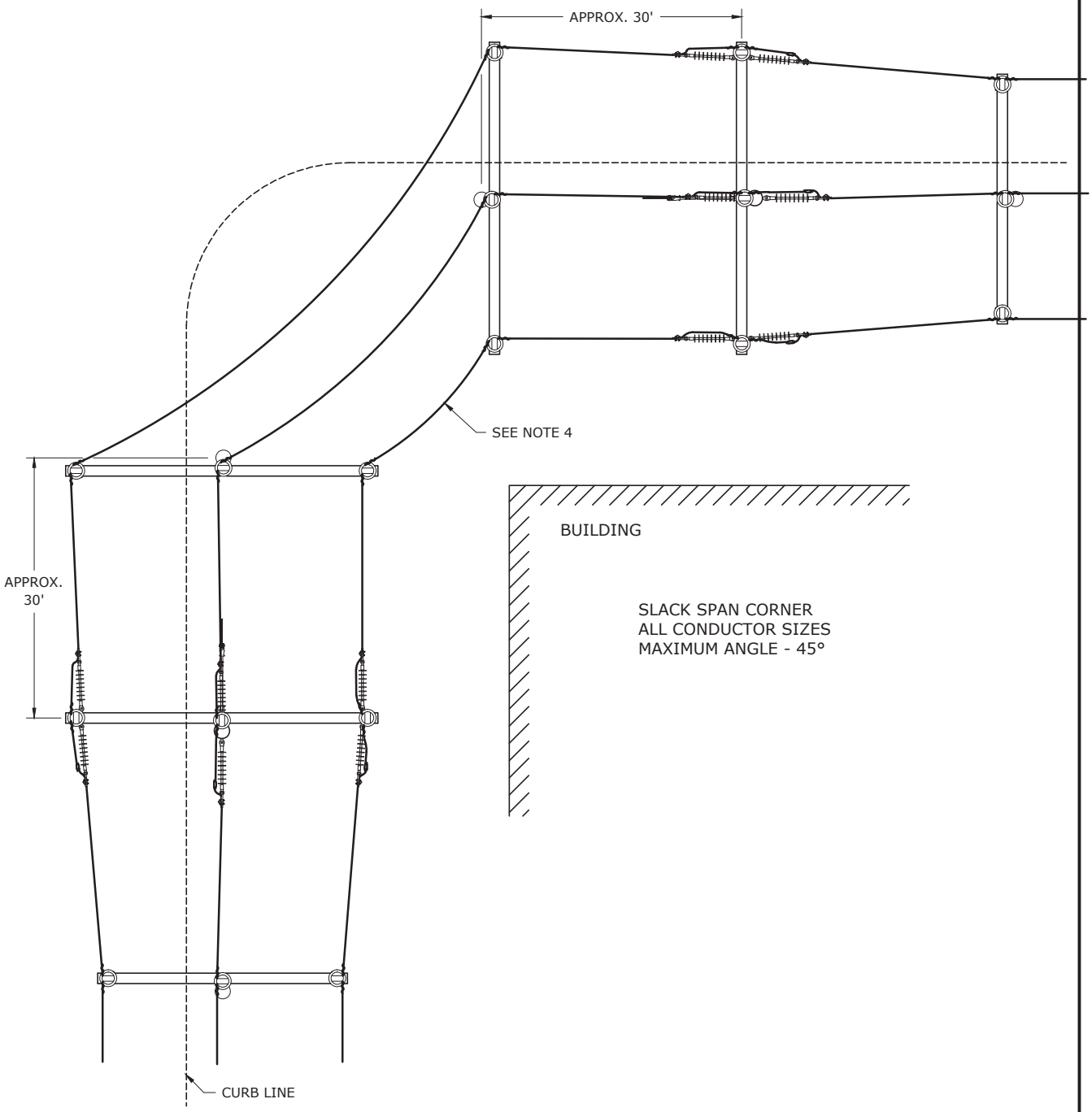
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE HORIZONTAL CONSTRUCTION -

THREE-PHASE SLACK SPAN FUSED TAP

DEC	DEM	DEP	DEF
			X

03.11-145C



SLACK SPAN CORNER
ALL CONDUCTOR SIZES
MAXIMUM ANGLE - 45°

NOTES:

1. MAINTAIN PHASING CONVENTION AS NEEED.
2. SEE DWG. 05.06-100 FOR MAXIMUM SLACK SPAN LENGTHS.
3. USE 10 FT. FIBERGLASS DEADEND ARMS.
4. THE THREE SPANS BETWEEN DEADENDS ARE SLACK.

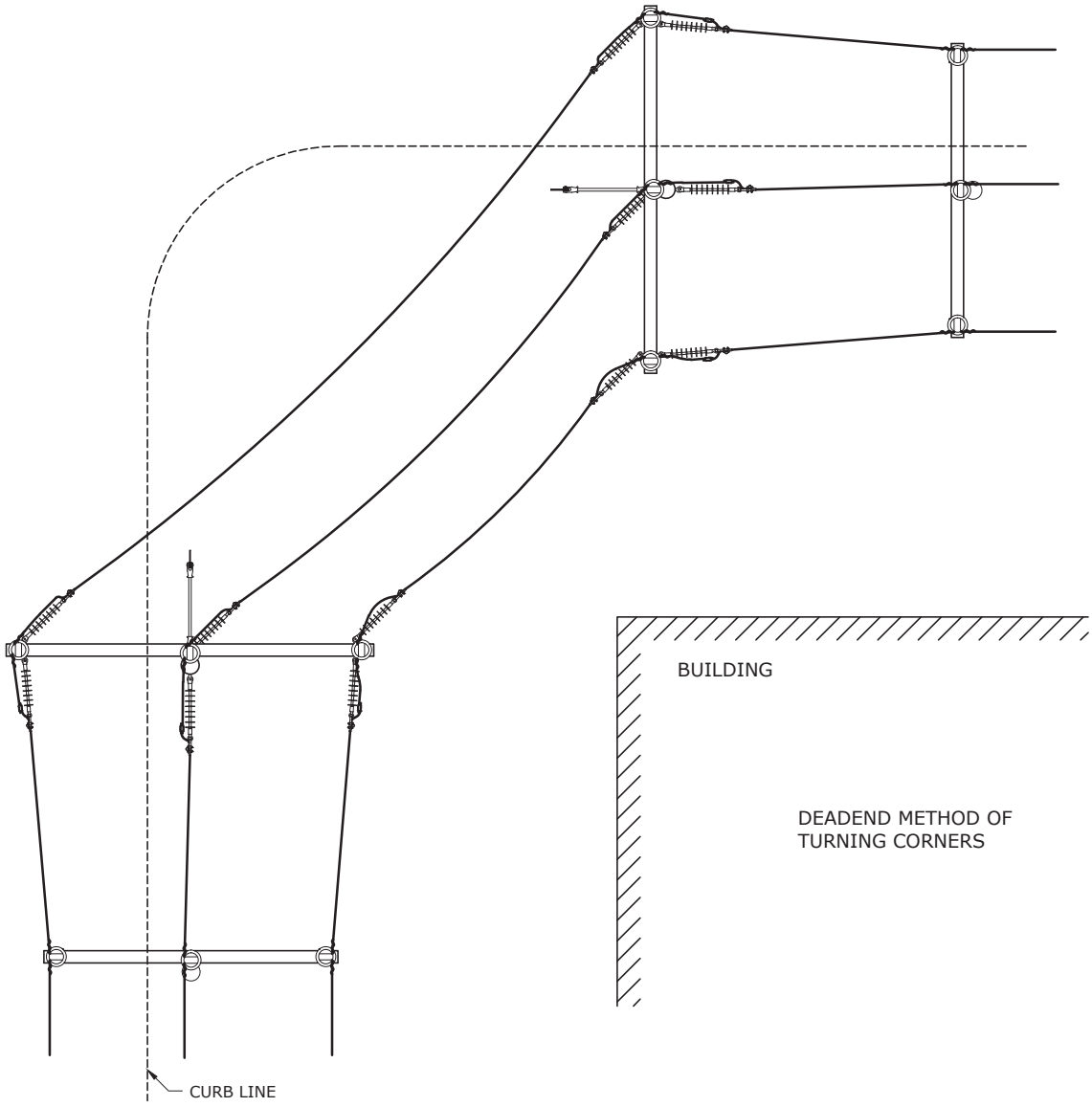
3				
2				
1				
0	12/12/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

TWO POLE CORNERS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-147A



DEADEND METHOD OF
TURNING CORNERS

NOTES:

1. MAINTAIN PHASING CONVENTION AS NEEED.

2. SEE DWG. 05.06-100 FOR MAXIMUM SLACK SPAN LENGTHS.

3. USE 10 FT. FIBERGLASS DEADEND ARMS.

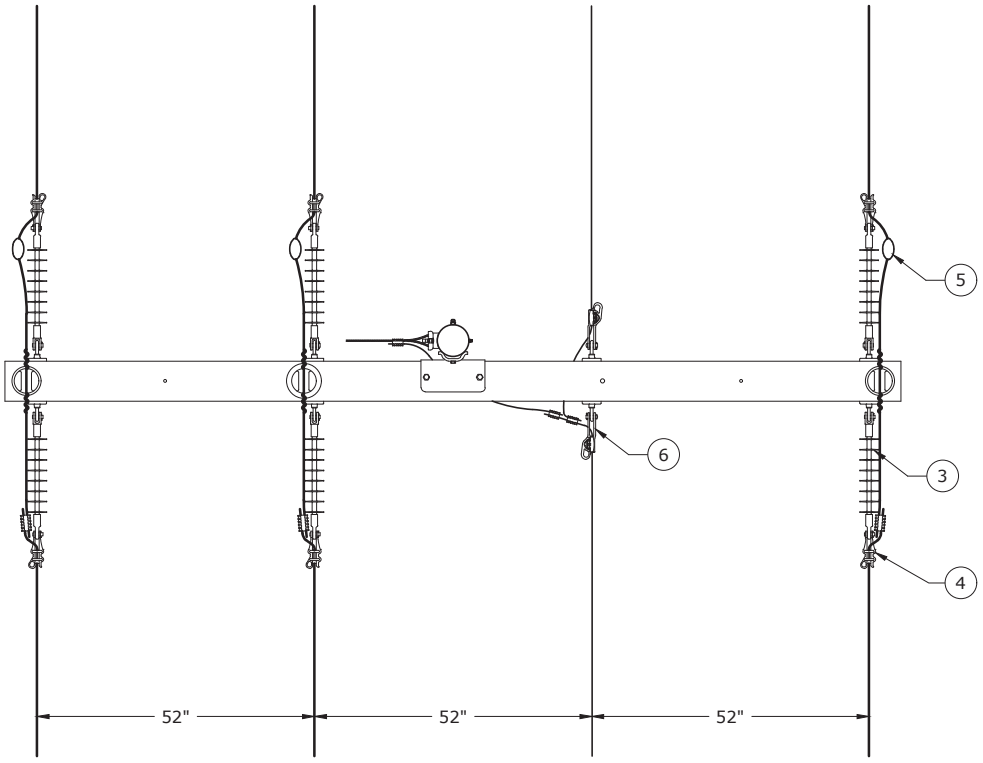
3				
2				
1				
0	12/12/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

TWO POLE CORNERS

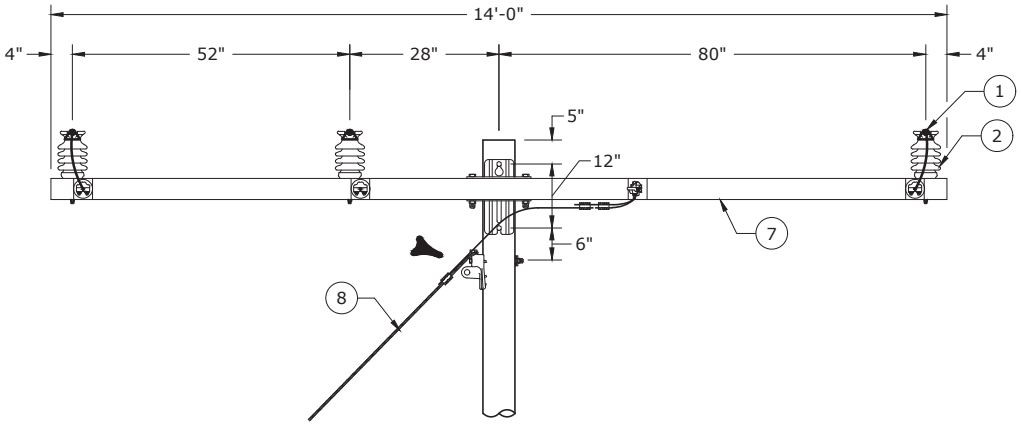
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-147B



PLAN VIEW



FRONT VIEW

NOTES:

1. USE ONLY WHEN HEIGHT OF POLE IS LIMITED, SUCH AS CROSSING UNDER A TRANSMISSION LINE AND NEUTRAL MUST BE BROUGHT UP ON THE ARM TO MAINTAIN ADEQUATE GROUND CLEARANCE. GROUND CLEARANCE MUST BE MINIMUM 18.5 FEET IN THE ENTIRE SPAN(S).

2. LIMIT SPAN LENGTH TO WIDTH OF TRANSMISSION RIGHT-OF WAY.

3. USE 14' FIBERGLASS DEADEND ARM.

4. IF GUY IS NEEDED, BOND GUY WIRE AND RUN BOND UNDER ARM OVER TO THE NEUTRAL. DO NOT USE GUY INSULATOR. WHEN NEUTRAL/GUY BOND APPROACHES A PHASE, USE TWO SETS OF DEADEND INSULATORS ON THAT PHASE.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 3/31/17	BENDER	BURLISON	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM CROSSING UNDER TRANSMISSION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-150A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	3	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	3	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
7	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD, GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)

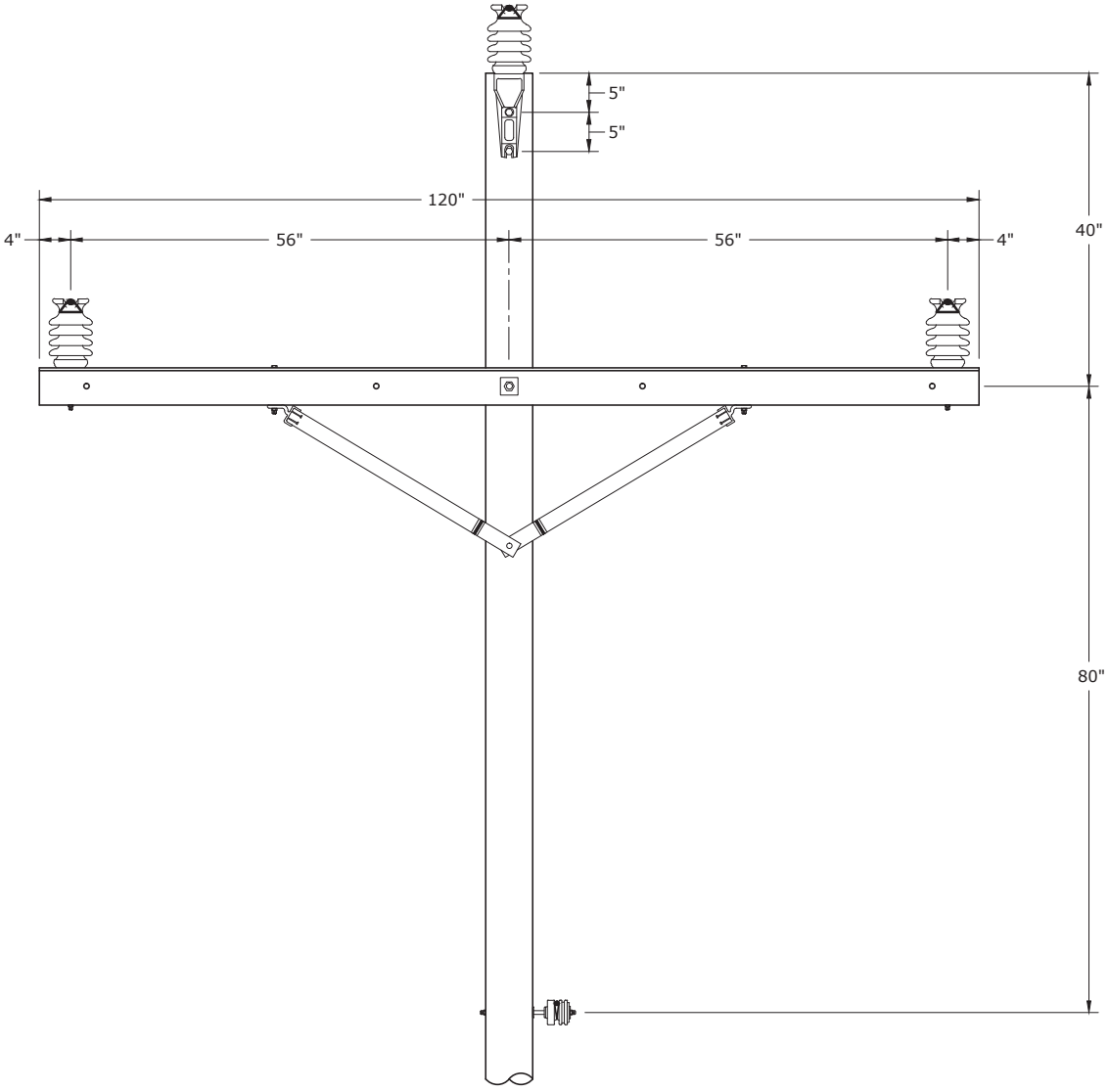
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION -
TANGENT CROSSARM
CROSSING UNDER TRANSMISSION

DEC	DEM	DEP	DEF
			X

03.11-150B



FRONT VIEW

NOTES:

1. NOT FOR USE WITH 795AAC.

2. THIS DRAWING DEPICTS THE SPACING REQUIREMENTS FOR THREE-PHASE HORIZONTAL CONSTRUCTION INTERMEDIATE SPANS. THIS SPACING CAN BE USED ON TANGENT, SMALL ANGLE, MEDIUM ANGLE AND DEADENDS. REFER TO THE BILL OF MATERIALS ASSOCIATED WITH THE TYPICAL SPANS FOR COMPATIBLE UNITS AND NUMBERS.

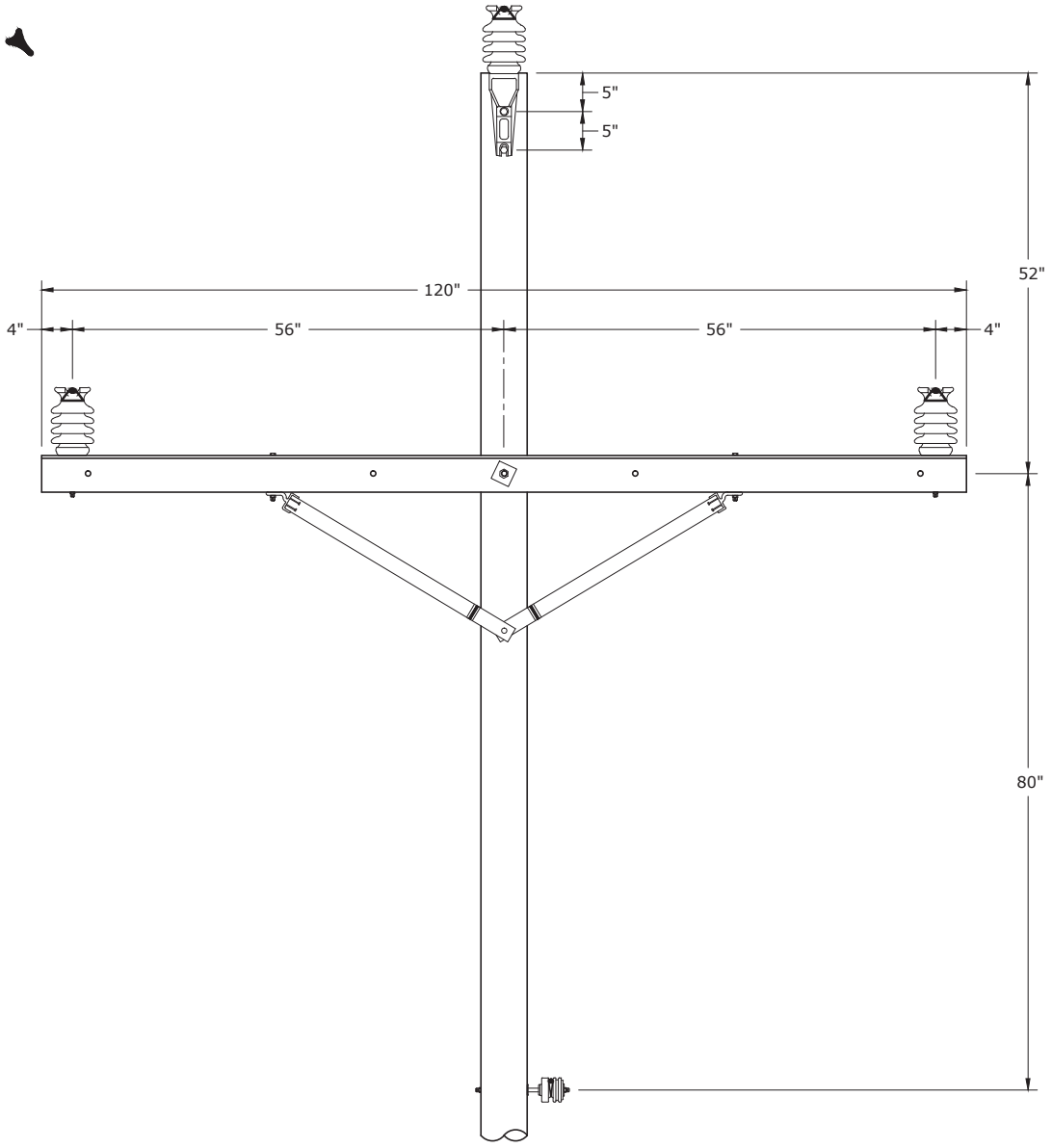
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/17	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM INTERMEDIATE SPANS - 250 FT TO 340 FT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-160



FRONT VIEW

NOTES:

1. 250 TO 500 FOOT SPAN WITH 795AAC.

2. THIS DRAWING DEPICTS THE SPACING REQUIREMENTS FOR THREE-PHASE HORIZONTAL CONSTRUCTION LONG SPANS. THIS SPACING CAN BE USED ON TANGENT, SMALL ANGLE, MEDIUM ANGLE AND DEADENDS. REFER TO THE BILL OF MATERIALS ASSOCIATED WITH THE TYPICAL SPANS FOR COMPATIBLE UNITS AND ITEM NUMBERS.

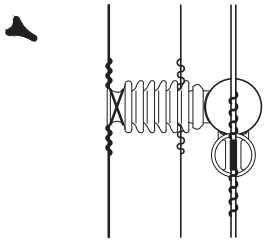
REVISED		BY	CHK'D	APPR.
3				
2				
1	5/9/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

THREE-PHASE HORIZONTAL CONSTRUCTION - TANGENT CROSSARM LONG SPAN - 340-500 FOOT

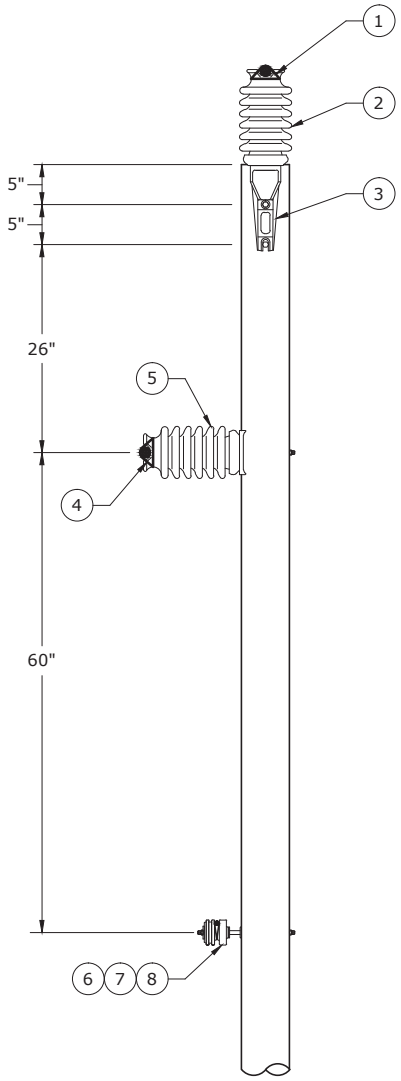
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.11-170



PLAN VIEW



FRONT VIEW

3				
2	8/7/17	BENDER	BURLISON	ADCOCK
1	7/29/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

TWO-PHASE VERTICAL CONSTRUCTION - TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.12-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	TIE-SIDE-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
5	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
5	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
5	INSL-GAIN-LG-F	1	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSULATOR
6	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
7	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

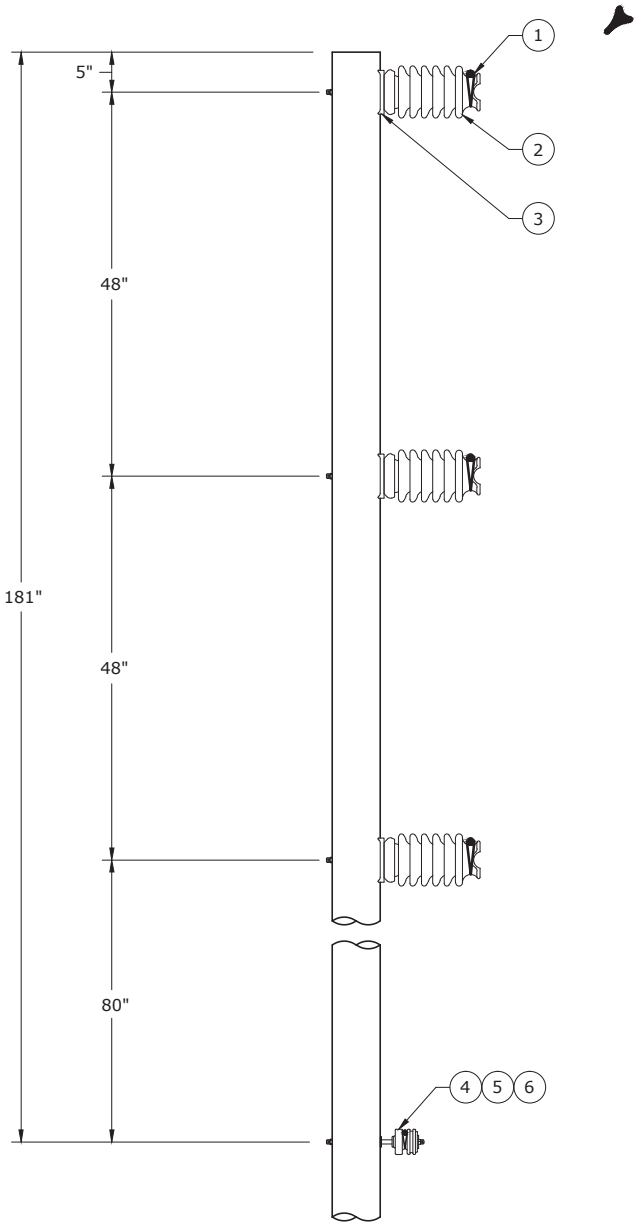
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

TWO-PHASE VERTICAL CONSTRUCTION - TANGENT

DEC	DEM	DEP	DEF
			X

03.12-100B



FRONT VIEW

NOTES:

1. WHEN DESIGNING WITH LARGER CLASS SIZES (1, H1, H2, H3), POLE SHOULD BE FRAMED USING BRACKETS. SEE DWG. 03.12-103A.

2. ALL ANGLES GREATER THAN 2 DEGREES MUST BE CHECKED IN POLEFOREMAN.

3. IF PLACING ARRESTERS ON POLE, SEE DWG. 03.12-127A FOR FIBERGLASS BRACKET PLACEMENT BELOW BOTTOM PHASE.

3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION - TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.12-102A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSULATOR
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

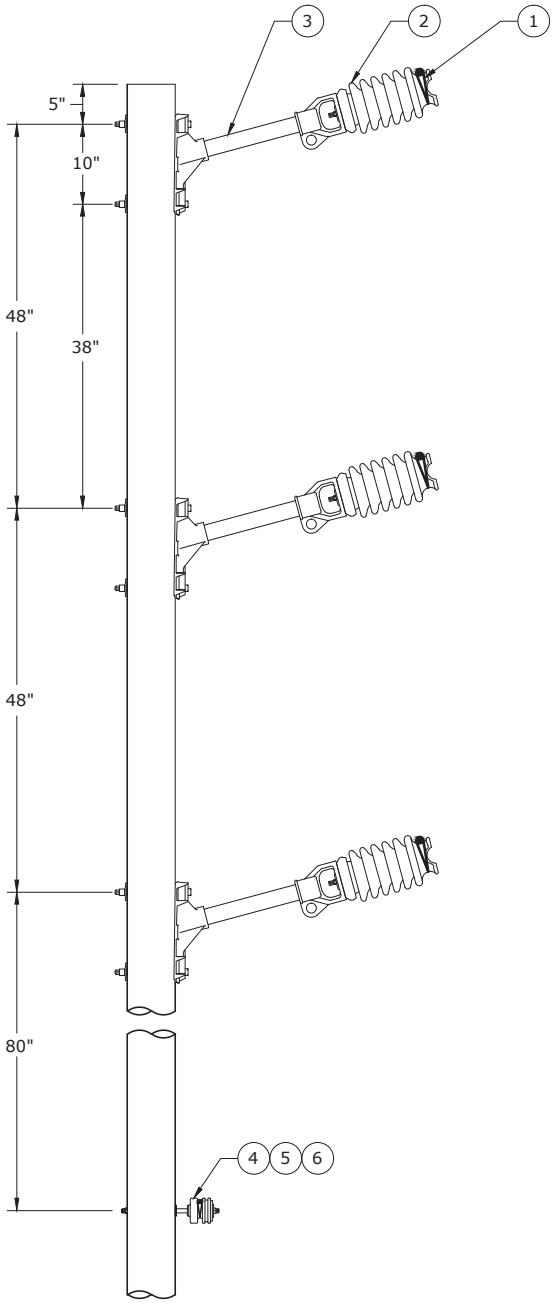
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.12-102B



FRONT VIEW

NOTES:

1. USE THIS CONSTRUCTION WHEN A DOUBLE CIRCUIT IS PLANNED FOR NEAR FUTURE OR IS NECESSARY TO MAINTAIN STRAIGHT LINE WHEN POLE NEEDS TO BE OFFSET DUE TO FIELD CONDITIONS.

2. LONGER BOLTS ARE REQUIRED FOR MOUNTING BRACKETS IF STRUCTURE IS TO BE PREPPED FOR FUTURE CIRCUIT.

3. TYPICAL INSTALLATIONS WILL BE 20" BRACKET. FOR APPLICATIONS REQUIRING ADDITIONAL CLEARANCE OR CFO, USE 30" BRACKET.

4. IF PLACING ARRESTERS ON POLE, SEE DWG. 03.12-127A FOR FIBERGLASS BRACKET PLACEMENT BELOW BOTTOM PHASE.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - OFFSET TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.12-103A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD,INSULATOR,5/8" DIA,10" LG,11 UNC,6" THD LG,GALV STL
3	BKT-INSL-POST-POLE-MD-FG-F	3	4002346	1	BRACKET, STANDOFF, 20", FIBERGLASS, W/ 8" & 10" BOLT SPACING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	BKT-INSL-POST-POLE-LG-FG-F	3	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

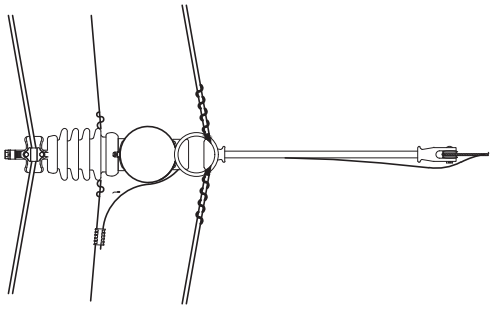
DUKE ENERGY.

3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

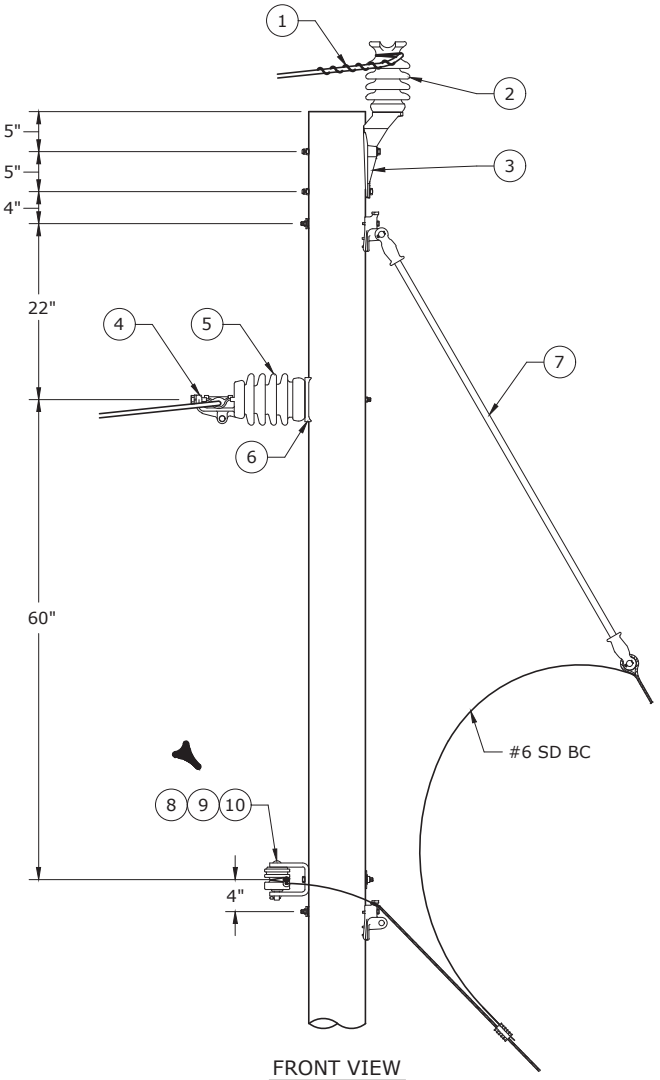
THREE-PHASE VERTICAL CONSTRUCTION - OFFSET TANGENT

DEC	DEM	DEP	DEF
			X

03.12-103B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AND SMALLER	15°	15°	10°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

TWO-PHASE VERTICAL CONSTRUCTION - SMALL ANGLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED RIBBED, 13/16" ID, 3" OD, 3/8" THK, GALV
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	CLAMP-TR-CUSHGRP-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	INSL-POST-35KV-PORC-HC-F	1	4002398	1	INSULATOR, LINE POST, 35KV, HOR CLAMP
5	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
6	INSL-GAIN-LG-F	1	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSULATOR
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" ST
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
9	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
10	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

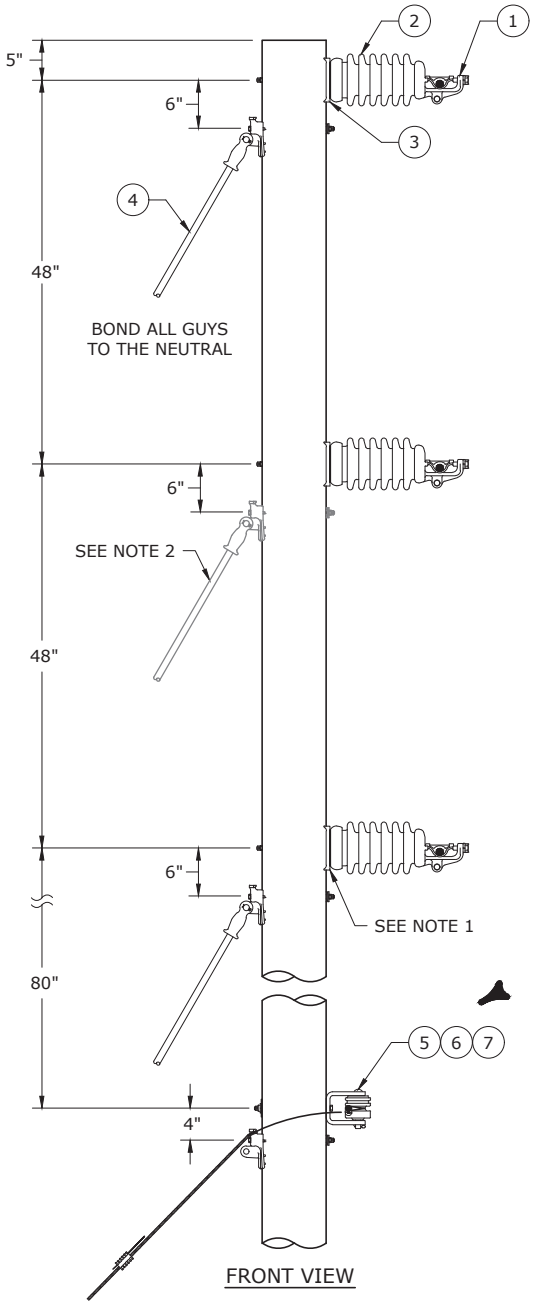
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

TWO-PHASE VERTICAL CONSTRUCTION - SMALL ANGLES

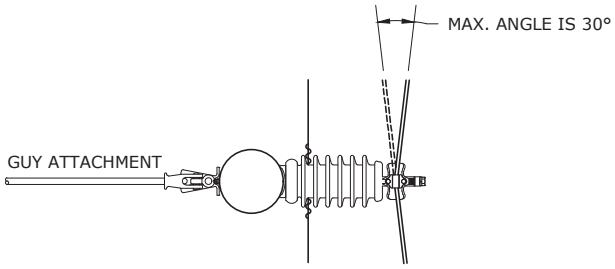
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.12-105B



FRONT VIEW



PLAN VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795	20°	-	-
556 AND SMALLER	30°	30°	20°

NOTES:

1. POLE GAINS ARE REQUIRED FOR POST INSULATOR INSTALLATIONS ON WOOD POLES WHEN SUPPORTING ALL CONDUCTORS OR SLACK SPAN AND JUMPERS LARGER THAN 1/0.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - SMALL ANGLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-107A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-35KV-PORC-HC-F	3	4002398	1	INSULATOR, LINE POST, 35KV, HOR CLAMP
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSUL TO POLES
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

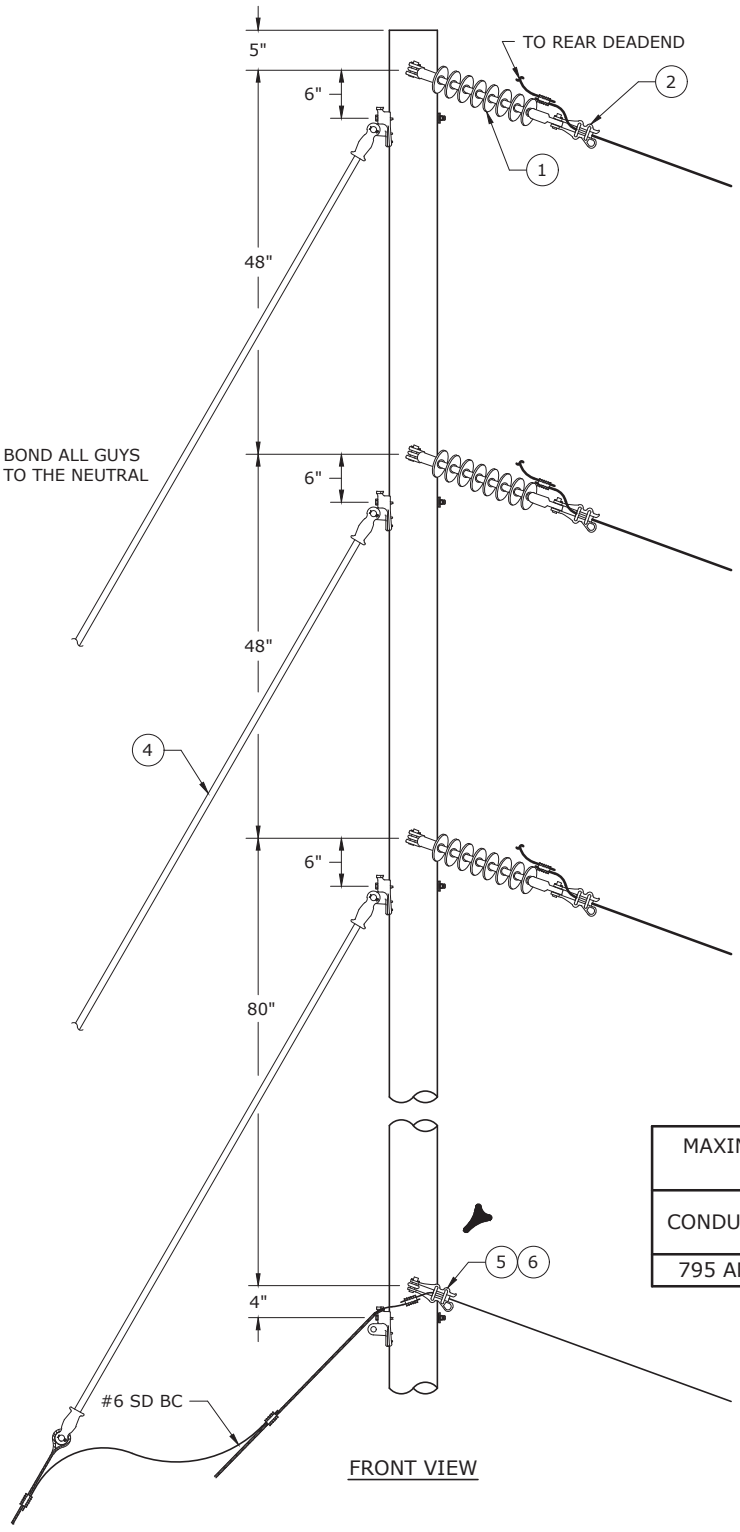
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

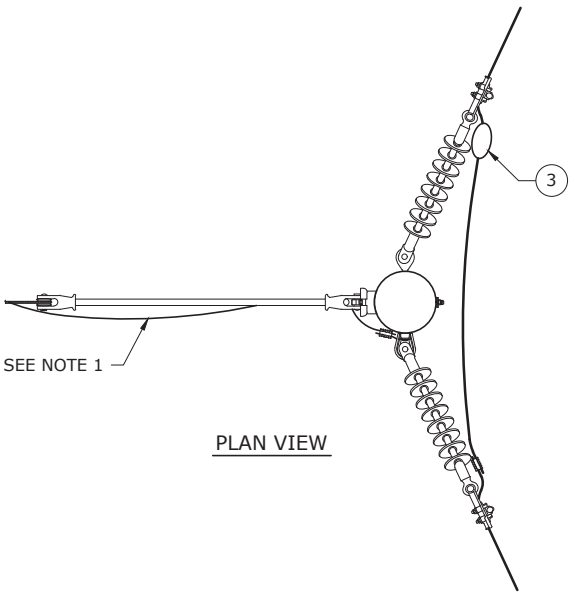
THREE-PHASE VERTICAL CONSTRUCTION - SMALL ANGLES

DEC	DEM	DEP	DEF
			X

03.12-107B



FRONT VIEW



PLAN VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795 AND SMALLER	70°	70°	70°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION - DOUBLE DEAD-END SIDE GUYED (MEDIUM ANGLES)

DEC	DEM	DEP	DEF
X	X	X	X

03.12-112A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
5	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
6	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

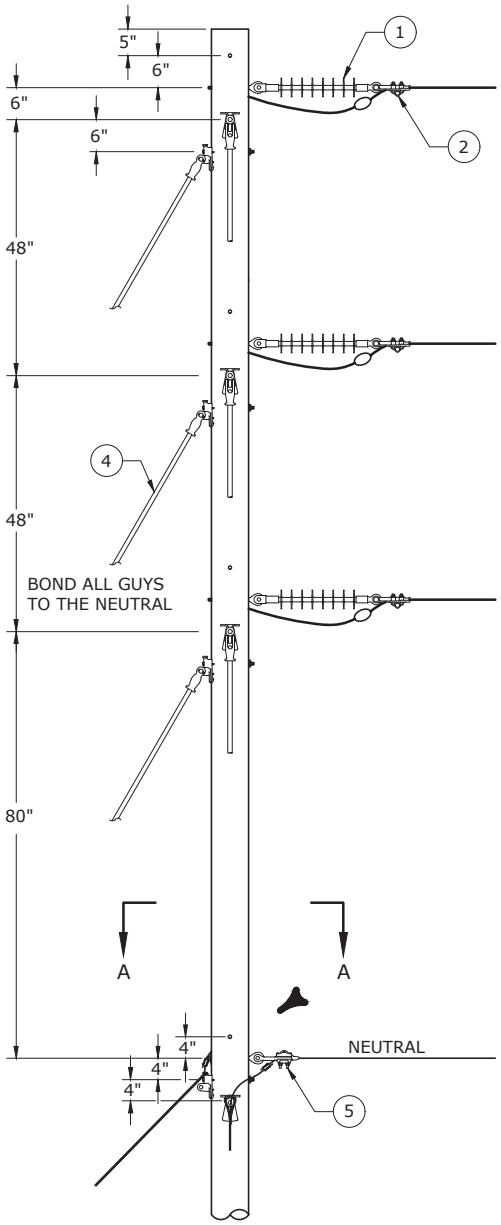
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

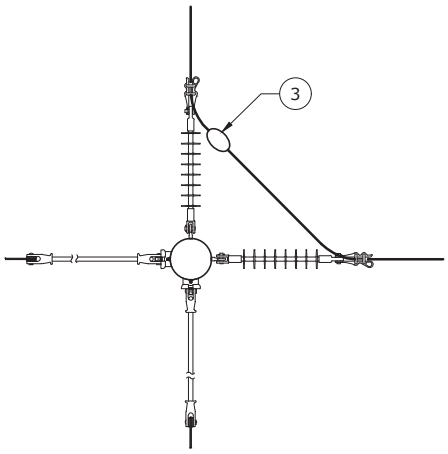
THREE-PHASE VERTICAL CONSTRUCTION - DOUBLE DEAD-END SIDE GUYED (MEDIUM ANGLES)

DEC	DEM	DEP	DEF
			X

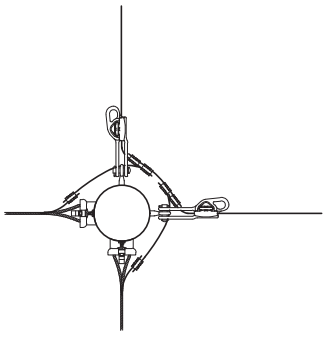
03.12-112B



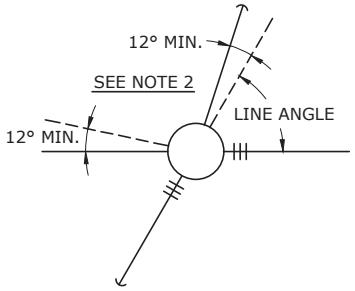
FRONT VIEW



PLAN VIEW



SECTION A-A



NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

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.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 7/29/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.12-119A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	6	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

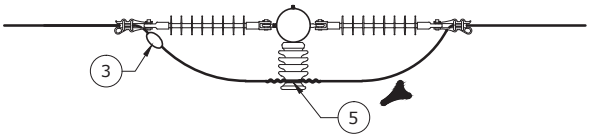
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

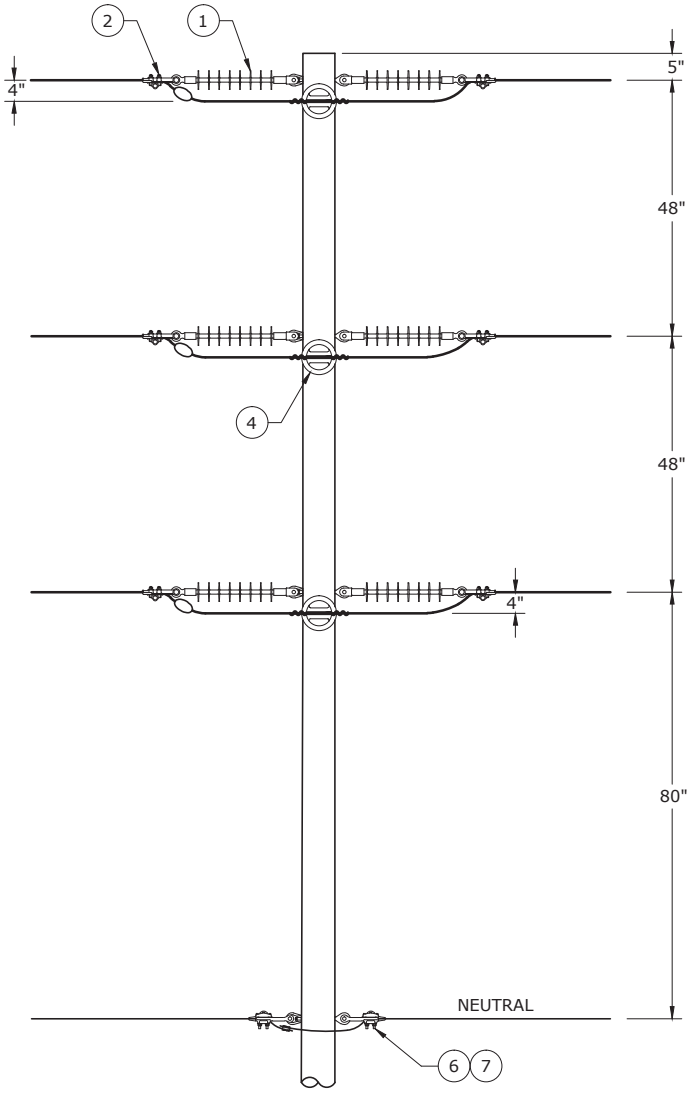
THREE-PHASE VERTICAL CONSTRUCTION - LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
			X

03.12-119B



PLAN VIEW



FRONT VIEW

3				
2	10/9/17	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL CONSTRUCTION -
DOUBLE DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
4	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
5	TIE-HAND-4-AL-F	3	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
6	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
6	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
7	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

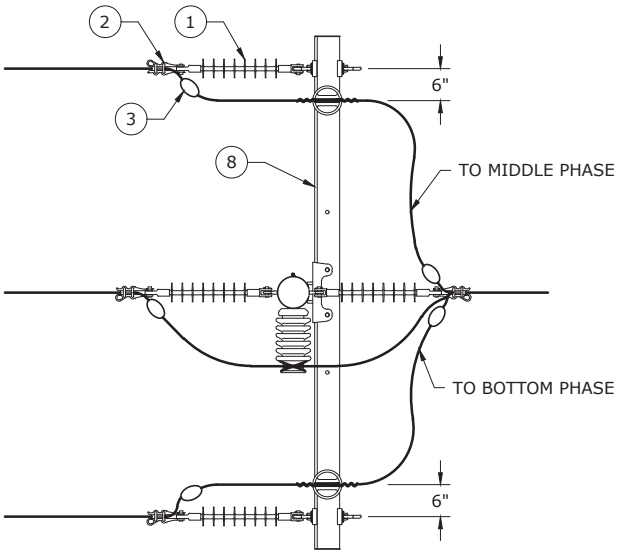
VERTICAL CONSTRUCTION -

DOUBLE DEADEND

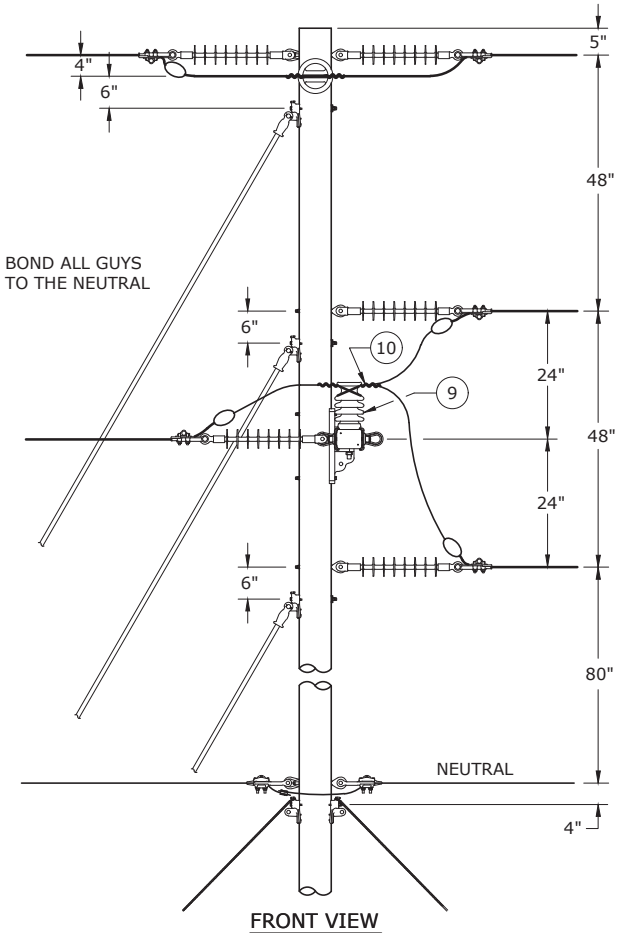
DEC	DEM	DEP	DEF
			X

03.12-120B

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

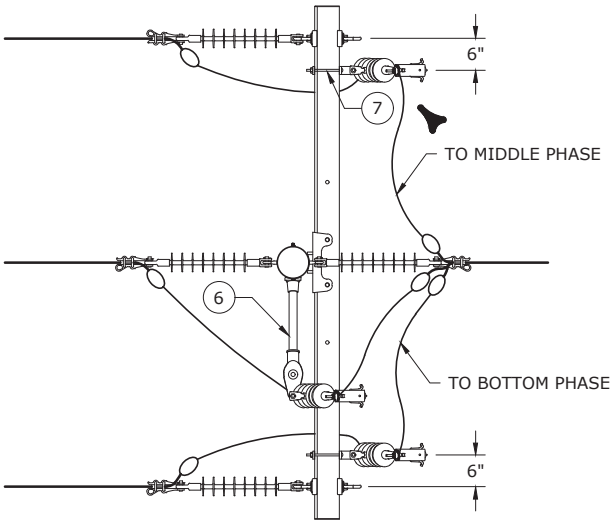


PLAN VIEW

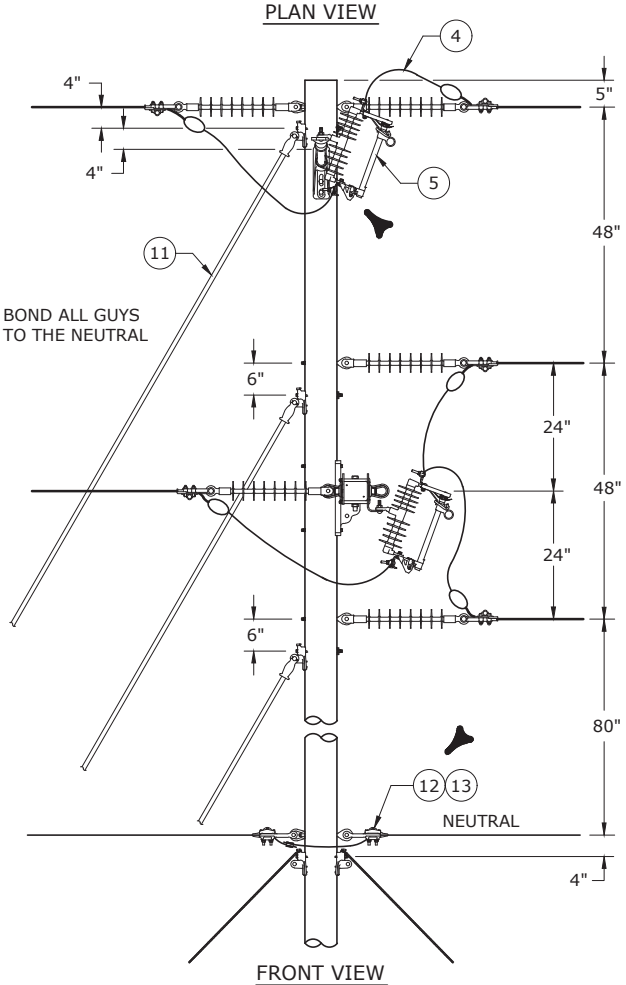


FRONT VIEW

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



PLAN VIEW



FRONT VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. CONFIGURATION SHALL BE USED WHEN BACKING UP SAME WIRE SIZE AT DIFFERENT TENSIONS.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - TRANSITION BETWEEN CONDUCTORS OF DIFFERENT SIZES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-122A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	BKT-EM-ARM-1P-STL-MD-F	2	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK,SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL
8	ARM-SDE-8-FBG-NB-F	1	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
9	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
9	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
9	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
9	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
10	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
11	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUY AND ANCHOR DETAILS
12	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
12	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
13	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

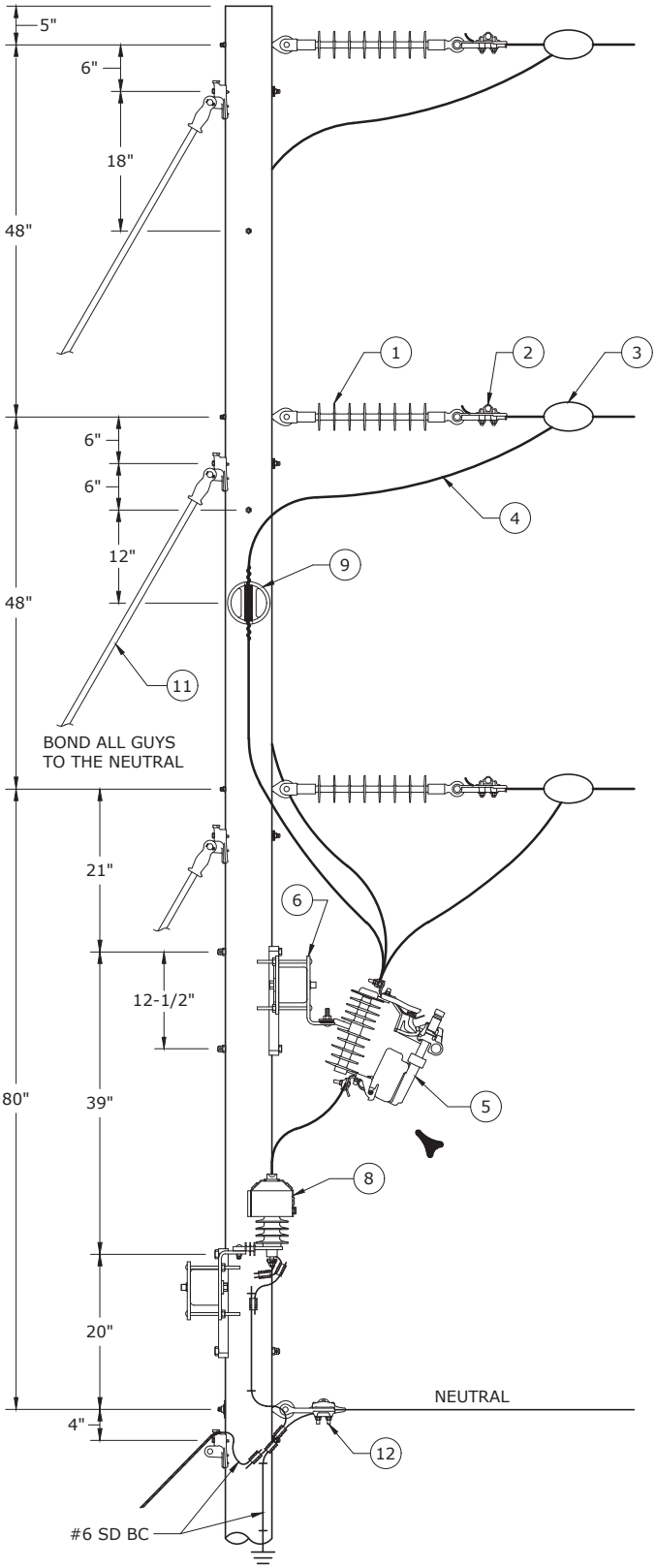
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

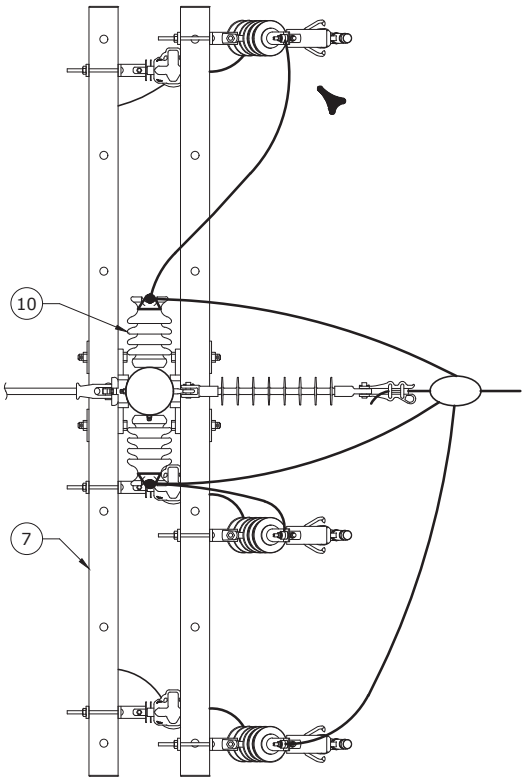
THREE-PHASE VERTICAL CONSTRUCTION - TRANSITION BETWEEN CONDUCTORS OF DIFFERENT SIZES

DEC	DEM	DEP	DEF
			X

03.12-122B



FRONT VIEW



PLAN VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION - DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-127A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V, W/ INSULATION
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE W/ EXTENSION ADAPTER USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SGL-10-FBG-NB-F	2	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	ARR-LINE-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
8	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
9	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
10	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
10	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
11	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
12	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

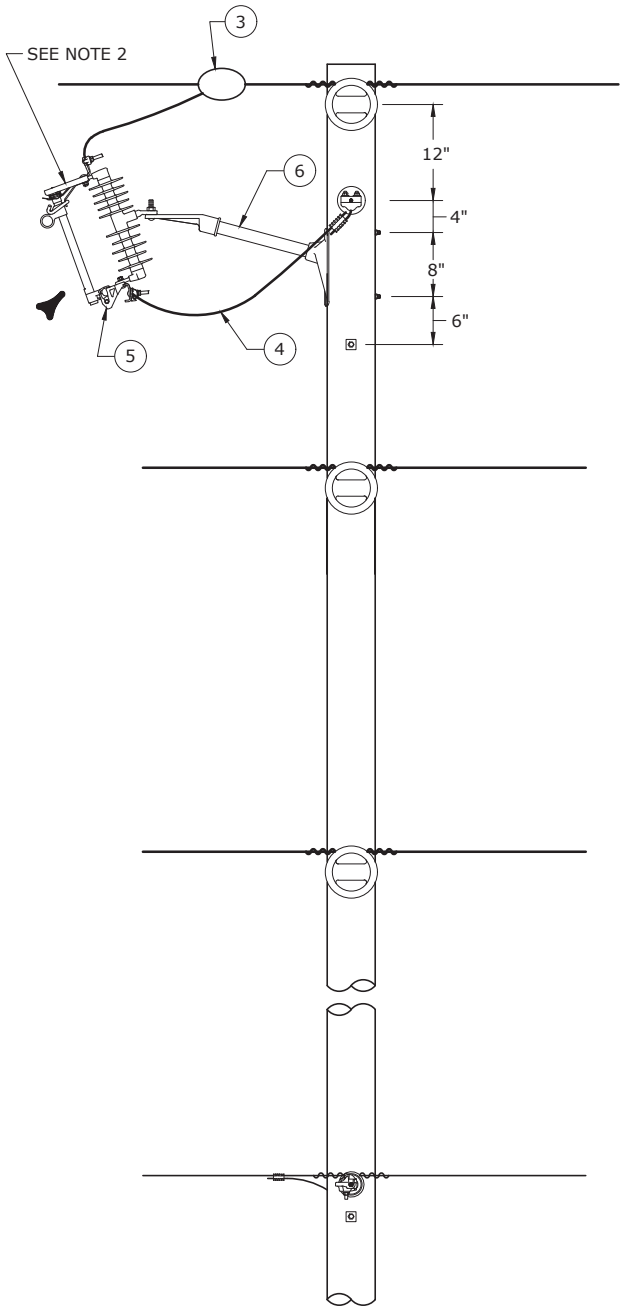
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

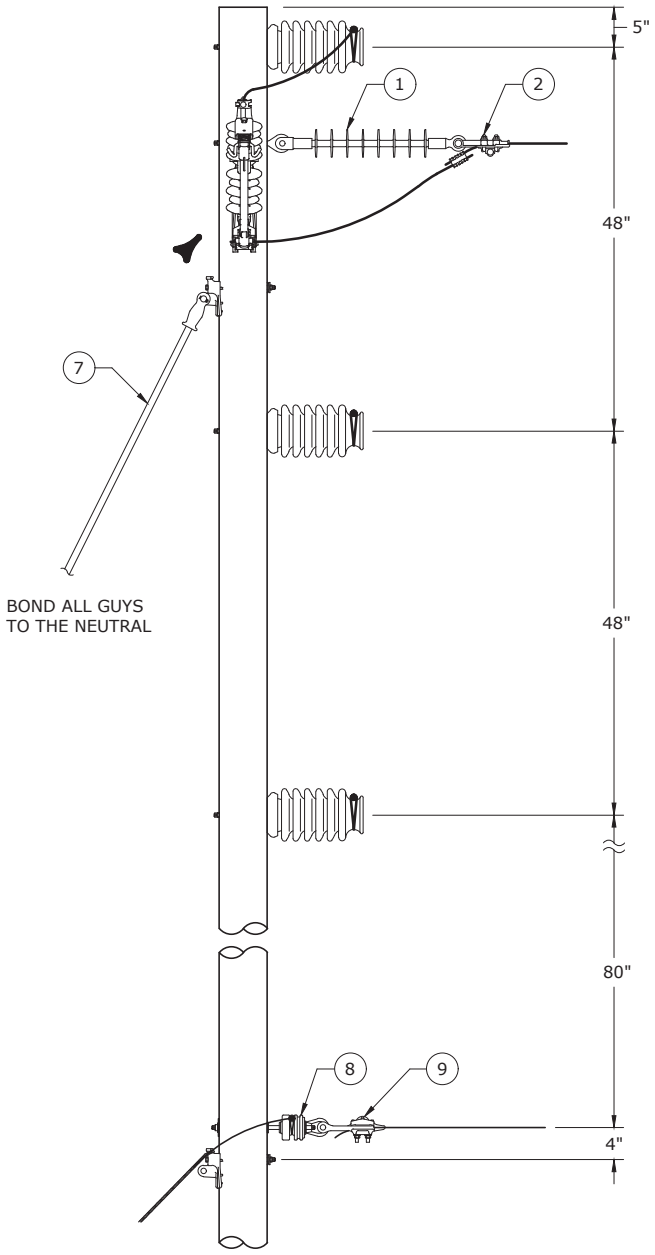
THREE-PHASE VERTICAL CONSTRUCTION - DEADEND

DEC	DEM	DEP	DEF
			X

03.12-127B



FRONT VIEW



SIDE VIEW

NOTES:

1. MAIN LINE PRIMARY MAY BE ON THE OTHER SIDE OF POLE BUT MUST REMAIN 8" FOR 12KV OR 12" FOR 25KV FROM GUY INSULATOR.
2. TAP MAY BE ON ANY PHASE.
3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - FUSED SINGLE-PHASE TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.12-130A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

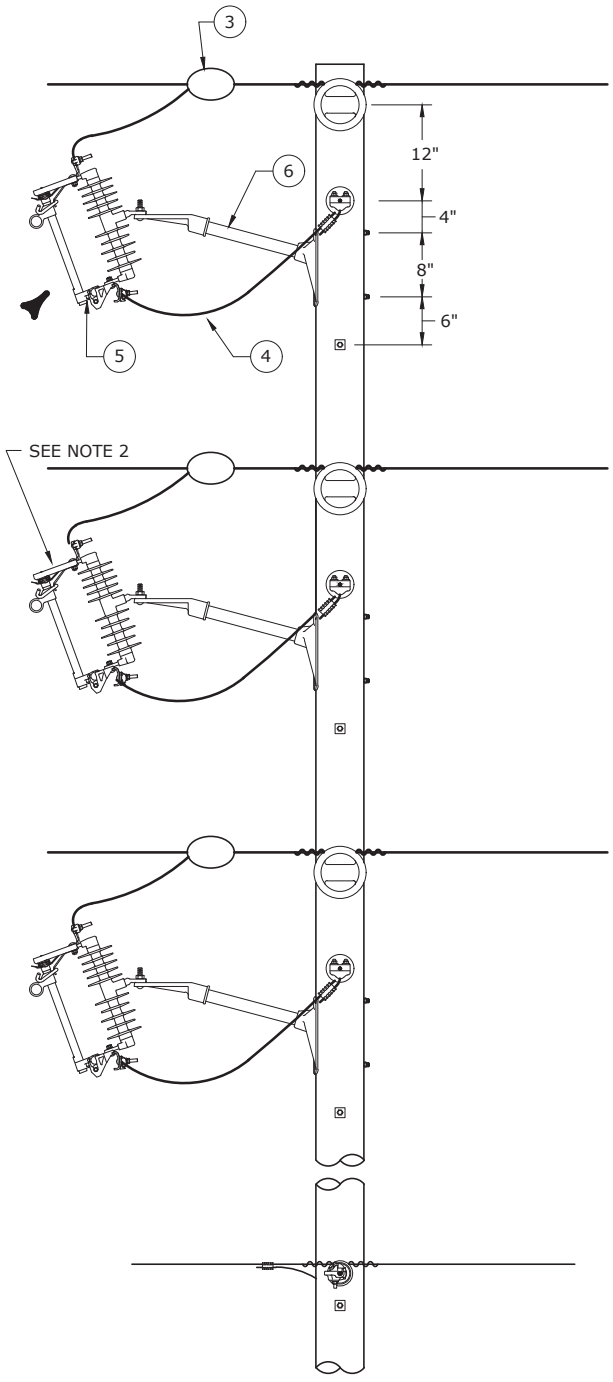
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

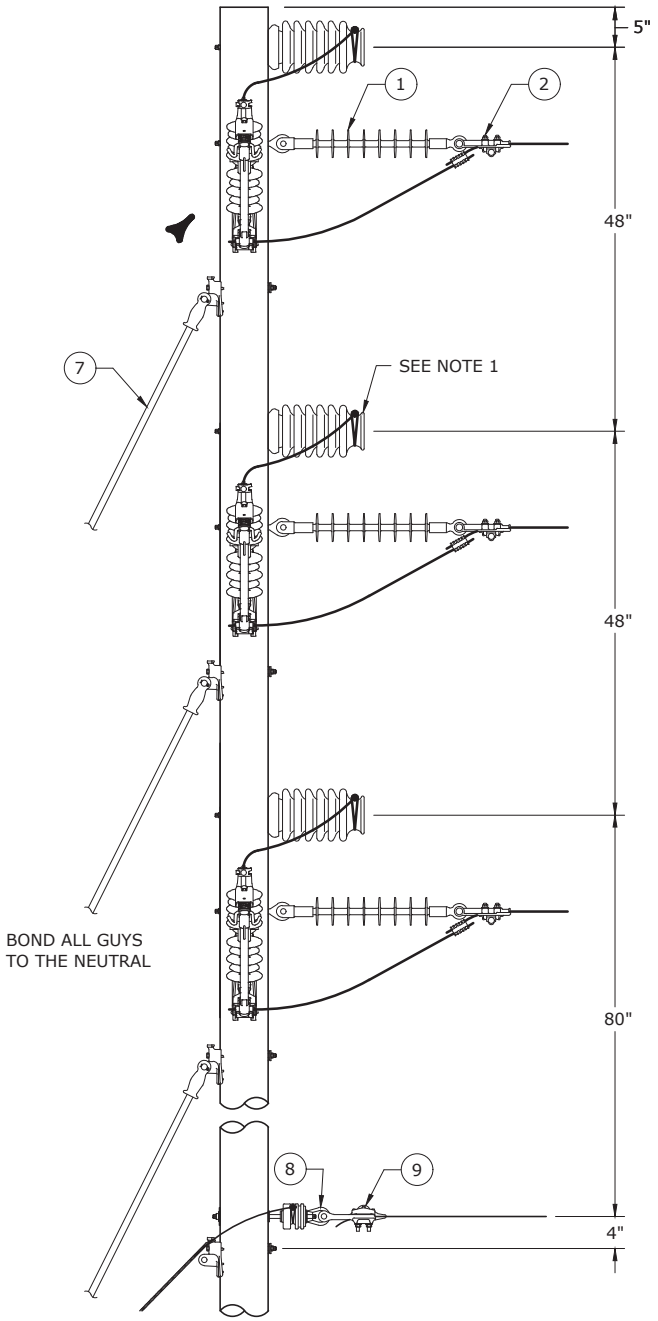
THREE-PHASE VERTICAL CONSTRUCTION -
FUSED SINGLE-PHASE TAP

DEC	DEM	DEP	DEF
			X

03.12-130B



FRONT VIEW



SIDE VIEW

NOTES:

1. MAIN LINE PRIMARY MAY BE ON THE OTHER SIDE OF POLE BUT MUST REMAIN 8" FOR 12KV OR 12" FOR 25KV FROM GUY INSULATOR.
2. MIDDLE PHASE FUSE MAYBE ON THE OPPOSITE SIDE OF POLE IF OPERATION IS NOT IMPACTED BY TERRAIN.
3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - FUSED THREE-PHASE TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-133A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	3	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

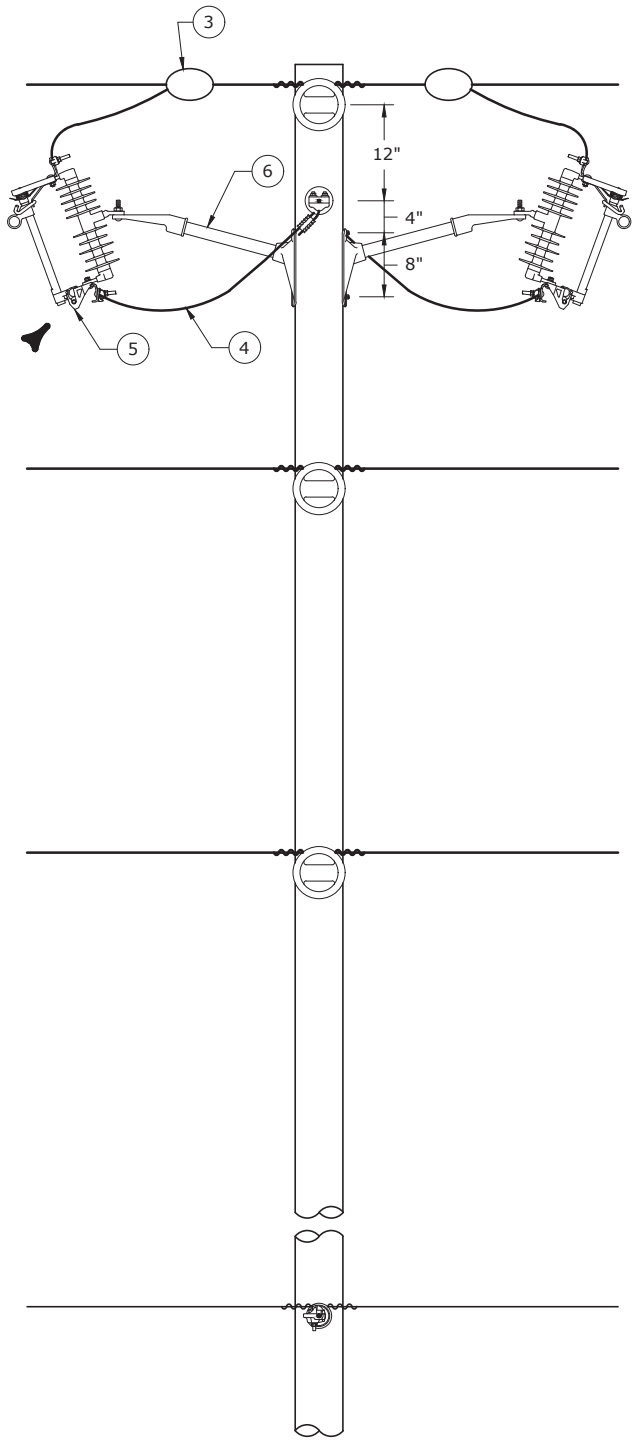
THREE-PHASE VERTICAL CONSTRUCTION -

FUSED THREE-PHASE TAP

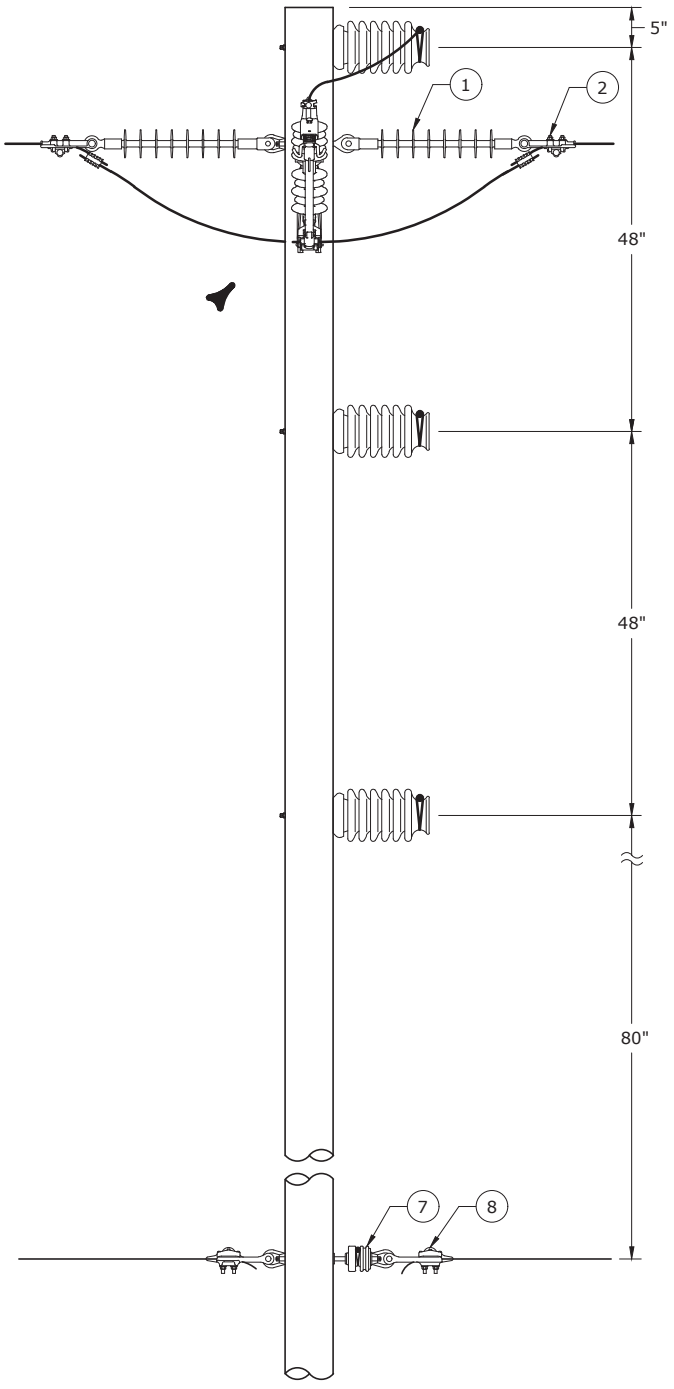
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.12-133B



FRONT VIEW



SIDE VIEW

NOTES:

1. THIS DESIGN MAY BE UTILIZED ON ANY PHASE BUT TAPS MUST BE ON SAME PHASE OR GUYING IS REQUIRED.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION -
TWO FUSED SINGLE-PHASE TAPS

DEC	DEM	DEP	DEF
X	X	X	X

03.12-135A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	2	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	2	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	2	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG ,GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
7	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

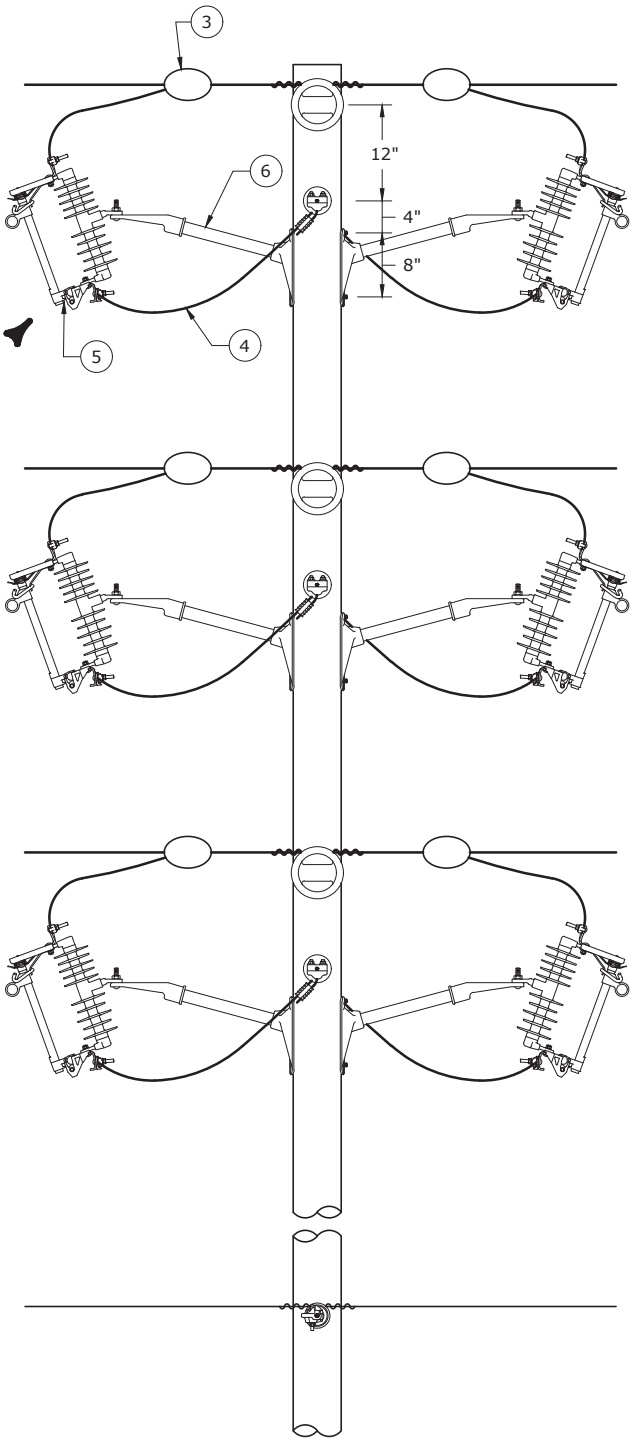
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

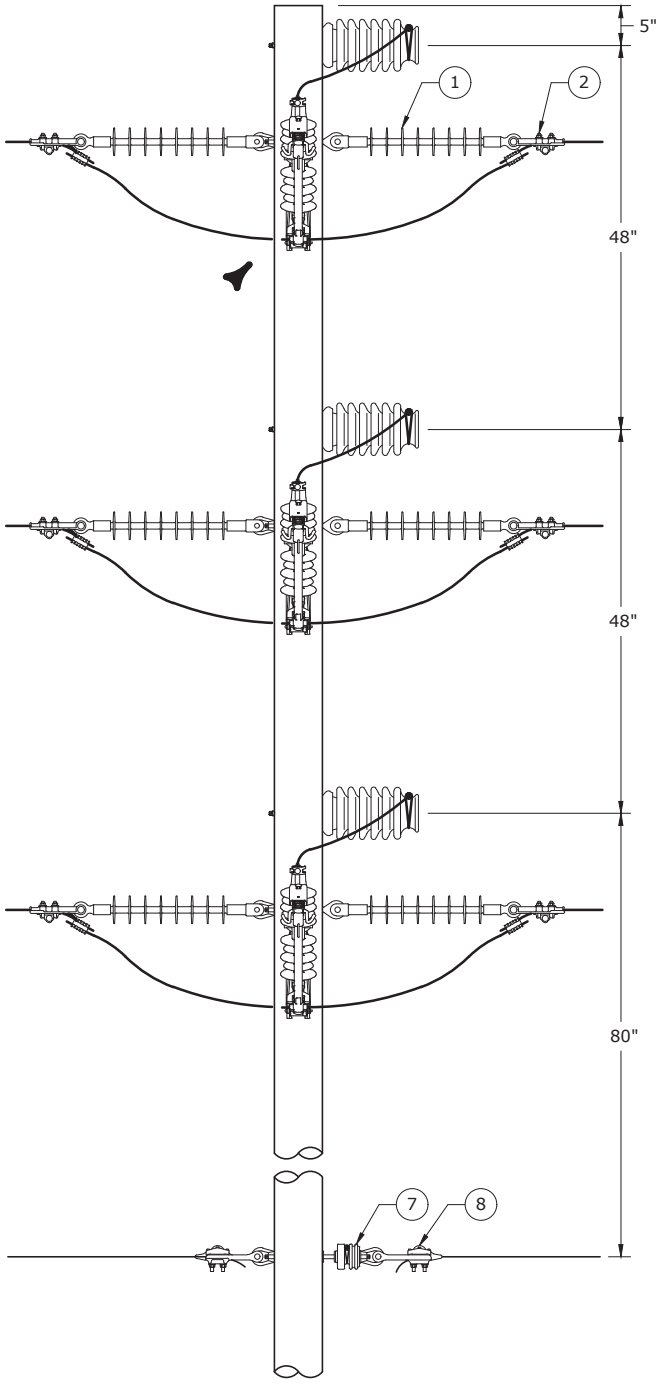
THREE-PHASE VERTICAL CONSTRUCTION -
TWO FUSED SINGLE-PHASE TAPS

DEC	DEM	DEP	DEF
			X

03.12-135B



FRONT VIEW



SIDE VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION - TWO FUSED THREE-PHASE TAPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-137A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	6	4192428	12	WIRE/CABLE,ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	6	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA 11 UNC 10" LG SQ HEAD, HOT DIP GALV STL
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

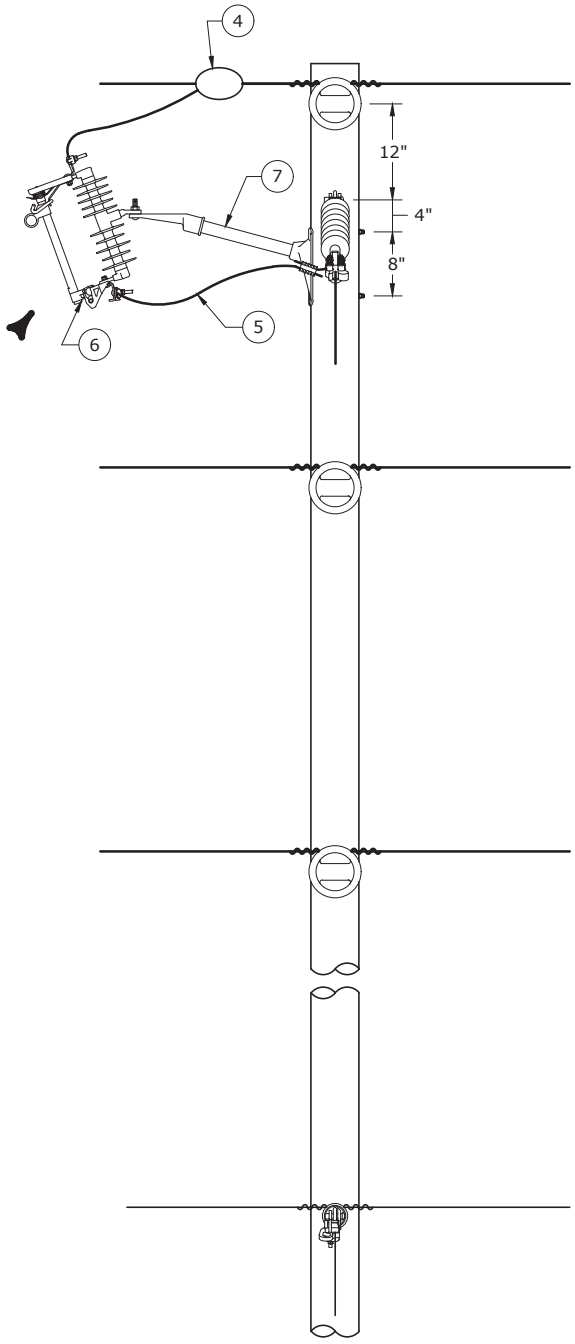
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

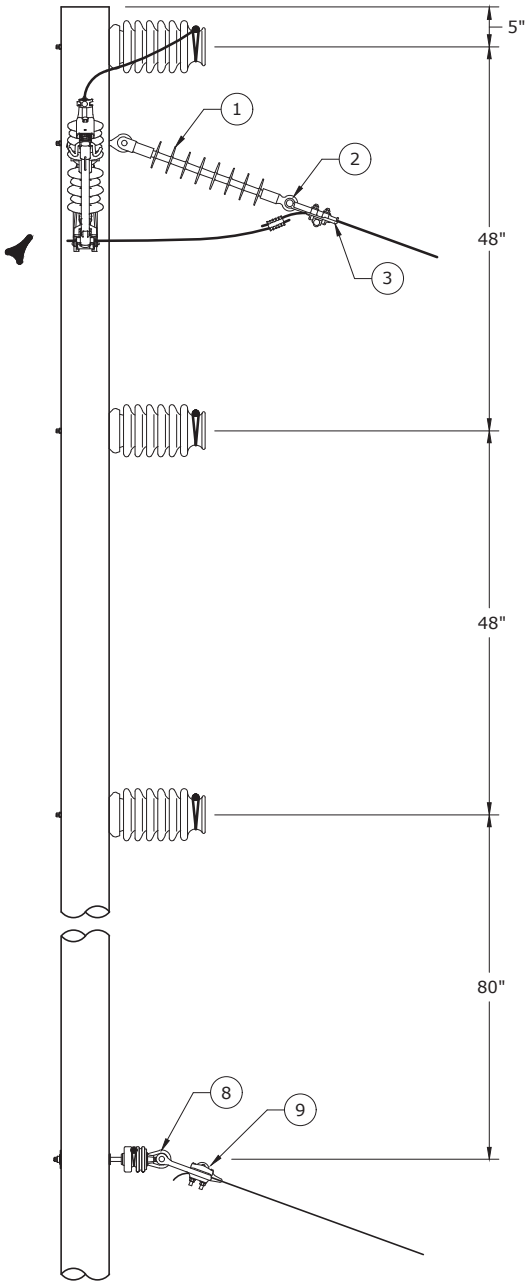
THREE-PHASE VERTICAL CONSTRUCTION - TWO FUSED THREE-PHASE TAPS

DEC	DEM	DEP	DEF
			X

03.12-137B



FRONT VIEW



SIDE VIEW

NOTES:

1. TAP MAY BE ON ANY PHASE.

2. SEE SECTION 03.06 FOR SHUNT CLIP SPECIFICATIONS.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - FUSED SINGLE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.12-140A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	INSL-CLIP-SHUNT-F	1	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

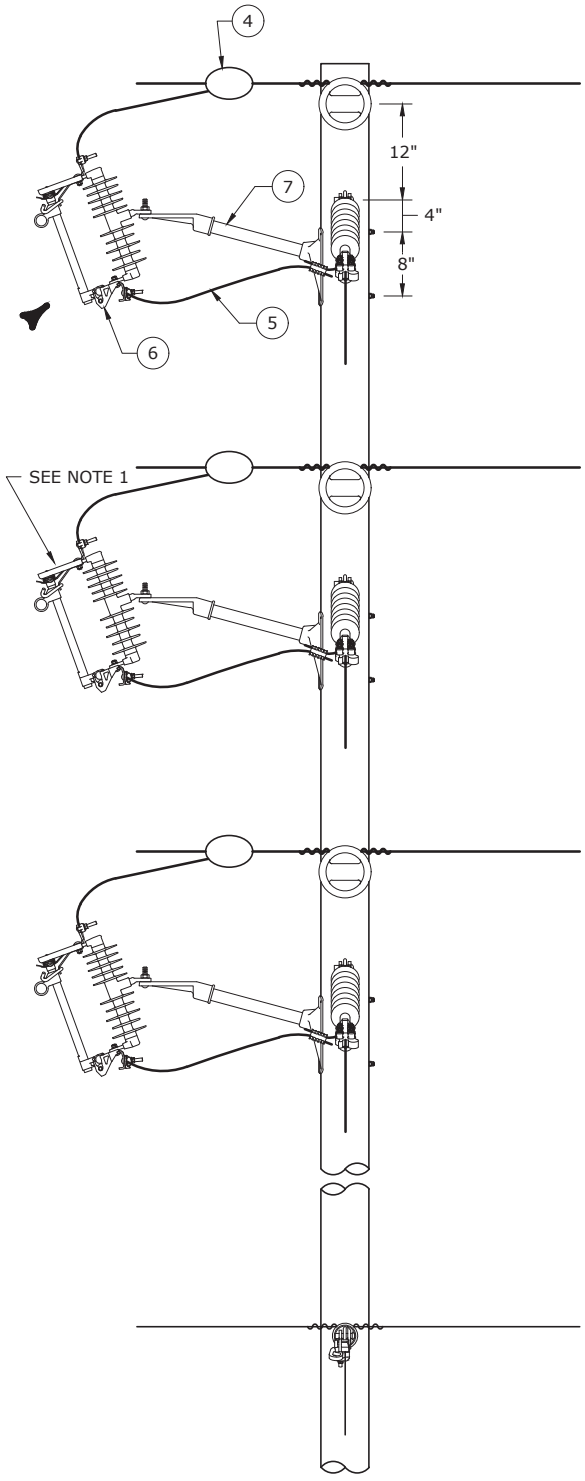
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

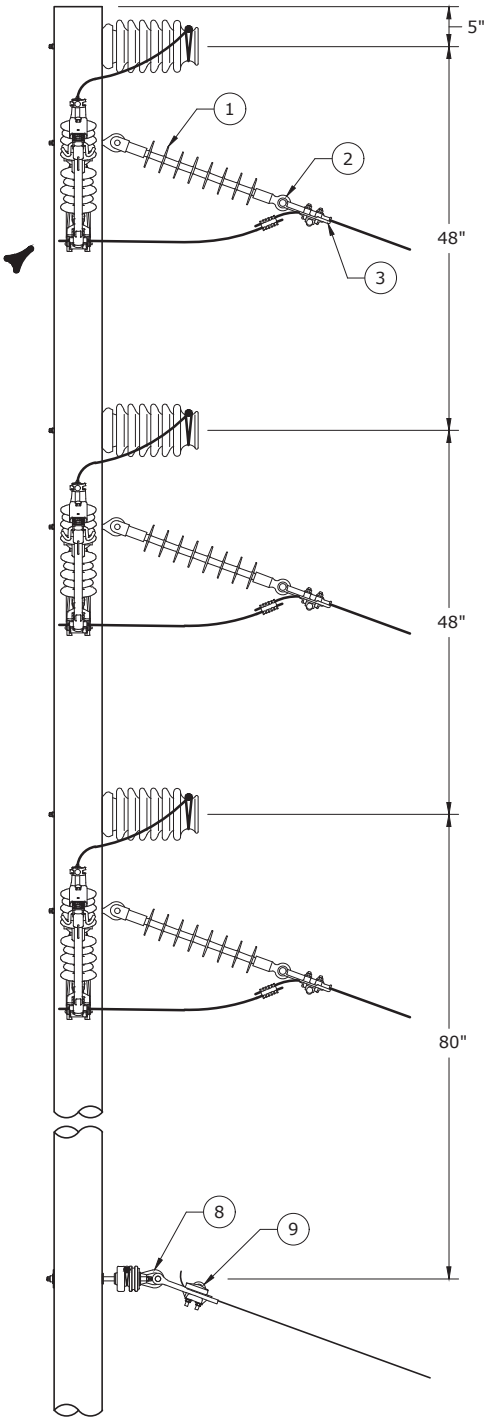
THREE-PHASE VERTICAL CONSTRUCTION - FUSED SINGLE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

03.12-140B



FRONT VIEW



SIDE VIEW

NOTES:

1. MIDDLE PHASE FUSE MAYBE ON THE OPPOSITE SIDE OF POLE IF OPERATION IS NOT IMPACTED BY TERRAIN.

2. SEE SECTION 03.06 FOR SHUNT CLIP SPECIFICATIONS.

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - FUSED THREE-PHASE SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.12-142A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	3	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-SWASH-SM-GALV-CURVE-F	3	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	INSL-CLIP-SHUNT-F	3	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	3	-	1	SEE SECTION 04 PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	3	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

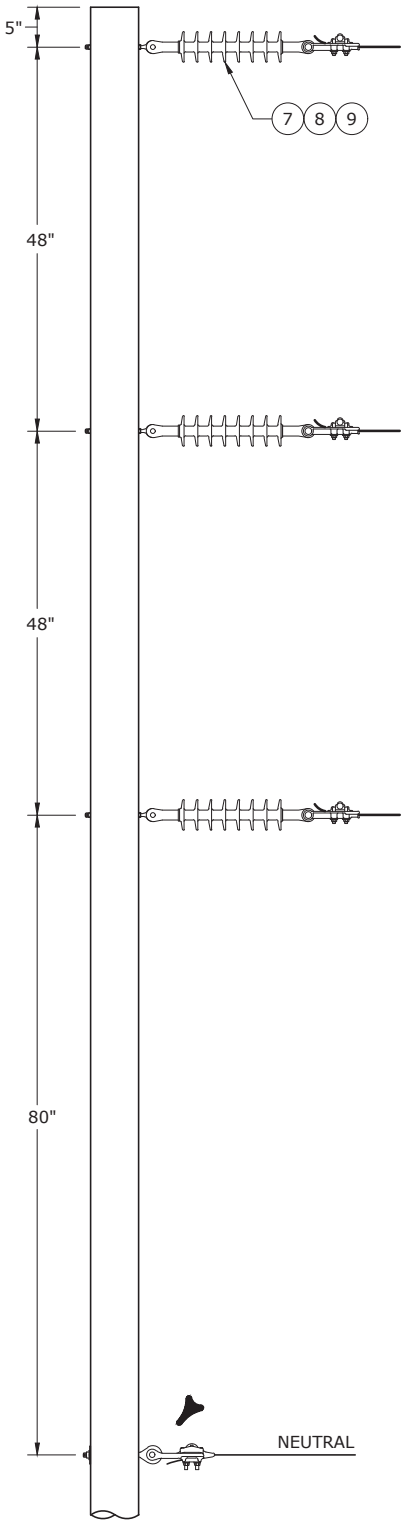
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION -

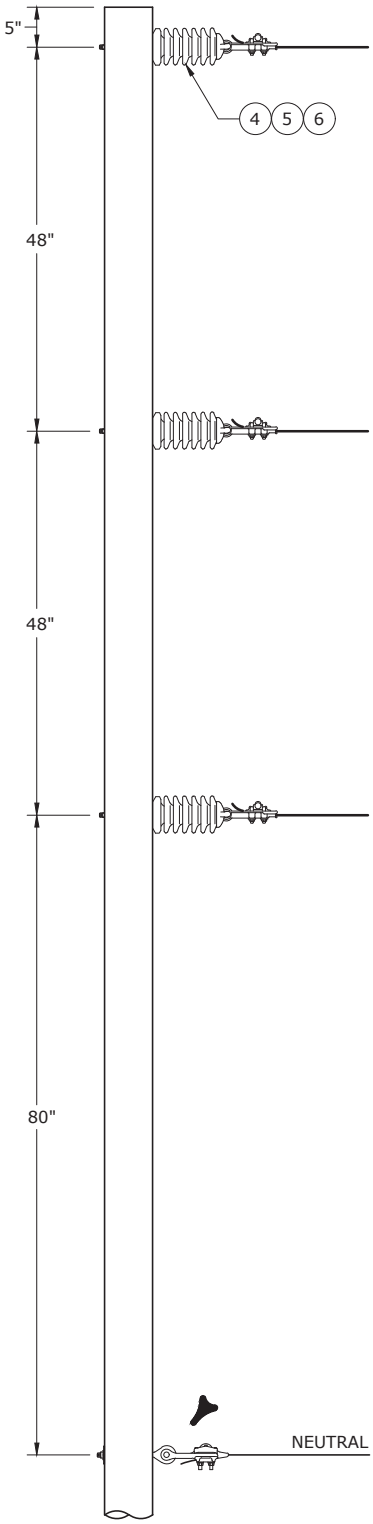
FUSED THREE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

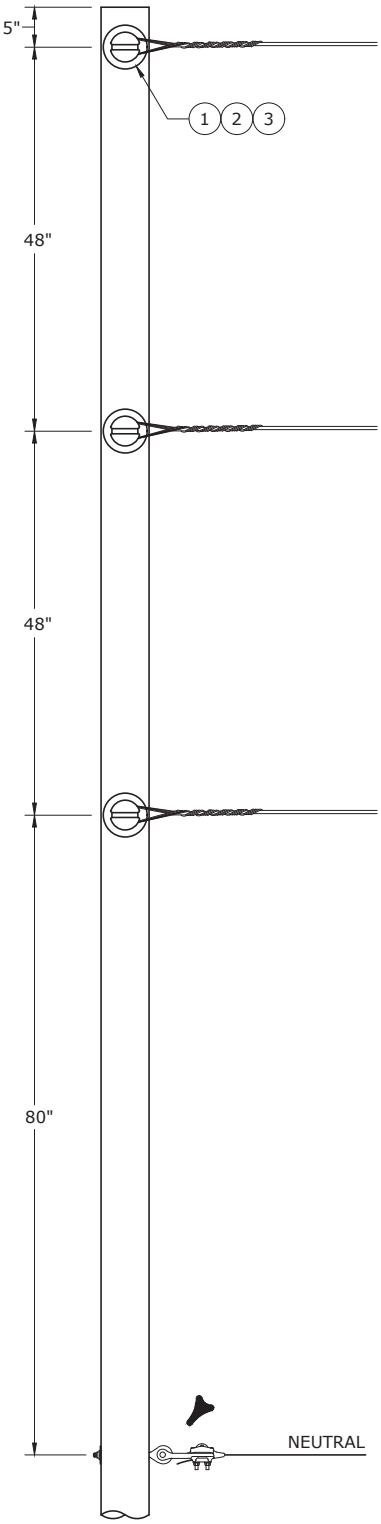
03.12-142B



FOR #2 THROUGH 795



FOR #4/0 THROUGH 795



FOR #2 AND #1/0 CONDUCTORS

NOTES:

1. DEADEND POLYMER IS THE PREFERRED METHOD. USE OTHER TWO METHODS WHEN CLEARANCE CONFLICTS EXIST SUCH AS DOWN GUYS.
2. DEADEND POLYMERS USED IN SLACK SPAN CONSTRUCTION REQUIRE FOUR SHUNT CLIPS EACH. SEE DWG. 03.06-140.

REVISED		BY	CK'D	APPR.
3	4/30/18	BENDER	BURLISON	ADCOCK
2	5/9/17	LOOSIER	BURLISON	ADCOCK
1	10/13/16	LOOSIER	BURLISON	ADCOCK
0	9/30/16	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - SLACK SPAN

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

03.12-144A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-12IN-THD-F	3	134398	1	STUD, INSULATOR, 5/8" DIA, 12" LG, 11 UNC, 6" THD LG, GALV STL
2	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSUL TO POLES
3	TIE-SLACK GRIP-2-AL-F	3	4161624	1	TIE SLACK SPAN GRIP 2AL
	TIE-SLACK GRIP-1/0-AL-F	3	930024	1	TIE SLACK SPAN GRIP 1/0AL
4	INSL-POST-35KV-PORC-VC-F	3	4022893	1	INSULATOR, CLAMP TOP VERT LINE POST, 35KV, ANSI 57-12
5	INSL-STUD-STL-12IN-THD-F	3	134398	1	STUD, INSULATOR, 5/8" DIA, 12" LG, 11 UNC, 6" THD LG, GALV STL
5	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSULATOR
5	HDWR-SP-SM-12IN-GALV-F	3	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
6	CLAMP-TR-SLACK-SM-F	3	4002481	1	CLAMP TRUNNION SLACK SPAN 2-4/0 AL
	CLAMP-TR-SLACK-LG-F	3	81233	1	CLAMP TRUNNION SLACK SPAN 336-795 AL
7	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DISTRIBUTION DEADEND, 35KV, 22" LG, POLYMER
8	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-EYEBOLT-SM-12IN-GALV-F	3	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-EYEBOLT-SM-14IN-GALV-F	3	931138	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 14" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
8	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
9	CLAMP-DE-LG-F	3	4002479	1	CLAMP, DEADEND, 0.68"-1.16", 556.5AAC, 556.5ACSR (18/1), 795AAC, 795ACSR 12000 LB, SO, 1/2" U-BOLT, SIDE OPENING
	CLAMP-DE-MD-F	3	4022409	1	CLAMP, DEADEND, 0.41"-0.88", 336.4AAC, 336.4ACSR (30/7) 477AAC, 477ACSR (26/7), 8000 LB, 1/2 U-BOLT, SIDE-OPENING
	CLAMP-DE-SM-F	3	4002478	1	CLAMP, DEADEND, 0.16"-0.57", 6-4/0 AWG SOL TINNED CU TO 4-4/0 AWG SOL TINNED ALUM, 8000 LB, 1/2 U-BOLT

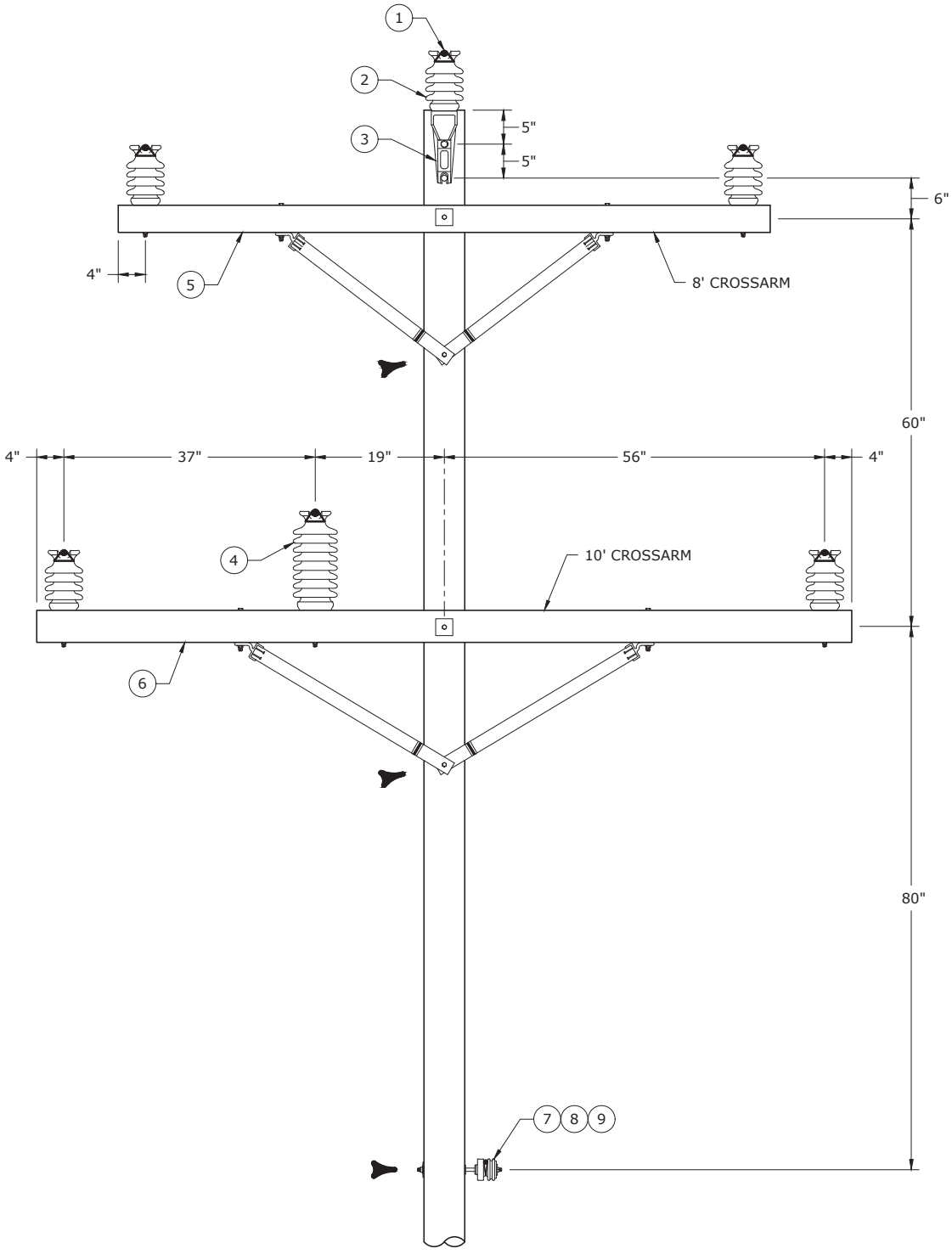
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - SLACK SPAN

DEC	DEM	DEP	DEF
			X

03.12-144B



FRONT VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-150A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	5	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, GALV STL
4	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

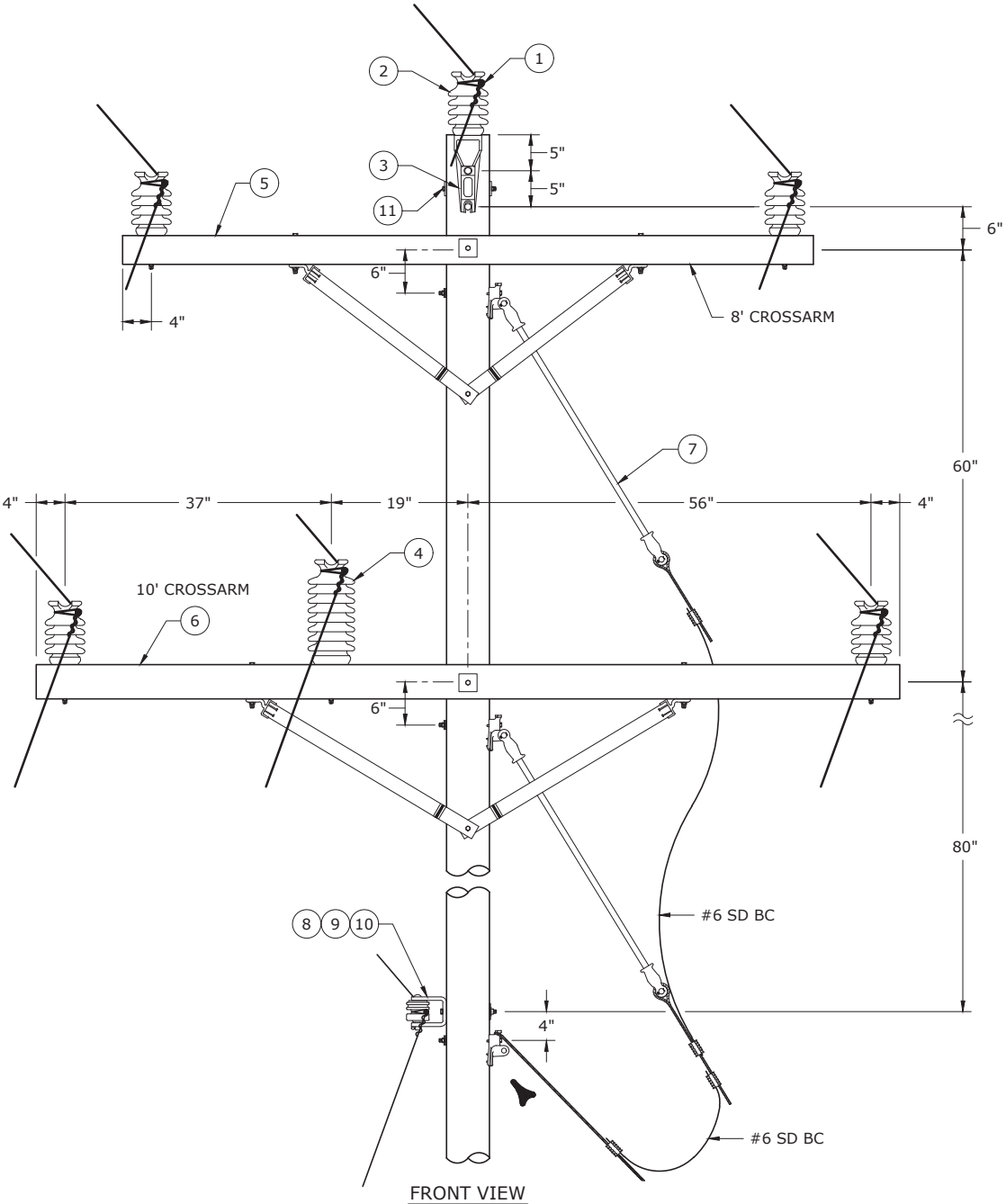
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.13-150B



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
#1/0 AAAC AND SMALLER	15°	15°	10°
4/0 AAAC	-	10°	10°
336.4 AAC	15°	10°	10°
477 AAC	-	10°	-
556.5 AAC	-	10°	5°
795 AAC	5°	-	-

NOTES:

1. A 5/8" MACHINE BOLT SHALL BE INSTALLED AS A SPLIT-OUT BOLT ON MEDIUM ANGLE AND DOUBLE POLE TOP INSULATOR APPLICATIONS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 10/13/16	WHITE	BURLISON	ADCOCK
0 6/30/16	WHITE	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER)
SMALL ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-155A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	5	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, GALV STL
4	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
9	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
10	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
11	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, GALV STL

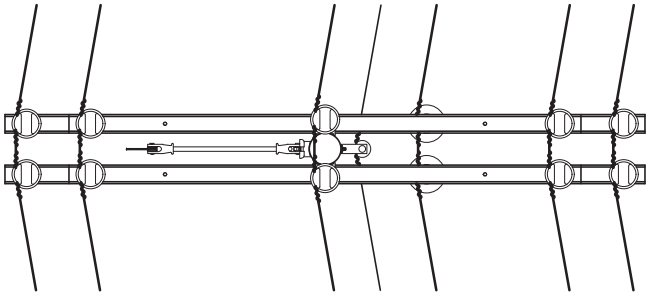
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

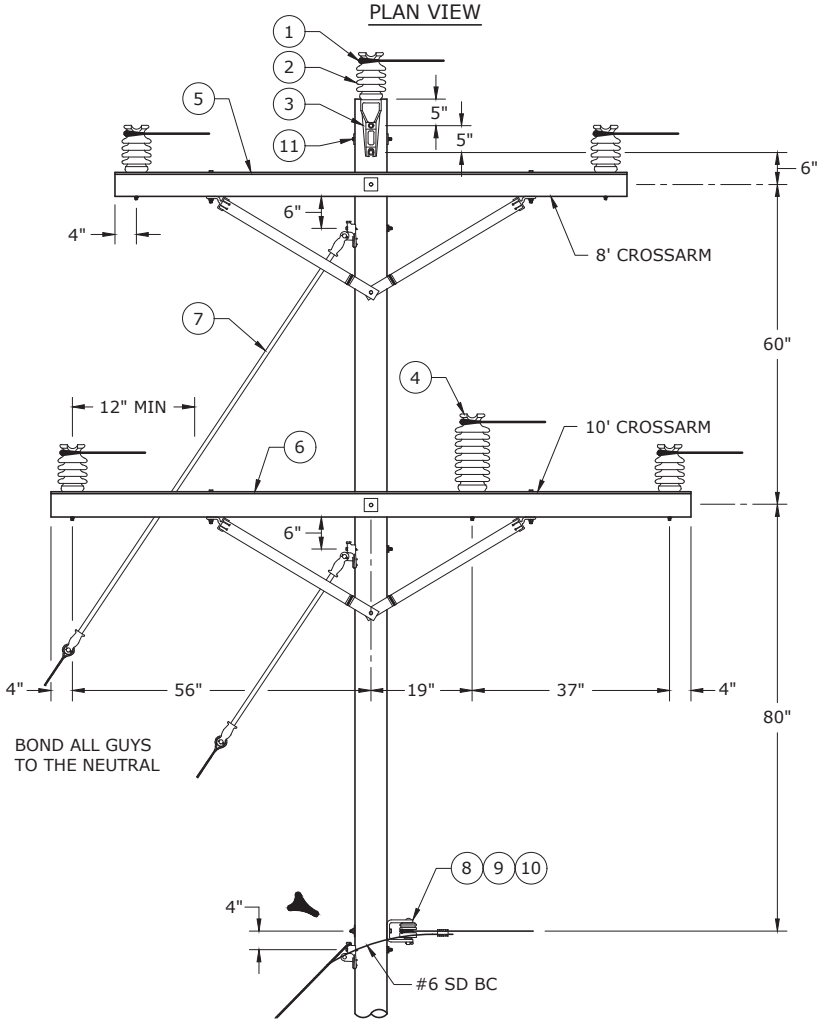
DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
SMALL ANGLE

DEC	DEM	DEP	DEF
			X

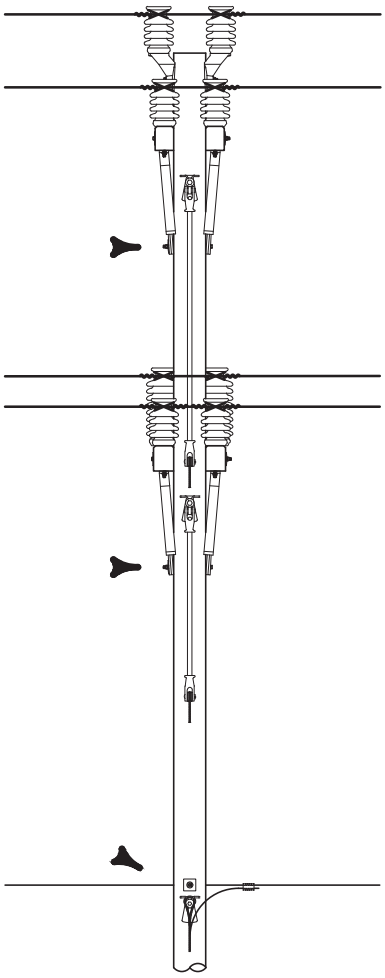
03.13-155B



PLAN VIEW



FRONT VIEW



SIDE VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
4/0 AAAC	-	25°	20°
336.4 AAC	25°	25°	20°
477 AAC	-	20°	-
556.4 AAC	-	20°	10°
795 AAC	10°	-	-

NOTES:

1. SEE DOWN GUY AND ANCHOR SPECIFICATION DRAWINGS FOR GUYING REQUIREMENTS.
2. A 5/8" MACHINE BOLT SHALL BE INSTALLED AS A SPLIT-OUT BOLT ON MEDIUM ANGLE AND DOUBLE POLE TOP INSULATOR APPLICATIONS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 10/13/16	WHITE	BURLISON	ADCOCK
0 6/30/16	ROBESON	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) MEDIUM ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-160A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-DSIDE-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	10	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	8	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	2	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-POST-45KV-PORC-TT-F	2	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	ARM-DBL-8-FBG-NB-F	1	4001743	2	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-DA-LG-22IN-GALV-F	2	930945	1	BOLT, DOUBLE ARMING, 3/4" DIA, 22" LG, 18350 LB, GALV STL
5	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	ARM-DBL-10-FBG-NB-F	1	1519861	2	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	10	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-DA-LG-22IN-GALV-F	2	930945	1	BOLT, DOUBLE ARMING, 3/4" DIA, 22" LG, 18350 LB, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
9	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
10	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
11	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV

NOTES:

1. SEE DWG. 03.13-160A FOR DESIGN SPECIFICATIONS.

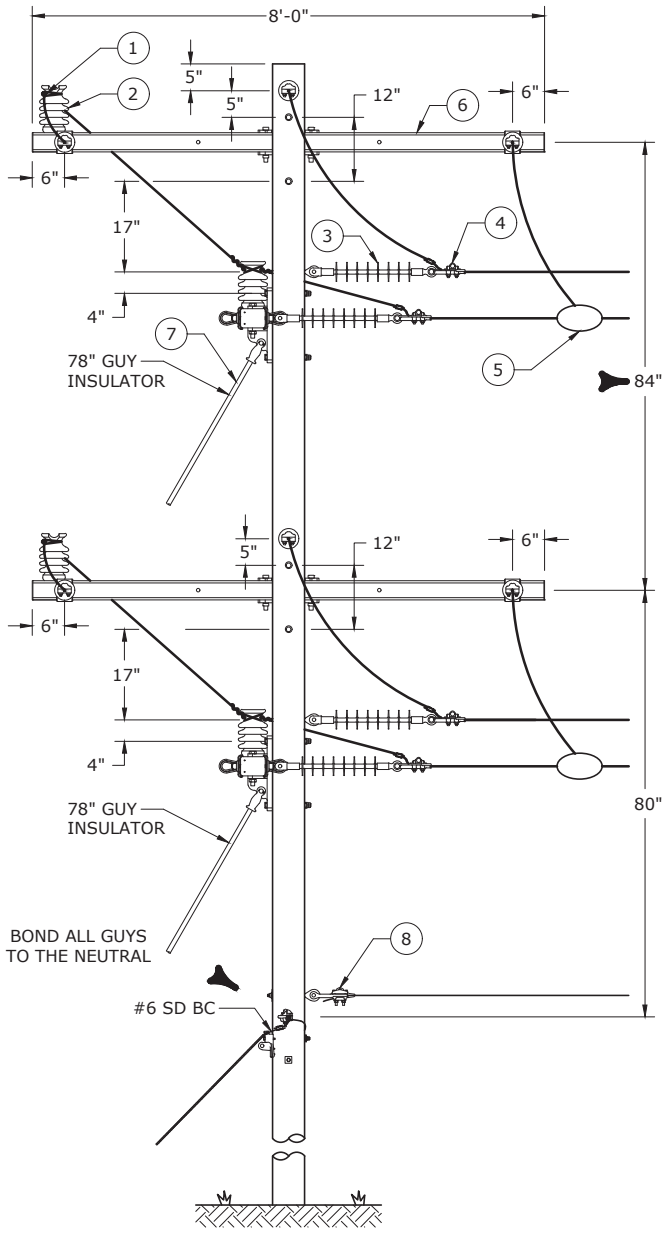
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

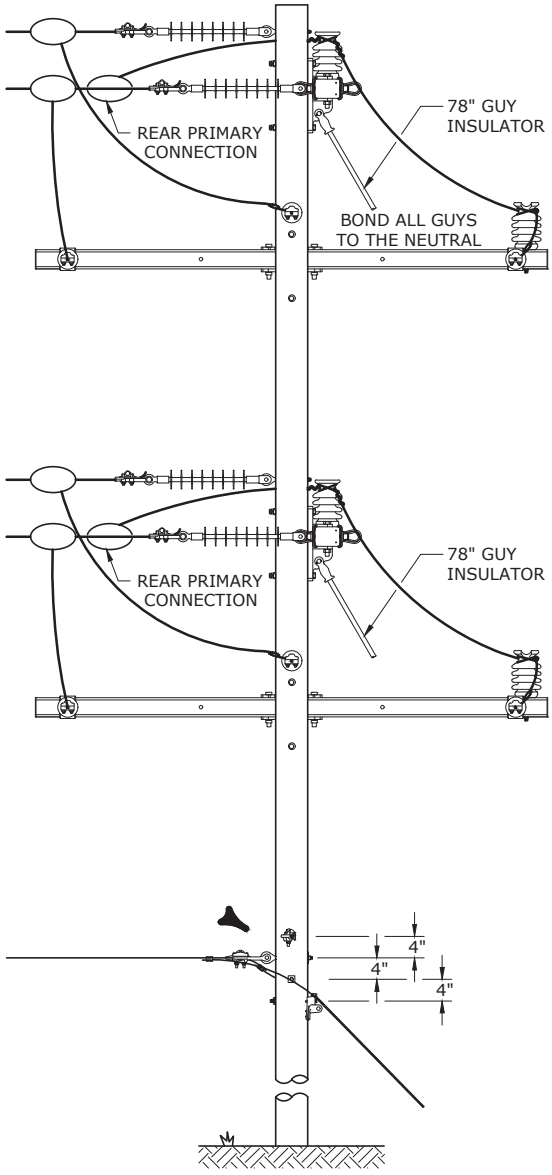
DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
MEDIUM ANGLE

DEC	DEM	DEP	DEF
			X

03.13-160B



FRONT VIEW



SIDE VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) BUCK ARM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-165A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	4	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	4	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
3	HDWR-EYEBOLT-SM-10IN-GALV-F	4	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC,10" LG,4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	4	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	8	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUY AND ANCHOR DETAILS
8	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE,OVAL, 5/8" DIA,11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

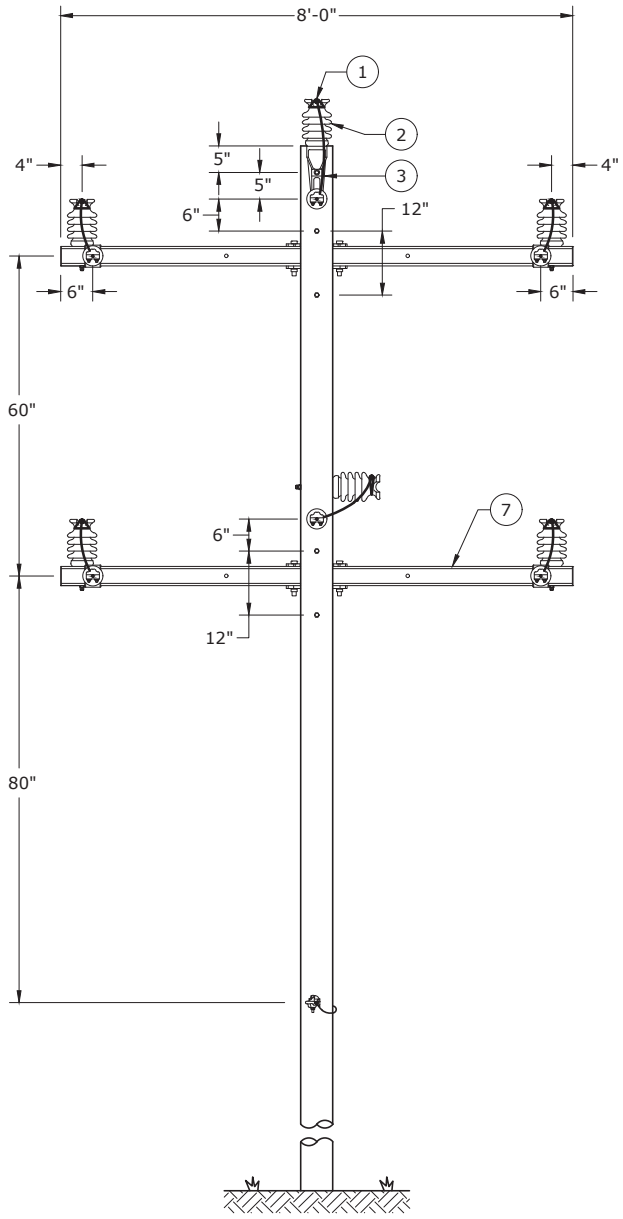
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

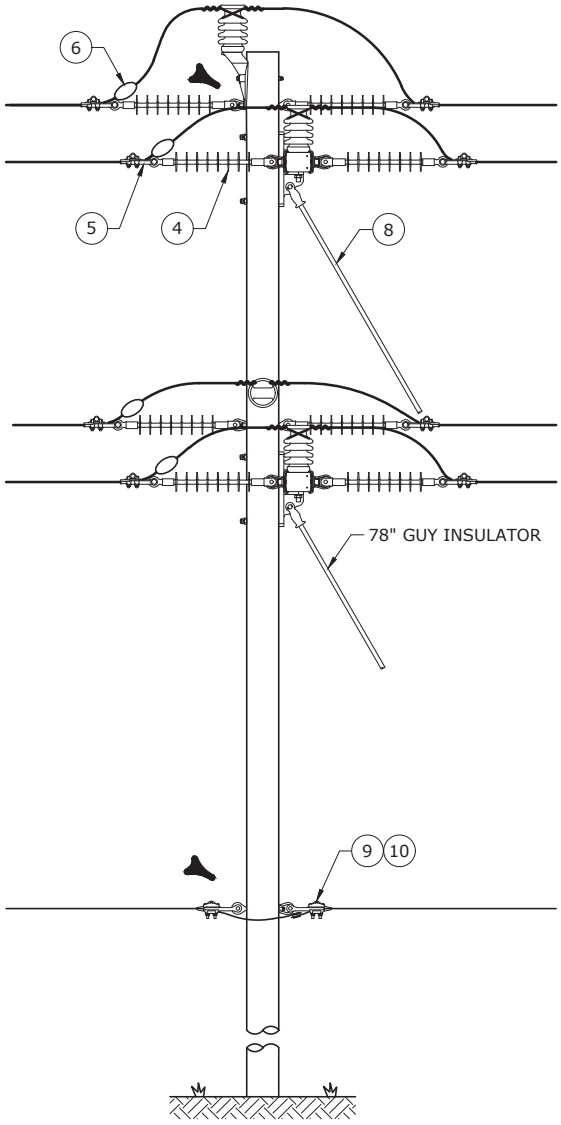
DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
BUCK ARM

DEC	DEM	DEP	DEF
			X

03.13-165B



FRONT VIEW



SIDE VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
DOUBLE DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.13-170A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	5	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
2	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-EYEBOLT-SM-10IN-GALV-F	2	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	ARM-SDE-8-FBG-NB-F	2	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
9	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA,11 UNC,12" LG,6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
9	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
10	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

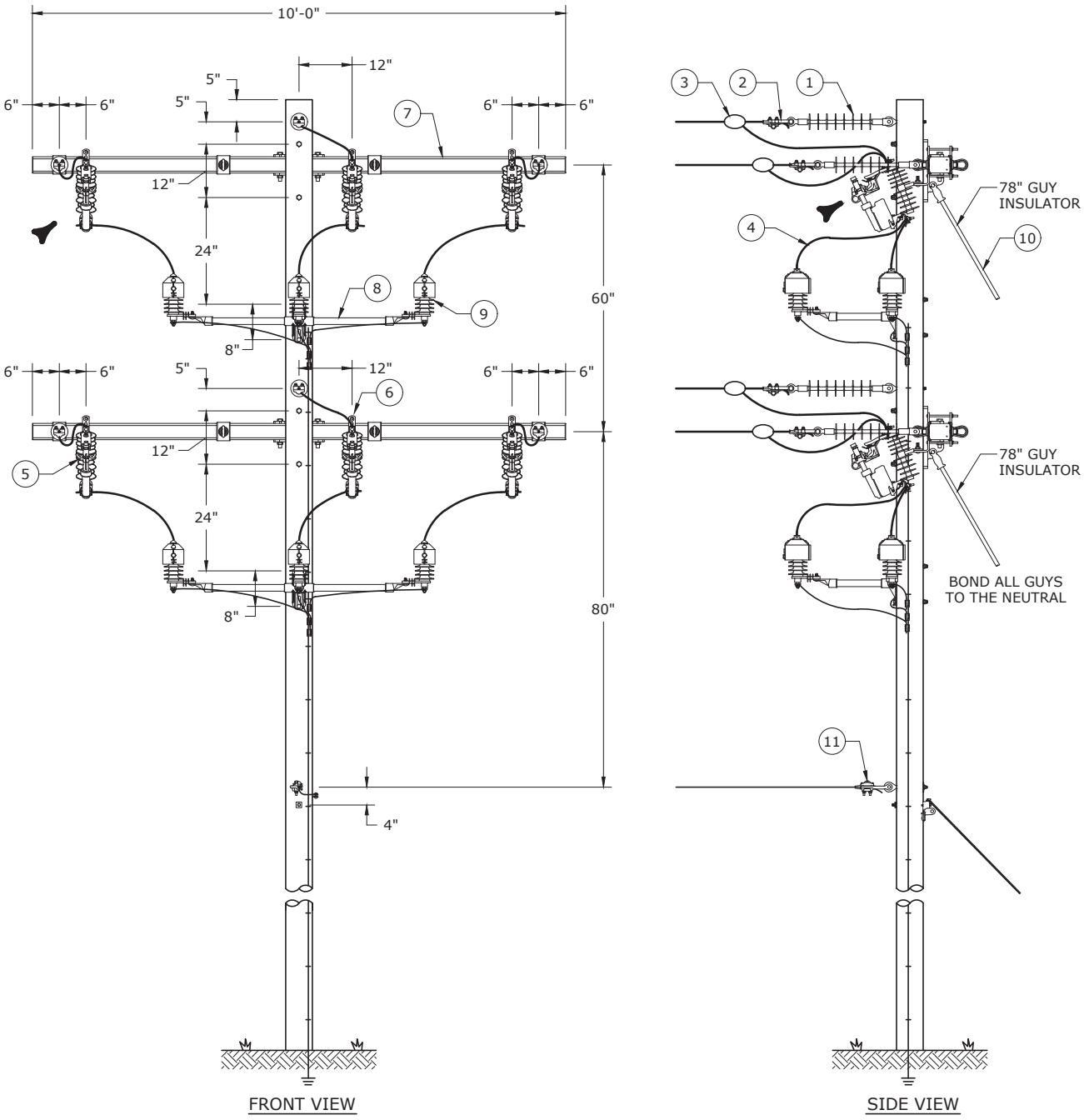
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
DOUBLE DEADEND

DEC	DEM	DEP	DEF
			X

03.13-170B



NOTES:

1. POLE GROUND TO BE INSTALLED ON SIDE OF POLE.

2. POLE MOUNTED CONDUCTOR FOR LOWER CIRCUIT TO HAVE TWO POLYMER INSULATORS INSTALLED.

REVISED		BY	CHK'D	APPR.
5	4/30/18	BENDER	BURLISON	ADCOCK
4	8/7/17	BENDER	BURLISON	ADCOCK
3	4/5/17	LOOSIER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.13-175A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	2	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	6	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V, W/ INSULATION
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	BKT-EM-ARM-1P-STL-MD-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	2	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	BKT-EM-POLE-3P-FG-LG-F	2	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			4197597	1	BRACKET, SGL POSITION 3PH, 48" X 24", FIBERGLASS, 0 DEG MOUNT
8	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT, MACHINE, 5/8" DIA 11 UNC, 12" LG SQ HEAD, HOT DIP GALV STL
9	ARR-LINE-10KV-F	6	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	6	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	6	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

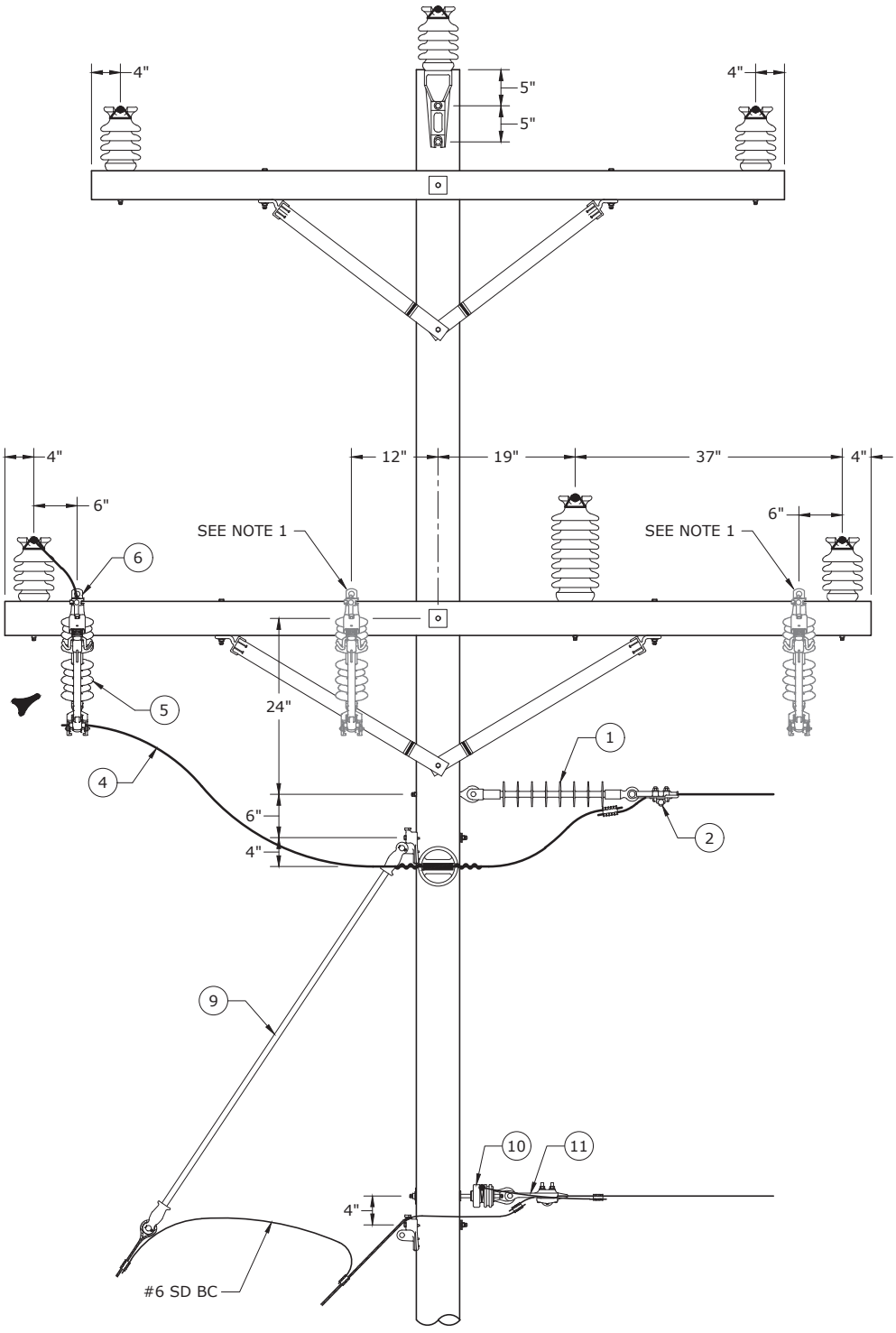
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

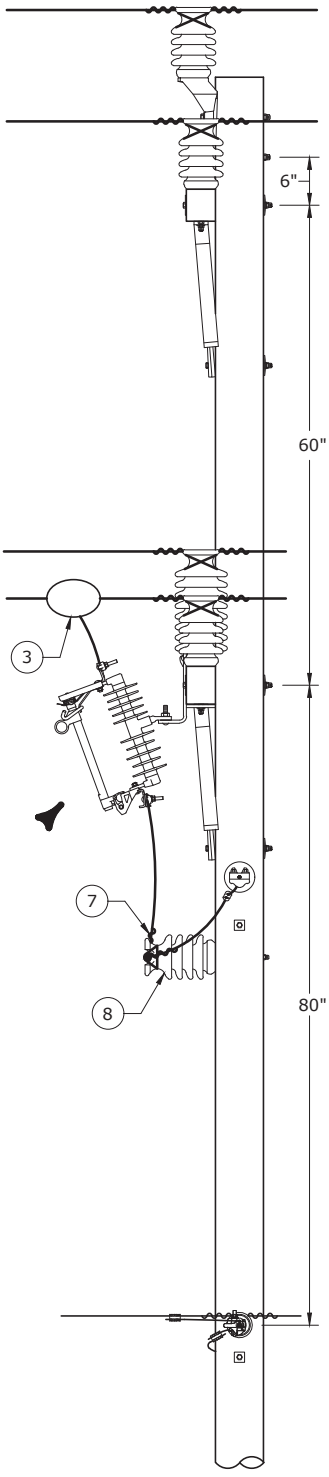
DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
DEADEND

DEC	DEM	DEP	DEF
			X

03.13-175B



FRONT VIEW



SIDE VIEW

NOTES:

1. POSITION OF CUTOUT IF THIS PHASE IS TAPPED.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
SINGLE-PHASE FUSED TAP BOTTOM CIRCUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-180A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL
7	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
8	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
8	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
9	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

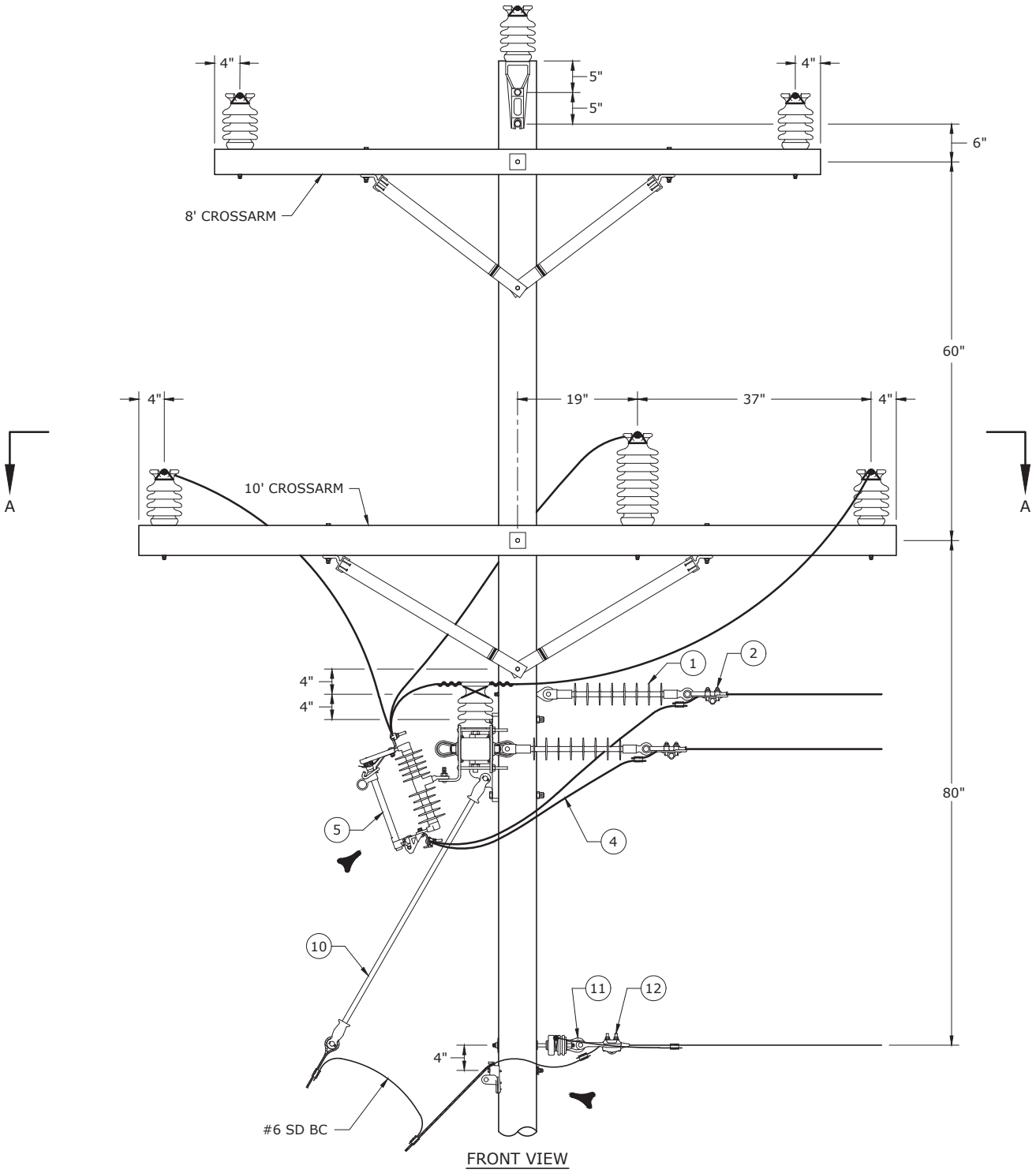
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
SINGLE-PHASE FUSED TAP BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
			X

03.13-180B



FRONT VIEW

NOTES:

1. OMIT CENTER PHASE AND USE 8' ARM FOR TWO-PHASE TAP.

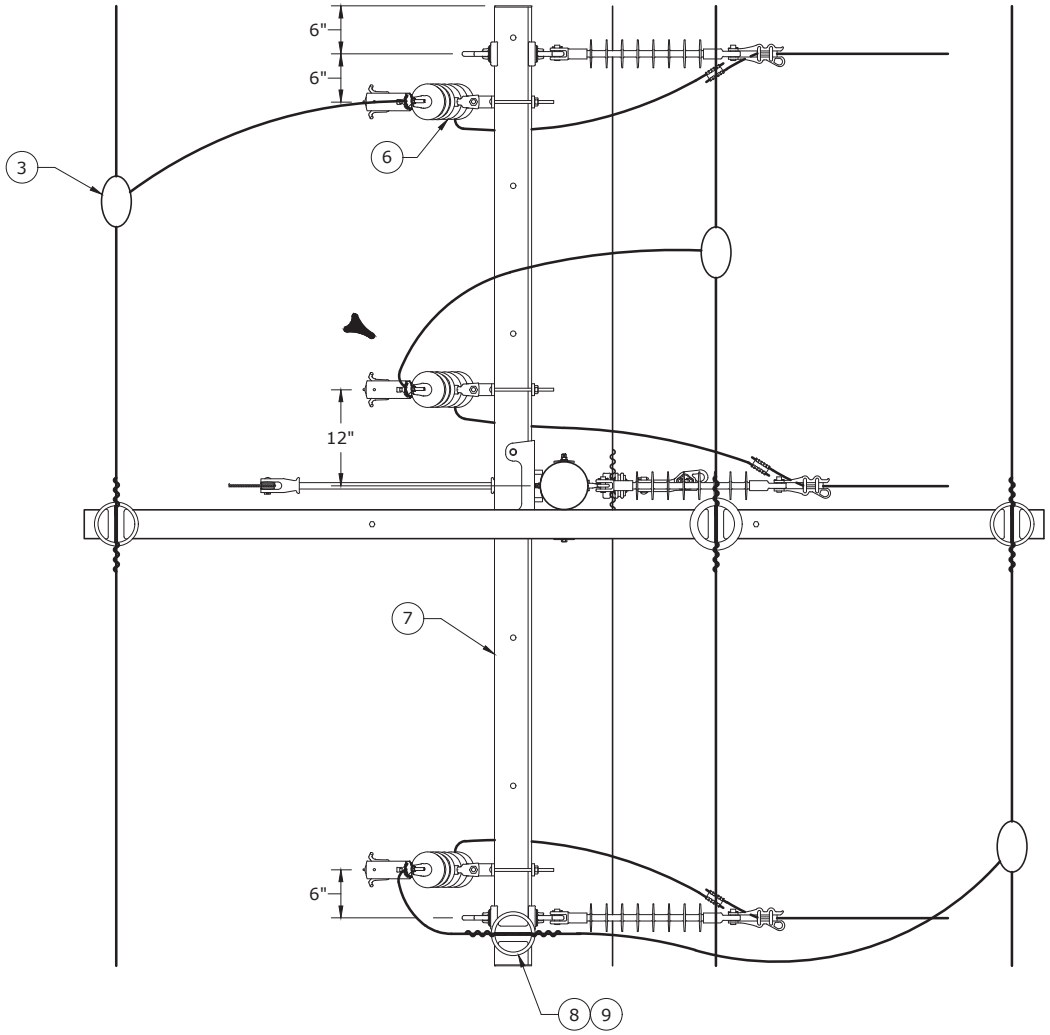
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) THREE-PHASE FUSED TAP BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-183A



SECTION A-A

NOTES:

1. OMIT CENTER PHASE AND USE 8' ARM FOR TWO-PHASE TAP.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
THREE-PHASE FUSED TAP BOTTOM CIRCUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-183B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
8	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
9	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

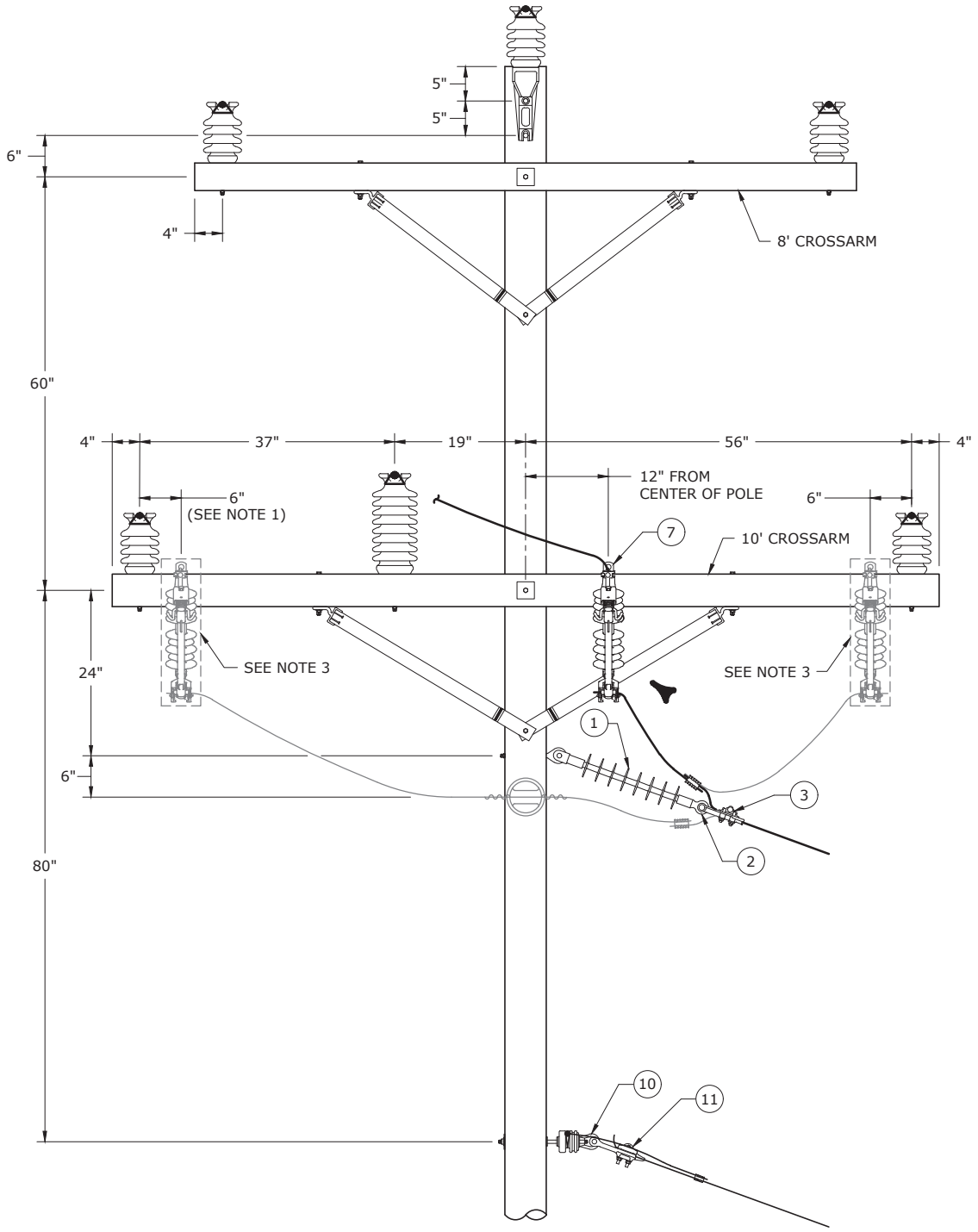
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	9/1/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
THREE-PHASE FUSED TAP BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
			X

03.13-183C



FRONT VIEW

NOTES:

1. POSITION OF CUTOUT IF THIS PHASE IS TAPPED.

2. USE POST INSULATOR FOR JUMPER SUPPORT IF THIS PHASE IS TAPPED.

3. BOXED CUTOUTS ARE SHOWN AS ALTERNATE FEEDS.

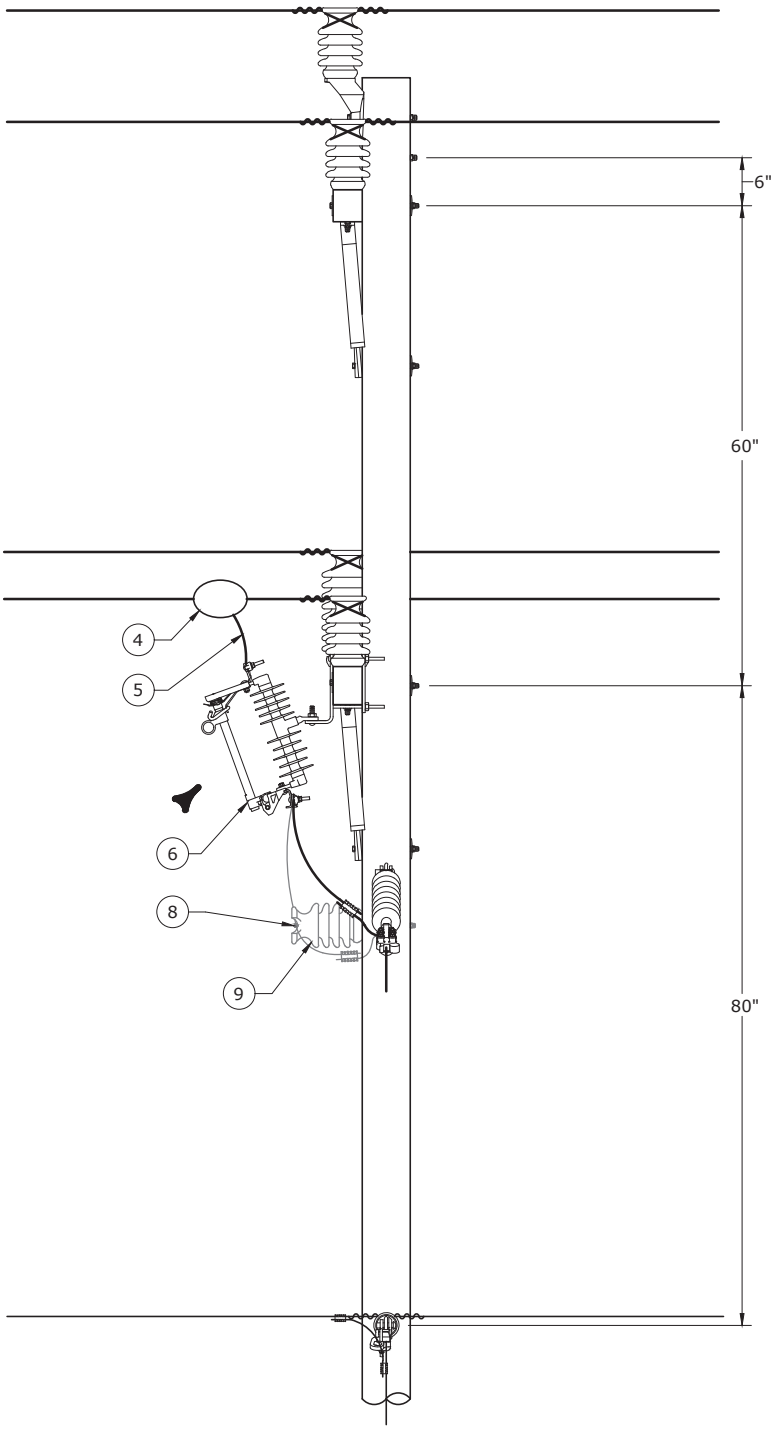
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) SINGLE-PHASE FUSED SLACK SPAN TAP - BOTTOM CIRCUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-190A



SIDE VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) SINGLE-PHASE FUSED SLACK SPAN TAP - BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-190B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	INSL-CLIP-SHUNT-F	1	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
9	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
9	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

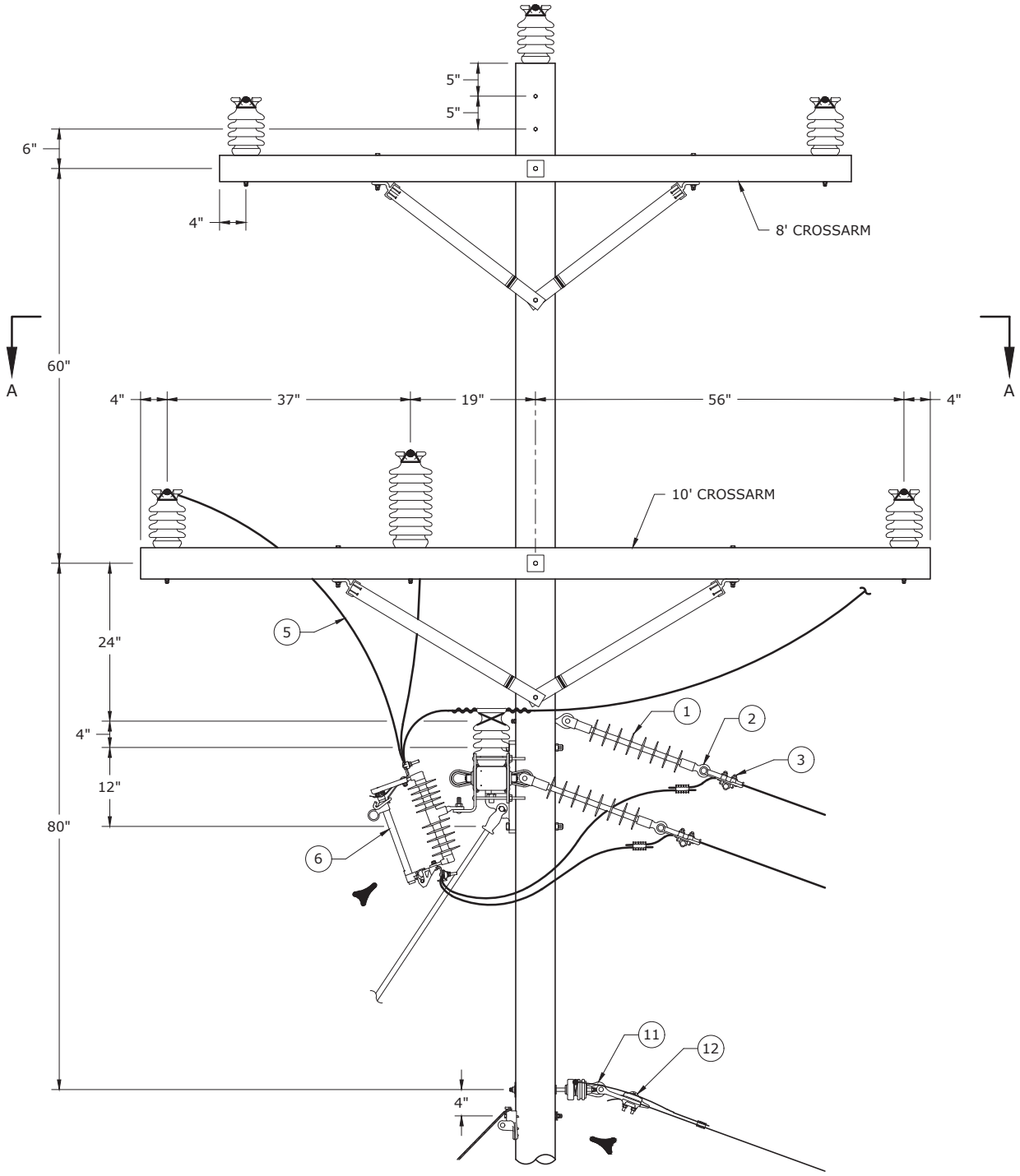
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER)
SINGLE-PHASE FUSED SLACK SPAN TAP - BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
			X

03.13-190C



FRONT VIEW

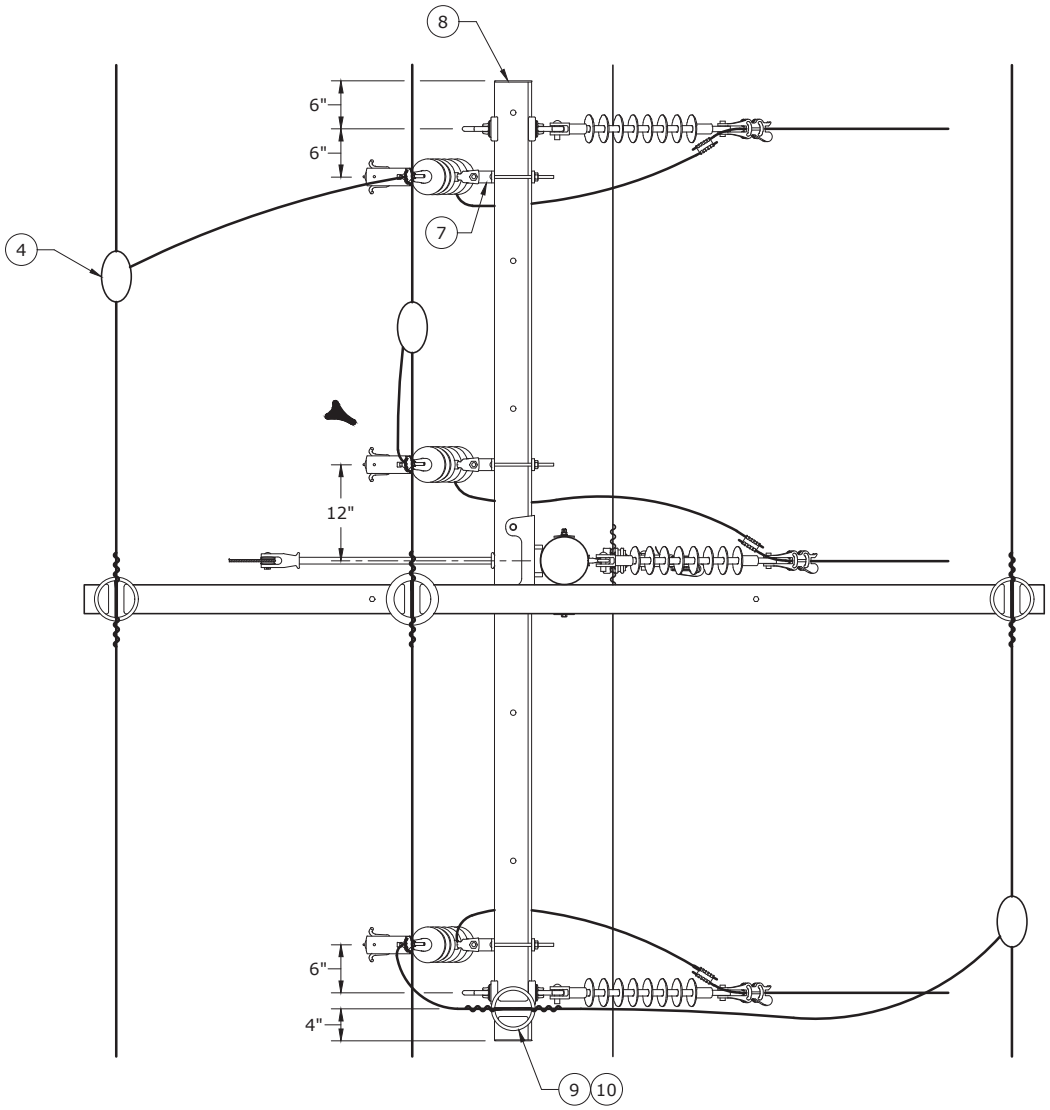
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	6/28/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) THREE-PHASE FUSED SLACK SPAN TAP - BOTTOM CIRCUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-193A



SECTION A-A

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION
(OVER/UNDER)
THREE-PHASE FUSED SLACK SPAN TAP -
BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-193B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
1	HDWR-SWASH-SM-GALV-CURVE-F	1	938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	INSL-CLIP-SHUNT-F	3	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-ARM-1P-STL-MD-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			50094140	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 8" LG, HOT DIP GALV STL
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARM-SDE-10-FBG-NB-F	1	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL.
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
9	INSL-POST-25KV-PORC-TT-F	1	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
9	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
10	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

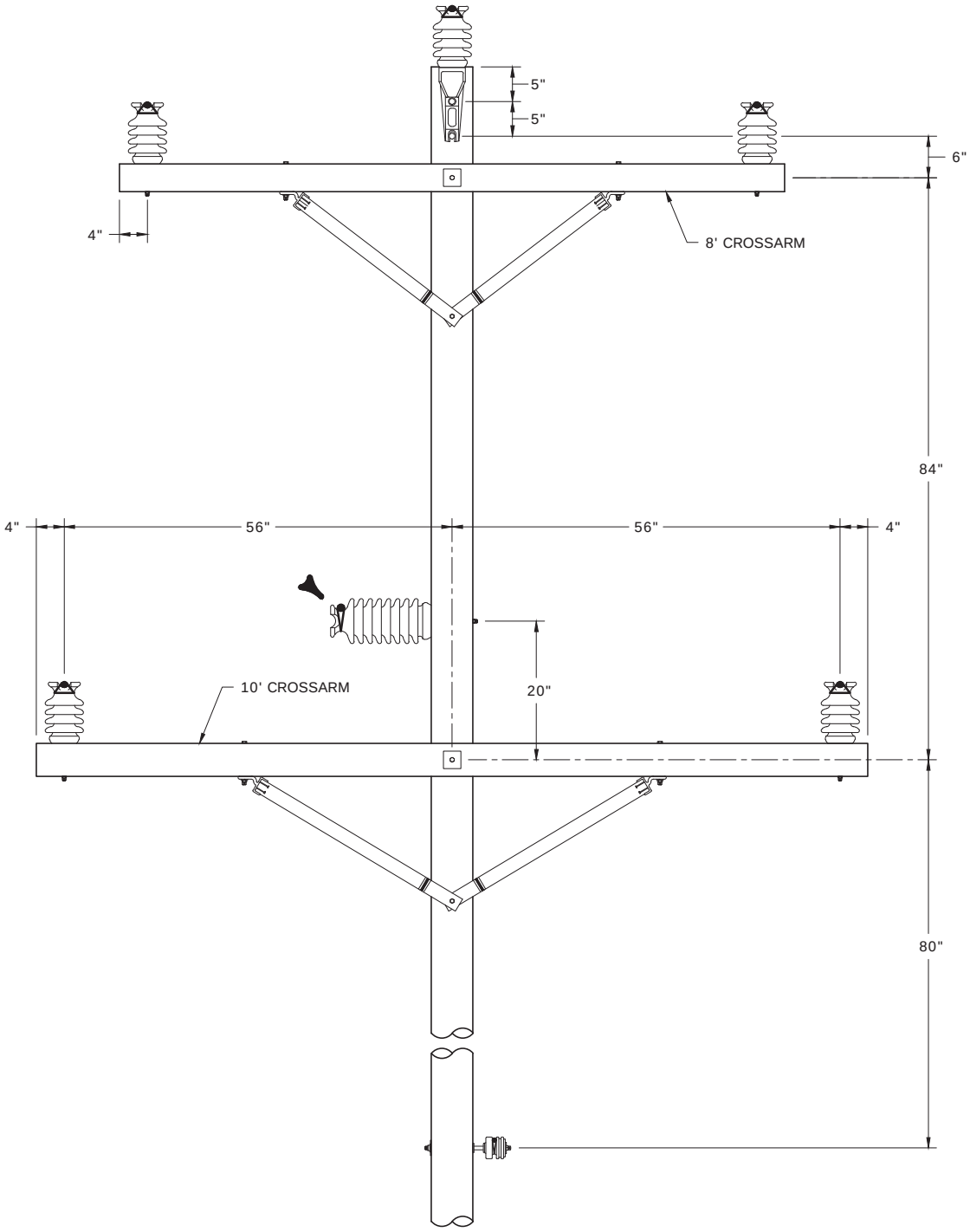
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) THREE-PHASE FUSED SLACK SPAN TAP - BOTTOM CIRCUIT

DEC	DEM	DEP	DEF
			X

03.13-193C



FRONT VIEW

NOTES:

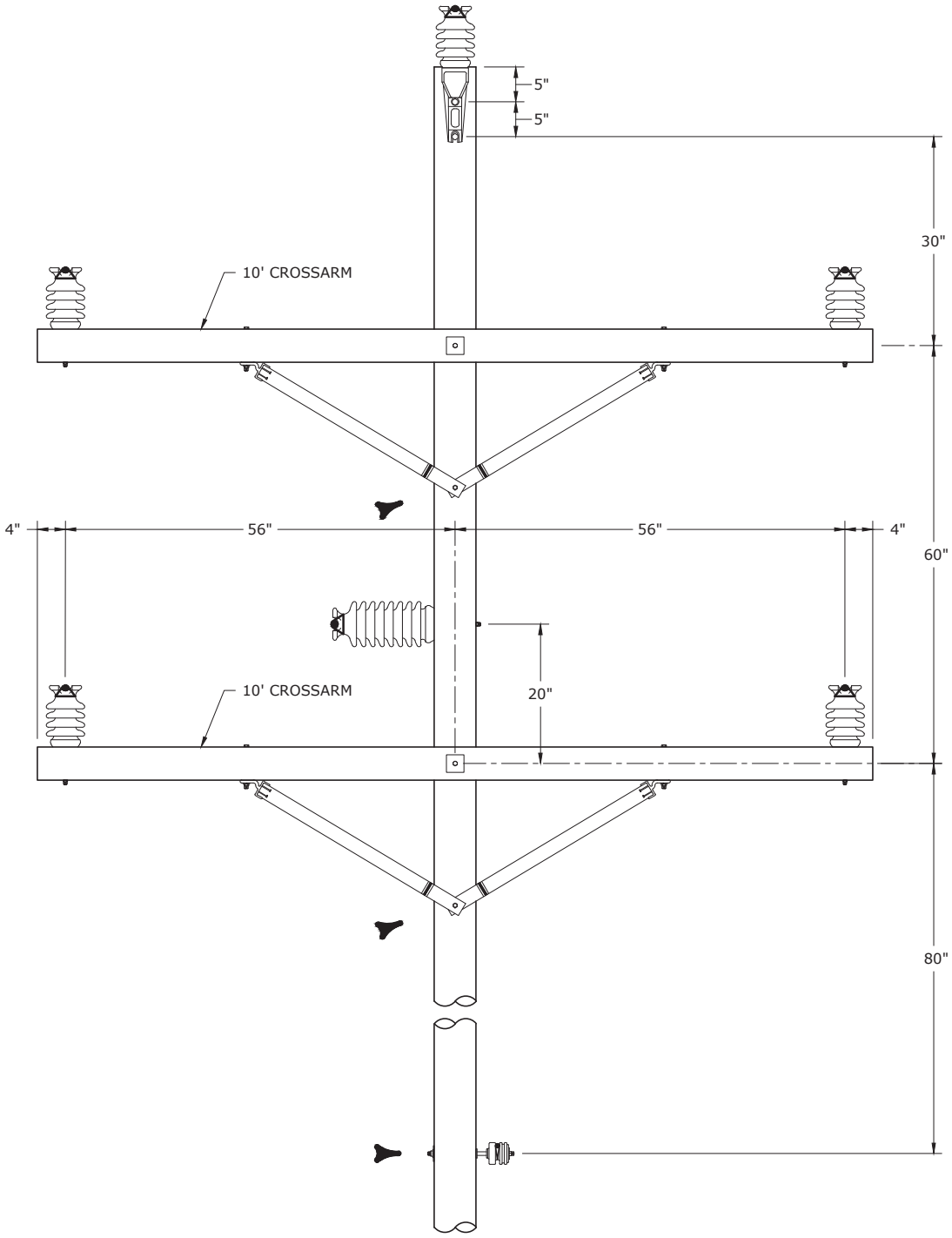
1. THIS DRAWING DEPICTS THE SPACING REQUIREMENTS FOR THREE-PHASE DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION MEDIUM SPANS. THIS SPACING CAN BE USED ON TANGENT, SMALL ANGLE, MEDIUM ANGLE AND DEADENDS. REFER TO THE BILL OF MATERIALS ASSOCIATED WITH THE TYPICAL SPANS FOR COMPATIBLE UNITS AND NUMBERS.

REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	ROBBINS	BURLISON	ADCOCK
1	4/30/18	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) TANGENT MEDIUM SPANS - 175 FT TO 250 FT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-195



FRONT VIEW

NOTES:

1. NOT FOR USE WITH 795AAC.

2. THIS DRAWING DEPICTS THE SPACING REQUIREMENTS FOR THREE-PHASE DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION INTERMEDIATE SPANS. THIS SPACING CAN BE USED ON TANGENT, SMALL ANGLE, MEDIUM ANGLE AND DEADENDS. REFER TO THE BILL OF MATERIALS ASSOCIATED WITH THE TYPICAL SPANS FOR COMPATIBLE UNITS AND NUMBERS.

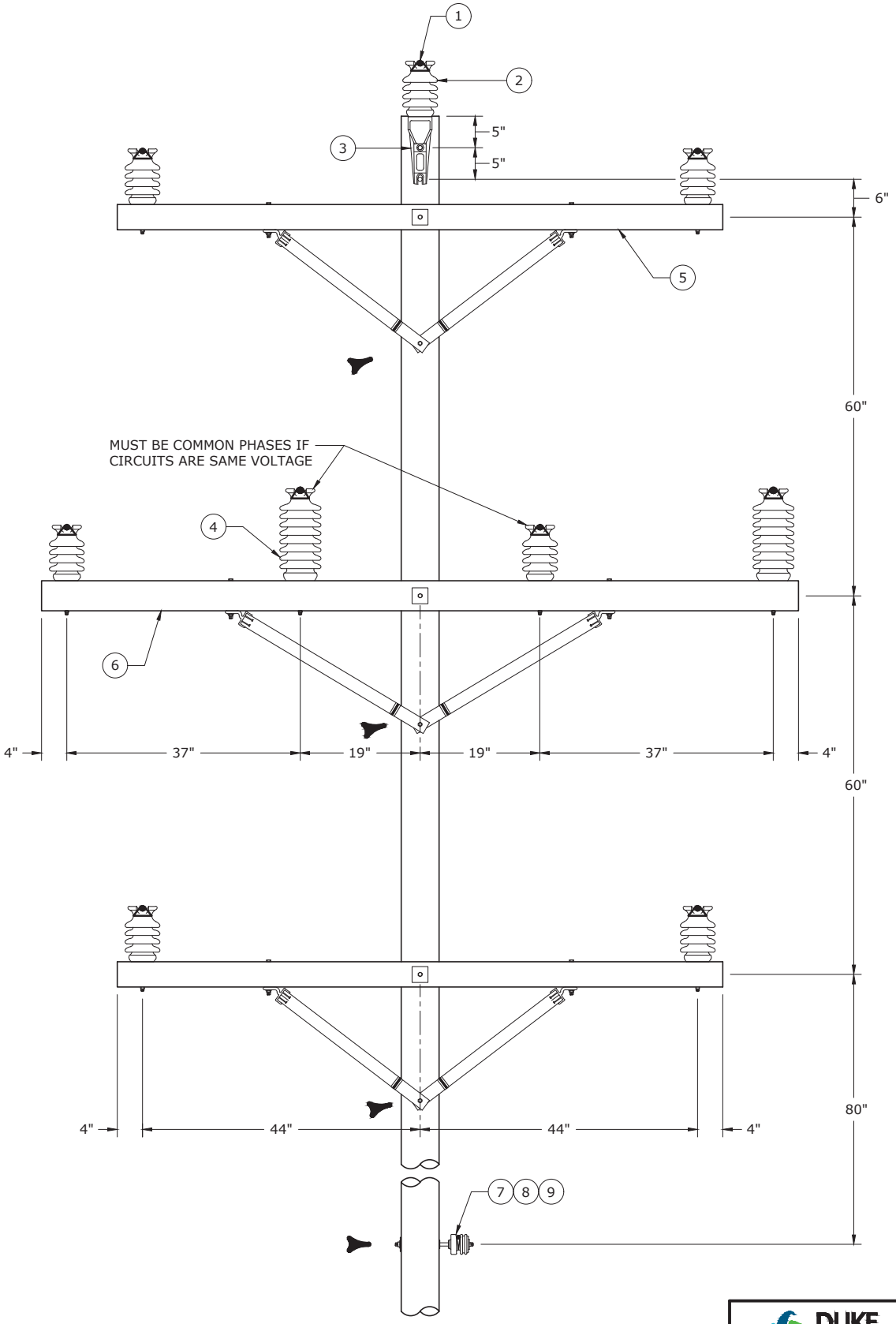
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DOUBLE CIRCUIT HORIZONTAL CONSTRUCTION (OVER/UNDER) TANGENT INTERMEDIATE SPANS - 250 FT TO 340 FT

DEC	DEM	DEP	DEF
X	X	X	X

03.13-196



FRONT VIEW

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

TRIPLE CIRCUIT
HORIZONTAL CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-198A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	9	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	7	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-POST-45KV-PORC-TT-F	2	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	ARM-SGL-8-FBG-NB-F	2	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

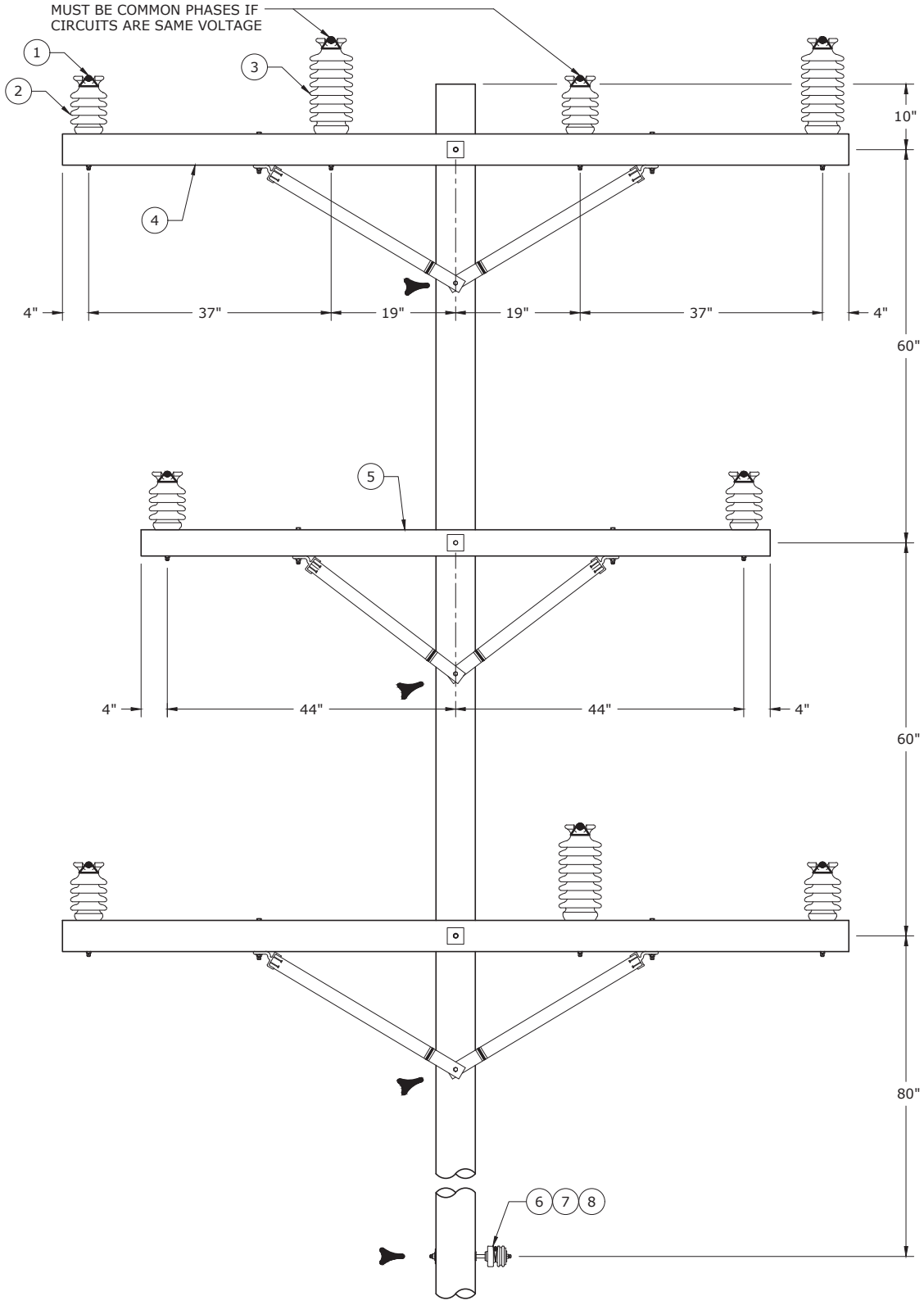
TRIPLE CIRCUIT

HORIZONTAL CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.13-198B



FRONT VIEW

NOTES:

1. CIRCUITS 1 AND 2 ARE SIDE BY SIDE ON TOP. CIRCUIT 3 IS ON THE BOTTOM.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	WHITE	BURLISON	ADCOCK

TRIPLE CIRCUIT HORIZONTAL CONSTRUCTION - ALTERNATIVE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.13-199A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	9	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-POST-45KV-PORC-TT-F	3	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
3	INSL-STUD-STL-7IN-THD-F	3	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
4	ARM-SGL-10-FBG-NB-F	2	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
4	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
5	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
7	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

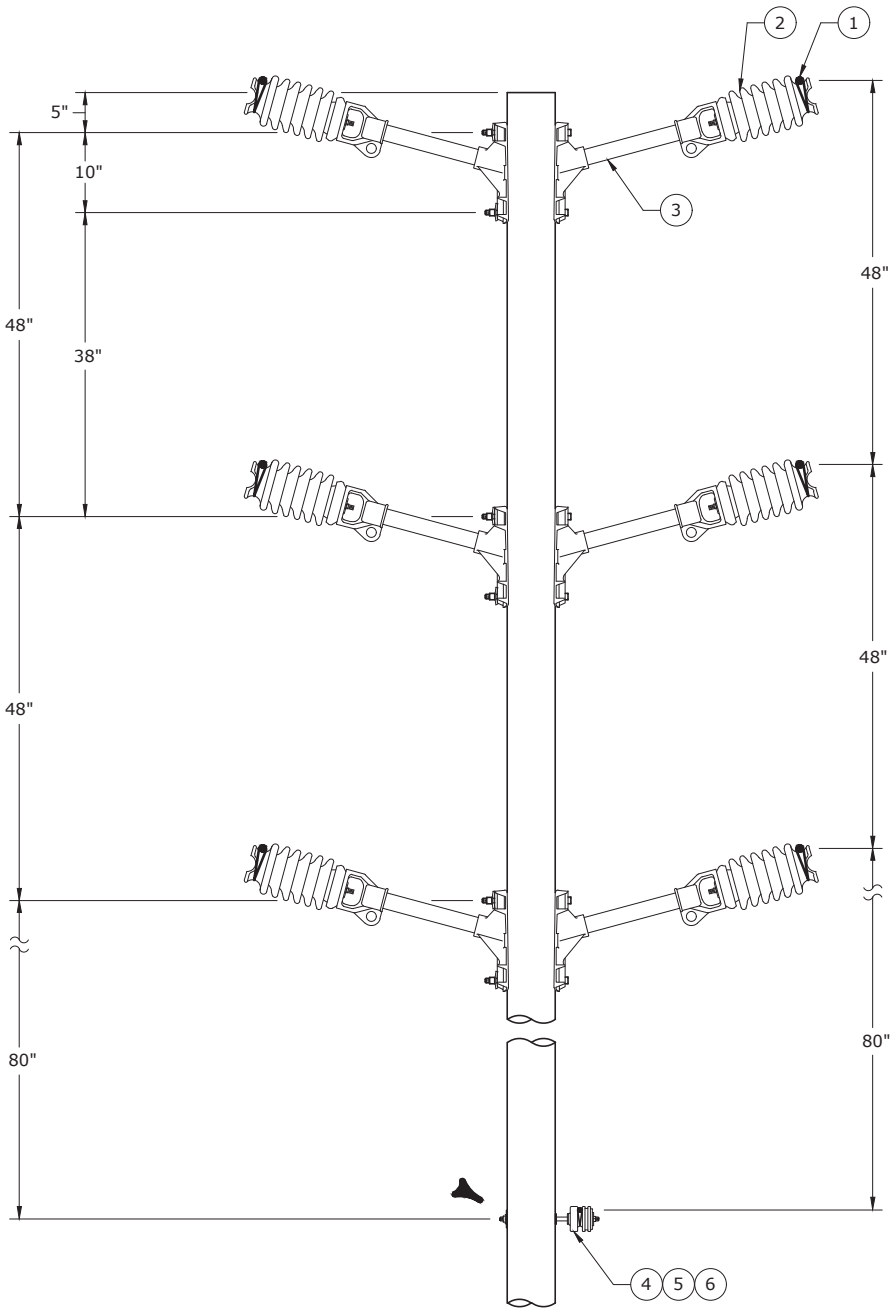
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

TRIPLE CIRCUIT HORIZONTAL CONSTRUCTION - ALTERNATIVE

DEC	DEM	DEP	DEF
			X

03.13-199B



FRONT VIEW

NOTES:

1. TYPICAL INSTALLATION WILL BE 20" BRACKET. FOR APPLICATIONS REQUIRING ADDITIONAL CLEARANCE OR CFO, USE 30" BRACKET.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.14-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-35KV-PORC-TT-F	6	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
3	BKT-INSL-POST-POLE-MD-FG-F	6	4002346	1	BRACKET, STANDOFF, 20", FIBERGLASS, W/ 8" & 10" BOLT SPACING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	BKT-INSL-POST-POLE-LG-FG-F	6	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-12IN-GALV-F	12	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

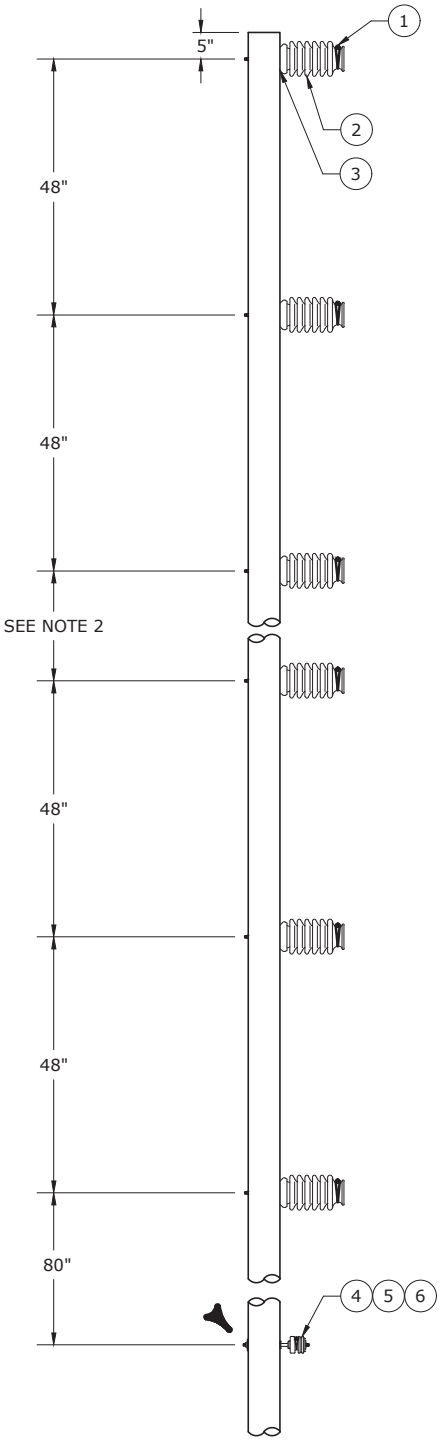
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - TANGENT

DEC	DEM	DEP	DEF
			X

03.14-100B



FRONT VIEW

NOTES:

1. PREFERRED CONSTRUCTION IS SIDE BY SIDE.

2. 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.

3. WILL REQUIRE MINIMUM 55' POLE.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.14-104A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-35KV-PORC-TT-F	6	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	6	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	INSL-GAIN-LG-F	6	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MNTING INSULATOR TO POLES
4	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

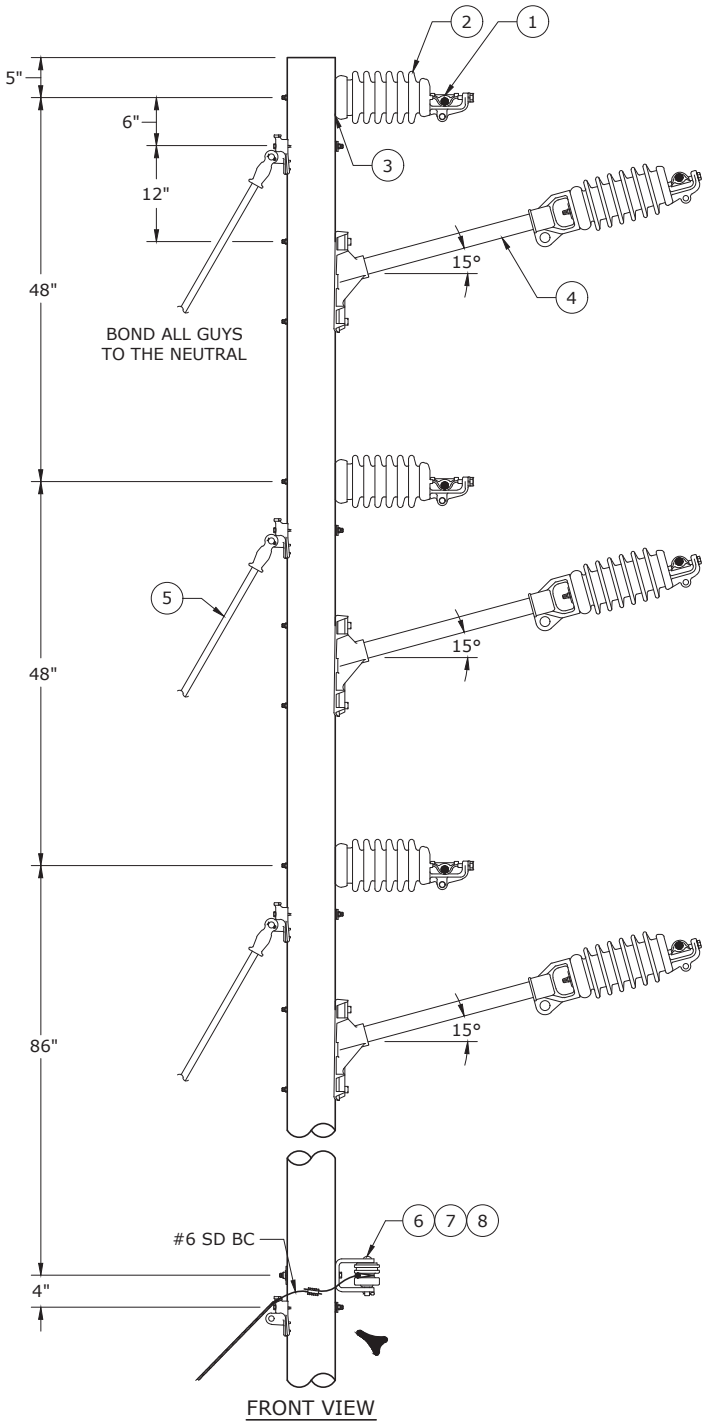
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.14-104B



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795	20°	-	-
556 AND SMALLER	30°	30°	20°

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. USE 30" BRACKETS FOR THIS APPLICATION.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 4/5/17	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - SMALL ANGLES (RIGHT-OF-WAY CONSTRAINTS)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-35KV-PORC-HC-F	6	4002398	1	INSULATOR, LINE POST, 35KV, HOR CLAMP
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSULATOR
4	BKT-INSL-POST-POLE-LG-FG-F	3	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
4	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
5	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
6	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
7	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
8	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

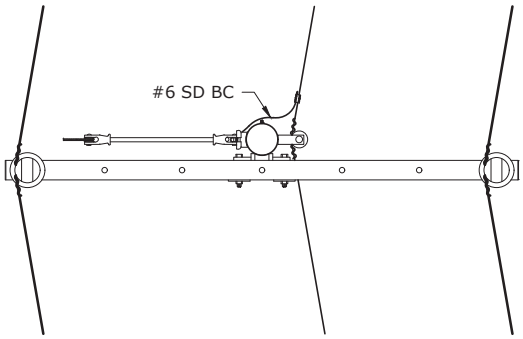
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - SMALL ANGLES (RIGHT-OF-WAY CONSTRAINTS)

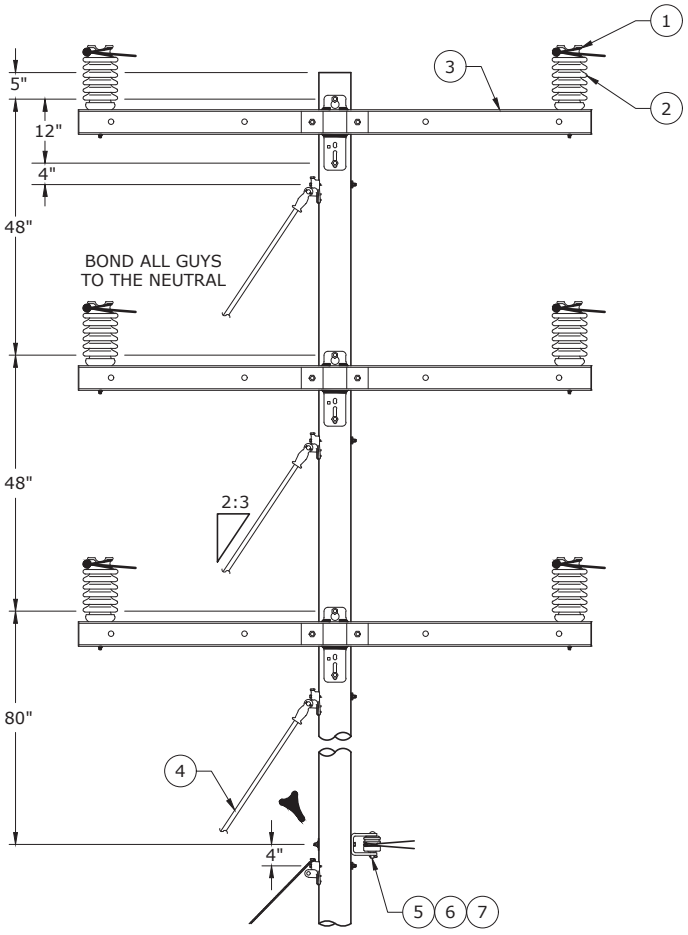
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.14-105B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZE	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
1/0 AAAC AND SMALLER	15°	15°	10°
4/0 AAAC	-	10°	10°
336.4 AAC	10°	10°	10°
477 AAC	-	10°	-
556.4 AAC	-	10°	10°
795 AAC	5°	-	-

NOTES:

1. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3	4/30/18	BENDER	BURLISON	ADCOCK
2	8/7/17	BENDER	BURLISON	ADCOCK
1	5/30/17	LOOSIER	BURLISON	ADCOCK
0	3/31/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - SMALL ANGLES (NO RIGHT-OF-WAY CONSTRAINTS)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-106A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	6	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	ARM-SGL-8-FBG-NB-F	3	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
3	HDWR-MACH-LG-10IN-GALV-F	6	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

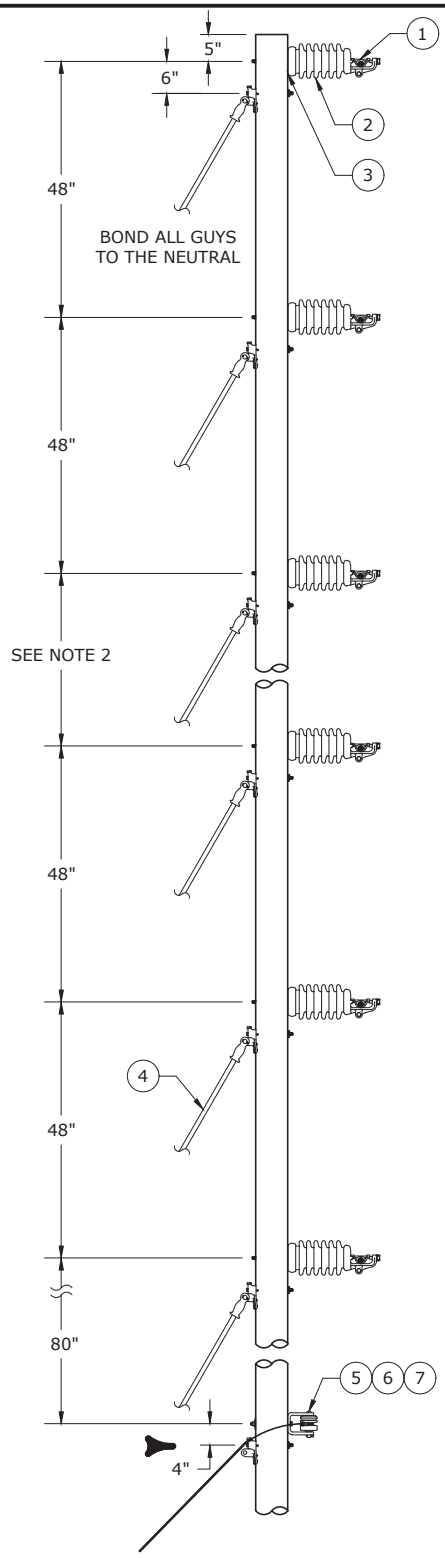
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - SMALL ANGLES (NO RIGHT-OF-WAY CONSTRAINTS)

DEC	DEM	DEP	DEF
			X

03.14-106B



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795	20°	-	-
556 AND SMALLER	30°	30°	30°

NOTES:

1. PREFERRED CONSTRUCTION IS SIDE BY SIDE.
2. 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 CONTACT DISTRIBUTION STANDARDS FOR OTHER SPANS.
3. WILL REQUIRE MINIMUM 55' POLE.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED SMALL ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.14-107A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-35KV-PORC-HC-F	6	4002398	1	INSULATOR, LINE POST, 35KV, HOR CLAMP
2	INSL-STUD-STL-10IN-THD-F	6	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	INSL-GAIN-LG-F	6	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MNTING INSULATOR TO POLES
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
6	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
6	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
7	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

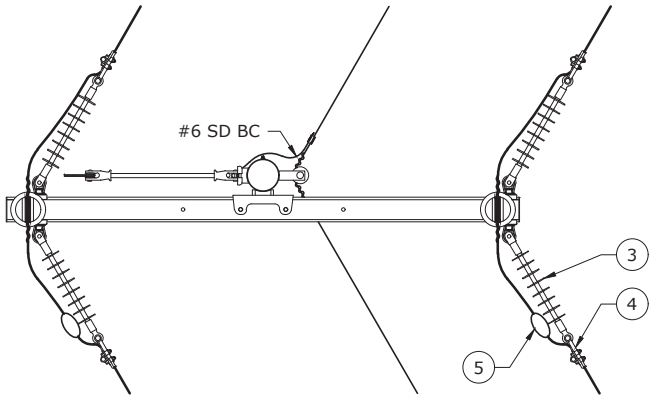
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

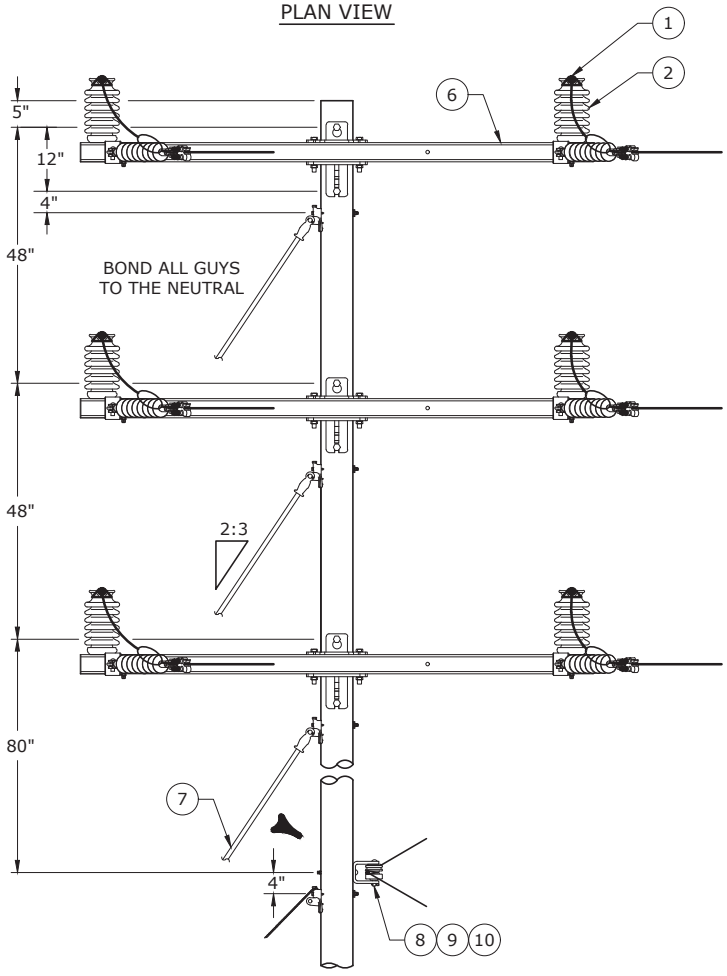
DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED SMALL ANGLE

DEC	DEM	DEP	DEF
			X

03.14-107B



PLAN VIEW



FRONT VIEW

MAXIMUM ANGLE BASED ON 280 FOOT RULING SPAN (200-340 FOOT SPANS)			
CONDUCTOR SIZING	NESC LOADING ZONES		
	LIGHT	MEDIUM	HEAVY
795 AND SMALLER	60°	60°	50°

NOTES:

1. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

REVISED		BY	CHK'D	APPR.
3	4/30/17	BENDER	BURLISON	ADCOCK
2	8/7/17	BENDER	BURLISON	ADCOCK
1	3/31/17	LOOSIER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - MEDIUM ANGLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	3	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	6	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
9	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
9	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
10	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

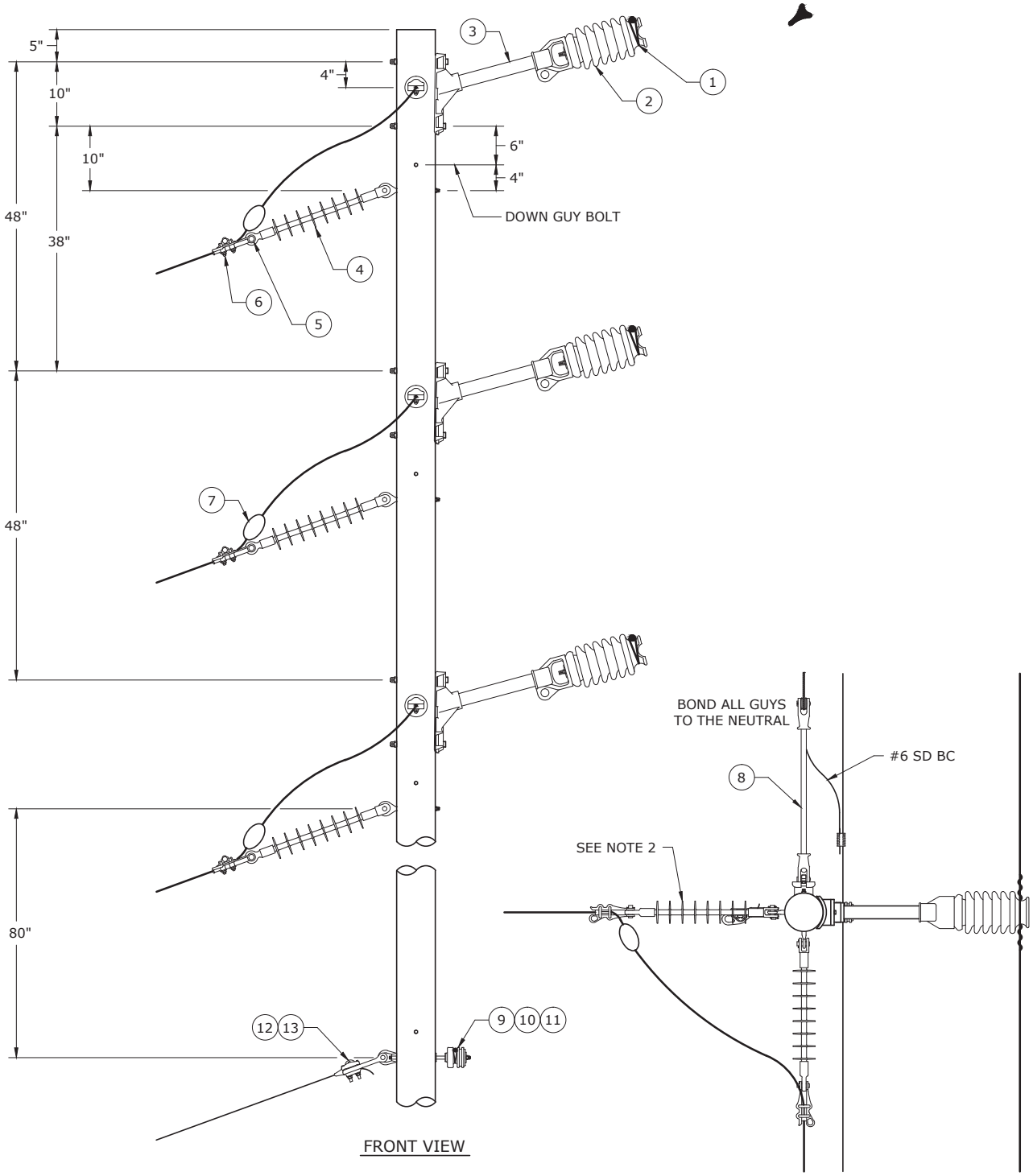
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - MEDIUM ANGLES

DEC	DEM	DEP	DEF
			X

03.14-110B



NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. TAP OFF MUST BE SLACK SPAN.

3				
2	8/7/17	BENDER	BURLISON	ADCOCK
1	8/5/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - RIGHT ANGLE OFF SINGLE CIRCUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-118A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-SIDE-(WIRE)-AL-FNECK-F	3	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG,11 UNC, 6" THD LG, GALV STL
3	BKT-INSL-POST-POLE-MD-FG-F	3	4002346	1	BRACKET, STANDOFF, 20", FIBERGLASS, W/ 8" & 10" BOLT SPACING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	BKT-INSL-POST-POLE-LG-FG-F	3	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
4	HDWR-EYEBOLT-SM-10IN-GALV-F	6	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	HDWR-LWASH-SM-GALV-F	6	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
4	HDWR-SWASH-SM-GALV-CURVE-F	6	4021825	1	WASHER, SQ CURVED RIBBED, 13/16" ID, 3" OD, 3/8" THK, GALV
4	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
5	INSL-CLIP-SHUNT-F	3	57785	4	CLIP, SPRING,STL, SUSPENSION INSULATOR SHUNT
6	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
7	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
9	HDWR-SP-SM-12IN-GALV-F	1	4001620	1	BOLT, SPOOL, 5/8" DIA, 12" LG, GALV STL, DBL UPSET
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
10	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
11	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
12	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
13	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

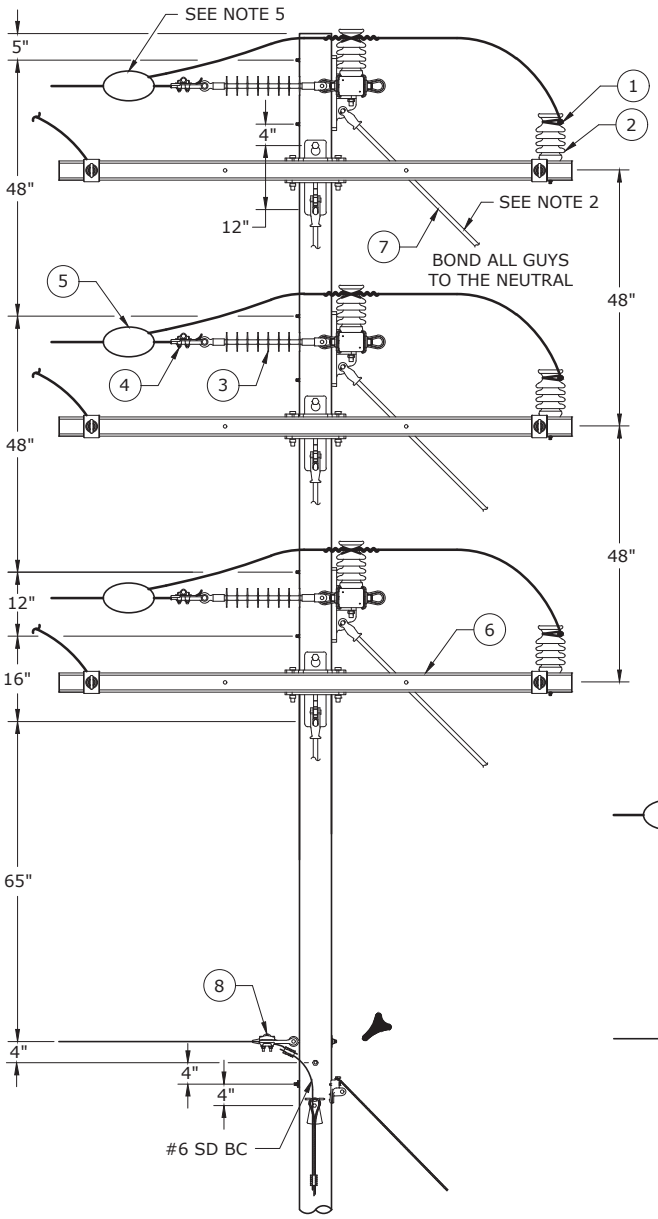
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

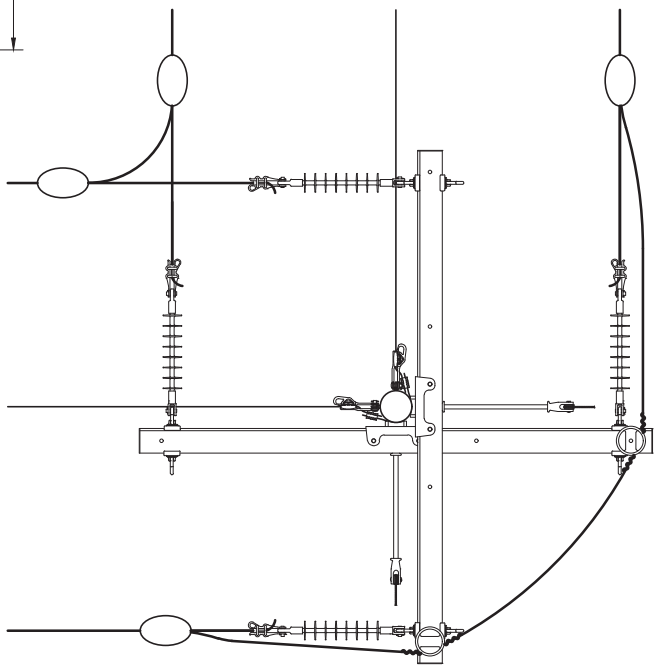
DOUBLE CIRCUIT VERTICAL CONSTRUCTION -
RIGHT ANGLE OFF SINGLE CIRCUIT

DEC	DEM	DEP	DEF
			X

03.14-118B



FRONT VIEW



PLAN VIEW

NOTES:

1. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.

2. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.

3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

4. POSITION OF JUMPER POSTS MAY BE ALTERED DUE TO FIELD CONDITIONS.

5. IF POSSIBLE, CONNECT DIRECTLY TO TAIL.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION
LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.14-119A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	6	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	12	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

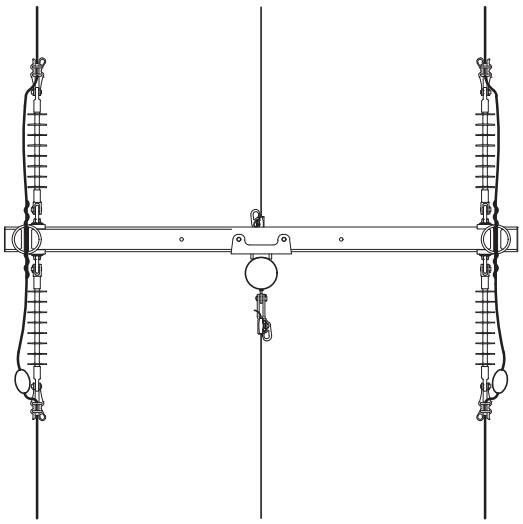
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

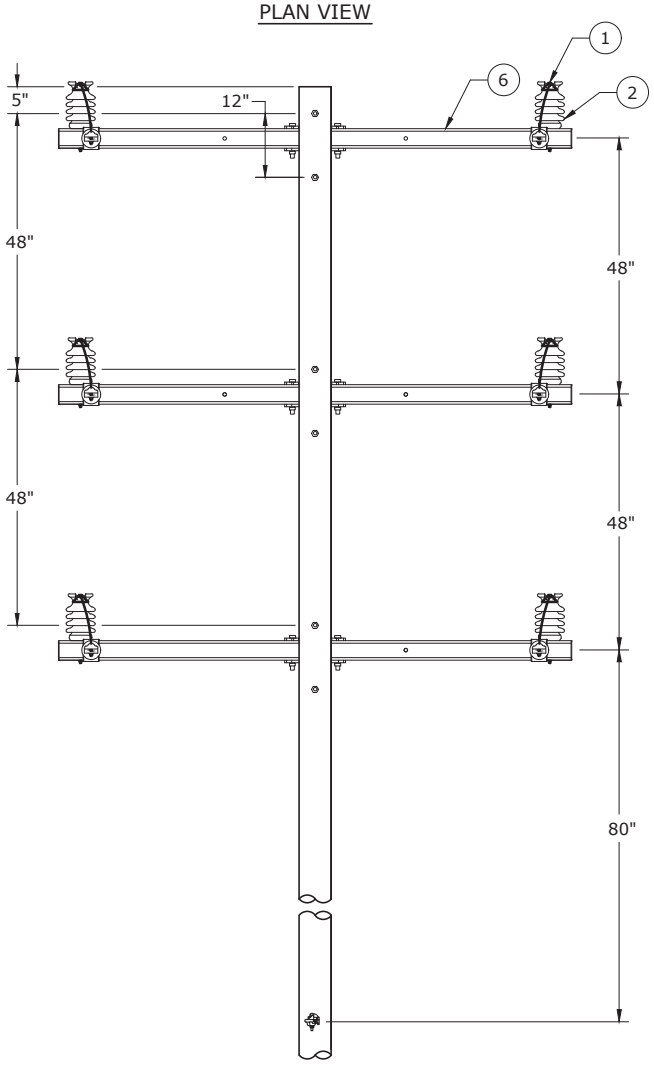
DOUBLE CIRCUIT VERTICAL CONSTRUCTION
LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
			X

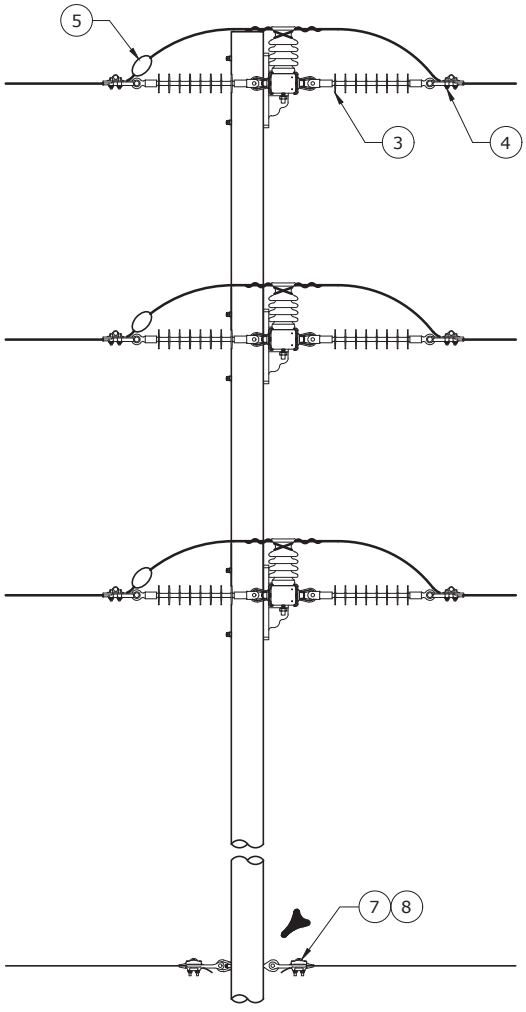
03.14-119B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. IF CHANGING TENSION, THE UNEVEN TENSION MUST BE GUYED IN A "V" CONFIGURATION IN ORDER TO CLEAR NEUTRAL. SEE SECTION 02.

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - DOUBLE DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.14-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	-	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	3	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	6	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV ST
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

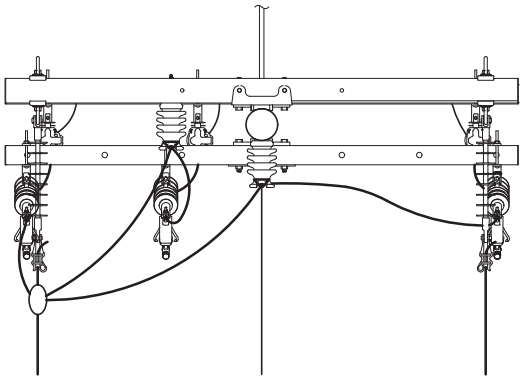
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

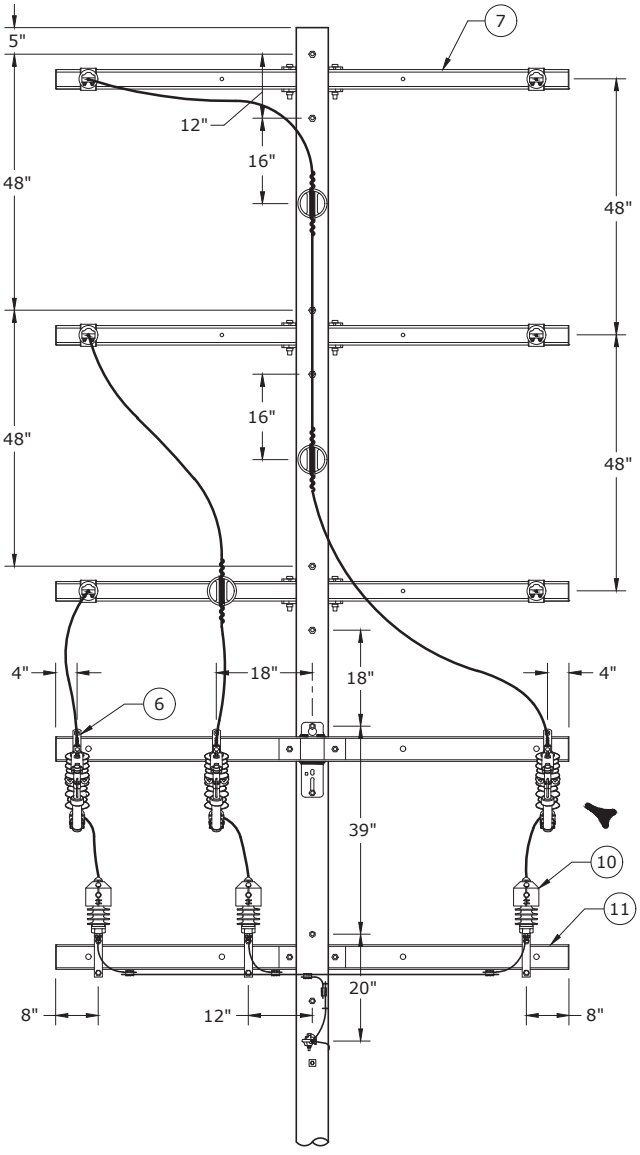
DOUBLE CIRCUIT VERTICAL CONSTRUCTION - DOUBLE DEADEND

DEC	DEM	DEP	DEF
			X

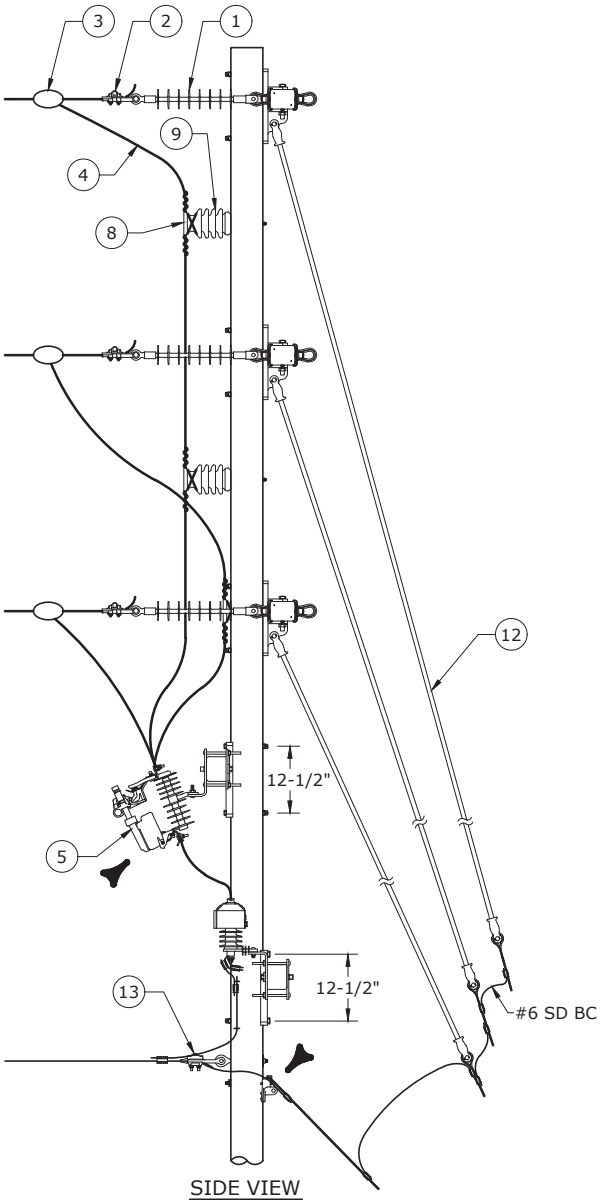
03.14-120B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
2. ARRESTERS FOR SECOND CIRCUIT SHALL BE INSTALLED ON SEPARATE POLE ONE SPAN UP.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - DEADEND - GUYED

DEC	DEM	DEP	DEF
X	X	X	X

03.14-125A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V, W/ INSULATION
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE W/ EXTENSION ADAPTER USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK,SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
7	ARM-SDE-10-FBG-NB-F	3	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4", 10' LG,UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	6	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
9	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
9	NSL-STUD-STL-10IN-THD-F	2	134390	1	STUD, INSULATOR, 5/8" DIA,10" LG, 11 UNC, 6" THD LG, GALV STL
9	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
10	ARR-LINE-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
10	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
11	ARM-SGL-10-FBG-NB-F	2	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
11	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
12	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
13	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
13	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

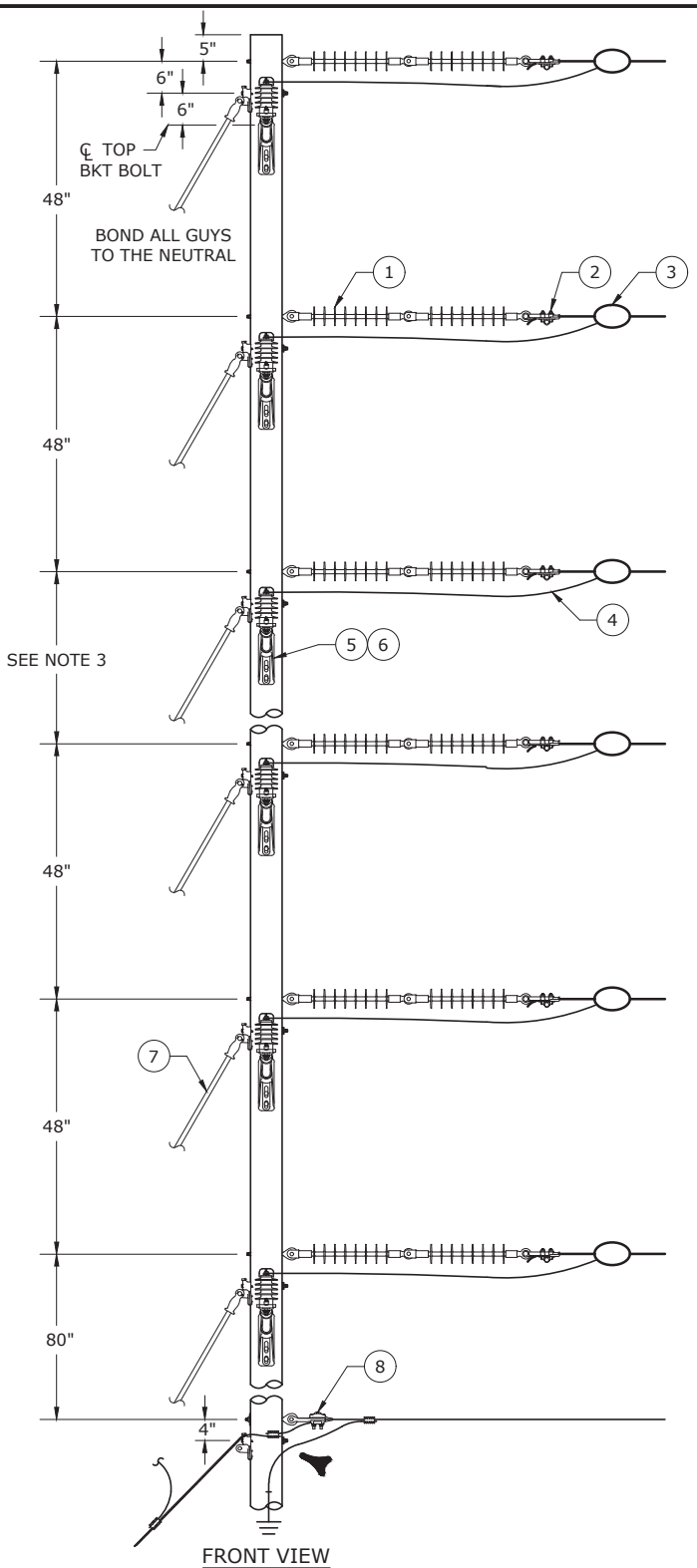
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION -
DEADEND - GUYED

DEC	DEM	DEP	DEF
			X

03.14-125B



FRONT VIEW

NOTES:

1. PREFERRED CONSTRUCTION IS SIDE BY SIDE.
2. ARRESTER PLACEMENT BETWEEN PHASES SHALL BE UTILIZED ONLY FOR THIS DESIGN.
3. 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 CONTACT DISTRIBUTION STANDARDS FOR OTHER SPANS.
4. WILL REQUIRE MINIMUM 55' POLE.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.14-127A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	6	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
1	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	6	4192428	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V, W/ INSULATION
5	BKT-EM-POLE-1P-FG-F	6	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
5	HDWR-MACH-SM-10IN-GALV-F	12	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
6	ARR-LINE-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-LINE-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC,12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
8	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

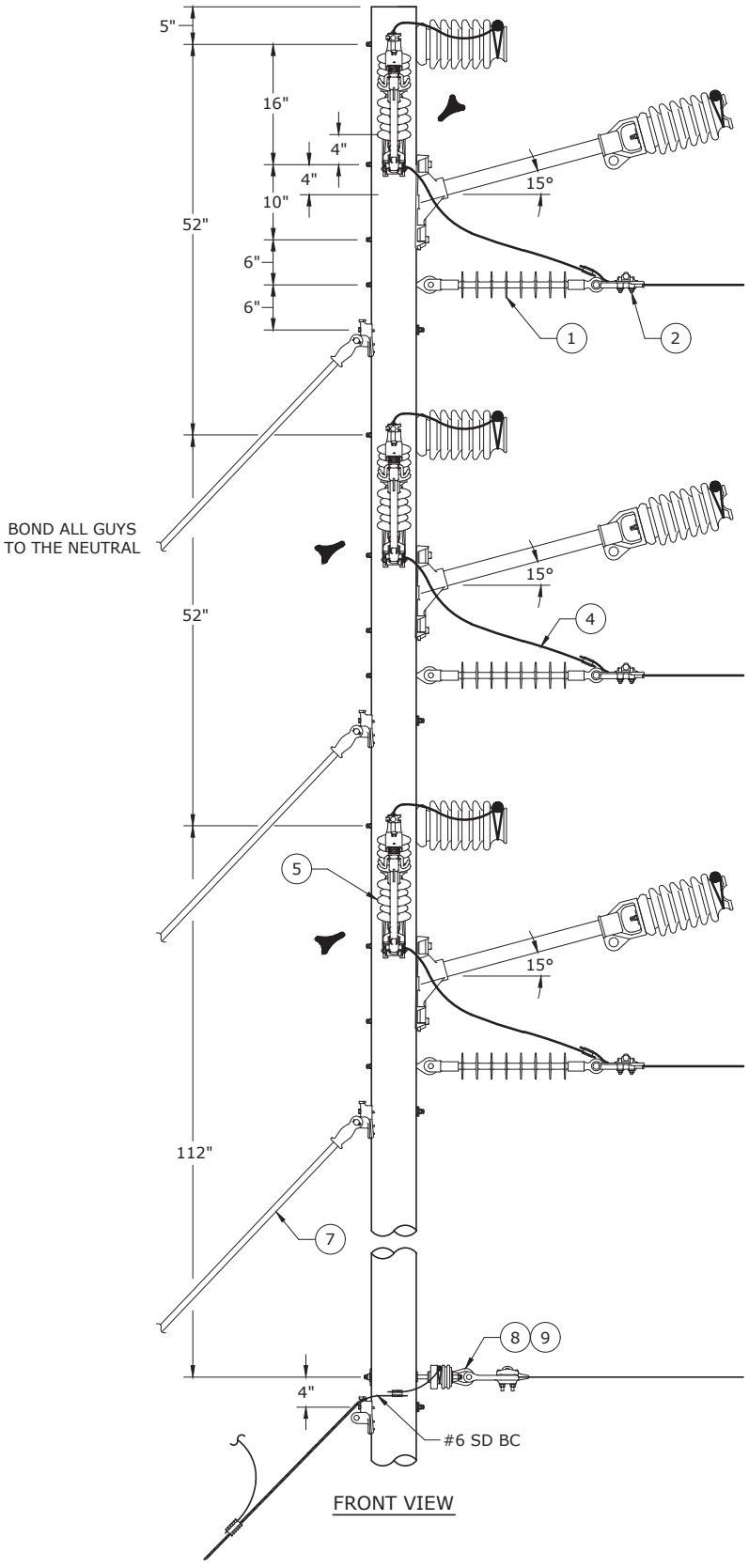
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION - STACKED DEADEND

DEC	DEM	DEP	DEF
			X

03.14-127B



FRONT VIEW

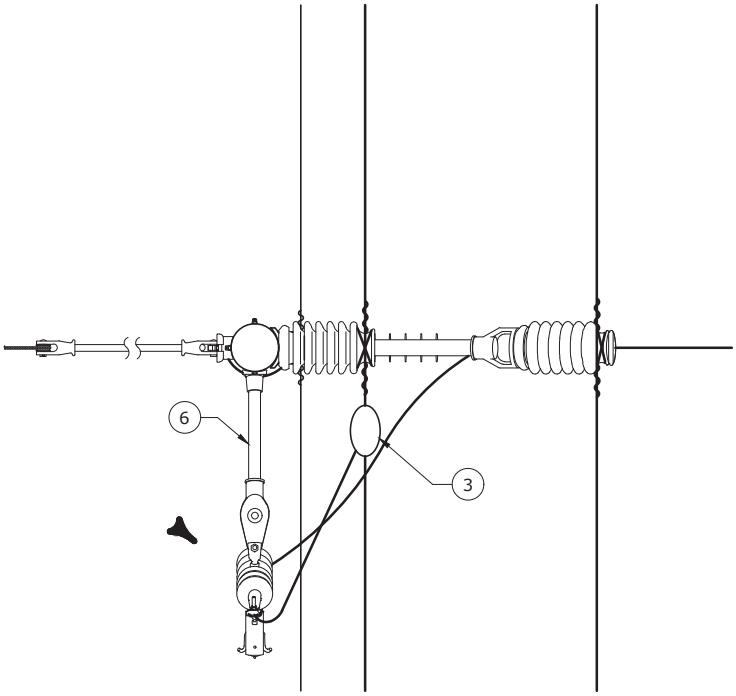
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION
FUSED THREE-PHASE TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-133A



PLAN VIEW

NOTES:

1. SPECIFICATION CAN BE UTILIZED FOR SINGLE-PHASE TAP APPLICATION.
2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
3. PREFERRED CONSTRUCTION IS STANDARD DOUBLE CIRCUIT WITH A SPAN GUY. USE THIS SPECIFICATION WHEN SPAN GUY IS NOT FEASIBLE.
4. HEAVIER CLASS POLE MAY BE REQUIRED. CONDUCT POLEFOREMAN ANALYSIS FOR APPROPRIATE LOADING ZONE.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION

FUSED THREE-PHASE TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.14-133B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	3	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

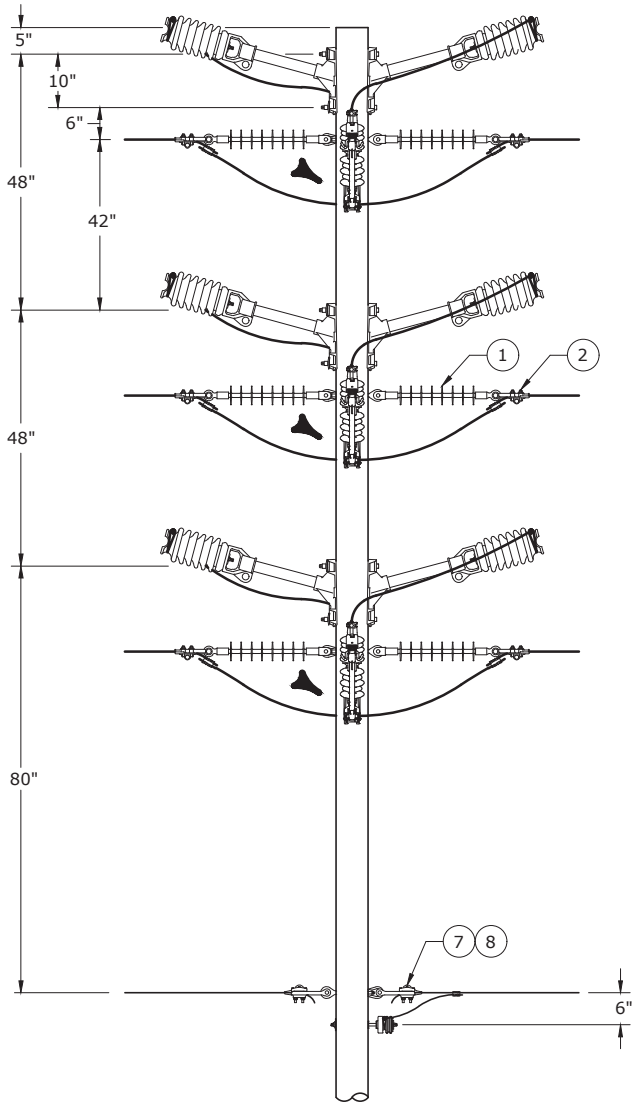
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION

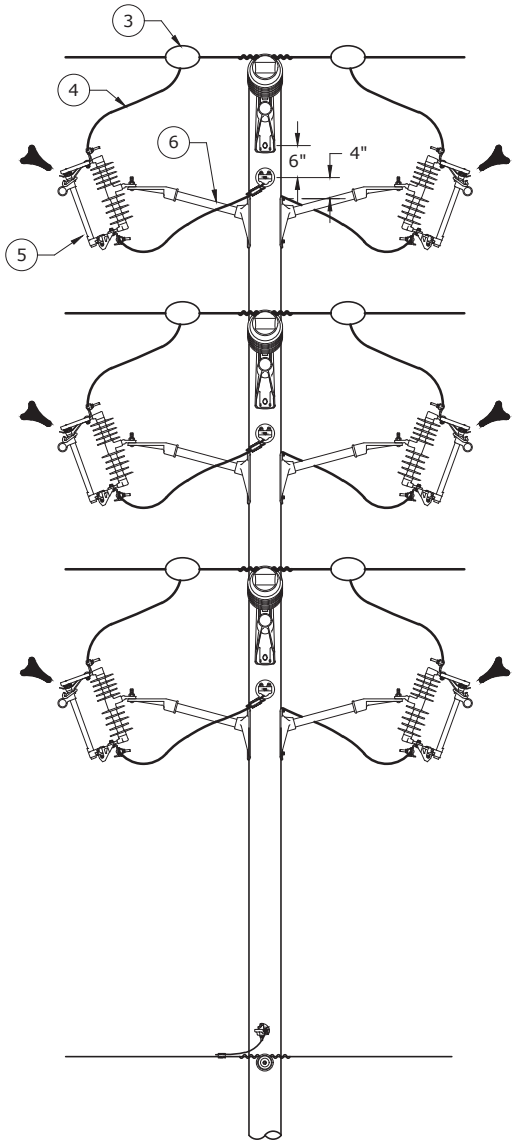
FUSED THREE-PHASE TAP

DEC	DEM	DEP	DEF
			X

03.14-133C



FRONT VIEW



SIDE VIEW

NOTES:

1. SPECIFICATION CAN BE UTILIZED FOR A TWO FUSED SINGLE-PHASE TAP APPLICATION.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION
TWO-FUSED THREE-PHASE TAPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.14-137A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	6	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-POLE-1P-FG-F	6	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
7	HDWR-EYENUT-SM-GALV-F	1	931130	-	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
8	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

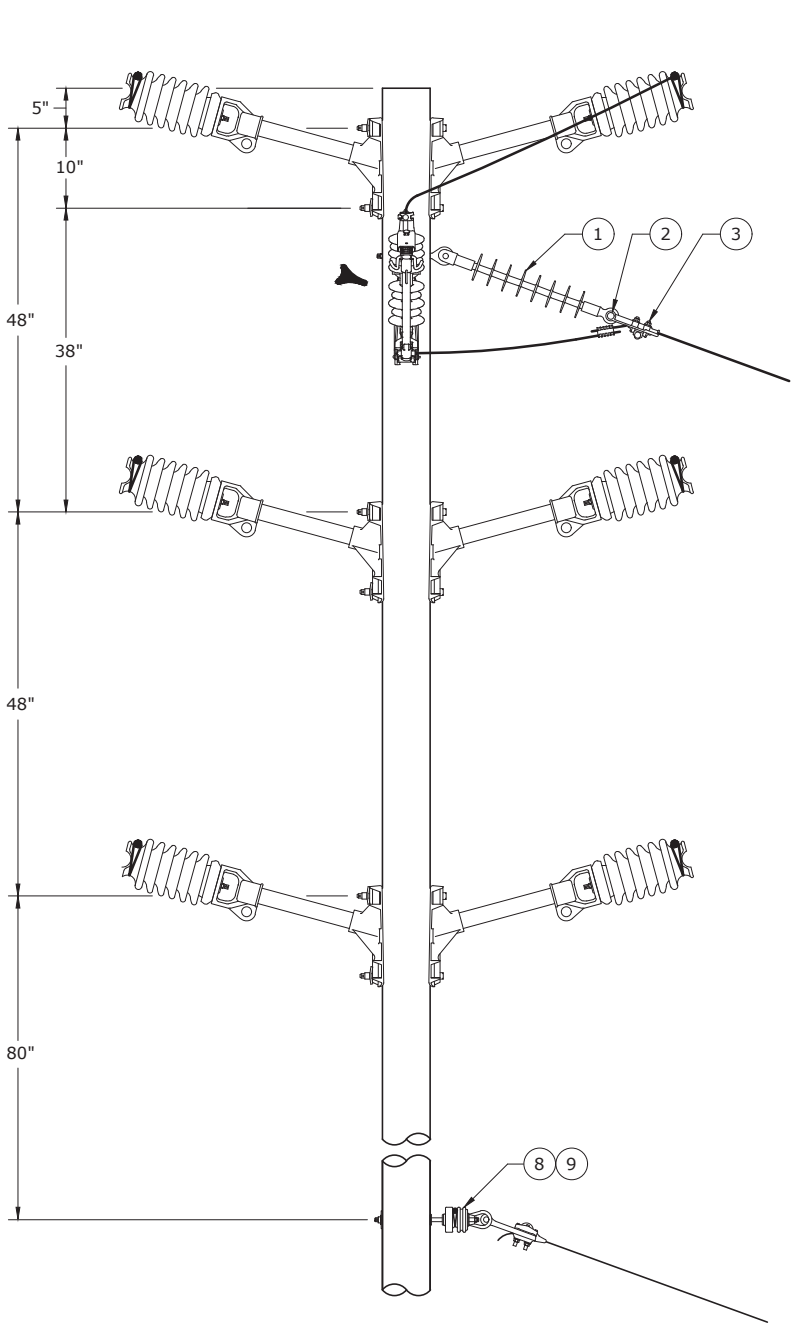
DUKE ENERGY.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION

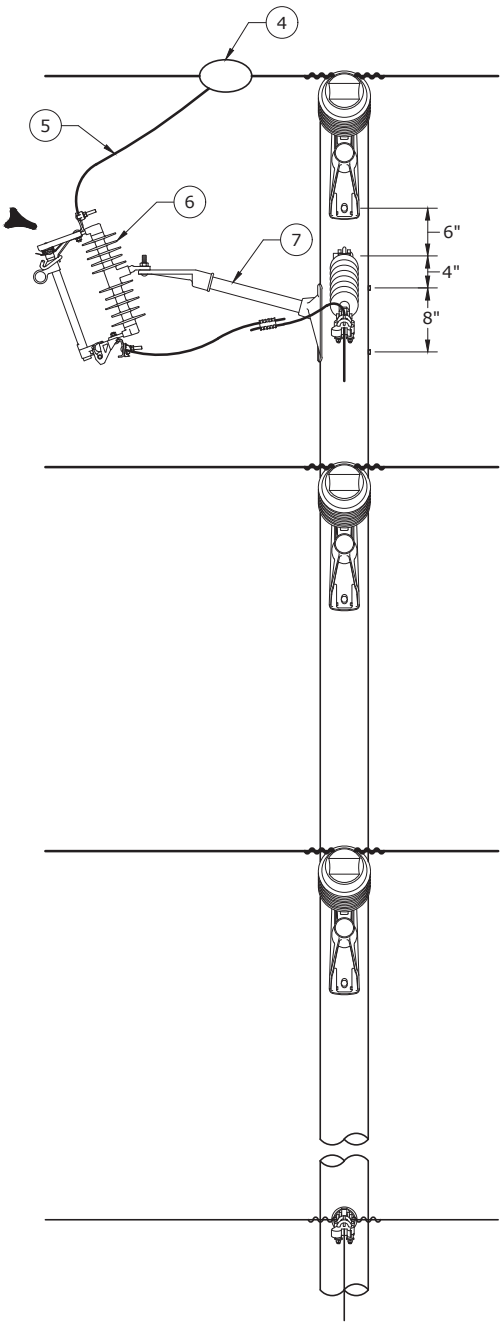
TWO-FUSED THREE-PHASE TAPS

DEC	DEM	DEP	DEF
			X

03.14-137B



FRONT VIEW



SIDE VIEW

NOTES:

1. POLE RECEIVING TAP SHOULD BE TALL ENOUGH TO KEEP SPAN LEVEL.
2. SEE SECTION 03.06 FOR SHUNT CLIP SPECIFICATIONS.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION
FUSED SINGLE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.14-140A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	1	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
1	HDWR-SWASH-SM-GALV-CURVE-F	1	4021825	1	WASHER, SQ CURVED RIBBED, 13/16" ID, 3" OD, 3/8" THK, GALV
1	INSL-DE/S-35KV-POLY-F	1	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	INSL-CLIP-SHUNT-F	1	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

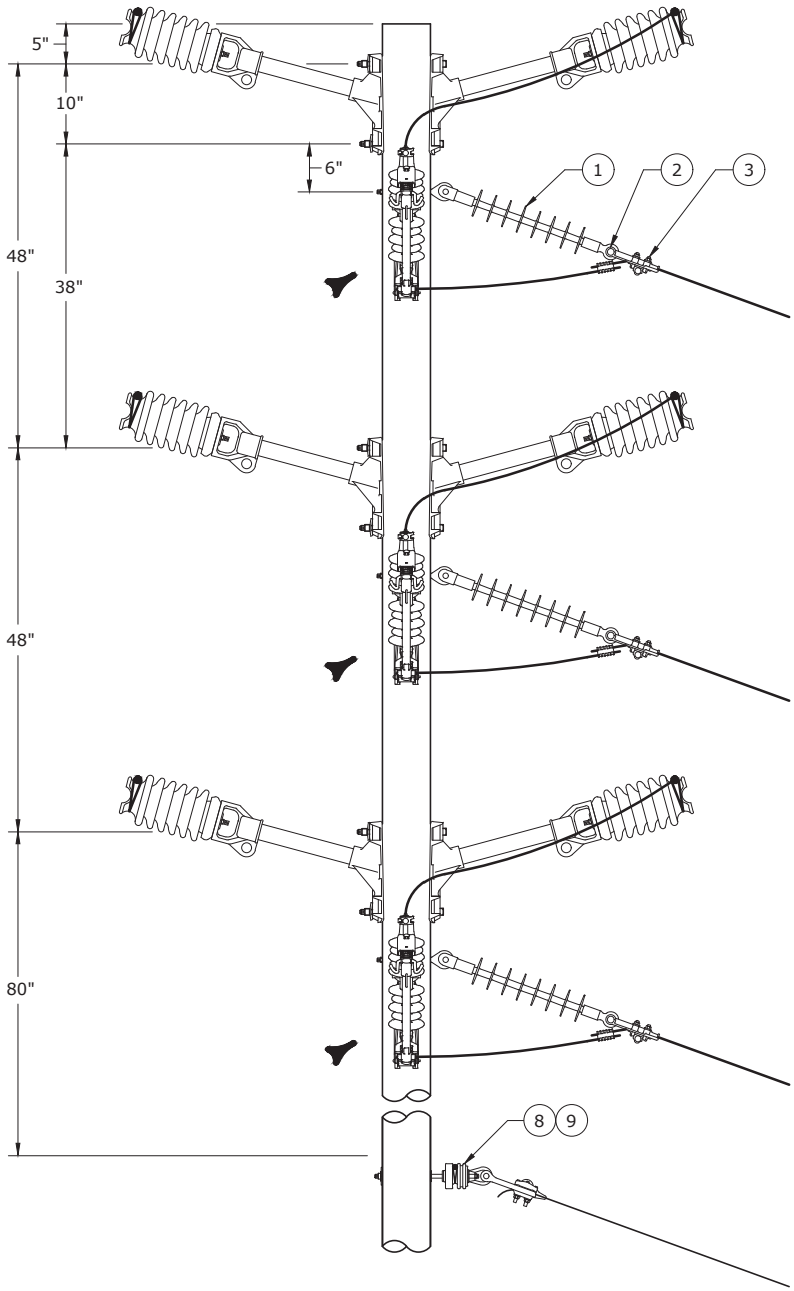
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT VERTICAL CONSTRUCTION

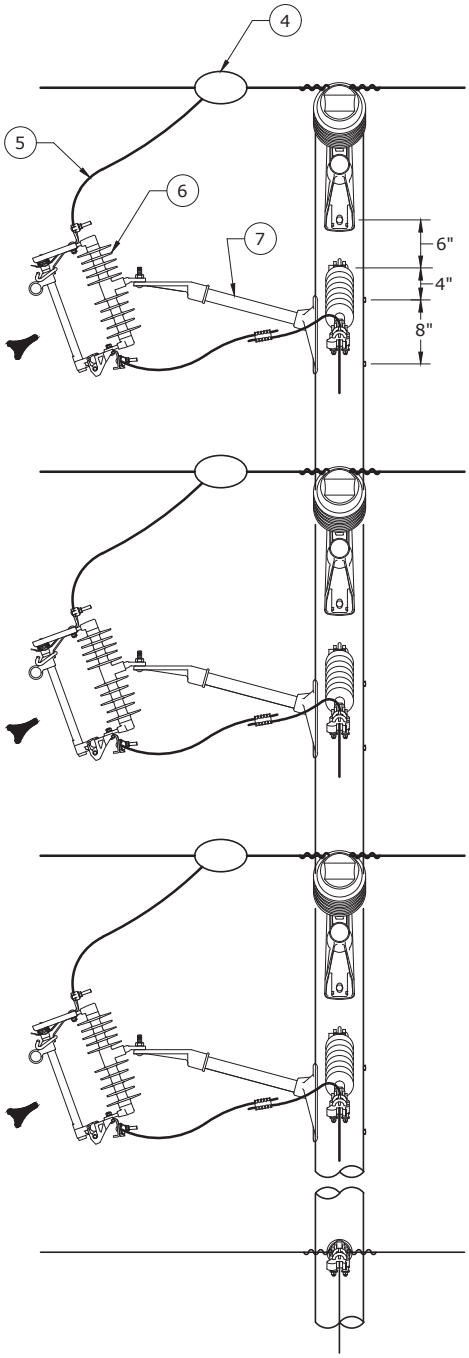
FUSED SINGLE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

03.14-140B



FRONT VIEW



SIDE VIEW

NOTES:

1. POLE RECEIVING TAP SHOULD BE TALL ENOUGH TO KEEP SPAN LEVEL.
2. SEE SECTION 03.06 FOR SHUNT CLIP SPECIFICATIONS.

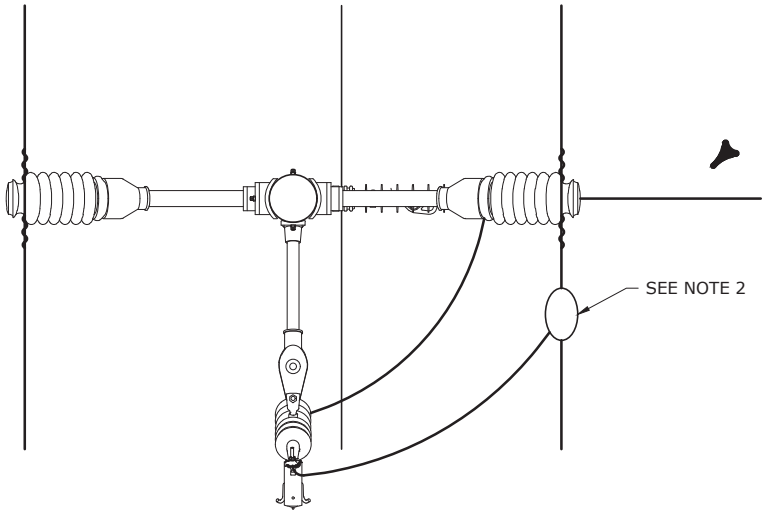
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT VERTICAL CONSTRUCTION
FUSED THREE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.14-143A



PLAN VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	3	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-LWASH-SM-GALV-F	3	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
1	HDWR-SWASH-SM-GALV-CURVE-F	3	4021825	1	WASHER, SQ CURVED RIBBED, 13/16" ID, 3" OD, 3/8" THK, GALV
1	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	INSL-CLIP-SHUNT-F	3	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	3	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-10IN-GALV-F	6	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SEE DWG. 03.14-143A FOR DESIGN SPEFIFICATIONS.
2. SEE SECTION 04.09 FOR PRIMARY CONNECTION DETAILS.
3. POLE RECEIVING TAP SHOULD BE TALL ENOUGH TO KEEP SPAN LEVEL.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

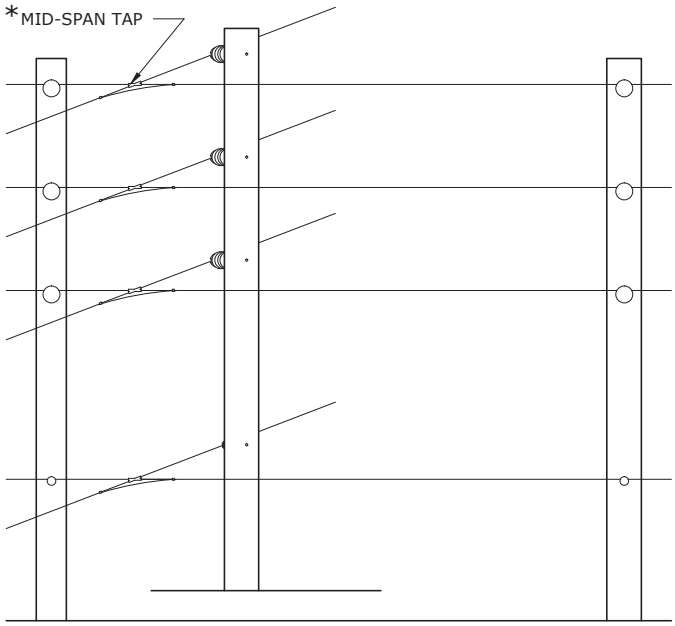
DUKE ENERGY.

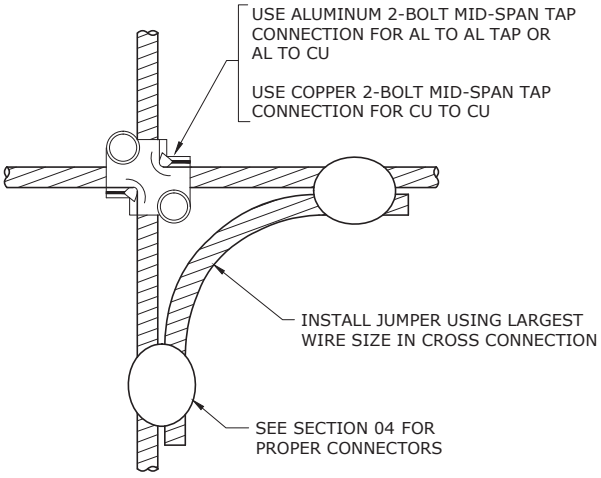
DOUBLE CIRCUIT VERTICAL CONSTRUCTION
FUSED THREE-PHASE SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

03.14-143B

MIDSPAN TAP CONNECTION
VERTICAL CONSTRUCTION





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. PHASE AND NEUTRAL SPACING SHOULD BE THE SAME.

4. USE AS A LAST RESORT ONLY WHERE NORMAL POLE AND GUY CONSTRUCTION CANNOT BE OBTAINED.

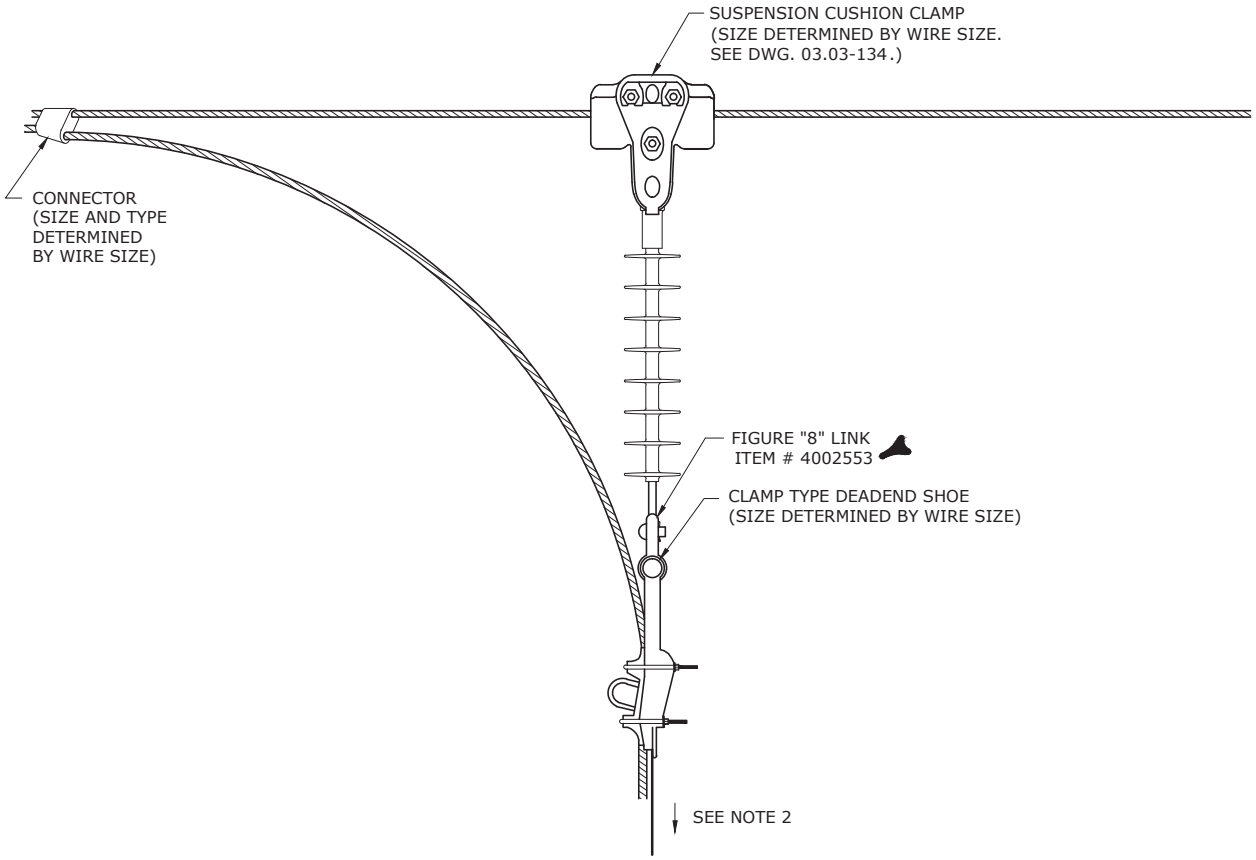
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADOCOK
REVISED		BY	CK'D	APPR.

MIDSPAN TAP CONNECTION FOR
VERTICAL CONSTRUCTION

DEC	DEM	DEP	DEF
X	X	X	X

03.18-100

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 WHERE BUCKET TRUCK ACCESSIBLE ONLY.
4. THIS IS A NON-PREFERRED METHOD OF TAPPING AN EXISTING LINE AND SHOULD ONLY BE USED WHERE THERE ARE NO OTHER AVAILABLE OPTIONS OR SOLUTIONS, I.E., TAPPING DIRECTLY OFF A POLE VIA AN OVERHEAD PRIMARY DEAD-END OR UNDERGROUND RISER.

3				
2	11/13/17	LOOSIER	BURLISON	ADCOCK
1	11/3/16	LOOSIER	BURLISON	ADCOCK
0	9/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

PRIMARY "T" TAP

DEC	DEM	DEP	DEF
			X

03.18-101

GRADE B CONSTRUCTION

THE NESC DEFINES THE GRADE OF CONSTRUCTION THAT SHALL BE USED. GRADE C IS REQUIRED FOR MOST DUKE ENERGY DISTRIBUTION LINES. UNLESS SPECIFICALLY NOTED, THESE DUKE ENERGY CONSTRUCTION SPECIFICATION MEET THE REQUIREMENTS OF GRADE C. GRADE B IS REQUIRED IN SPECIAL LOCATIONS AS DEFINED BY THE NESC LIKE RAILROAD CROSSINGS, LIMITED ACCESS HIGHWAY CROSSINGS AND NAVIGABLE WATERWAY CROSSINGS. GRADE B INCREASES THE OVERLOAD FACTOR USED TO DESIGN LINES. THE RESULT IS AN INCREASE IN POLE CLASS, GUYING AND IN SOME CASES, INSULATOR STRENGTHS.

1. WHEN GRADE B LINES ARE REQUIRED, POLEFOREMAN SHOULD BE USED TO ANALYZE THE STRENGTH OF POLES, CROSSARMS, BRACKETS, INSULATORS, GUYS AND ANCHORS OF COMPLIANCE.
2. WHEN A LINE TRANSVERSES AN AREA REQUIRING GRADE B CONSTRUCTION, THE LINE MUST TRANSITION FROM GRADE C TO GRADE B FOR THE ENTIRE LENGTH OF THE LINE IN THE AREA REQUIRING GRADE B AND THEN TRANSITION BACK TO GRADE C.
3. TRANSITION POINTS CAN LIE OUTSIDE OF THE AREA REQUIRING GRADE B IF NECESSARY; HOWEVER IN MOST CASES IT WILL BE BEST TO TRANSITION AS CLOSE TO THE EDGE OF THE AREA REQUIRING GRADE B AS POSSIBLE.
4. OFTEN THE AREA REQUIRING GRADE B CAN BE CROSSED WITH ONE SPAN; HOWEVER, IN MAY TAKE SEVERAL SPANS TO CROSS THE AREA REQUIRING GRADE B. EACH POLE IN THE AREA REQUIRING GRADE B MUST FULLY MEET THE STRENGTH REQUIREMENTS OF GRADE B.
5. THE TWO TRANSITION POLES SHOULD BE FULLY DEAD-END GUYED TO SUPPORT THE GRADE B SECTION AS A STAND ALONE LINE.
6. SIDE GUYS CAN BE USED TO REDUCE THE REQUIRED POLE CLASS. THIS IS THE PREFERRED METHOD OF OBTAINING THE REQUIRED TRANSVERSE STRENGTH OF THE POLE AS SHOWN ON THE CONSTRUCTION SPECIFICATIONS. IF SIDE GUYS CANNOT BE INSTALLED, THE POLE MUST BE CLASSED TO MEET THE TRANSVERSE STRENGTH REQUIREMENTS OF GRADE B.
7. CROSSING SPANS SHOULD REMAIN 20' HORIZONTAL FROM BRIDGES AND OVERPASSES. DOT AND CORP OF ENGINEERING REQUIREMENTS MAY VARY FROM LOCATION TO LOCATION. CONSULT WITH LOCAL AUTHORITIES BEFORE DESIGNING A NEW CROSSING NEXT TO A BRIDGE.
8. GRADE B LINES SHALL NOT CONTAIN SPLICES, EXCEPT FOR EMERGENCY RESTORATION. IF SPLICES ARE USED FOR EMERGENCY RESTORATION, ENGINEERING SHOULD BE NOTIFIED FOR REPLACEMENT OF ENTIRE WIRE SPAN IN A TIMELY MANNER.
9. GRADE B LINES SHOULD CROSS THE HIGHWAY, RAILROAD OR WATERWAY AS CLOSE TO 90 DEGREES PERPENDICULAR AS POSSIBLE.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	12/31/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GRADE B CONSTRUCTION
FOR LIMITED ACCESS HIGHWAY, RAILROAD
AND NAVIGABLE WATERWAY CROSSINGS

DEC	DEM	DEP	DEF
X	X	X	X

03.20-100

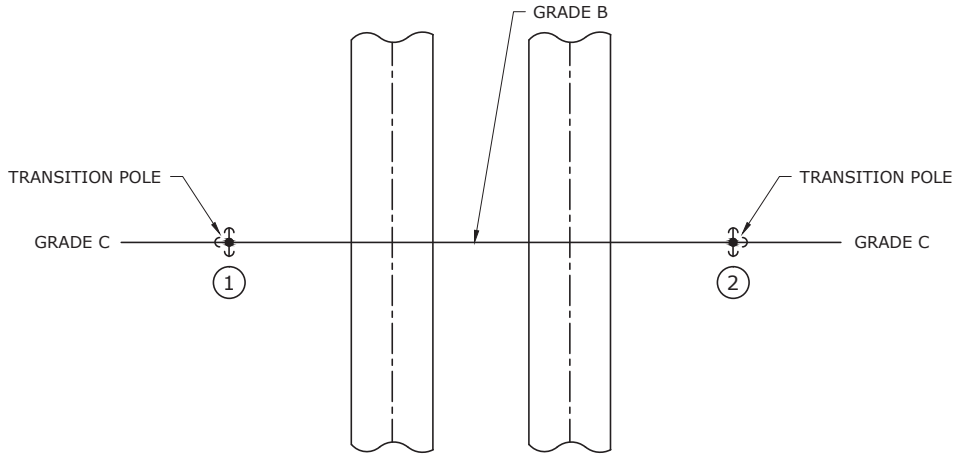


FIGURE 1

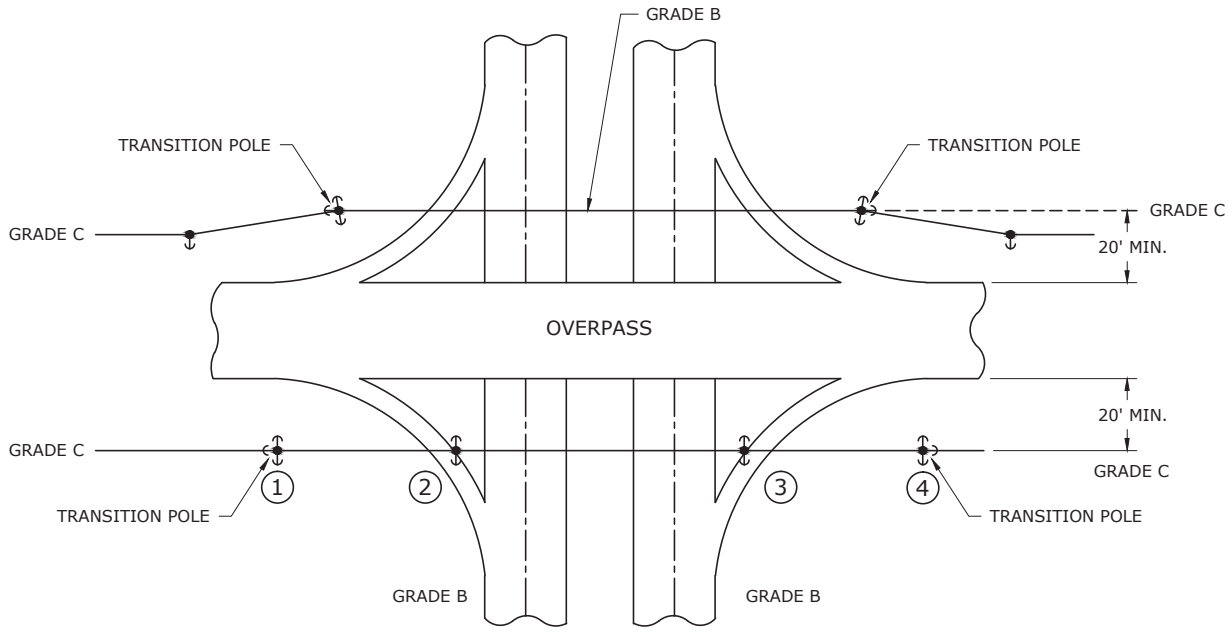


FIGURE 2

NOTES:

1. DISTRIBUTION CONDUCTORS MUST BE 20’ MINIMUM FROM BRIDGE OVERPASS. DOT REQUIREMENTS BESIDE A BRIDGE VARY FROM STATE TO STATE. CONSULT WITH LOCAL DOT PERSONNEL BEFORE DESIGNING A NEW CROSSING NEXT TO A BRIDGE.

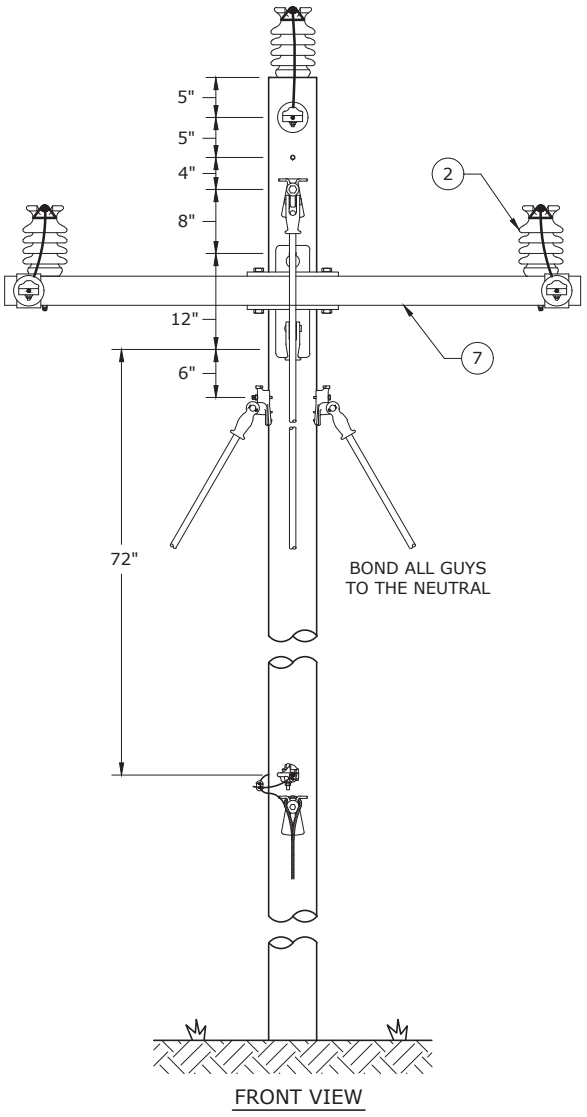
3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

GRADE B CONSTRUCTION
CONTROLLED ACCESS HIGHWAY
AND CLEARANCE FROM BRIDGES

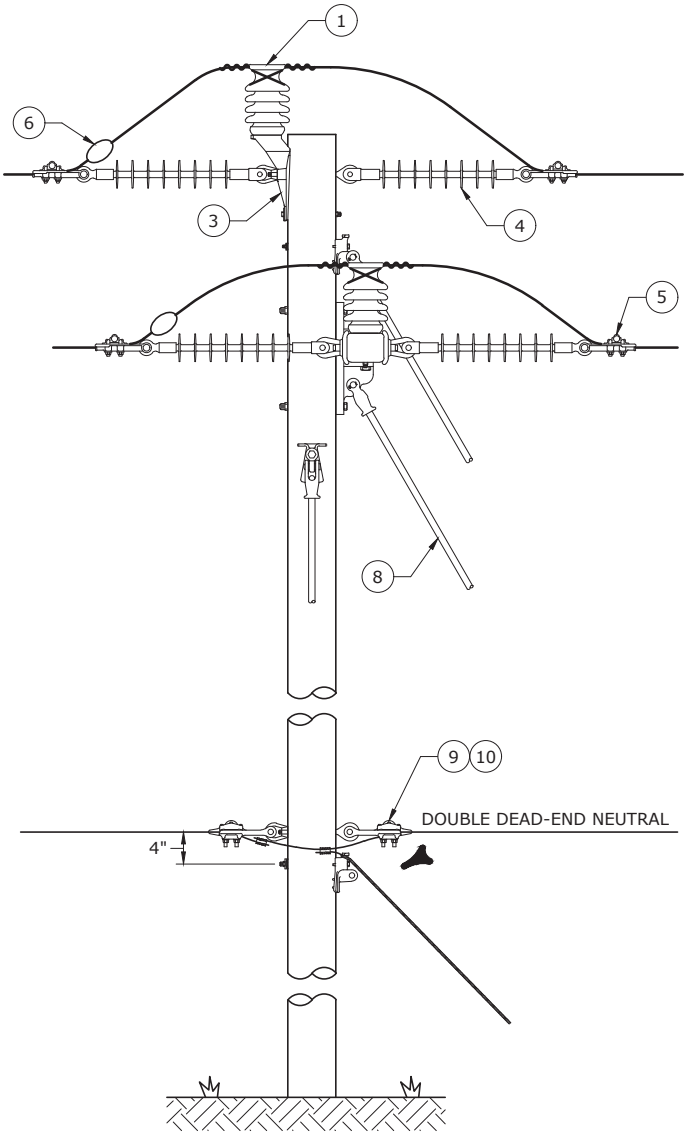
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.20-102



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE NOTES ON DWG. 03.20-110B.

2. USE THIS SPACING FOR SPANS LESS THAN OR EQUAL TO 250 FT. FOR LONGER SPANS, FOLLOW SPACING GUIDELINES ON DWG .03.00-100C.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GRADE B
HORIZONTAL CONSTRUCTION
TRANSITION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.20-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	3	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, POLE TOP MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-EYEBOLT-SM-10IN-GALV-F	1	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG,4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
4	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	ARM-SDE-8-FBG-NB-F	1	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	2	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
9	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG , GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
9	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
10	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

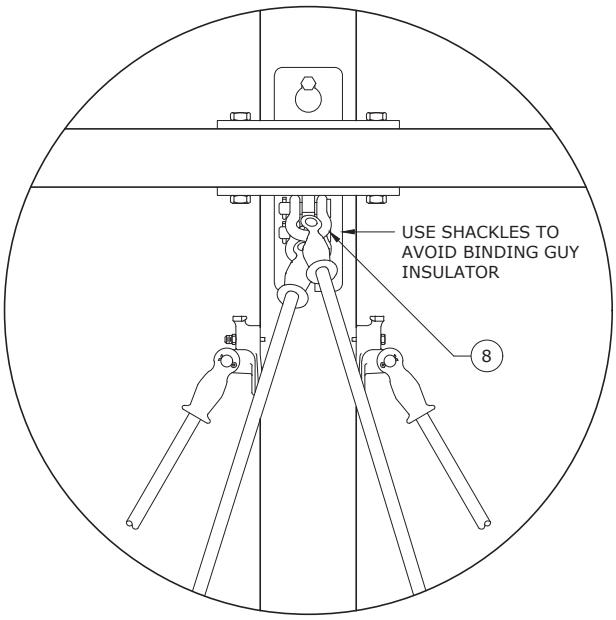
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

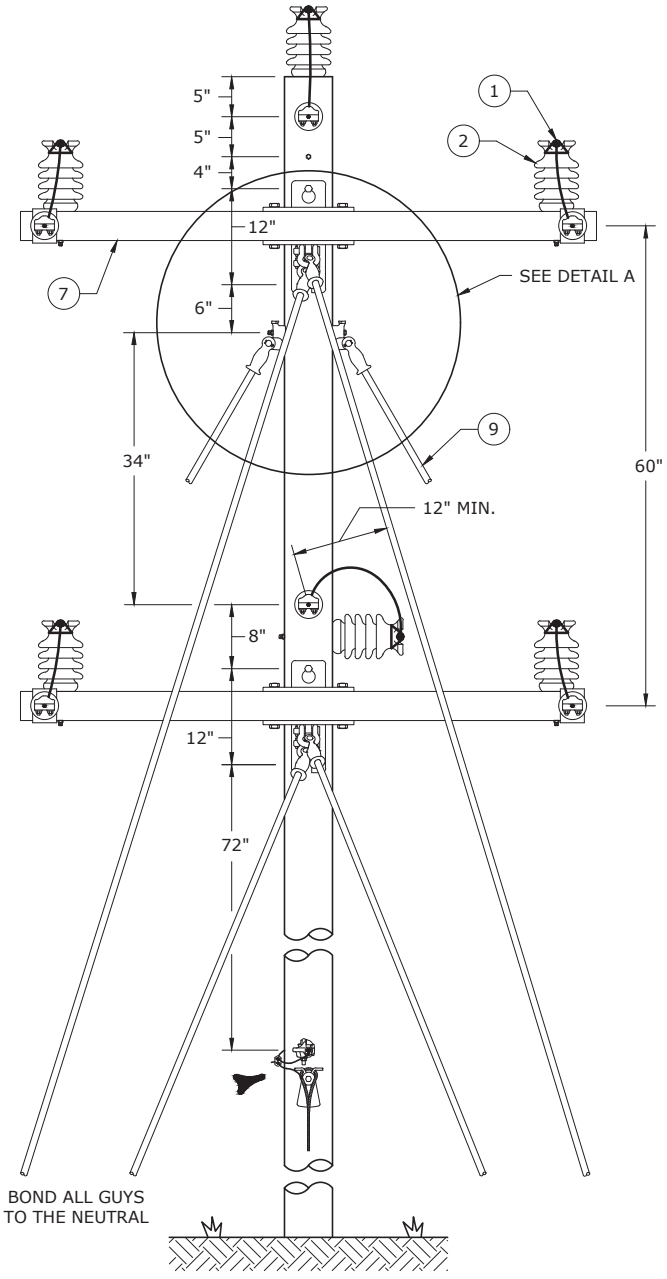
GRADE B
HORIZONTAL CONSTRUCTION
TRANSITION POLE

DEC	DEM	DEP	DEF
			X

03.20-110B



DETAIL A



FRONT VIEW

NOTES:

1. SEE NOTES ON DWG. 03.20-100.
2. SEE DWG. 03.20-130B FOR SIDE VIEW.
3. USE THIS SPACING FOR SPANS LESS THAN OR EQUAL TO 175 FT. FOR LONGER SPANS, FOLLOW SPACING GUIDELINES ON DWG .03.00-100C.

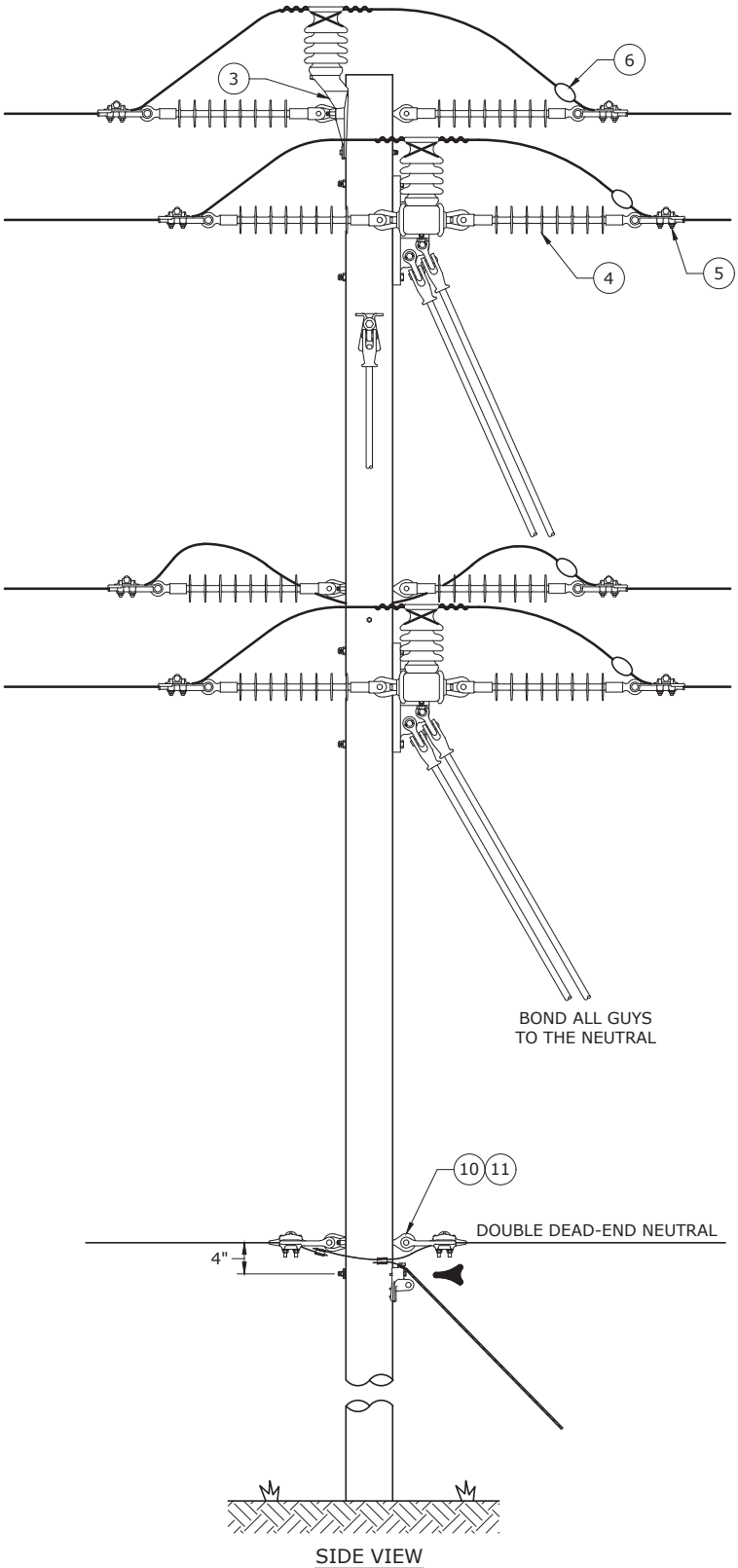
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GRADE B
HORIZONTAL DOUBLE CIRCUIT CONSTRUCTION
OVER/UNDER TRANSITION POLE

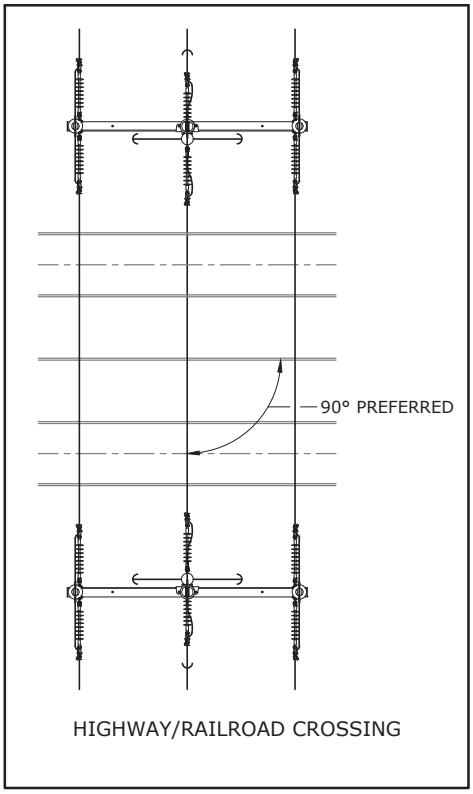
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.20-130A



SIDE VIEW



HIGHWAY/RAILROAD CROSSING

NOTES:

1. SEE NOTES ON DWG. 03.20-100.
2. SEE DWG. 03.20-130A FOR FRONT VIEW.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CHK'D	APPR.

GRADE B
HORIZONTAL DOUBLE CIRCUIT CONSTRUCTION
OVER/UNDER TRANSITION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.20-130B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	5	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
2	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
3	BKT-INSL-POST-PTOP-STL-F	1	50129169	1	BRACKET, MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV ST
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
3	HDWR-MACH-SM-10IN-GALV-F	1	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DISTRIBUTION DEADEND, 35KV, 22" LG, POLYMER
4	HDWR-EYEBOLT-SM-10IN-GALV-F	2	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV ST
4	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	ARM-SDE-8-FBG-NB-F	2	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	HDWR-SHACKLE-SM-GALV-F	2	4002562	1	SHACKLE, ANCHOR, 7/8" INSIDE WD, 2-3/16" INSIDE LG, 5/8" PIN
9	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
10	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG , GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV ST
10	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

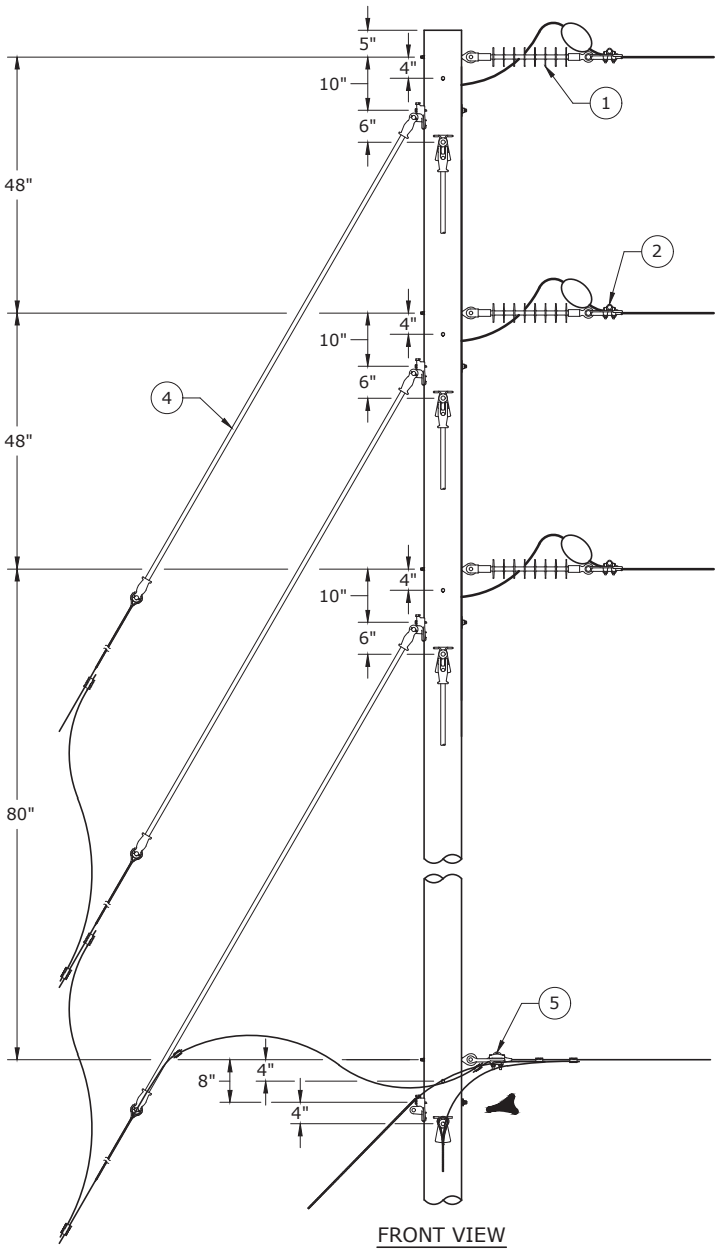
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

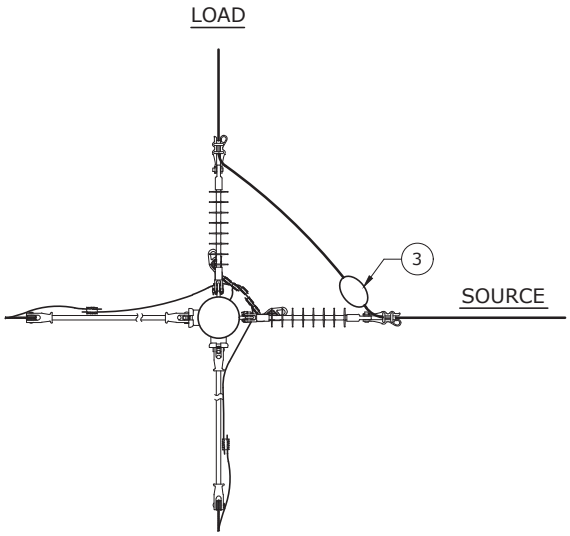
GRADE B
HORIZONTAL DOUBLE CIRCUIT CONSTRUCTION
OVER/UNDER TRANSITION POLE

DEC	DEM	DEP	DEF
			X

03.20-130C



FRONT VIEW



PLAN VIEW

NOTES:

1. SEE NOTES ON DWG. 03.20-100.

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GRADE B
VERTICAL CONSTRUCTION
LARGE ANGLE TRANSISTION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.20-140A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-EYEBOLT-SM-10IN-GALV-F	6	931122	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 10" LG, 4" THD LG, GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
5	HDWR-EYEBOLT-SM-12IN-GALV-F	2	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG ,GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

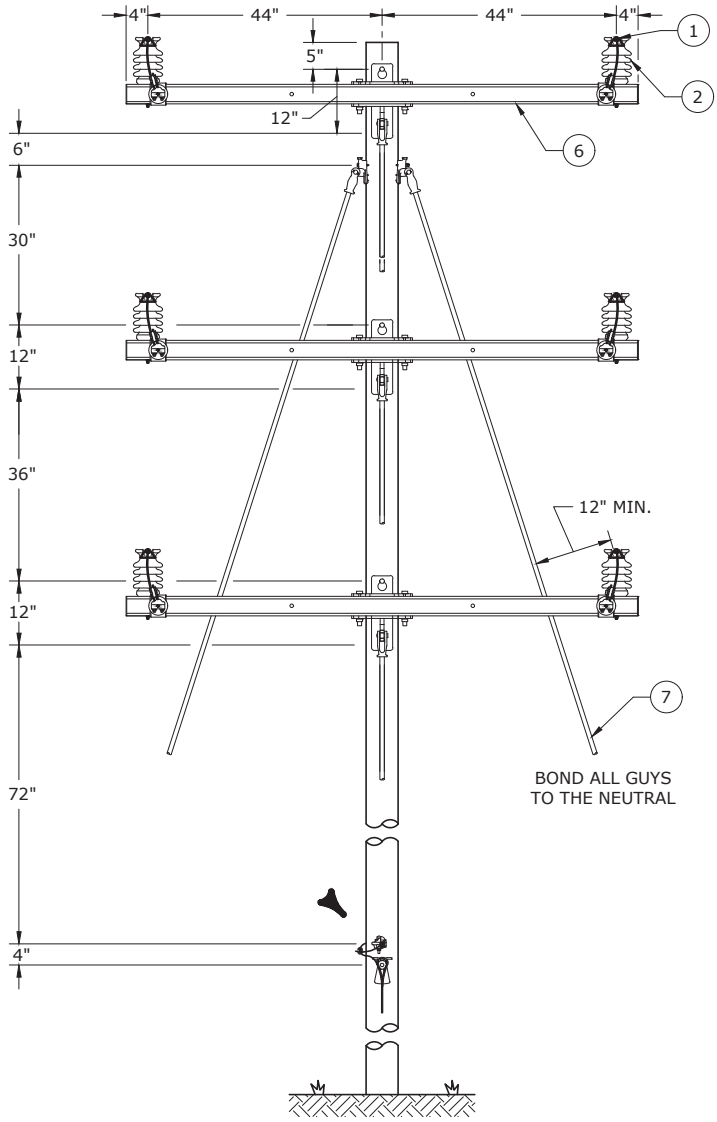
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

GRADE B
VERTICAL CONSTRUCTION
LARGE ANGLE TRANSITION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.20-140B



FRONT VIEW

NOTES:

1. SEE NOTES ON DWG. 03.20-100.

2. SEE DWG. 03.20-150B FOR SIDE VIEW.

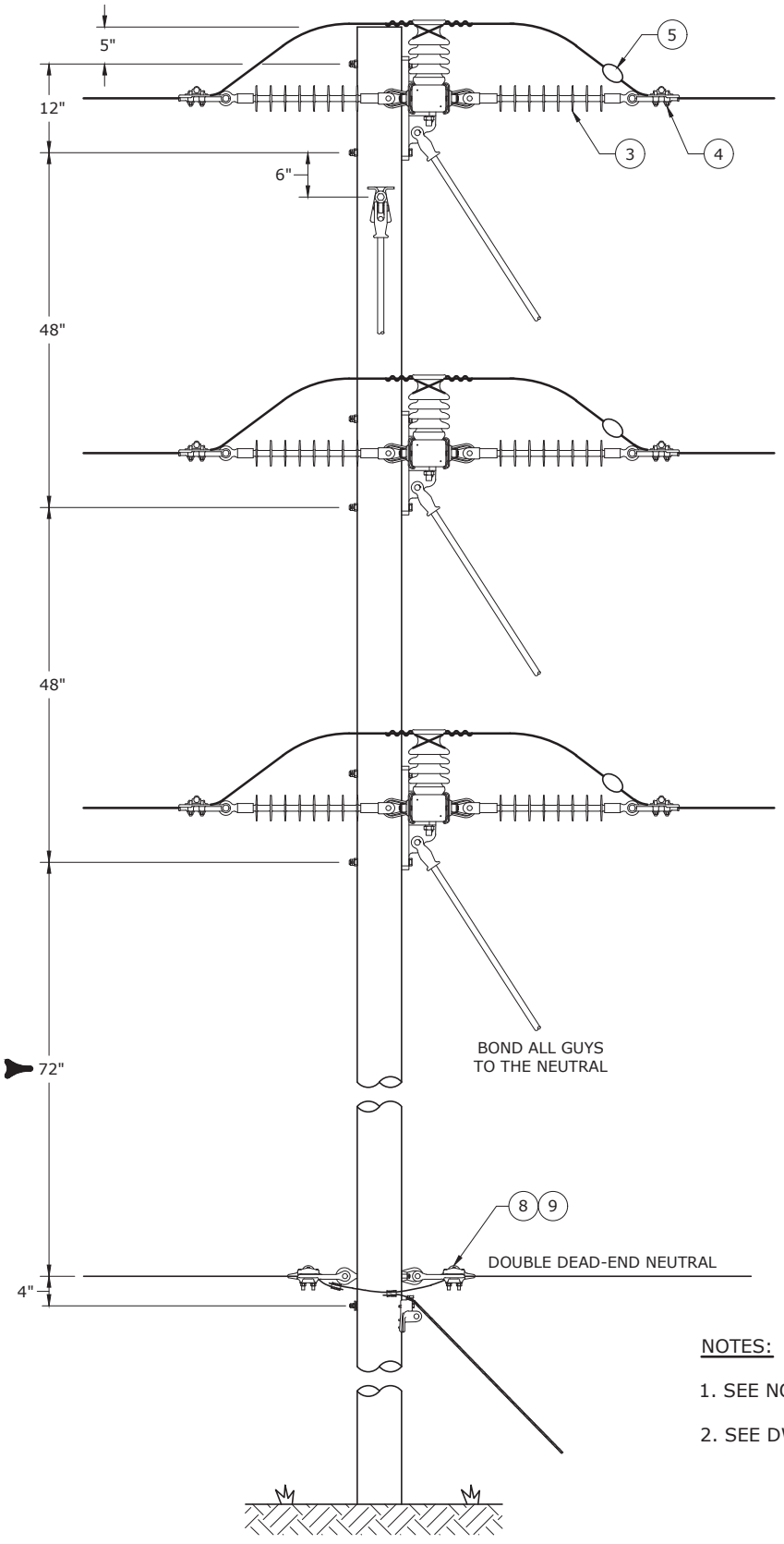
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	BURLISON	WHITE	ADCOCK

GRADE B
VERTICAL DOUBLE CIRCUIT CONSTRUCTION
TRANSITION POLE

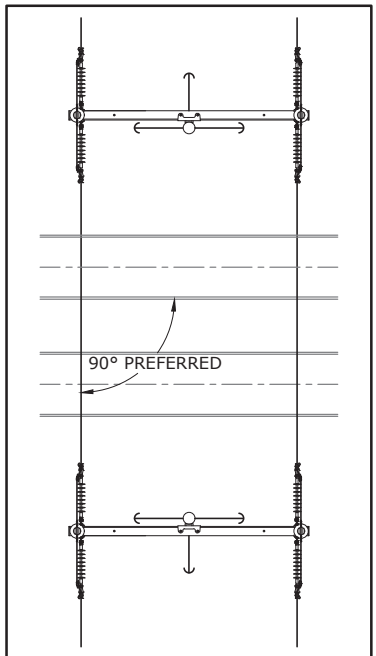
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.20-150A



SIDE VIEW



HIGHWAY/RAILROAD CROSSING

NOTES:

1. SEE NOTES ON DWG. 03.20-100.
2. SEE DWG. 03.20-150A FOR FRONT VIEW.

REVISED	BY	CHK'D	APPR.
3 10/26/18	ROBBINS	BURLISON	ADCOCK
2 4/30/18	BENDER	BURLISON	ADCOCK
1 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	BURLISON	WHITE	ADCOCK

GRADE B
VERTICAL DOUBLE CIRCUIT CONSTRUCTION
TRANSITION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.20-150B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS (VARIES)
6	ARM-SDE-8-FBG-NB-F	3	50117393	1	CROSSARM, POLE, 6" X 4", 8' LG, UV STABILIZED FOAM FILL, FBG.
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
6	HDWR-MACH-LG-10IN-GALV-F	6	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
8	HDWR-EYEBOLT-SM-12IN-GALV-F	1	931130	1	BOLT, EYE, OVAL, 5/8" DIA, 11 UNC, 12" LG, 6" THD LG ,GALV STL
			938975	1	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
9	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

GRADE B
VERTICAL DOUBLE CIRCUIT CONSTRUCTION
TRANSITION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.20-150C

DISTRIBUTION STANDARDS SECTION 03.23 IS INTENDED TO ADDRESS THE CONSTRUCTION OF SINGLE-PHASE ELECTRIC DISTRIBUTION CIRCUITS UNDERBUILT ON STEEL AND CONCRETE TRANSMISSION POLES. FOR MULT-PHASE CONSTRUCTION, SEE SECTIONS 03.24 AND 03.25.

DISTRIBUTION FRAMING SHOULD START FROM THE GROUND UP. THE LOWEST POWER ATTACHMENT POINT (TYPICALLY THE NEUTRAL) SHOULD BE DETERMINED BASED ON GROUND CLEARANCE AND ANY JOINT USE REQUIREMENTS. THE SPACING UP TO THE HIGHEST POWER ATTACHMENT SHOULD BE MEASURED FROM THE LOWEST POINT UP IN ACCORDANCE WITH THE STANDARDS IN THIS SECTION. COORDINATION WITH TRANSMISSION ENGINEERING IS CRITICAL AND AT NO TIME SHALL THE DISTRIBUTION ATTACHMENT BE CLOSER THAN THE MINIMUM CLEARANCES DESCRIBED BELOW. SEE FIGURE 1 ON DWG. 03.24-100B.

MINIMUM CLEARANCE BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS

FOR 69KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE HIGHEST DISTRIBUTION ATTACHMENT SHALL NOT BE LESS THAN 10' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY LOCAL TRANSMISSION ENGINEERING.

FOR 138KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE HIGHEST DISTRIBUTION ATTACHMENT SHALL NOT BE LESS THAN 11' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY LOCAL TRANSMISSION ENGINEERING.

MINIMUM VERTICAL CLEARANCES BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS VARY ACCORDING TO THE TRANSMISSION FRAMING, VOLTAGE, SPAN LENGTH, AND CONDUCTOR TENSION. CLEARANCES AT MID-SPAN MUST ALSO BE CONSIDERED. FOR OTHER TRANSMISSION VOLTAGES OR FOR SITUATIONS NOT ADDRESSED ABOVE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO DETERMINE THESE MINIMUM CLEARANCES.

SPECIAL SITUATIONS

IF EXTENUATING CIRCUMSTANCES EXIST THAT ABSOLUTELY PROHIBIT THE USE OF A STEEL TRANSMISSION POLE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO CONSIDER THESE OPTIONS:

1. PLACE A WOODEN TRANSMISSION POLE INSTEAD OF A STEEL POLE.
2. SET A SEPARATE WOODEN POLE FOR DISTRIBUTION. THIS CAN BE A WOODEN POLE ADJACENT TO THE STEEL TRANSMISSION POLE OR A SKIP SPAN / INTERMEDIATE POLE. THE USE OF SKIP SPAN / INTERMEDIATE POLES IS ACCEPTABLE AND ENCOURAGED WHERE APPROPRIATE.
3. RELOCATE THE OVERHEAD DISTRIBUTION LINE.
4. CONVERT THE OVERHEAD DISTRIBUTION LINE TO UNDERGROUND.

WHERE POSSIBLE AND PRACTICAL, THE PREFERRED METHOD IS TO NOT ATTACH DISTRIBUTION TO TRANSMISSION STEEL POLES.

GENERAL NOTES

1. WHEN UNDERBUILD IS ADDED TO A TRANSMISSION LINE, TRANSMISSION GUYS MUST BE INSULATED TO PREVENT TRANSMISSION VOLTAGE FROM TRANSFERRING TO THE DISTRIBUTION LINE AND TO KEEP DISTRIBUTION VOLTAGE FROM TRANSFERRING TO THE BOTTOM OF THE GUY SHOULD THE TRANSMISSION GUY BECOME SLACK OR BROKE.
2. ALL STEEL POLES SHALL BE BONDED TO THE SYSTEM NEUTRAL.
3. VERIFY THE GROUNDING CONNECTION IS PRESENT AT THE BASE OF THE POLE WHEN DISTRIBUTION CONSTRUCTION BEGINS. REPORT ANY MISSING POLE GROUND CONNECTIONS TO C+M SUPERVISOR.

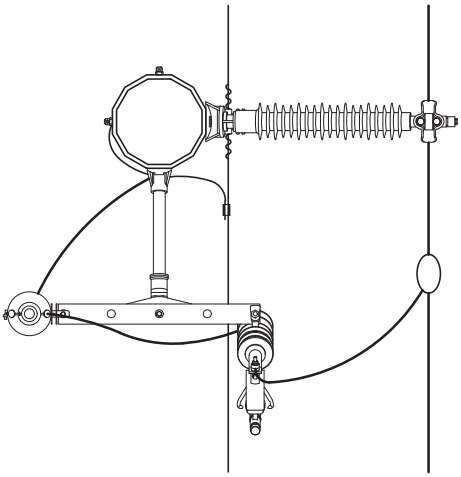
DUKE ENERGY.

3				
2				
1				
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

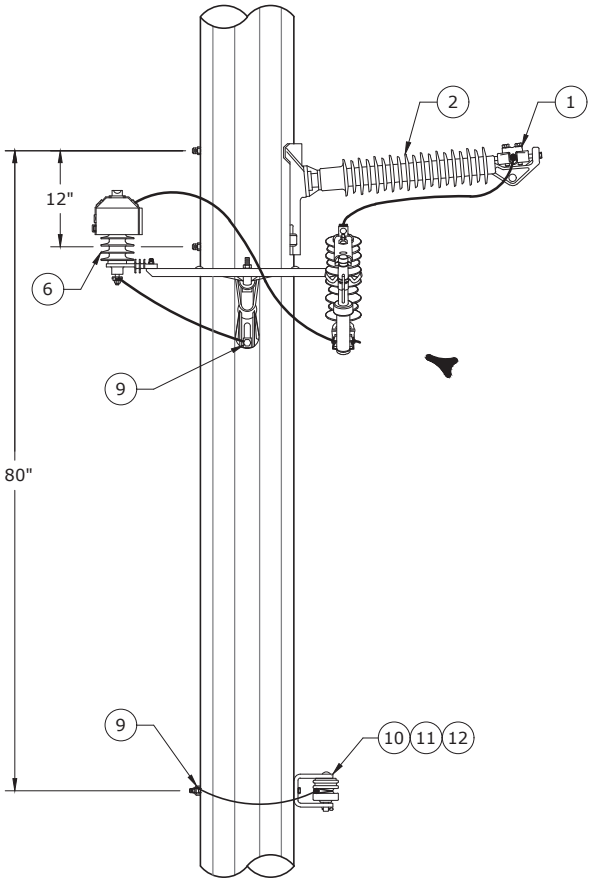
GENERAL INFORMATION -
SINGLE-PHASE ELECTRIC DISTRIBUTION ON
STEEL AND CONCRETE TRANSMISSION POLES

DEC	DEM	DEP	DEF
X	X	X	X

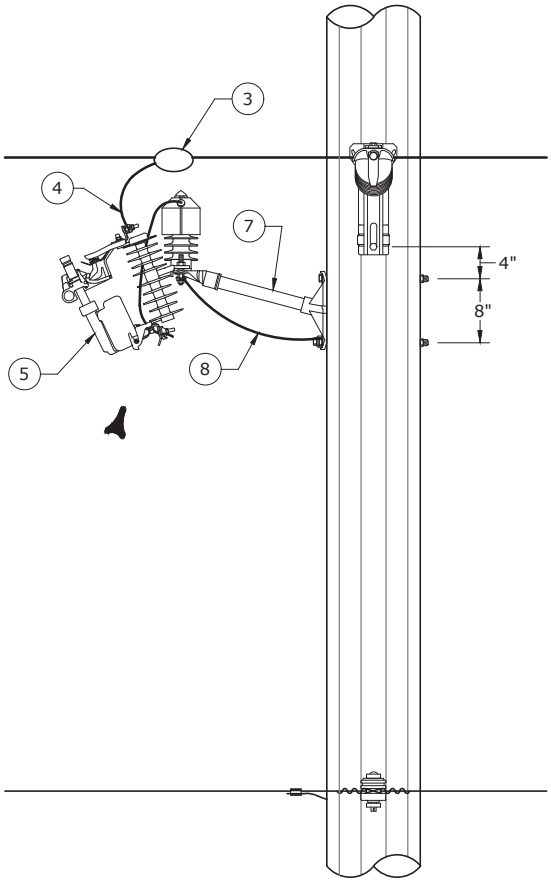
03.23-100A



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-105B FOR BILL OF MATERIALS.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

DEC	DEM	DEP	DEF
X	X	X	X

03.23-105A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-69KV-POLY-HC-GB-F	1	4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV,FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT. ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
11	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
11	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, GALV STL
12	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

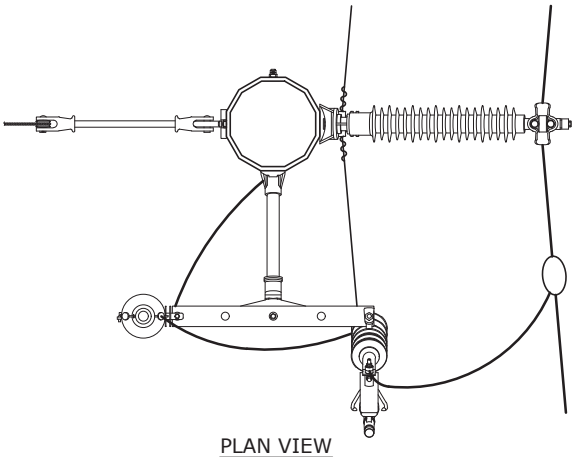
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

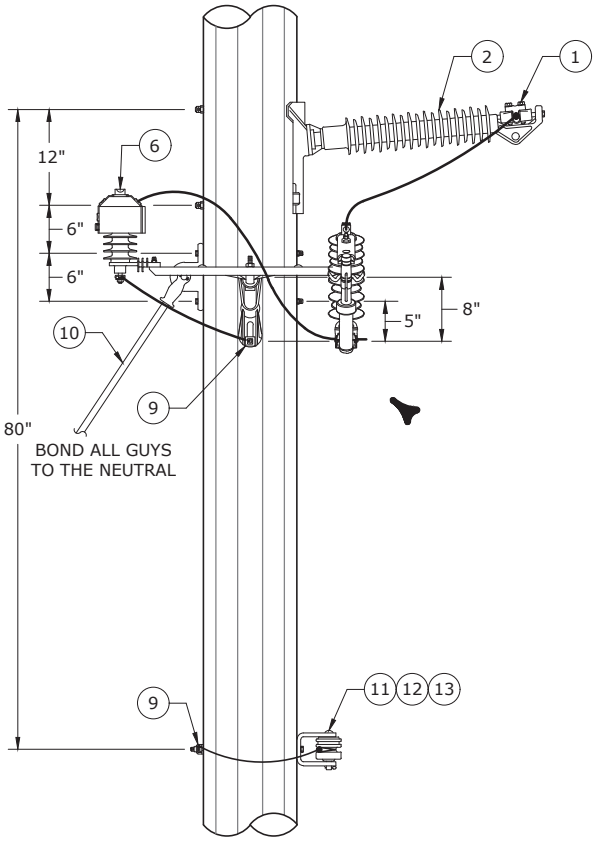
SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

DEC	DEM	DEP	DEF
			X

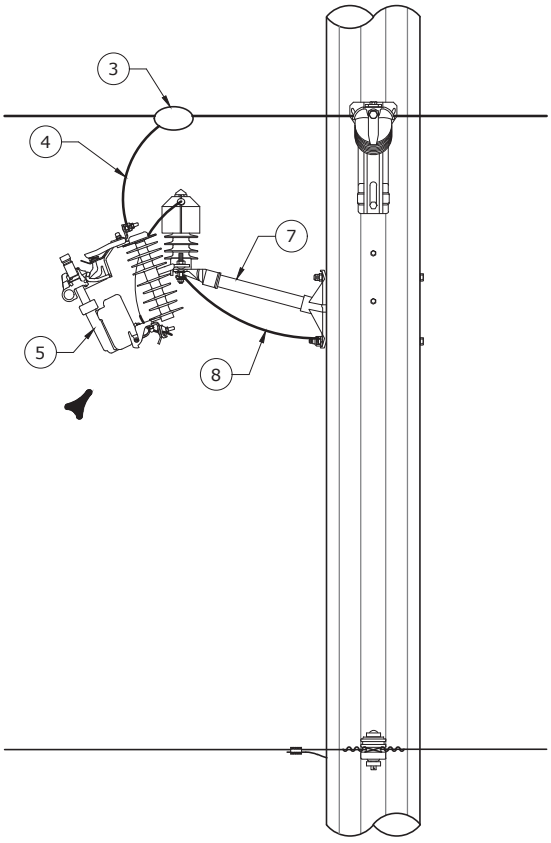
03.23-105B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-110B FOR BILL OF MATERIALS.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
SMALL ANGLE

DEC	DEM	DEP	DEF
X	X	X	X

03.23-110A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-69KV-POLY-HC-GB-F	1	4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV,FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT. ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
12	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
12	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, GALV STL
13	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

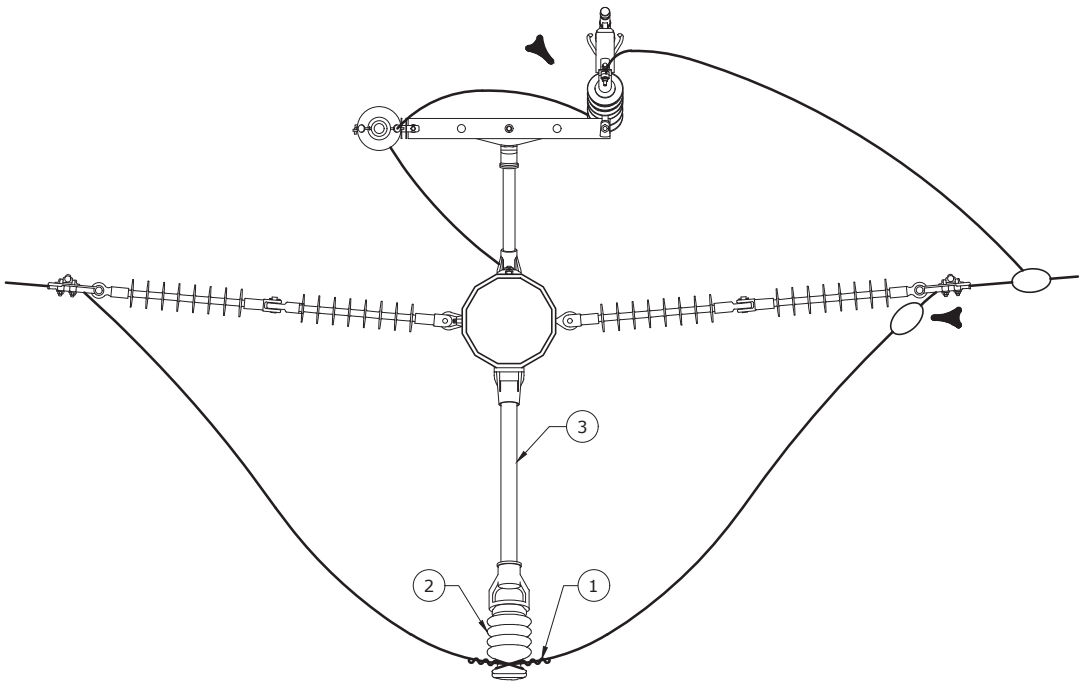
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

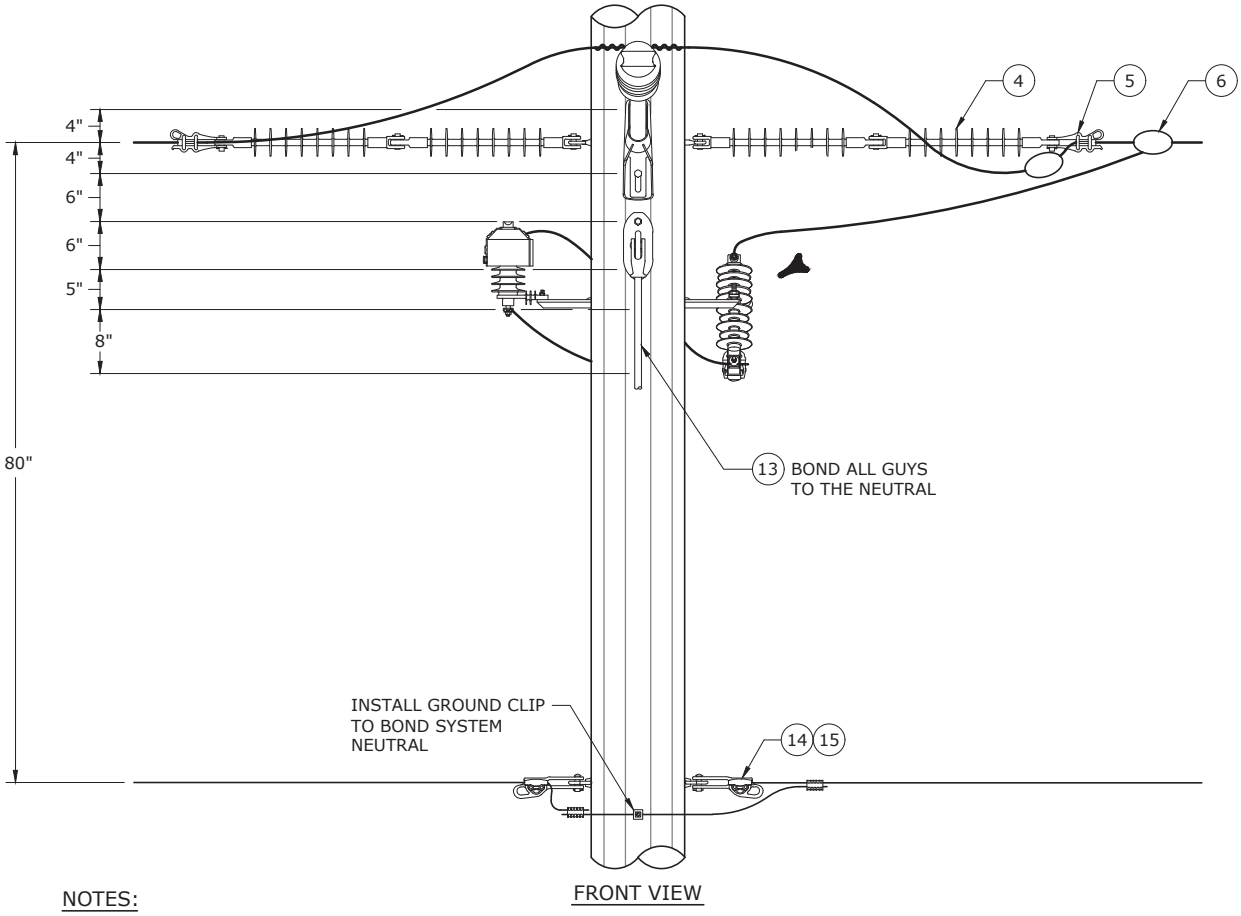
SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES - SMALL ANGLE

DEC	DEM	DEP	DEF
			X

03.23-110B



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 03.23-115B FOR PLAN AND SIDE VIEW.
2. SEE DWG. 03.23-115C FOR BILL OF MATERIALS.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

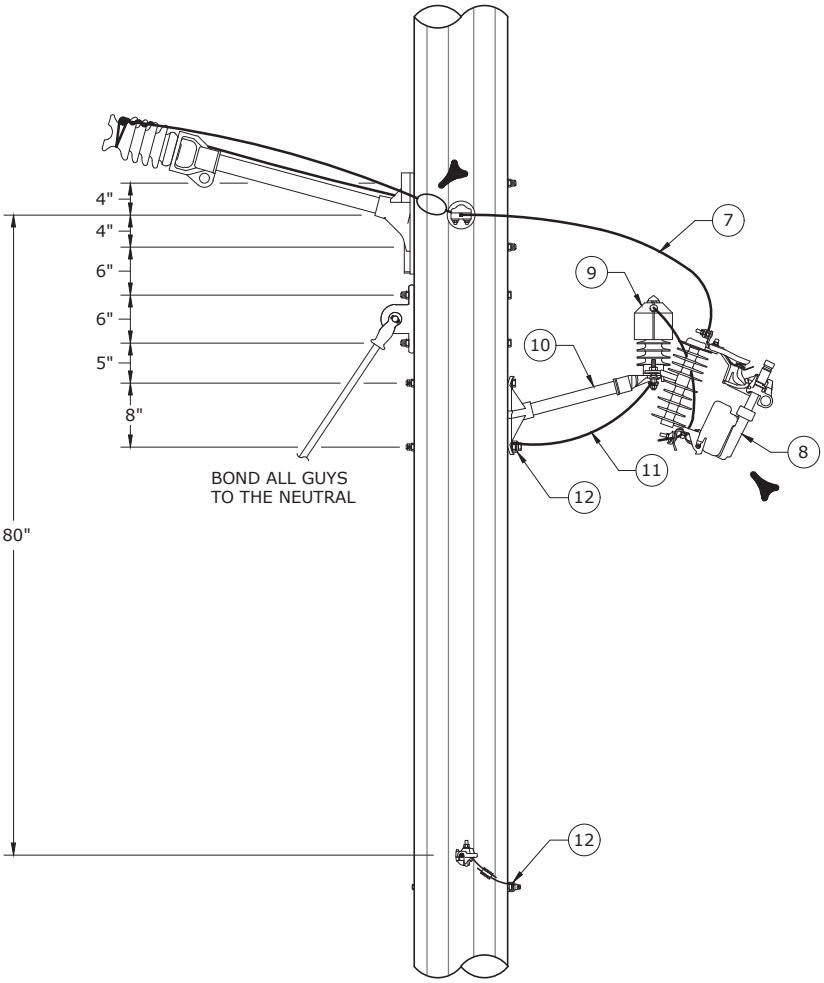
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - MEDIUM ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.23-115A



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-115A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 03.23-115C FOR BILL OF MATERIALS.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
MEDIUM ANGLE

DEC	DEM	DEP	DEF
X	X	X	X

03.23-115B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	1	4022333	1	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD,INSULATOR,5/8" DIA,10" LG,11 UNC,6" THD LG,GALV STL
3	BKT-INSL-POST-POLE-LG-FG-F	1	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	4	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV,FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT. ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
11	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
14	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
14	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
15	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

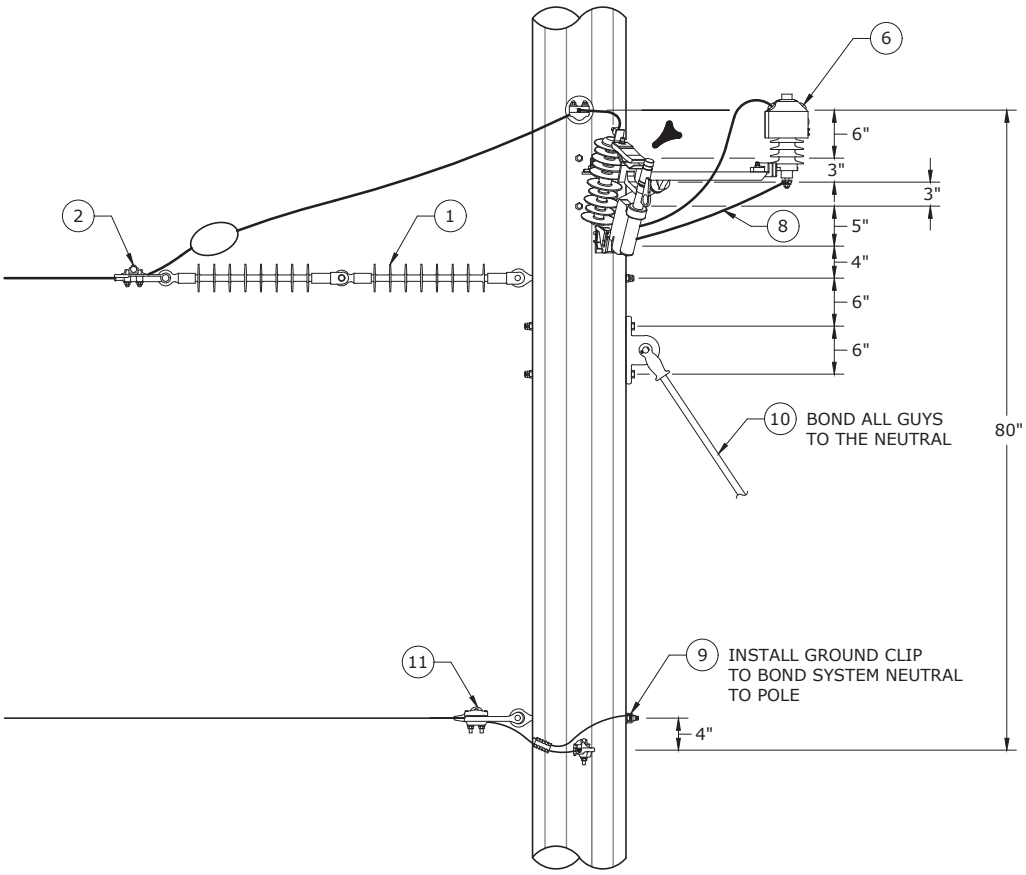
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
MEDIUM ANGLE

DEC	DEM	DEP	DEF
			X

03.23-115C



FRONT VIEW

NOTES:

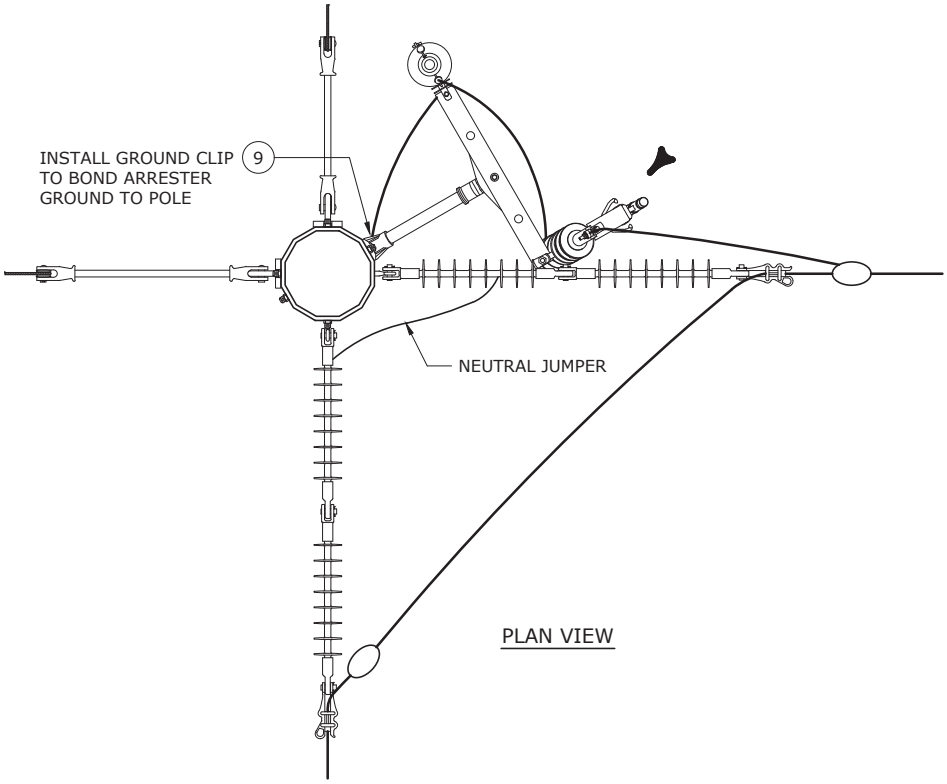
1. SEE DWG. 03.23-120B FOR SIDE AND PLAN VIEW.
2. SEE DWG. 03.23-120C FOR BILL OF MATERIALS.
3. USE GROUND CLIP TO CONNECT ARRESTER GROUND LEAD TO BRACKET BOLT.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK

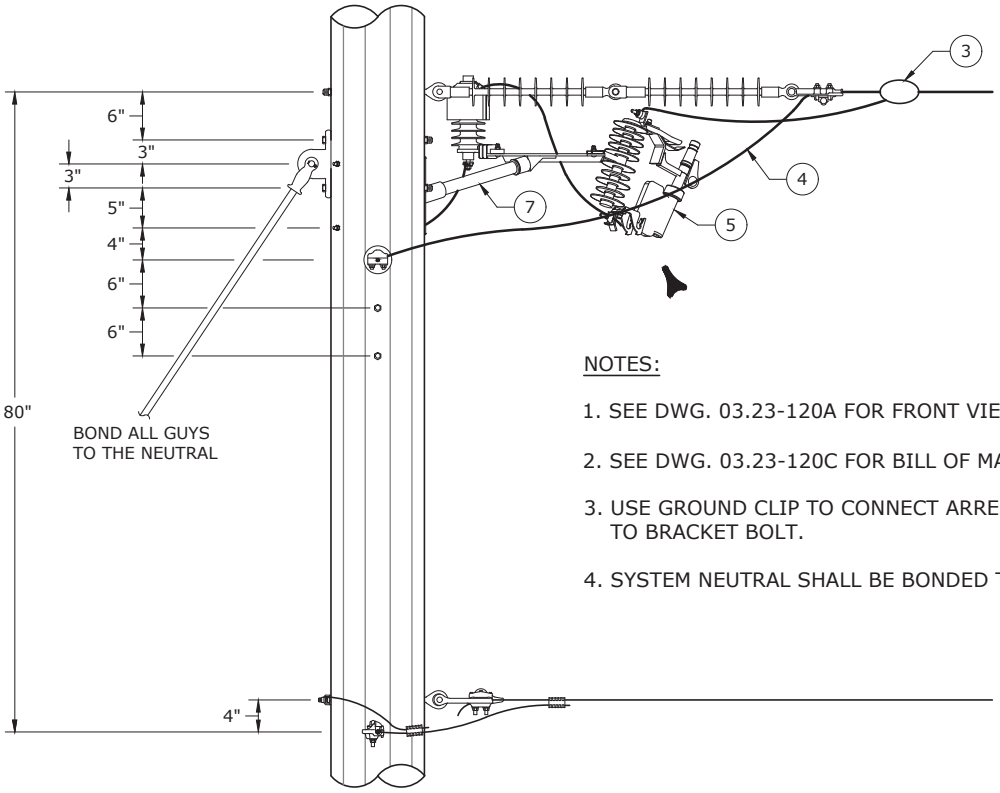
SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - LARGE ANGLE (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.23-120A



PLAN VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-120A FOR FRONT VIEW.
2. SEE DWG. 03.23-120C FOR BILL OF MATERIALS.
3. USE GROUND CLIP TO CONNECT ARRESTER GROUND LEAD TO BRACKET BOLT.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - LARGE ANGLE (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.23-120B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	4	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	2	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV,FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT. ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-DA-SM-28IN-GALV-F	2	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
11	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

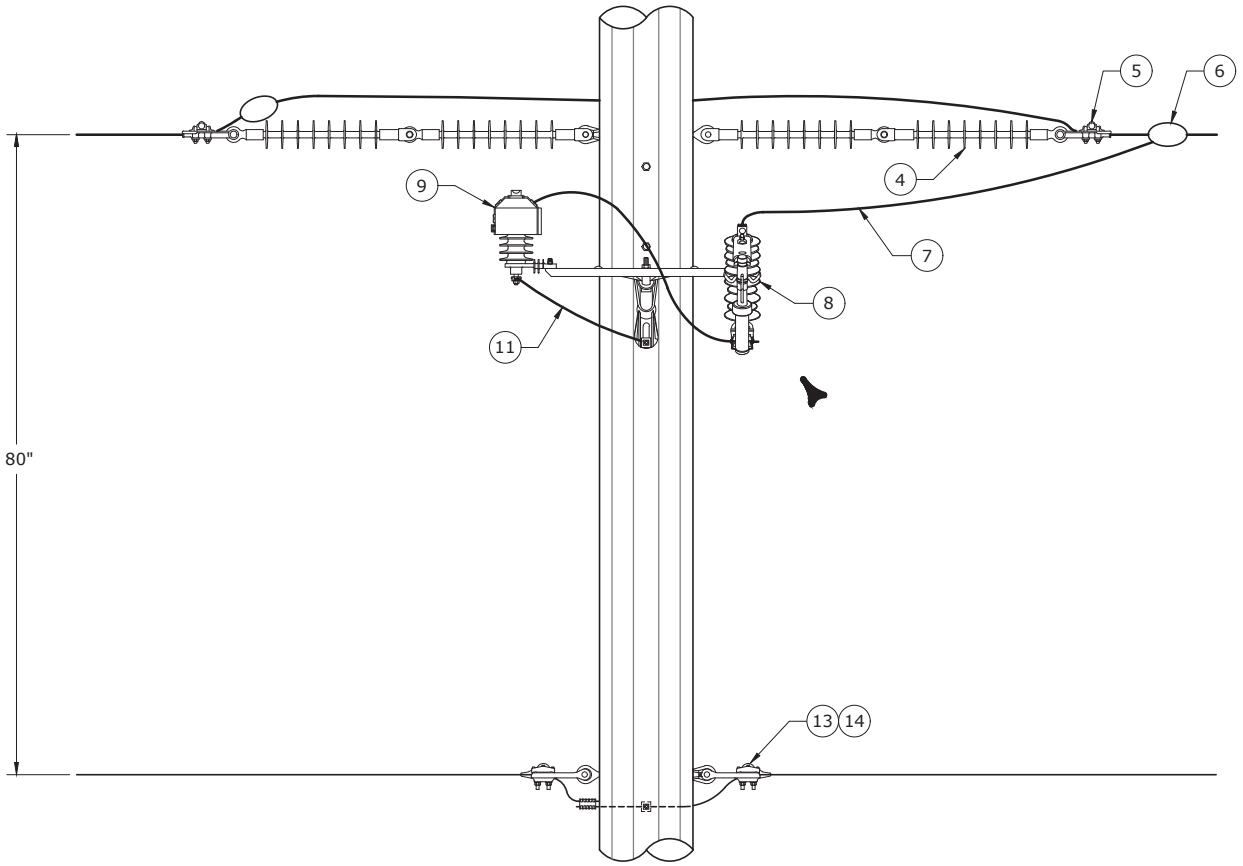
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
LARGE ANGLE (RIGHT ANGLE)

DEC	DEM	DEP	DEF
			X

03.23-120C



FRONT VIEW

NOTES:

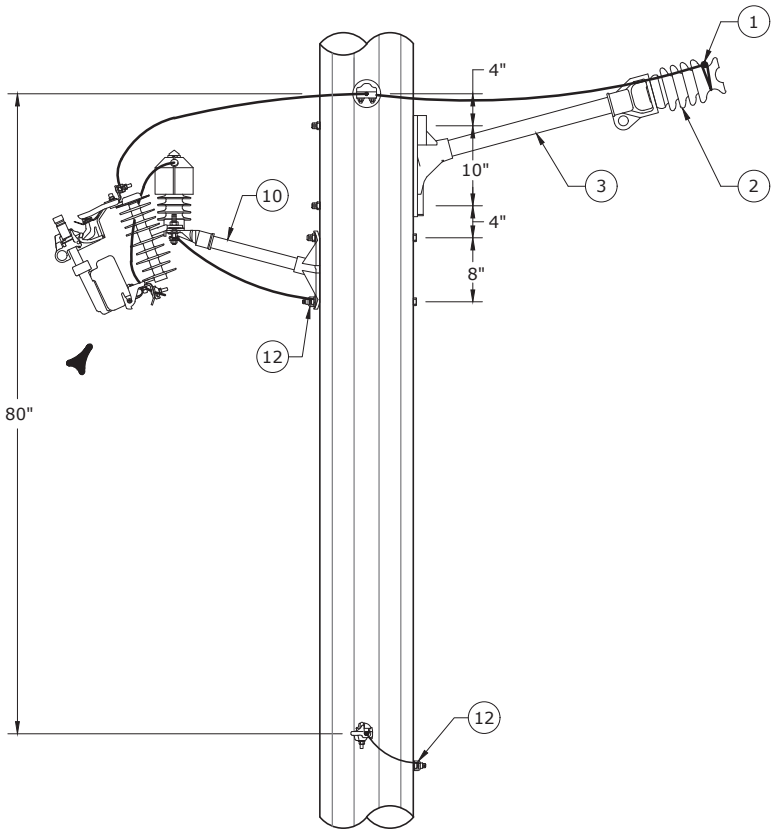
1. SEE DWG. 03.23-125B FOR SIDE AND PLAN VIEW.
2. SEE DWG. 03.23-125C FOR BILL OF MATERIALS.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK

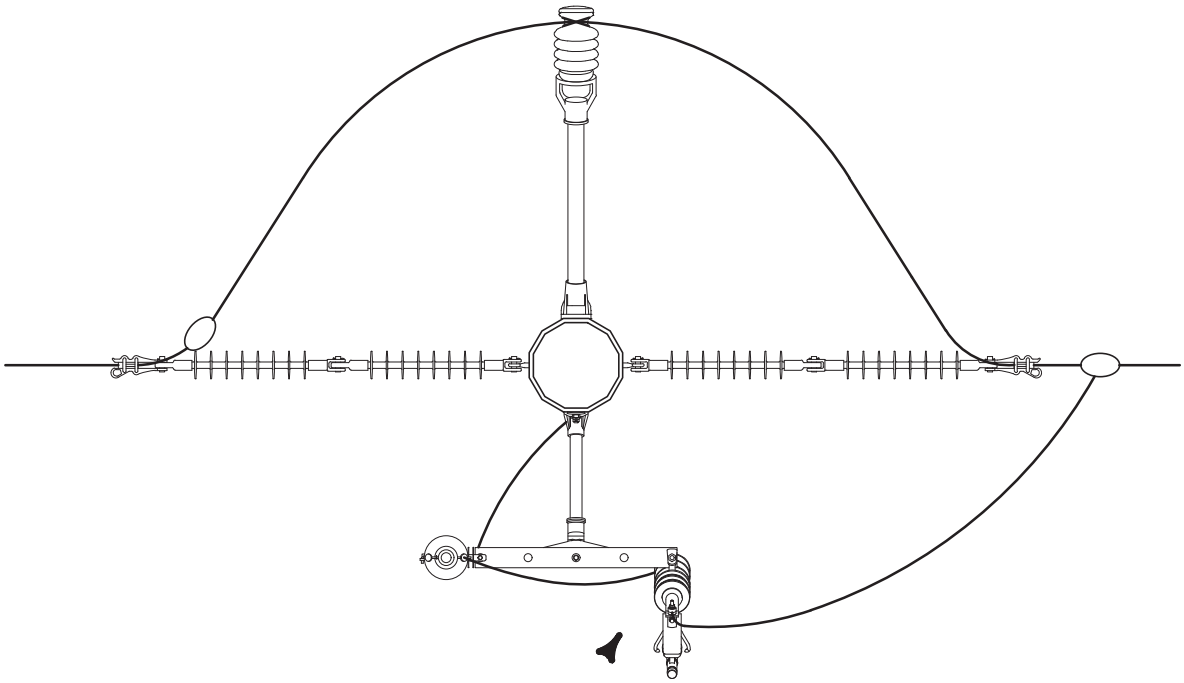
SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - DOUBLE DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.23-125A



SIDE VIEW



PLAN VIEW

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - DOUBLE DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.23-125B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	1	4022333	1	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	1	134390	1	STUD,INSULATOR,5/8" DIA,10" LG,11 UNC,6" THD LG,GALV STL
3	BKT-INSL-POST-POLE-LG-FG-F	1	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	4	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV,FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXT. ADAPTER, USE IN 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
11	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
13	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
14	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

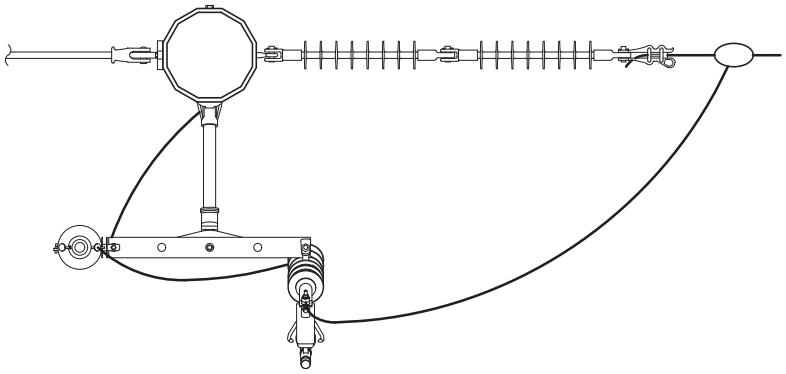
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

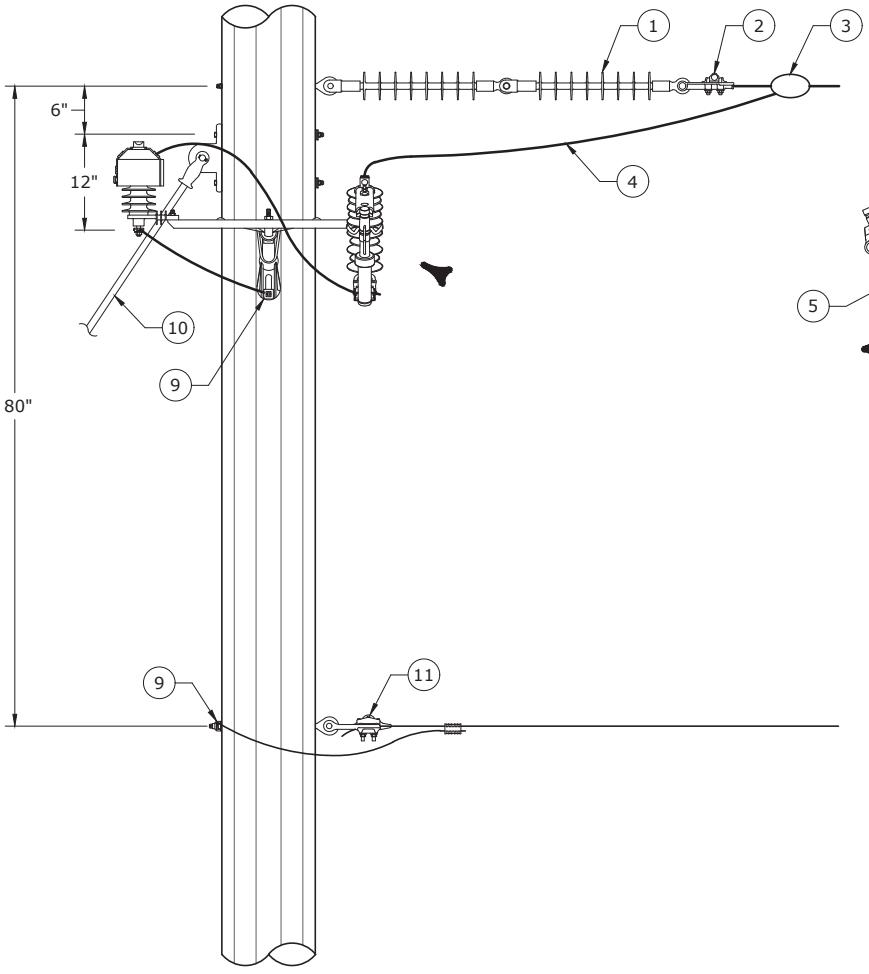
SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
DOUBLE DEADEND

DEC	DEM	DEP	DEF
			X

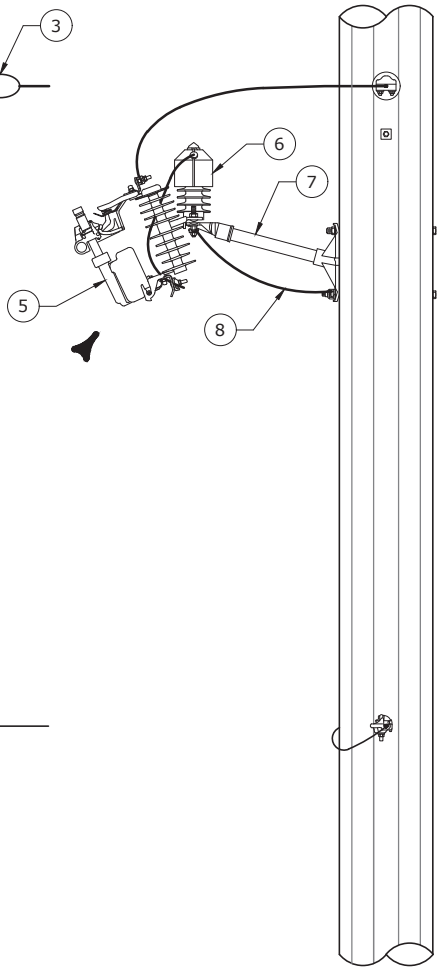
03.23-125C



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-130B FOR BILL OF MATERIALS.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.23-130A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	1	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

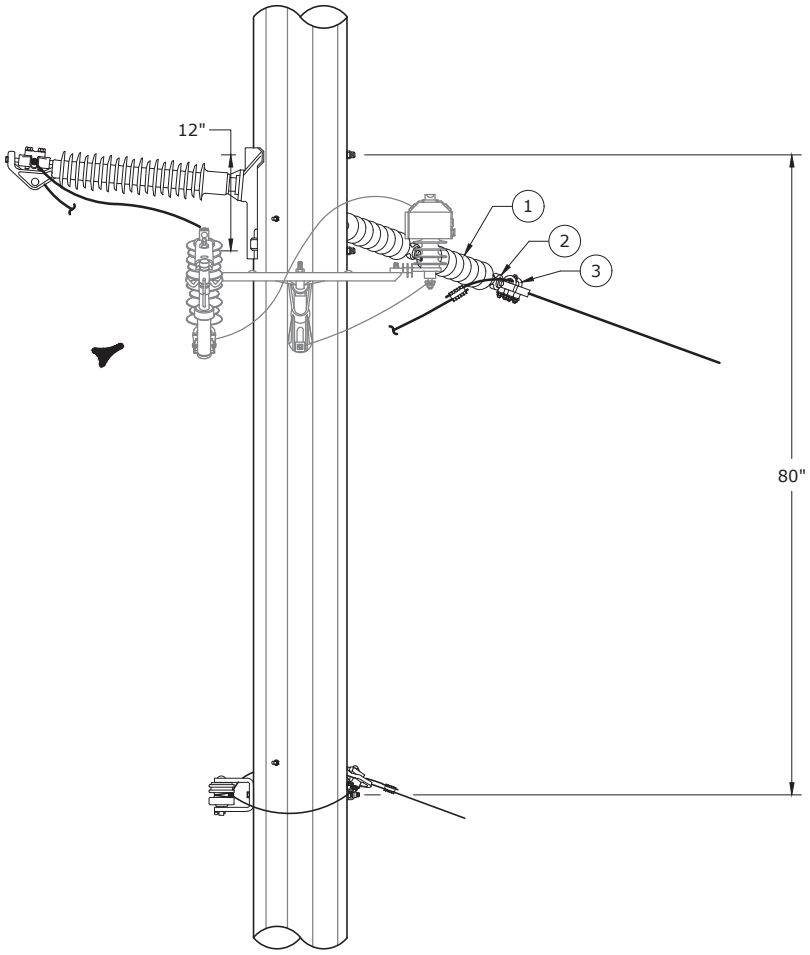
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES - DEADEND

DEC	DEM	DEP	DEF
			X

03.23-130B



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

NOTES:

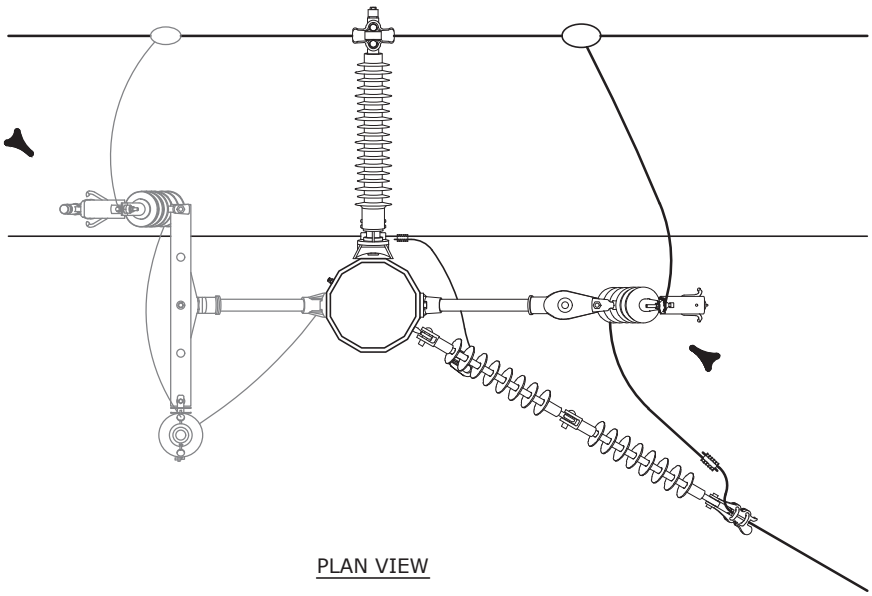
1. SEE DWG. 03.23-135B FOR SIDE AND PLAN VIEWS.
2. SEE DWG. 03.23-135C FOR BILL OF MATERIALS.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK

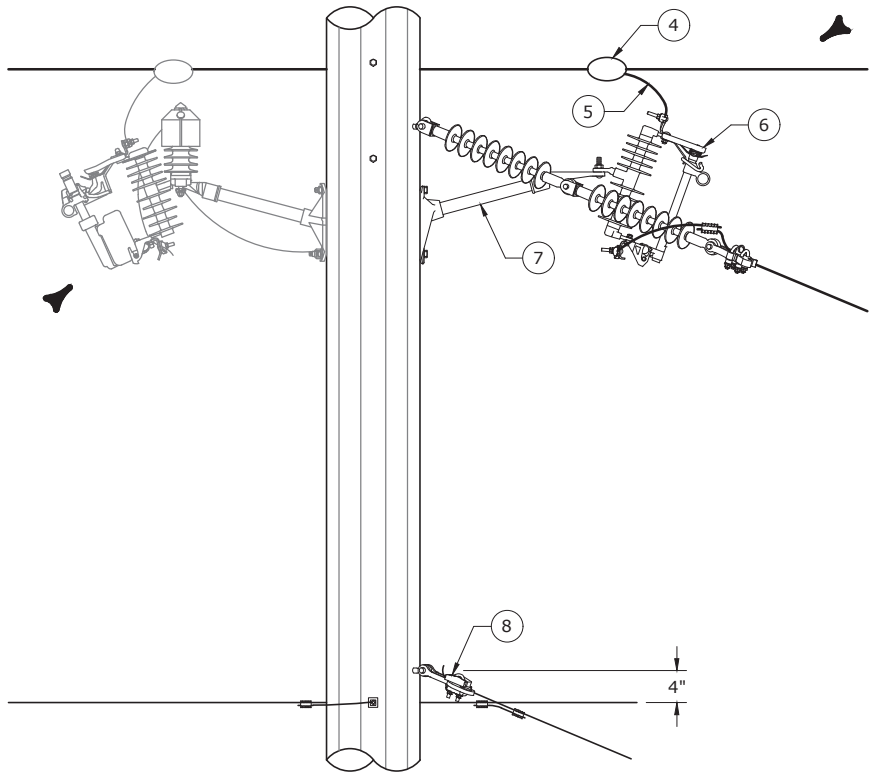
SINGLE-PHASE UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SINGLE-PHASE FUSED SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.23-135A



PLAN VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 03.23-135A FOR FRONT VIEW.
2. SEE DWG. 03.23-135C FOR BILL OF MATERIALS.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	12/31/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
SINGLE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.23-135B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	INSL-CLIP-SHUNT-F	2	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/17/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
SINGLE-PHASE FUSED SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

03.23-135C

DISTRIBUTION STANDARDS SECTION 03.24 IS INTENDED TO ADDRESS THE CONSTRUCTION OF ELECTRIC DISTRIBUTION CIRCUITS UNDERBUILT ON STEEL TRANSMISSION POLES.

DISTRIBUTION FRAMING SHOULD START FROM THE GROUND UP. THE LOWEST POWER ATTACHMENT POINT (TYPICALLY THE NEUTRAL) SHOULD BE DETERMINED BASED ON GROUND CLEARANCE AND ANY JOINT USE REQUIREMENTS. THE SPACING UP TO THE HIGHEST POWER ATTACHMENT SHOULD BE MEASURED FROM THE LOWEST POINT UP IN ACCORDANCE WITH THE STANDARDS IN THIS SECTION. COORDINATION WITH TRANSMISSION ENGINEERING IS CRITICAL AND AT NO TIME SHALL THE DISTRIBUTION ATTACHMENT BE CLOSER THAN THE MINIMUM CLEARANCES DESCRIBED BELOW. SEE FIGURE 1 ON DWG. 03.24-100B.

MINIMUM CLEARANCE BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS

FOR 69KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE CENTERLINE OF THE DISTRIBUTION CROSS ARM SHALL NOT BE LESS THAN 10' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY TRANSMISSION ENGINEERING.

FOR 138KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE CENTERLINE OF THE DISTRIBUTION CROSS ARM SHALL NOT BE LESS THAN 11' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY TRANSMISSION ENGINEERING.

MINIMUM VERTICAL CLEARANCES BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS VARY ACCORDING TO THE TRANSMISSION FRAMING, VOLTAGE, SPAN LENGTH, AND CONDUCTOR TENSION. CLEARANCES AT MID-SPAN MUST ALSO BE CONSIDERED. FOR OTHER TRANSMISSION VOLTAGES OR FOR SITUATIONS NOT ADDRESSED ABOVE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO DETERMINE THESE MINIMUM CLEARANCES.

SPECIAL SITUATIONS

IF EXTENUATING CIRCUMSTANCES EXIST THAT ABSOLUTELY PROHIBIT THE USE OF A STEEL TRANSMISSION POLE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO CONSIDER THESE OPTIONS:

1. PLACE A WOODEN TRANSMISSION POLE INSTEAD OF A STEEL POLE.
2. SET A SEPARATE WOODEN POLE FOR DISTRIBUTION. THIS CAN BE A WOODEN POLE ADJACENT TO THE STEEL TRANSMISSION POLE OR A SKIP SPAN / INTERMEDIATE POLE. THE USE OF SKIP SPAN / INTERMEDIATE POLES IS ACCEPTABLE AND ENCOURAGED WHERE APPROPRIATE.
3. RELOCATE THE OVERHEAD DISTRIBUTION LINE.
4. CONVERT THE OVERHEAD DISTRIBUTION LINE TO UNDERGROUND.

WHERE POSSIBLE AND PRACTICAL, THE PREFERRED METHOD IS TO NOT ATTACH DISTRIBUTION TO TRANSMISSION STEEL POLES.

GENERAL NOTES

1. WHEN UNDERBUILD IS ADDED TO A TRANSMISSION LINE, TRANSMISSION GUYS MUST BE INSULATED TO PREVENT TRANSMISSION VOLTAGE FROM TRANSFERRING TO THE DISTRIBUTION LINE AND TO KEEP DISTRIBUTION VOLTAGE FROM TRANSFERRING TO THE BOTTOM OF THE GUY SHOULD THE TRANSMISSION GUY BECOME SLACK OR BROKE.
2. ALL STEEL POLES SHALL BE BONDED TO THE SYSTEM NEUTRAL.
3. VERIFY THE GROUNDING CONNECTION IS PRESENT AT THE BASE OF THE POLE WHEN DISTRIBUTION CONSTRUCTION BEGINS. REPORT ANY MISSING POLE GROUND CONNECTIONS TO C+M SUPERVISOR.

DUKE ENERGY.

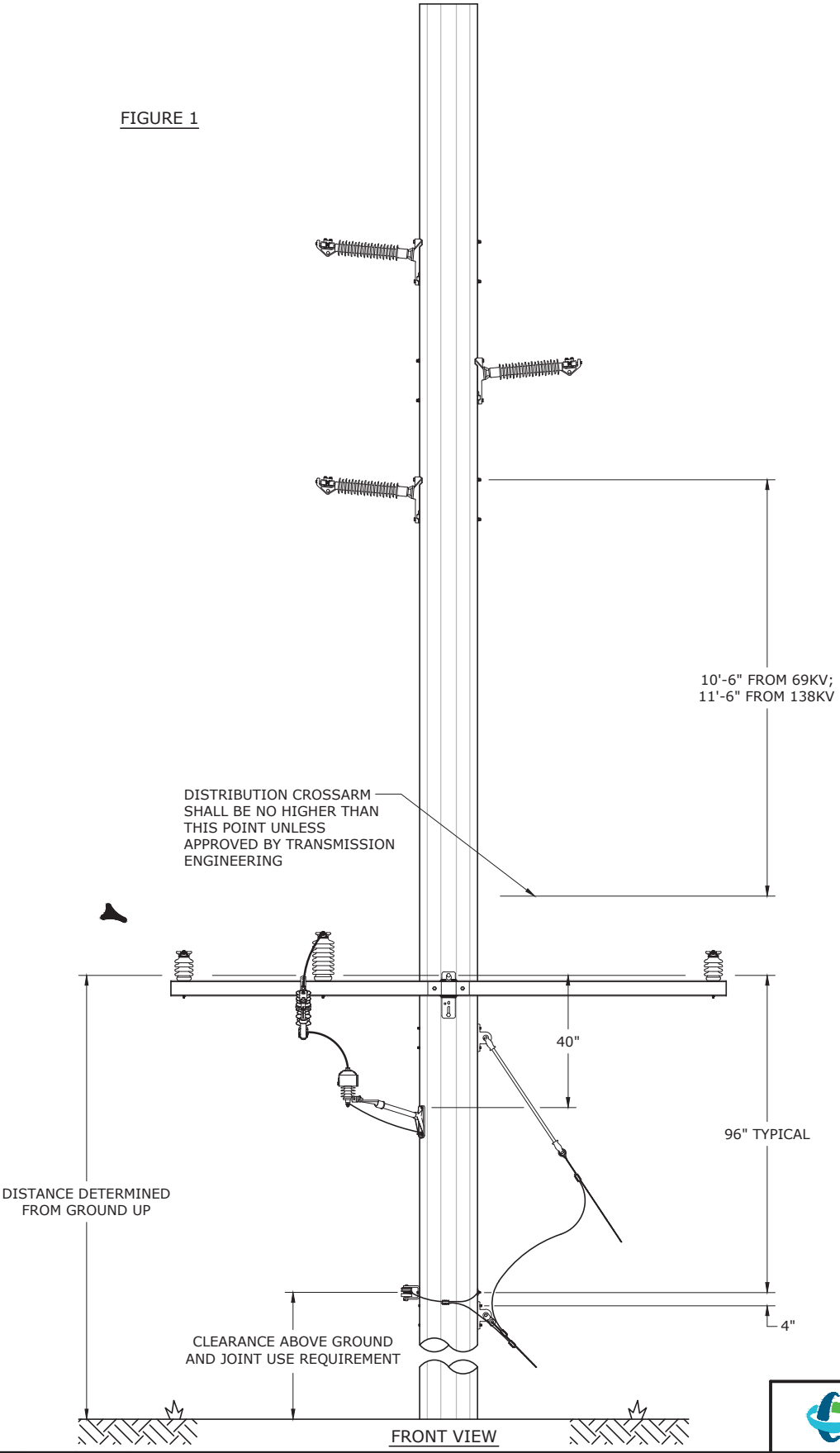
REVISED		BY	CK'D	APPR.
3				
2				
1	12/31/16	GORLEY	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK

GENERAL INFORMATION - ELECTRIC DISTRIBUTION ON STEEL TRANSMISSION POLES

DEC	DEM	DEP	DEF
X	X	X	X

03.24-100A

FIGURE 1



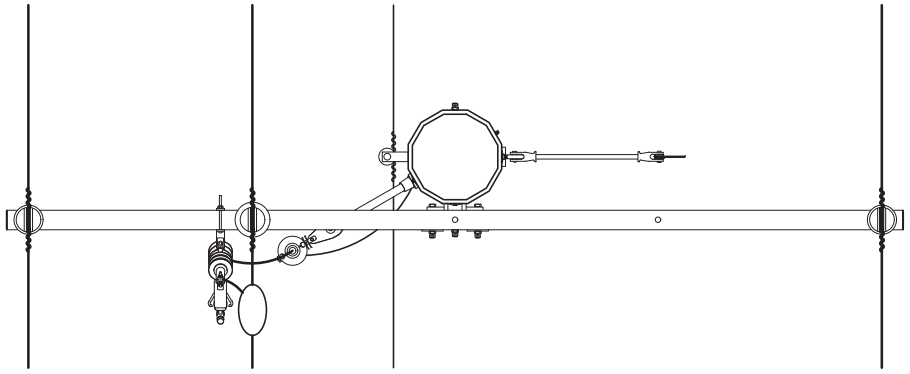
REVISED	BY	CHK'D	APPR.
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 12/31/16	GORLEY	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

GENERAL INFORMATION - ELECTRIC DISTRIBUTION ON STEEL TRANSMISSION POLES

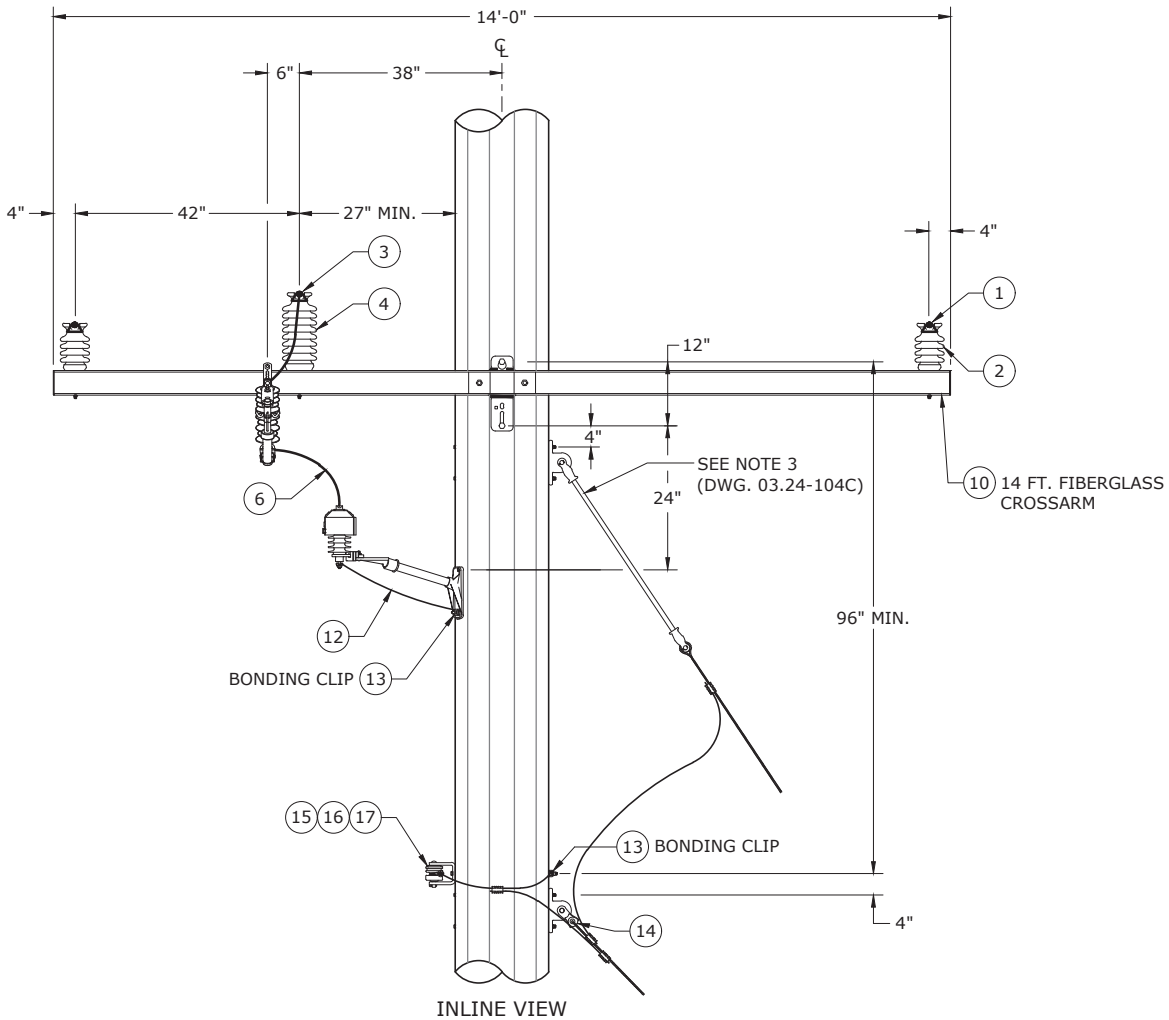
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-100B



PLAN VIEW



INLINE VIEW

NOTES:

1. SEE DWG. 03.24-104B FOR SIDE VIEW. SEE DWG. 03.24-104C FOR BILL OF MATERIALS AND NOTES.
2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.
3. MOUNT THE EMB AT AN ANGLE SO THAT IT WILL NOT BE IN THE WAY OF POSSIBLE FUTURE DOWN GUYS OR TAPS.

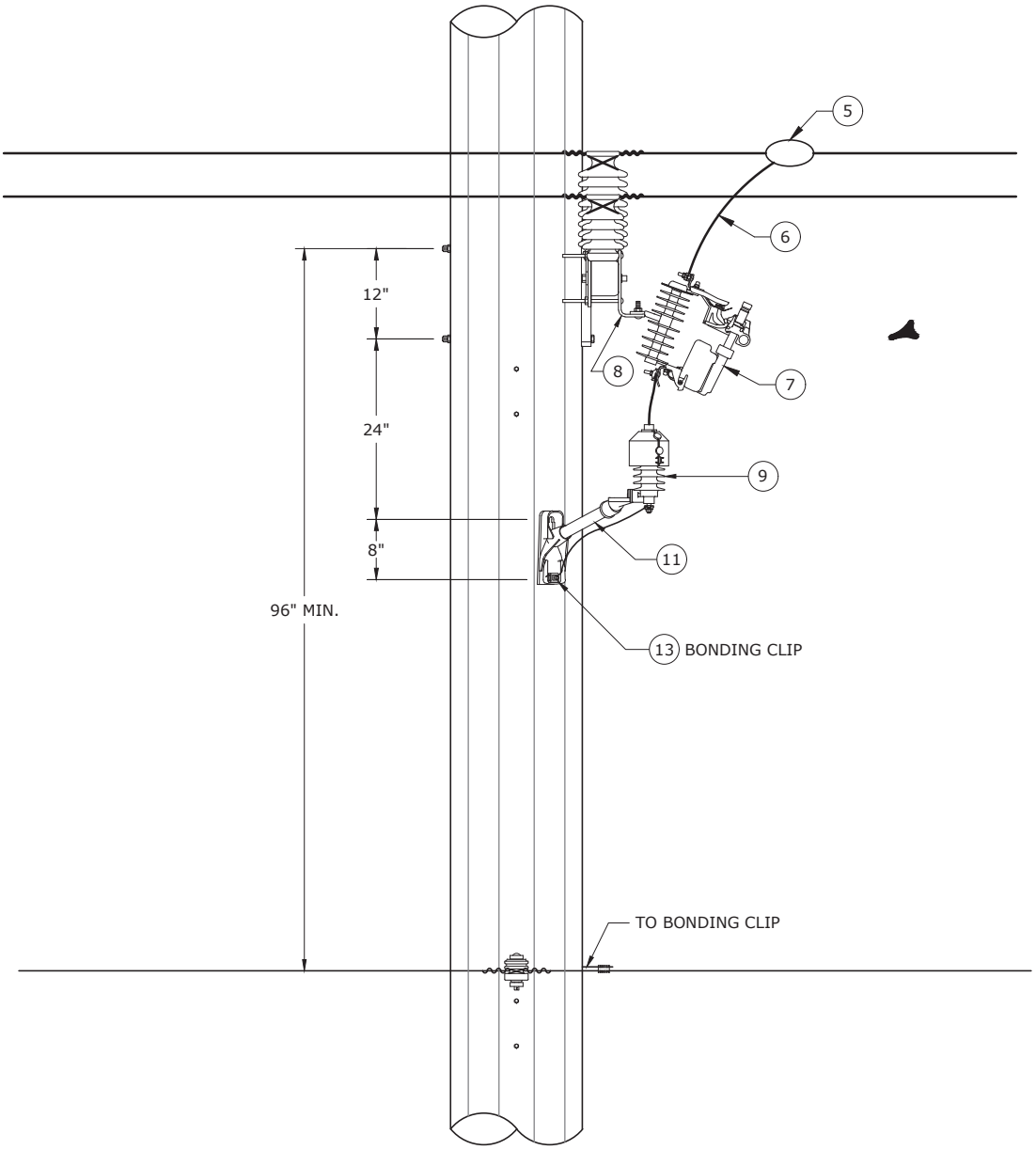
REVISED	BY	CHK'D	APPR.
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

TANGENT CONSTRUCTION UNDERBUILD ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-104A



SIDE VIEW

NOTES:

1. SEE DWG. 03.24-104A FOR INLINE AND PLAN VIEWS. SEE DWG. 03.24-104C FOR BILL OF MATERIALS AND NOTES.
2. SEE DWG. 02.03-112 FOR BONDING CLIP DETAILS.
3. MOUNT THE EMB AT AN ANGLE SO THAT IT WILL NOT BE IN THE WAY OF A FUTURE DOWN GUY OR TAP.

3				
2	3/31/18	BRUINS	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

TANGENT CONSTRUCTION UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-104B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
	INSL-POST-35KV-PORC-TT-F	2	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN, ANSI
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	TIE-TOP-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
4	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	CONN-OH-STRP-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
5	CONN-OH-HLC-2/0CU-8CUSOL-F	1	933034	1	CONNECTOR, OH, HOT LINE CLAMP
6	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
7	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	ARM-SGL-14-FBG-NB-F	1	1517219	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 14' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
11	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	2	WASHER,LOCK, DBL COIL SPRING, 5/8", GALV STL
11	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
12	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
13	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
14	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
15	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
16	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
16	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
17	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE DWG. 03.04-102L FOR WIRE TIE DETAILS

NOTES:

1. SEE DWG. 03.24-104A AND 03.24-104B FOR DESIGN SPECIFICATIONS.
2. INSTALL THE EMB WITH "NUT" SIDE OF LOWER BOLT ON THE BRACKET SIDE. THIS WILL ALLOW THE BONDING CLIP FOR THE ARRESTER GROUND TO ATTACH BELOW THE ARRESTER ON THE EMB BRACKET.
3. FOR ANGLE APPLICATIONS, SEE DWG. 02.04-101A FOR GUY ATTACHMENT POINT ON STEEL POLE, MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
4. AFTER DRILLING GALVANIZED POLE, USE ITEM # 50102957 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

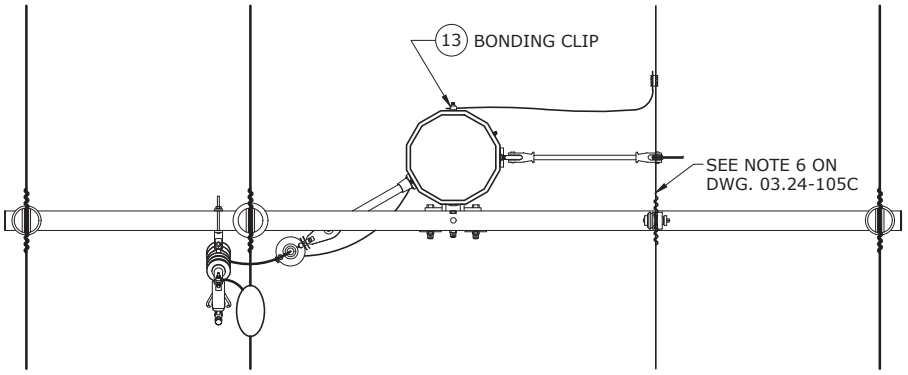
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

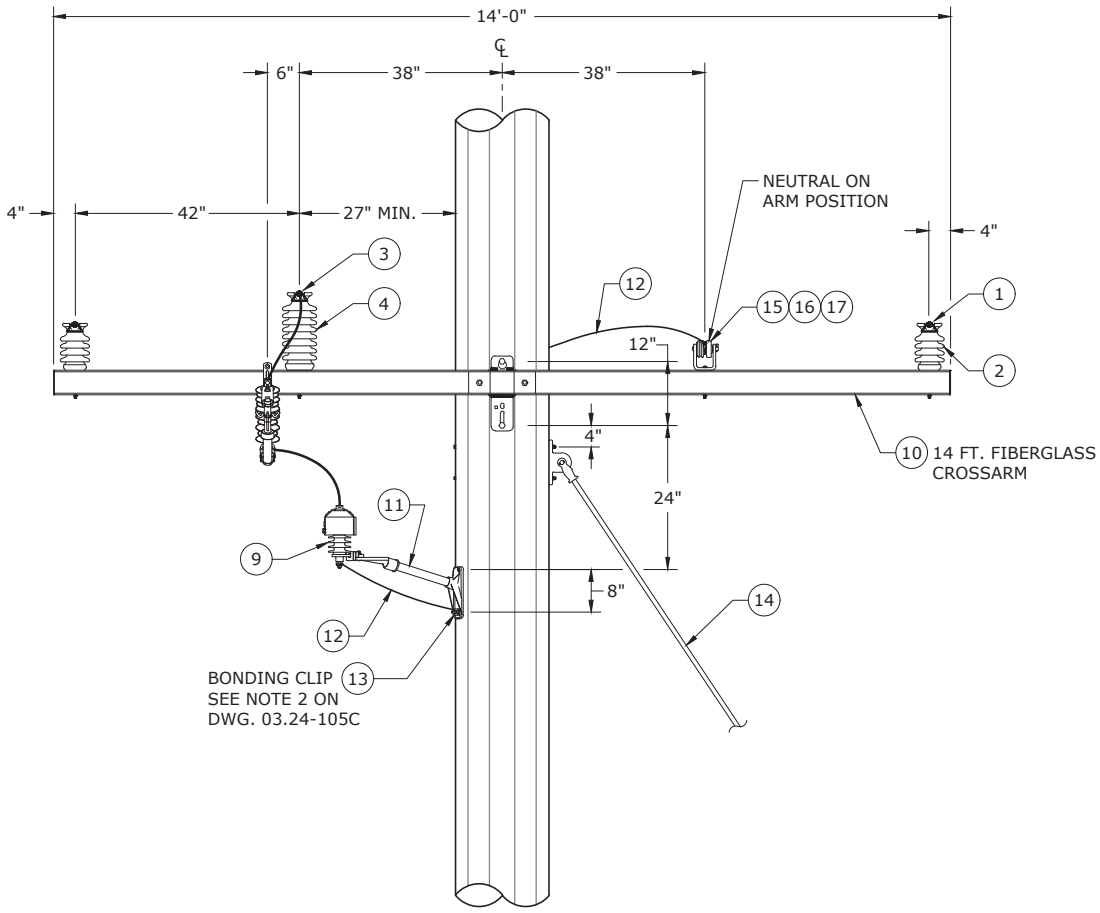
DEC	DEM	DEP	DEF
			X

TANGENT CONSTRUCTION UNDERBUILD
ON STEEL TRANSMISSION POLE

03.24-104C



PLAN VIEW



INLINE VIEW

NOTES:

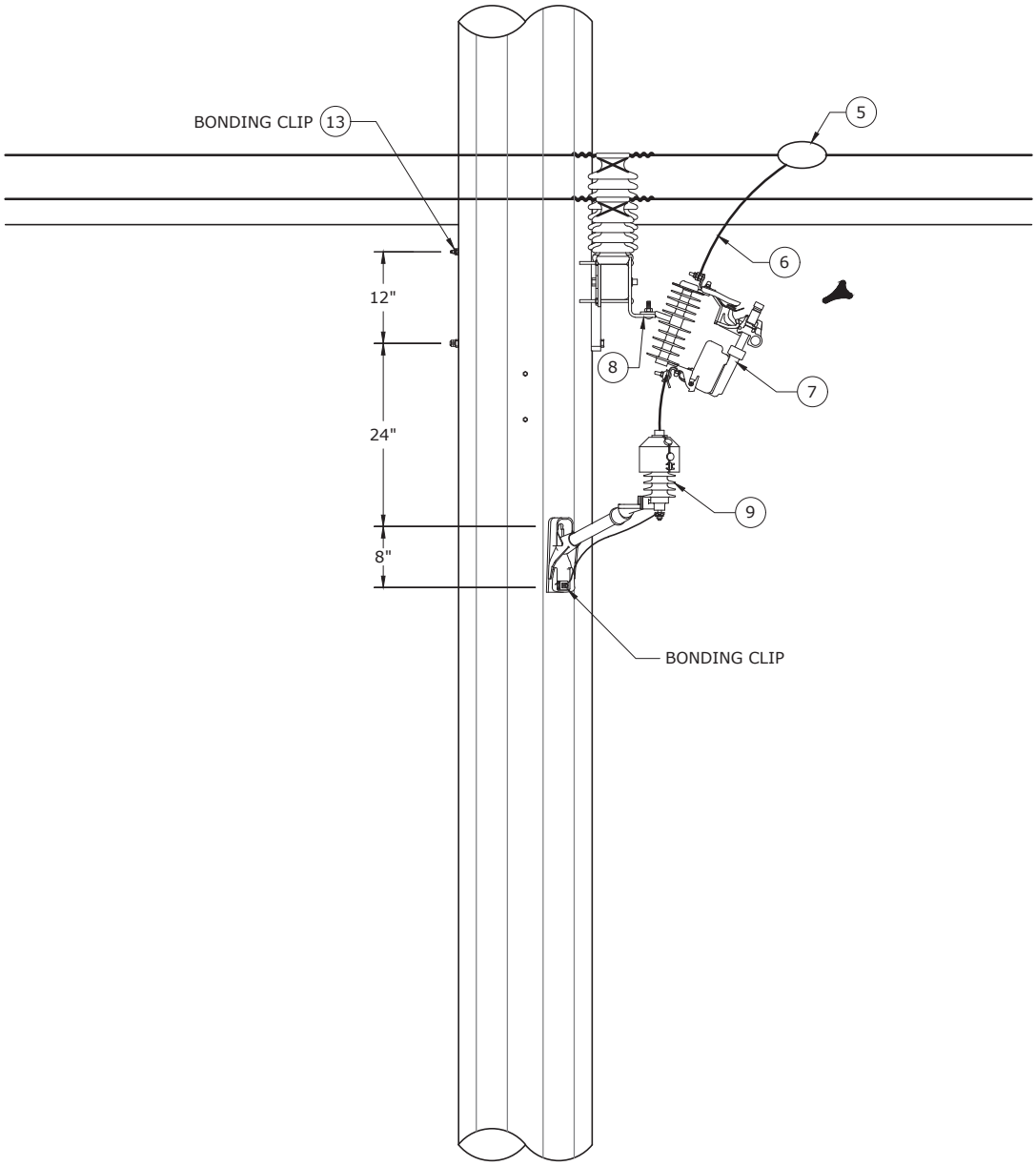
1. NEUTRAL SHOULD ONLY BE PLACED ON PHASE ARM IF EXISTING SITUATION PREVENTS PROPER CLEARANCES.
2. SEE DWG. 03.24-105B FOR SIDE VIEW AND DWG. 03.24-105C FOR BILL OF MATERIALS AND NOTES.
3. ROTATE EMB 30 DEGREES IF DOWN GUY IS IN THE WAY.

REVISED	BY	CHK'D	APPR.
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

TANGENT CONSTRUCTION UNDERBUILD ON STEEL TRANSMISSION POLE (WITH NEUTRAL ON CROSSARM MIDDLE-PHASE PROTECTED)

DEC	DEM	DEP	DEF
X	X	X	X

03.24-105A



SIDE VIEW

NOTES:

1. SEE DWG. 03.24-105A FOR INLINE AND PLAN VIEWS. SEE DWG. 03.24-105C FOR BILL OF MATERIALS AND NOTES.
2. SEE DWG. 02.03-112 FOR BONDING CLIP DETAILS.
3. MOUNT THE EMB AT AN ANGLE SO THAT IT WILL NOT BE IN THE WAY OF A FUTURE DOWN GUY OR TAP.

REVISED	BY	CHK'D	APPR.
3			
2	3/31/18	BRUINS	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK

TANGENT CONSTRUCTION UNDERBUILD ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-105B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	TIE-TOP-(WIRE)-AL-FNECK-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
4	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	CONN-OH-STRP-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
5	CONN-OH-HLC-2/0CU-8CUSOL-F	1	933034	1	CONNECTOR, OH, HOT LINE CLAMP
6	LEAD-EQ-6-CU-COVER-F	1	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
7	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	ARM-SGL-14-FBG-NB-F	1	1517219	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 14' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
11	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
11	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
12	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
13	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
14	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
15	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
16	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
16	HDWR-MACH-SM-8IN-GALV-F	1	931539	1	BOLT, MACHINE, 5/8" DIA, UNC, 8" LG, SQ HEAD, GALV STL, CONE
17	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

NOTES:

1. SEE DWGS. 03.24-105A AND 03.24-105B FOR DESIGN SPECIFICATIONS.
2. INSTALL 10 FT. TANGENT ARM WITH "NUT" SIDE OF LOWER BOLT ON THE GAIN BRACKET SIDE. THIS WILL ALLOW BONDING CLIP FOR ARRESTER GROUND BUS TO ATTACH AT LOWER BOLT OF GAIN BRACKET.
3. FOR ANGLE APPLICATIONS, SEE DWG. 02.04-101A FOR GUY ATTACHMENT POINT ON STEEL POLE, MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
4. AFTER DRILLING GALVANIZED POLE, USE ITEM # 50102957 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

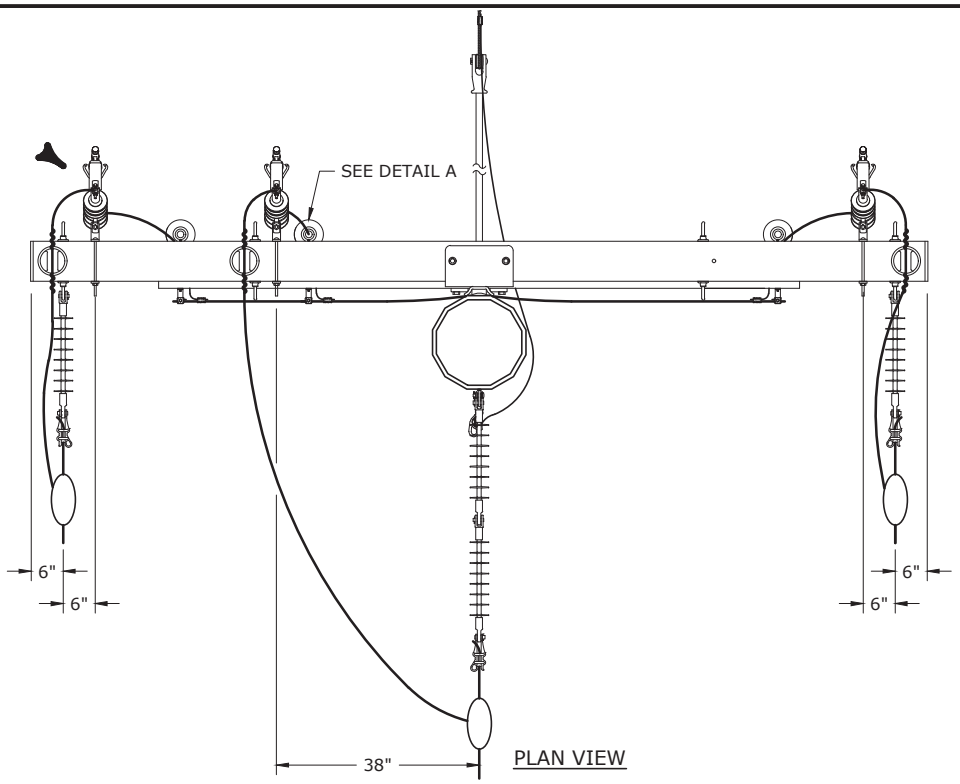
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DUKE ENERGY.

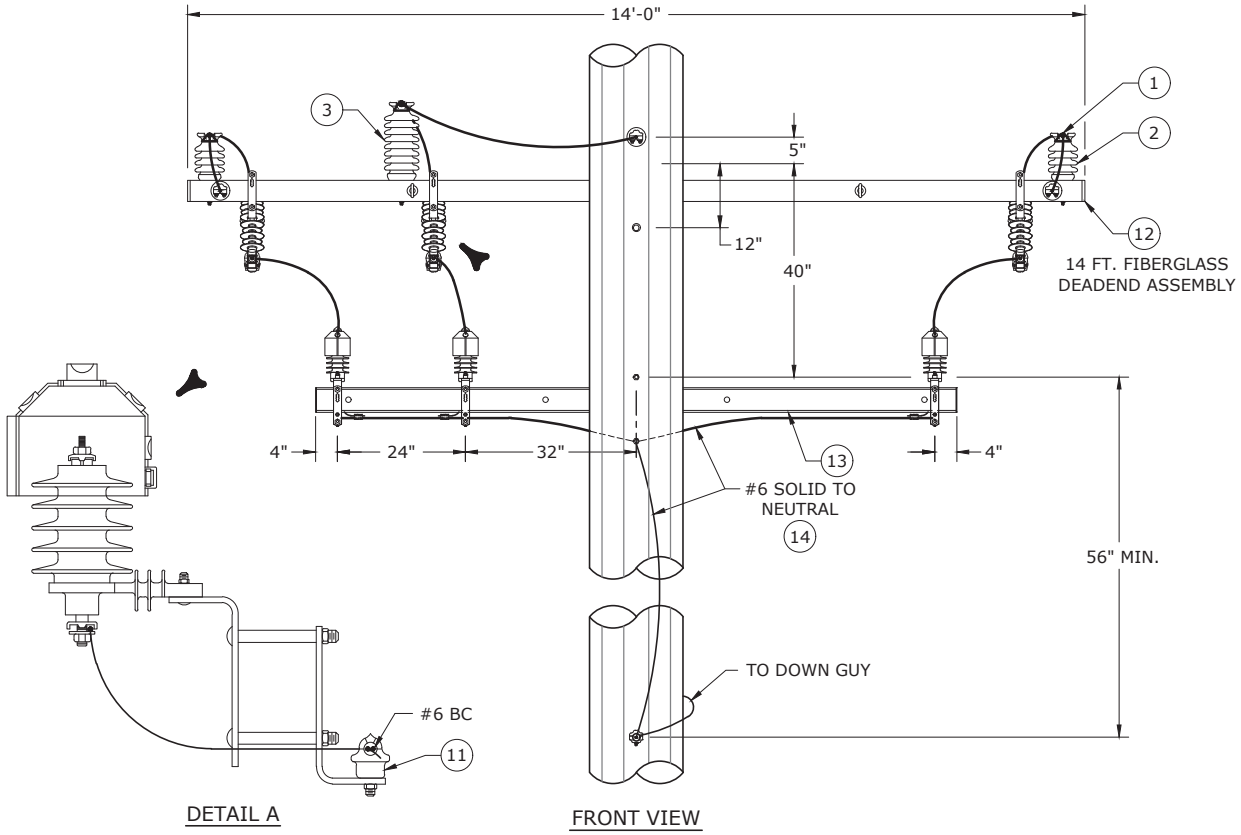
TANGENT CONSTRUCTION UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
			X

03.24-105C



PLAN VIEW



DETAIL A

FRONT VIEW

NOTES:

1. SEE DWG. 03.24-106B FOR SIDE VIEW AND DWG. 03.24-106C FOR NOTES AND BILL OF MATERIALS.

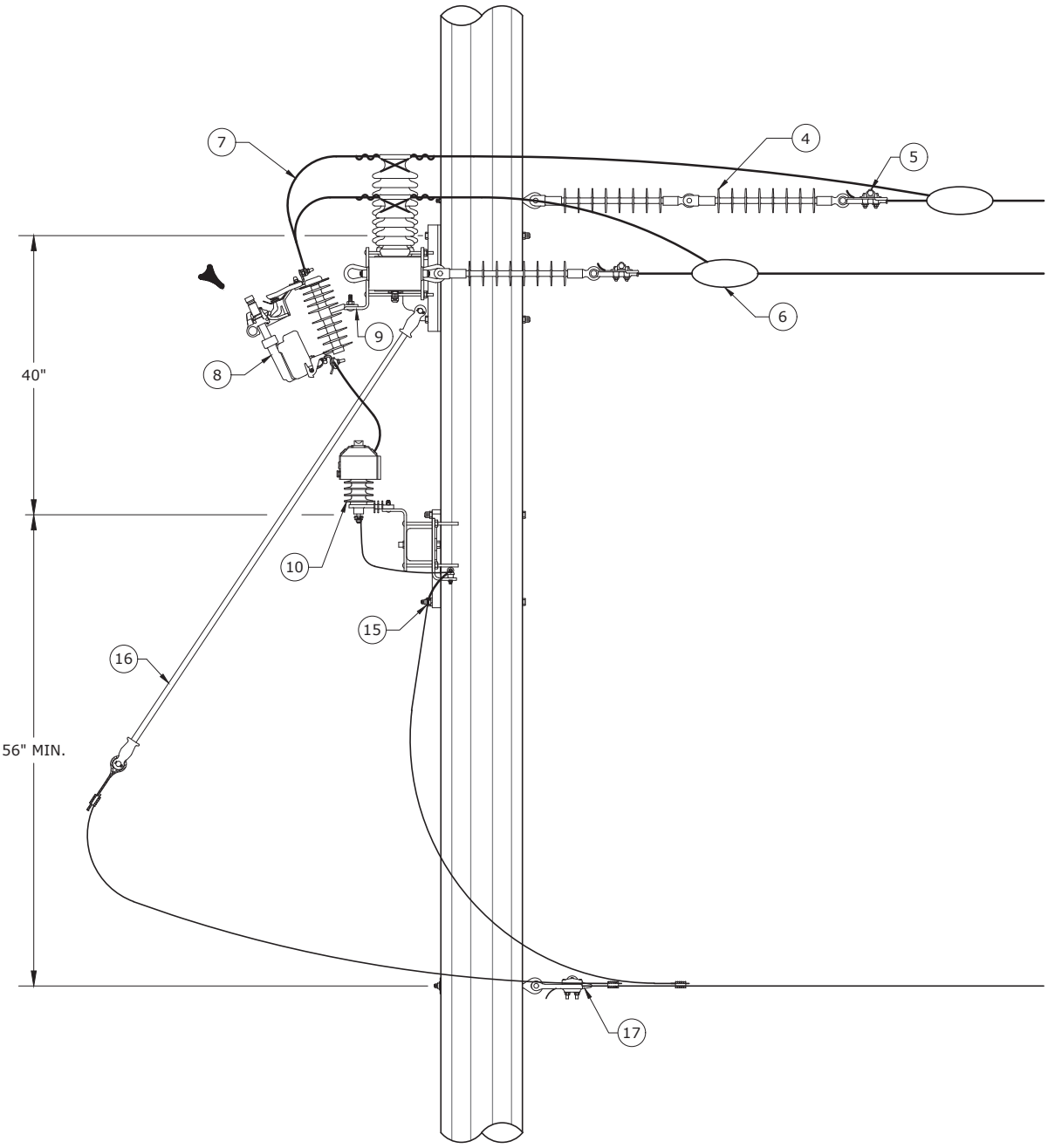
3				
2	3/31/18	BRUINS	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-106A



SIDE VIEW

NOTES:

1. SEE DWG. 03.24-106A FOR FRONT AND PLAN VIEWS. SEE DWG. 03.24-106C FOR BILL OF MATERIALS AND NOTES.

REVISED		BY	CHK'D	APPR.
3				
2	3/31/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK

DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-106B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
3	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
4	INSL-DE/S-35KV-POLY-F	4	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	CONN-OH-STRP-(TYPE)-(SIZE)-F	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
6	CONN-OH-HLC-2/0CU-8CUSOL-F	3	933034	1	CONNECTOR, OH, HOT LINE CLAMP
7	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	BKT-EM-ARM-1P-STL-LG-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
			1519723	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 10" LG, HOT DIP GALV STL
10	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
10	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
11	CONN-OH-TAP-GND-2/0CU-FLAT-F	3	1490109	1	CONNECTOR, ELECTRICAL, TERMINAL, CABLE TO FLAT (TLS)
12	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
12	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
13	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
13	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
14	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
15	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
16	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
17	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
17	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
17	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL

NOTES:

1. SEE DWG. 03.24-106A FOR FRONT AND PLAN VIEWS. SEE DWG. 03.24-106B FOR SIDE VIEW.
2. AFTER DRILLING GALVANIZED POLE, USE ITEM # 420444 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
3. SEE POLEFOREMAN FOR GUY AND ANCHOR STRENGTH INFORMATION.
4. FOR ANGLE APPLICATIONS, SEE DWG. 02.04-101A FOR GUY ATTACHMENT POINT ON STEEL POLE, MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

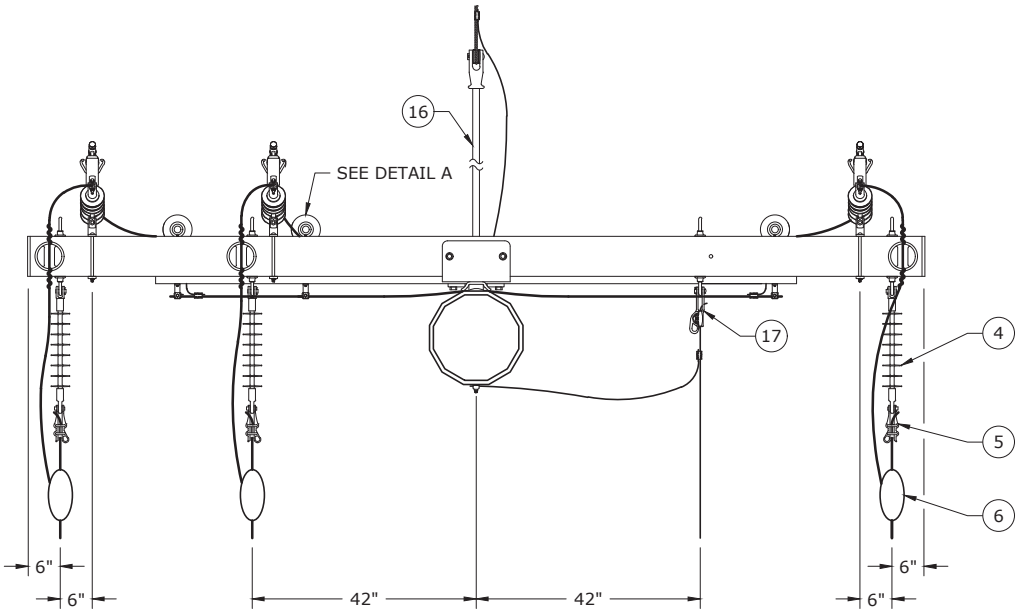
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3			
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

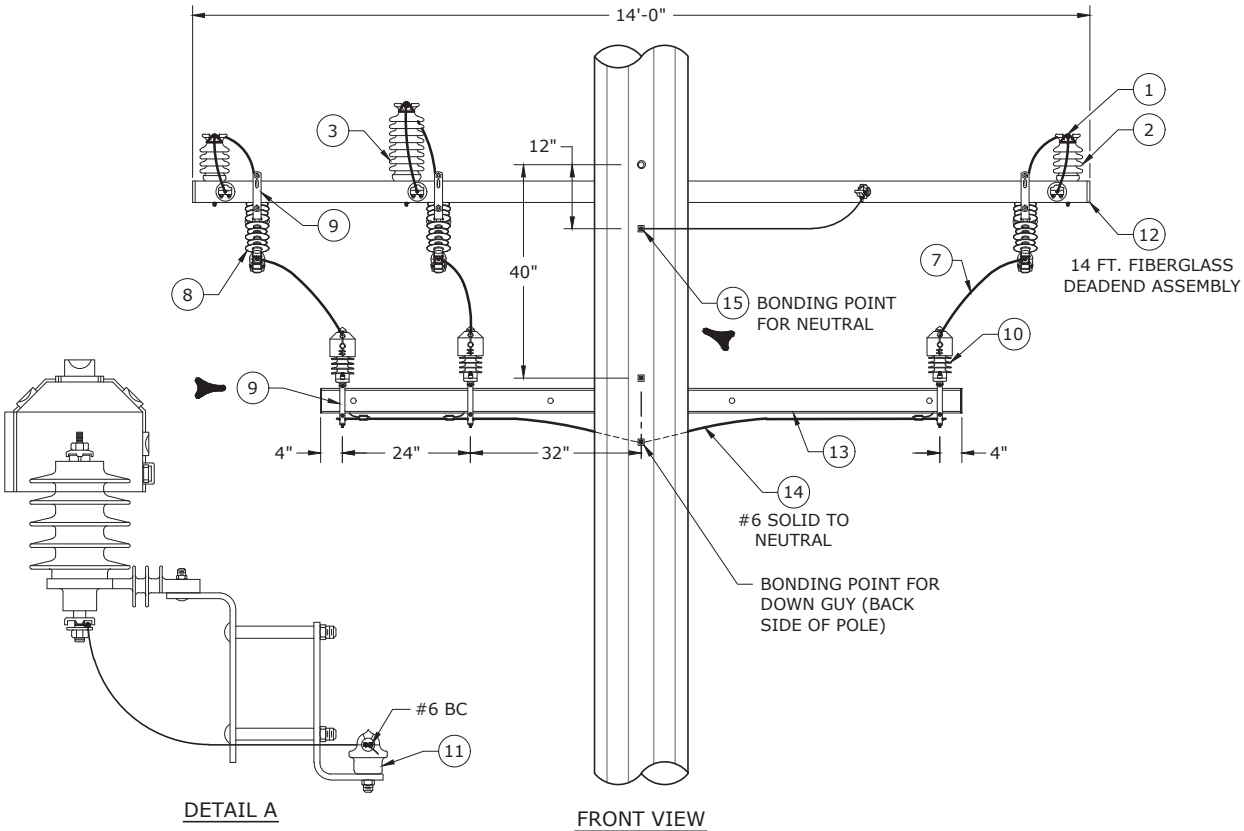
DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
			X

03.24-106C



PLAN VIEW



DETAIL A

FRONT VIEW

NOTES:

1. SEE DWG. 03.24-106A FOR PREFERRED METHOD. NEUTRAL SHOULD ONLY BE PLACED ON PHASE ARM IF EXISTING SITUATION PREVENTS PROPER CLEARANCES.

2. SEE DWG. 03.24-107B FOR NOTES AND BILL OF MATERIALS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BRUINS	BURLISON	ADCOCK
2 3/31/18	BENDER	BURLISON	ADCOCK
1 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

FOUR-POSITION DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-107A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
3	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
4	INSL-DE/S-35KV-POLY-F	3	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
5	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	CONN-OH-STRP-(TYPE)-(SIZE)-F	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	CONN-OH-HLC-2/0CU-8CUSOL-F	3	933034	1	CONNECTOR, OH, HOT LINE CLAMP
7	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	BKT-EM-ARM-1P-STL-LG-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
			1519723	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 10" LG, HOT DIP GALV STL
10	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
10	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
11	CONN-OH-TAP-GND-2/0CU-FLAT-F	3	1490109	1	CONNECTOR, ELECTRICAL, TERMINAL, CABLE TO FLAT (TLS)
12	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
12	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
13	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
13	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
14	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
15	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
16	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
17	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SEE DWG. 03.24-107A FOR FRONT AND PLAN VIEWS.
2. AFTER DRILLING GALVANIZED POLE, USE ITEM # 420444 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
3. SEE POLEFOREMAN FOR GUY AND ANCHOR STRENGTH INFORMATION.
4. FOR ANGLE APPLICATIONS, SEE DWG. 02.04-101A FOR GUY ATTACHMENT POINT ON STEEL POLE, MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
5. BOND DOWN GUY TO ARRESTER GROUND BUS.
6. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

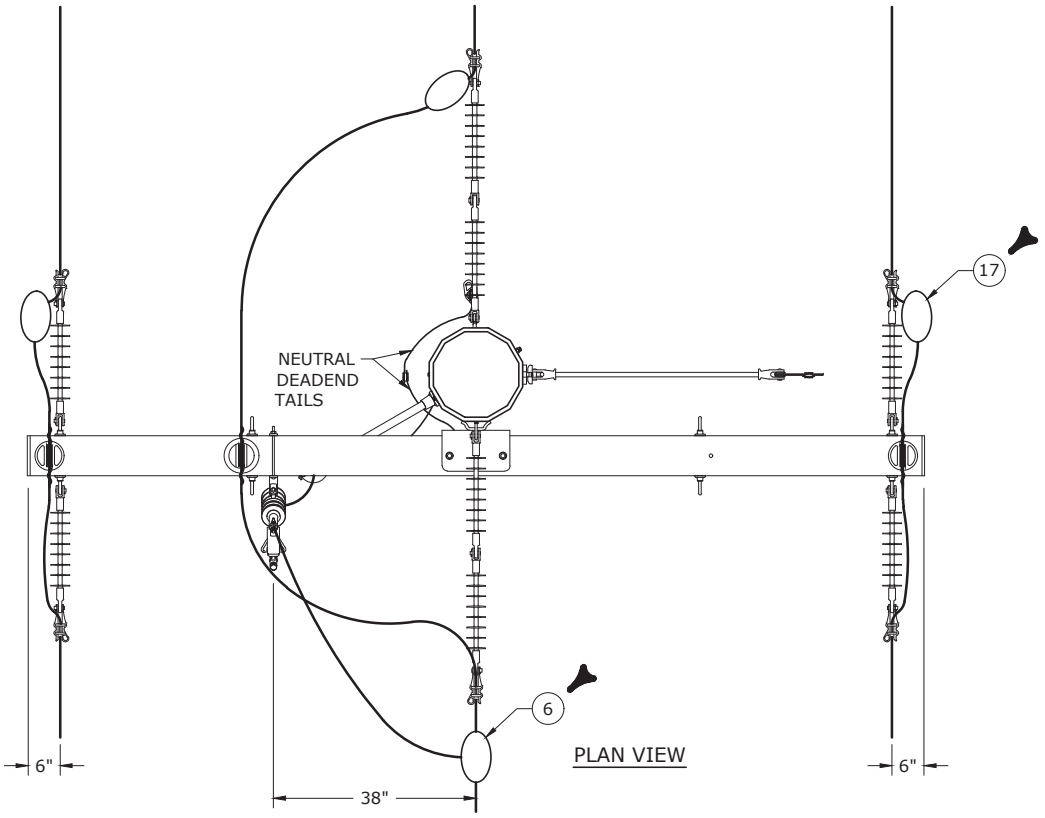
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

FOUR-POSITION DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

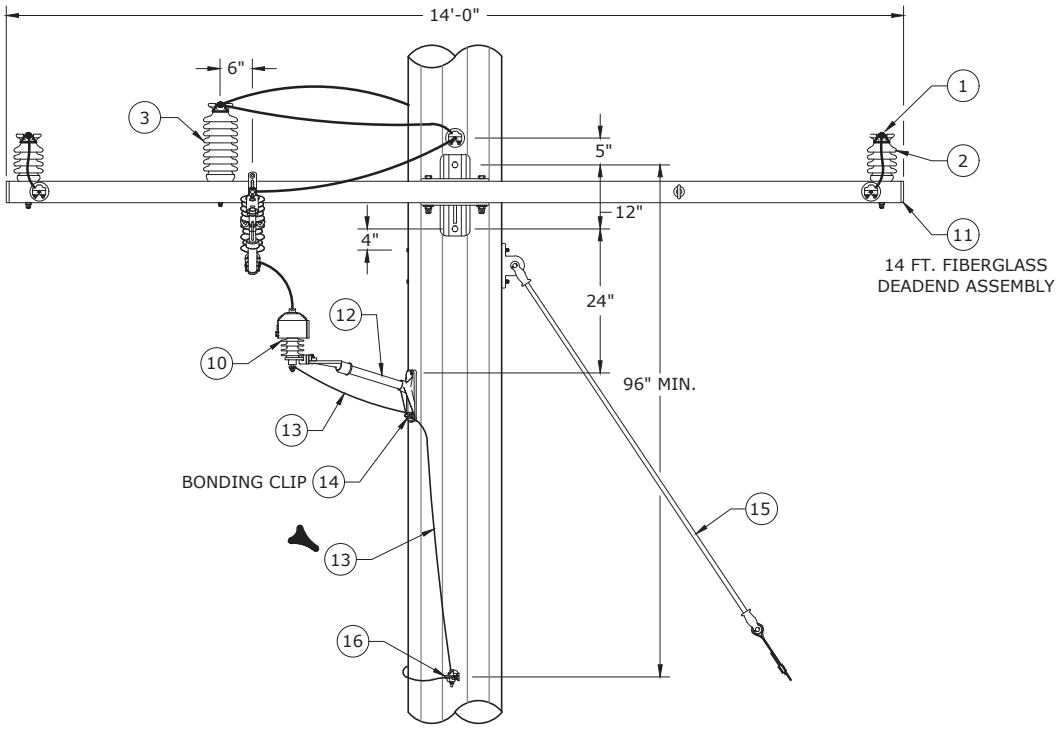
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.24-107B



PLAN VIEW



14 FT. FIBERGLASS
DEADEND ASSEMBLY

INLINE VIEW

NOTES:

1. SEE DWG. 03.24-108B FOR SIDE VIEW AND DWG. 03.24-108C FOR NOTES AND BILL OF MATERIALS.

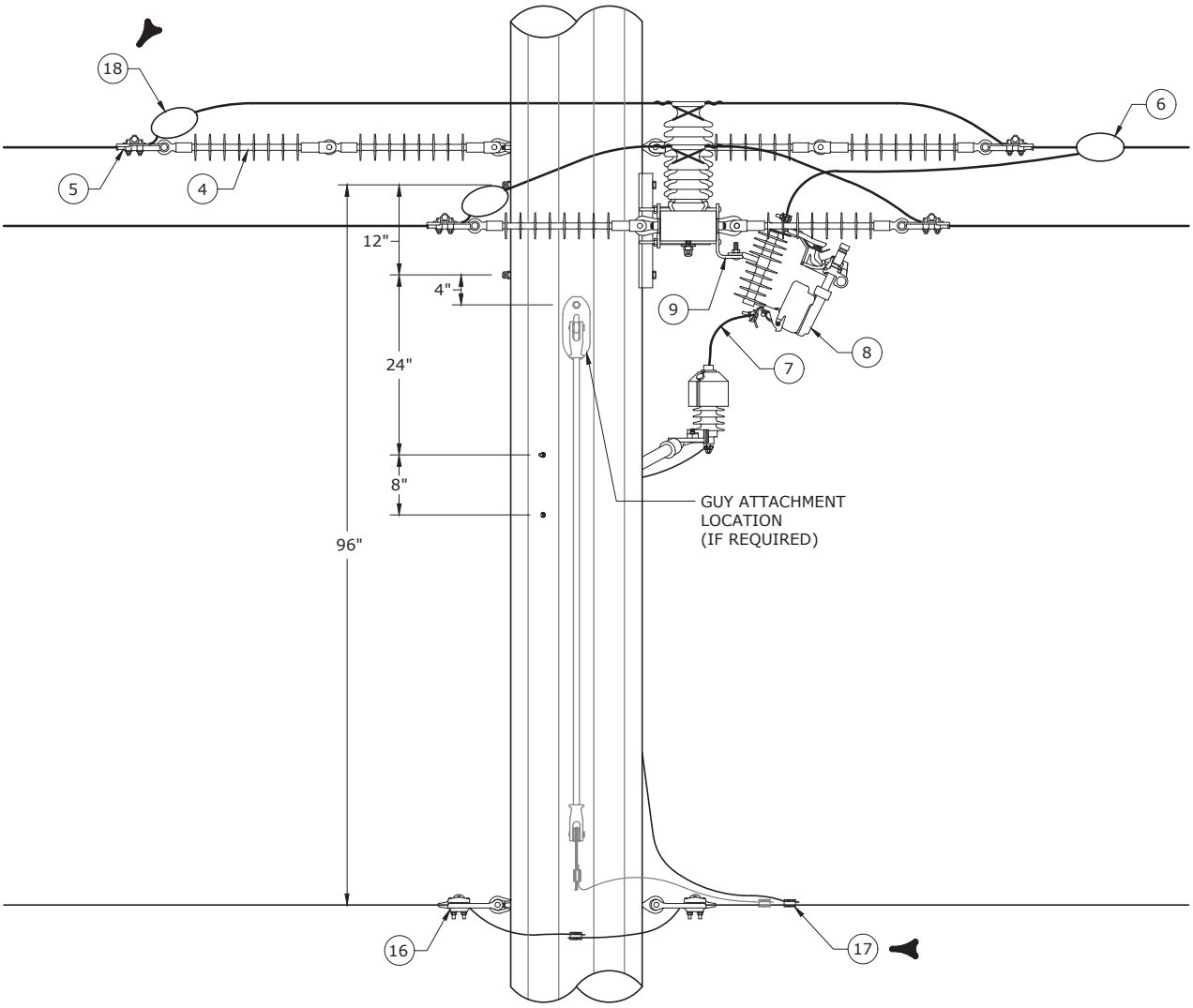
2. ROUTE MIDDLE PHASE TO OPPOSITE SIDE OF POLE AWAY FROM DOWN GUY.

REVISED		BY	CHK'D	APPR.
3	4/30/18	BRUINS	BURLISON	ADCOCK
2	3/31/18	BRUINS	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK

DOUBLE DEAD-END UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-108A



SIDE VIEW

NOTES:

1. SEE DWG. 03.24-108A FOR INLINE AND PLAN VIEWS.
2. SEE DWG. 03.24-108C FOR BILL OF MATERIALS.
3. SEE DWG. 02.03-112 FOR BONDING CLIP DETAILS.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BRUINS	BURLISON	ADCOCK
2 3/31/18	BRUINS	BURLISON	ADCOCK
1 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

DOUBLE DEAD-END UNDERBUILD
ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-108B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	1	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
3	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
4	INSL-DE/S-35KV-POLY-F	8	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	CONN-OH-STRP-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
6	CONN-OH-HLC-2/0CU-8CUSOL-F	1	933034	1	CONNECTOR, OH, HOT LINE CLAMP
7	LEAD-EQ-6-CU-COVER-F	1	4192427	12FT	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	BKT-EM-ARM-1P-STL-LG-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
			1519723	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 10" LG, HOT DIP GALV STL
10	ARR-UB-10KV-F	1	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	1	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
10	WG-BUSH-COV-SM-F	1	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
11	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
11	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
12	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL,
			930030	2	WASHER,LOCK, DBL COIL SPRING, 5/8", GALV STL
12	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
13	GND-EQUIP-6-BOND-F	2	234664	5 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
14	GND-POLE-CLIP-5/8-F	2	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
15	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
16	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
16	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
16	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
17	CONN-OH-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS - BASED ON NEUTRAL SIZE
18	CONN-OH-(TYPE)-(SIZE)-F	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS - BASED ON PRIMARY SIZE

NOTES:

1. SEE DWG. 03.24-108A FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 03.24-108B FOR SIDE VIEW.
3. AFTER DRILLING GALVANIZED POLE, USE ITEM # 420444 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
4. SEE POLEFOREMAN FOR GUY AND ANCHOR STRENGTH INFORMATION.
5. FOR ANGLE APPLICATIONS, SEE DWG. 02.04-101A FOR GUY ATTACHMENT POINT ON STEEL POLE, MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
6. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

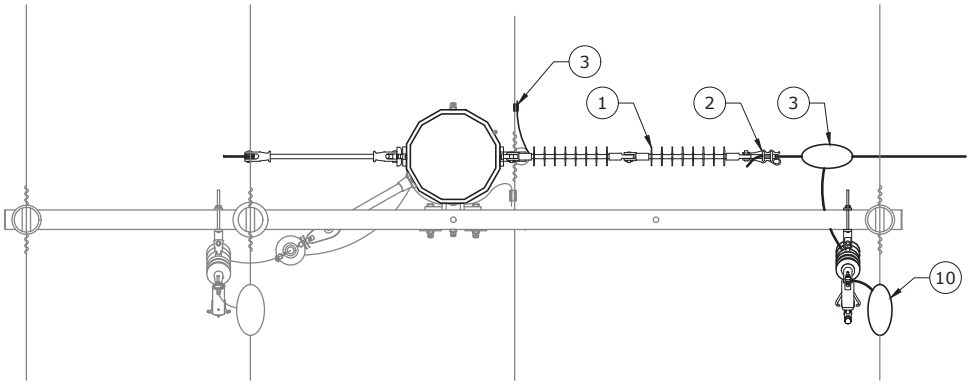
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

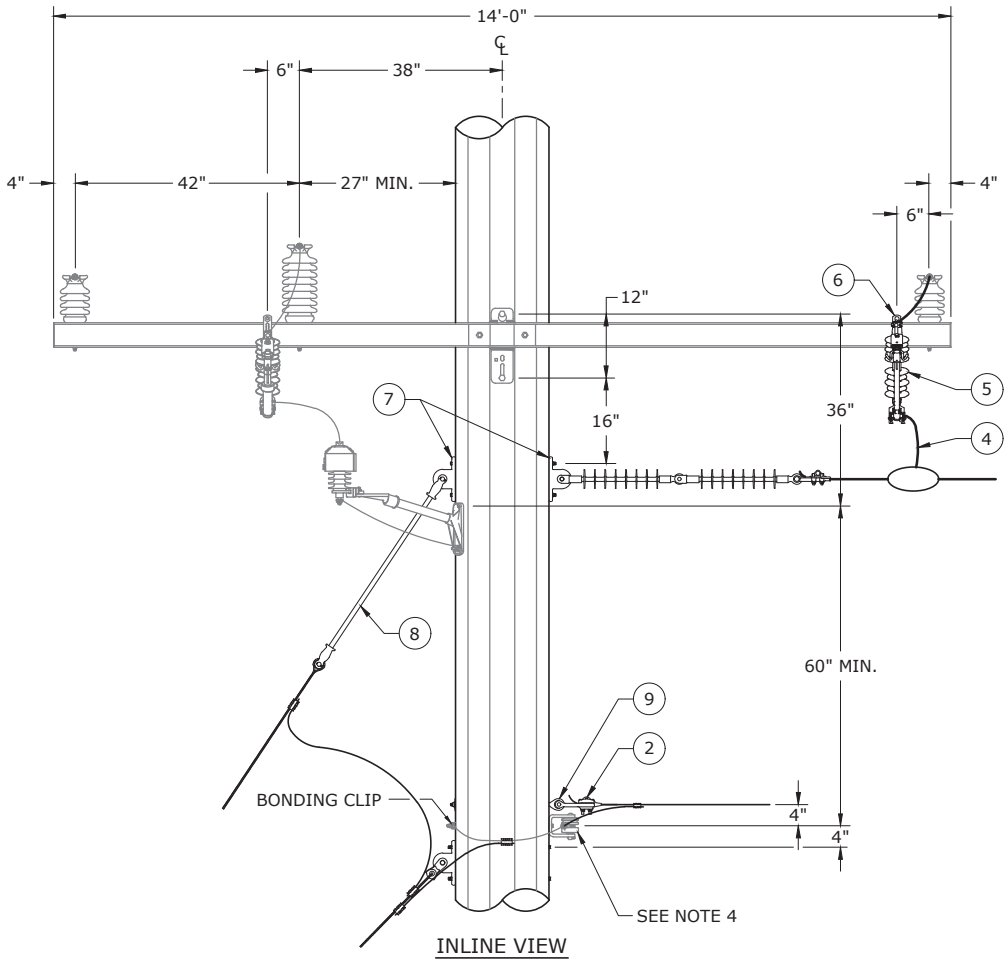
DOUBLE DEAD-END UNDERBUILD
ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
			X

03.24-108C



PLAN VIEW



INLINE VIEW

NOTES:

1. SEE DWG. 03.24-110C FOR BILL OF MATERIALS AND NOTES.
2. SEE DWG. 02.03-112 FOR BONDING CLIP DETAILS.
3. IF ADDING TAP TO EXISTING CONFIGURATION, MOVE FAULT TAMER CUTOUT TO LOCATION SHOWN.
4. CONNECT TAP NEUTRAL TO SYSTEM NEUTRAL.

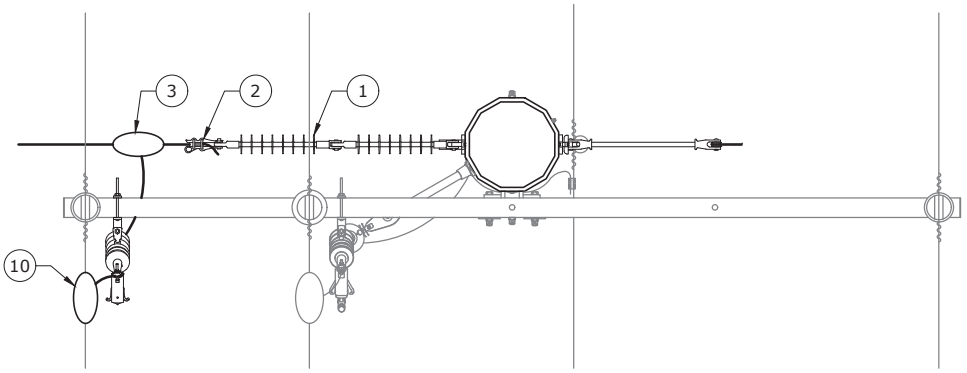
REVISED	BY	CHK'D	APPR.
4 4/30/18	BRUINS	BURLISON	ADCOCK
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

SINGLE-PHASE TAP UNDERBUILD ON STEEL TRANSMISSION POLE

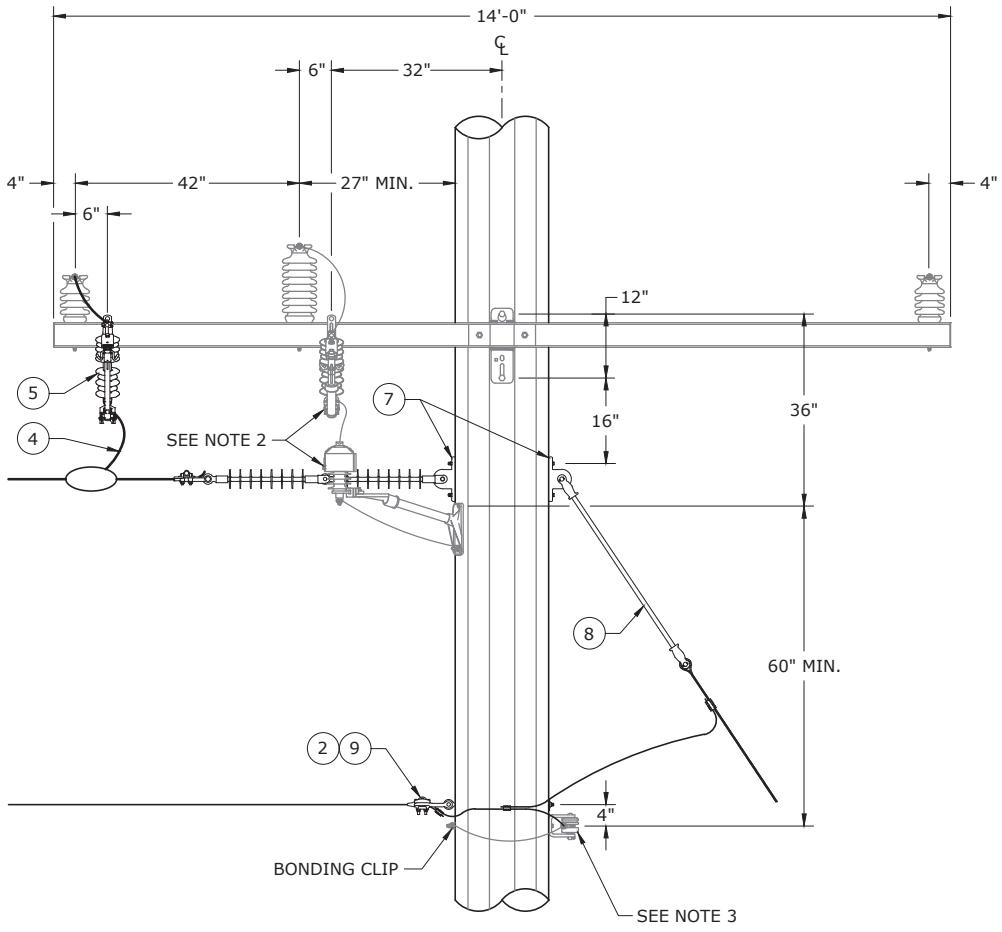
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-110A



PLAN VIEW



INLINE VIEW

NOTES:

1. SEE DWG. 03.24-110C FOR BILL OF MATERIALS AND NOTES.

2. IF ADDING TAP TO EXISTING CONFIGURATION, MOVE FAULT TAMER CUTOUT AND ARRESTER IF IT IS IN THE WAY.

3. CONNECT TAP NEUTRAL TO SYSTEM NEUTRAL.

REVISED		BY	CHK'D	APPR.
3				
2	3/31/18	BRUINS	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	GORLEY	BURLISON	ADCOCK

SINGLE-PHASE TAP UNDERBUILD ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-110B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
2	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	CONN-OH-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR NEUTRAL CONNECTOR (BASED ON NEUTRAL SIZE)
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-SM-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK,SPRING,3/8",7/16" ID,1/8" THK,GALV STL
7	GUY-PLATE-GALV-EYE-UB-F	2	50124576	1	PLATE, DEADEND TEE, 3-1/2" WD X 8-1/4" LG X 3-5/8" HT, STL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
8	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
9	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
9	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
9	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
10	PRIMARY CONNECTOR	1	-	1	SEE SECTION 04 FOR CONNECTOR (BASED ON PRIMARY SIZE)

NOTES:

1. SEE DWGS. 03.24-110A AND 03.24-110B FOR DESIGN SPECIFICATIONS.
2. AFTER DRILLING GALVANIZED POLE, USE ITEM # 420444 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
3. SEE POLEFOREMAN FOR GUY AND ANCHOR STRENGTH INFORMATION.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

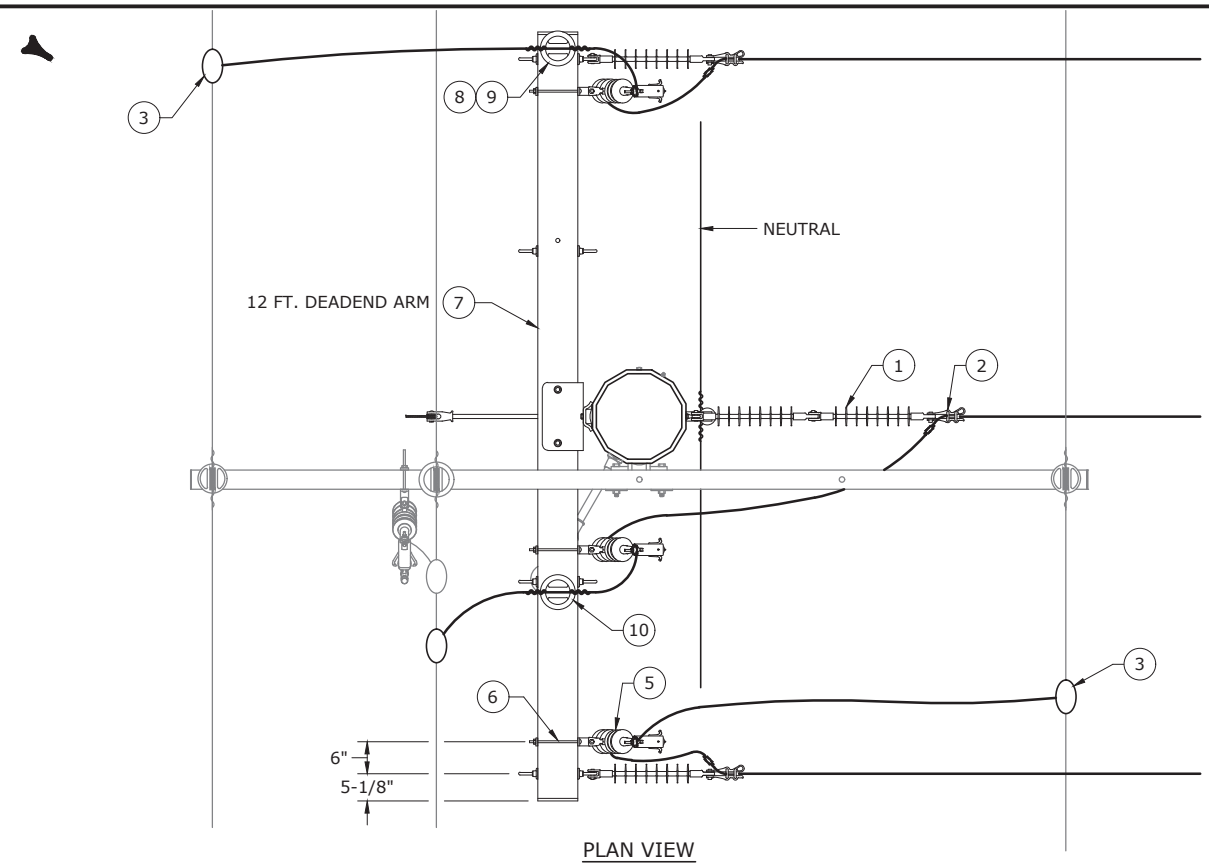
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BRUINS	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

SINGLE-PHASE TAP UNDERBUILD
ON STEEL TRANSMISSION POLE

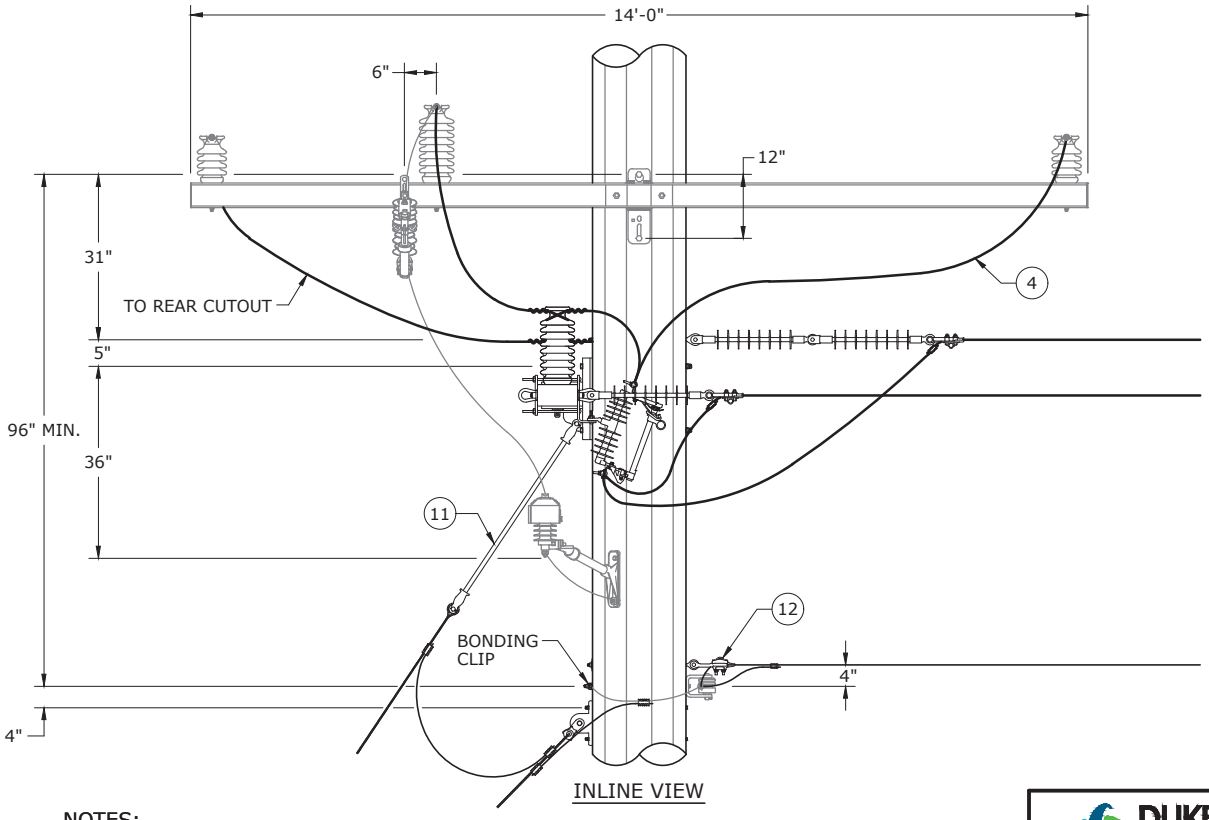
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.24-110C



PLAN VIEW



INLINE VIEW

NOTES:

1. SEE DWG. 03.24-115C FOR NOTES AND BILL OF MATERIALS.

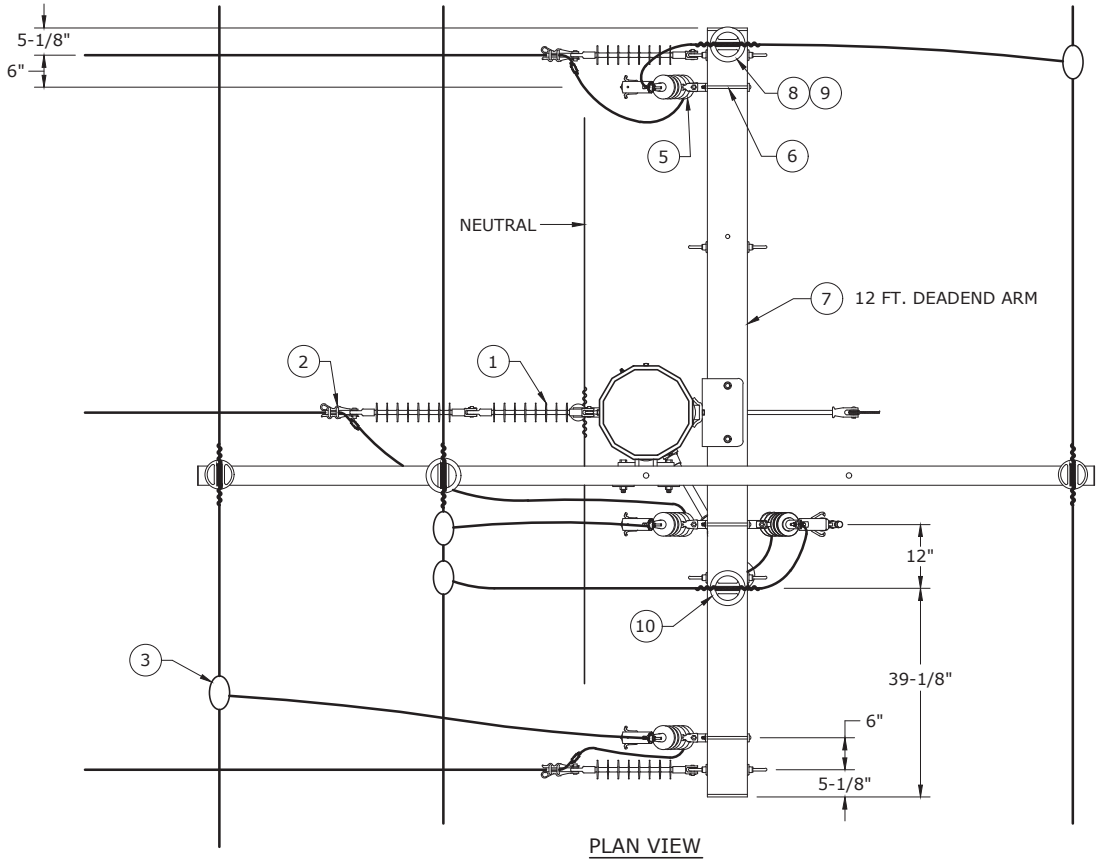
REVISED	BY	CHK'D	APPR.
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

THREE-PHASE TAP (RIGHT) UNDERBUILD ON STEEL TRANSMISSION POLE

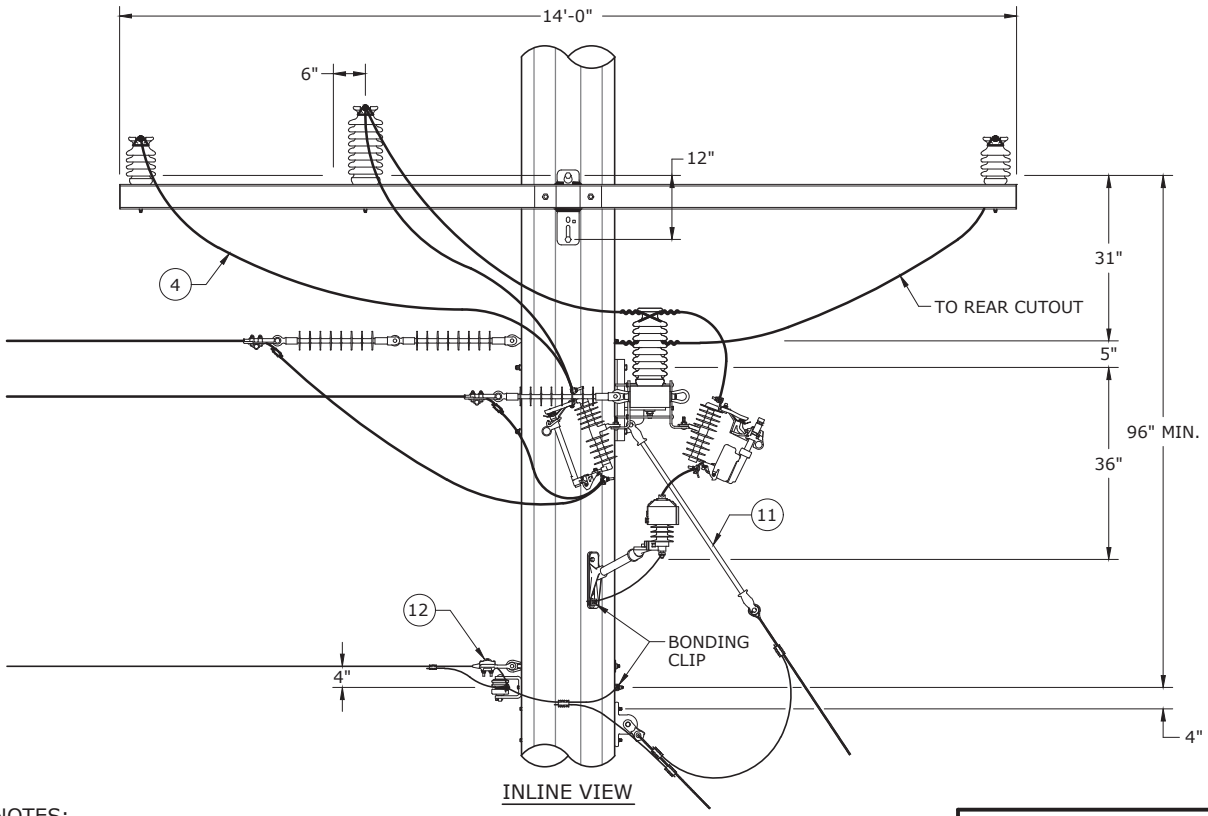
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-115A



PLAN VIEW



INLINE VIEW

NOTES:

1. SEE DWG. 03.24-115C FOR NOTES AND BILL OF MATERIALS.
2. SEE DWG. 02.03-112 FOR BONDING CLIP DETAILS.

REVISED	BY	CHK'D	APPR.
3 3/31/18	BRUINS	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 9/30/16	BURLISON	WHITE	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

THREE-PHASE TAP (LEFT) UNDERBUILD ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-115B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	4	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	PRIMARY CONNECTOR	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
5	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
6	BKT-EM-ARM-1P-STL-LG-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK,SPRING,3/8",7/16" ID,1/8" THK,GALV STL
			1519723	2	BOLT, CARRIAGE, 3/8" DIA, 16 UNC, 10" LG, HOT DIP GALV STL
7	ARM-SDE-14-FBG-NB-F	1	1479000	1	CROSSARM, DEADEND, 7-1/2" WD X 14' LG X 4" HT, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
8	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 6 AWG TO 2 AWG
9	INSL-POST-25KV-PORC-TT-F	2	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
9	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
10	INSL-POST-45KV-PORC-TT-F	1	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
10	INSL-STUD-STL-7IN-THD-F	1	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
11	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
12	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
12	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
12	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL

NOTES:

1. SEE DWGS. 03.24-115A AND 03.24-115B FOR DESIGN SPECIFICATIONS.
2. RELOCATE THE FAULT TAMER CUTOUT AND ARRESTER AS SHOWN ON DWG. 03.24-115B.
3. INSTALL THE EMB WITH "NUT" SIDE OF LOWER BOLT ON THE BRACKET SIDE. THIS WILL ALLOW THE BONDING CLIP FOR THE ARRESTER GROUND TO ATTACH BELOW THE ARRESTER ON THE EMB BRACKET.
4. AFTER DRILLING GALVANIZED POLE, USE ITEM # 50102957 COLD GALVANIZING SPRAY TO TREAT BARE METAL SURFACE.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.
6. SEE POLEFOREMAN FOR GUY AND ANCHOR STRENGTH INFORMATION.

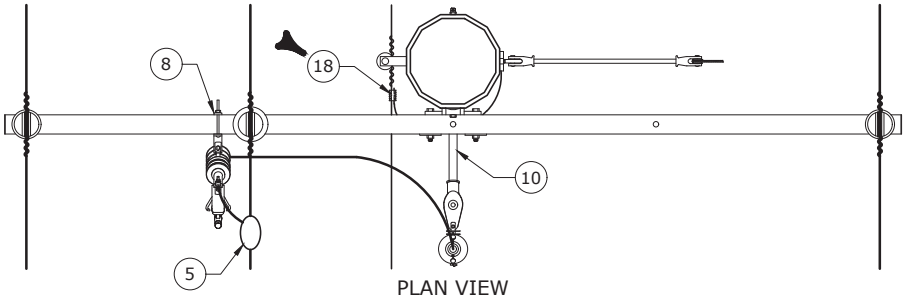
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BRUINS	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

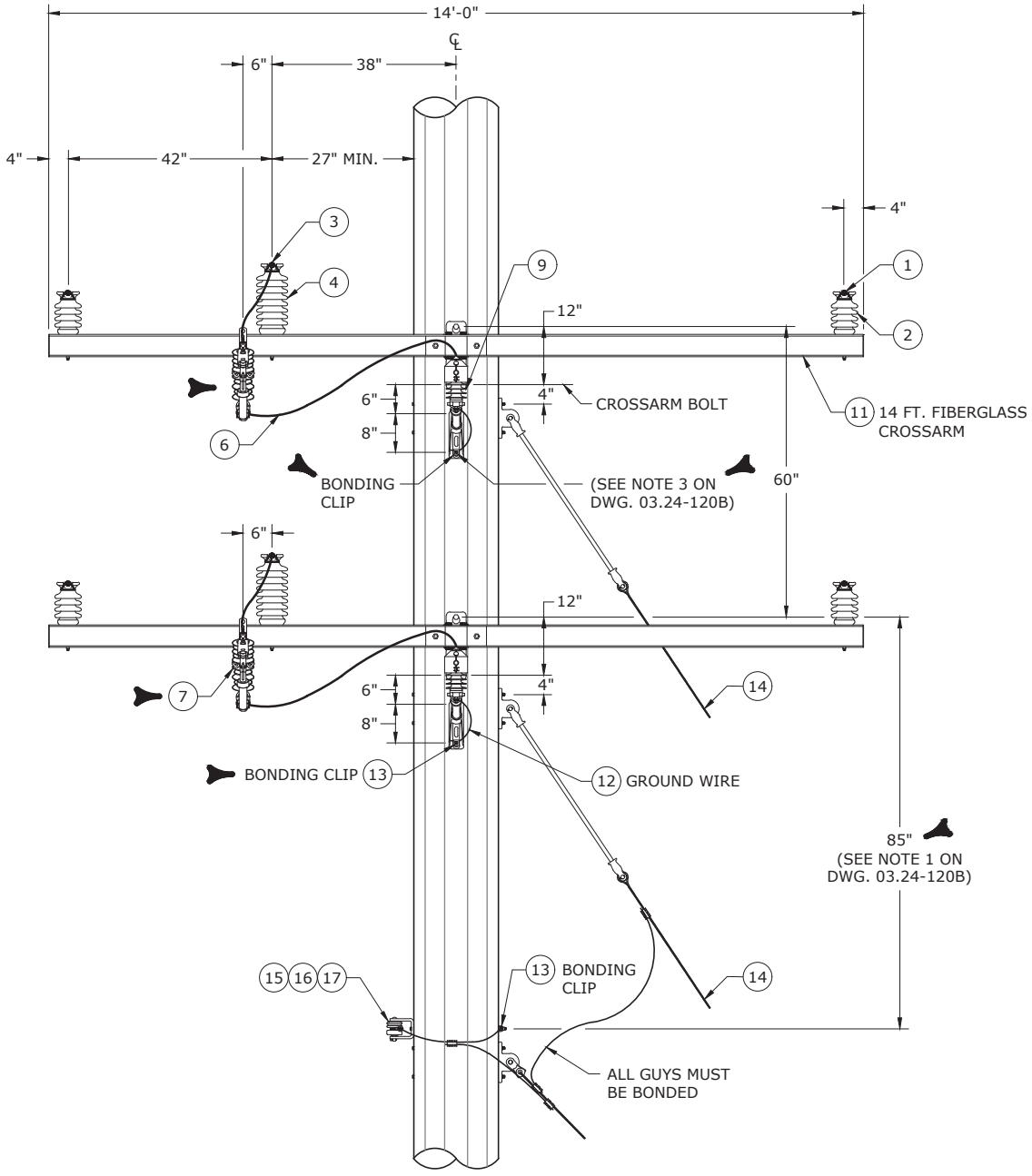
THREE-PHASE TAP UNDERBUILD
ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
			X

03.24-115C



PLAN VIEW



INLINE VIEW

REVISED	BY	CHK'D	APPR.
5 4/30/18	BRUINS	BURLISON	ADCOCK
4 3/31/18	BRUINS	BURLISON	ADCOCK
3 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

DOUBLE CIRCUIT (OVER/UNDER) UNDERBUILD ON STEEL TRANSMISSION POLE

DEC	DEM	DEP	DEF
X	X	X	X

03.24-120A

NOTES:

1. STANDARD NEUTRAL SPACING BELOW THE BOTTOM CIRCUIT IS 96". WHEN REPLACING A POLE IN AN EXISTING LINE, THE NEUTRAL SPACE MAY BE LESS THAN 96" IF APPROVED BY DISTRIBUTION ENGINEERING. THE NEUTRAL SPACING IS DESIGNED TO ALLOW FOR EQUIPMENT INSTALLATIONS AND TAPS OFF OF THE LINE. PLEASE NOTE THAT REDUCING THIS 96" SPACING WILL LIMIT THE ABILITY TO ADD EQUIPMENT OR TAPS IN THE FUTURE.

2. SEE DWG. 03.24-120A FOR DESIGN SPECIFICATIONS, AND DWG. 03.24-120C FOR BILL OF MATERIALS AND ADDITIONAL NOTES.

3. INSTALL THE BOTTOM BOLT OF THE EMBS WITH THE NUT SIDE OF THE BOLT ON THE BRACKET SIDE. THIS WILL ALLOW THE BONDING CLIPS FOR THE ARRESTERS TO ATTACH AT THE LOWER BOLT OF THE BRACKET.

4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED	BY	CHK'D	APPR.
4 4/30/18	BRUINS	BURLISON	ADCOCK
3 3/31/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
0 6/30/16	GORLEY	BURLISON	ADCOCK

DOUBLE CIRCUIT (OVER/UNDER) UNDERBUILD
ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.24-120B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-TOP-(WIRE)-AL-FNECK-F	4	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
2	INSL-POST-25KV-PORC-TT-F	4	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	4	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	TIE-TOP-(WIRE)-AL-FNECK-F	2	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
4	INSL-POST-45KV-PORC-TT-F	2	50129474	1	INSULATOR, LINE POST, 45KV, 6-1/2" DIA X 15" LG, PORCELAIN
4	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
5	CONN-OH-STRP-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
5	CONN-OH-HLC-2/0CU-8CUSOL-F	1	933034	1	CONNECTOR, OH, HOT LINE CLAMP
6	LEAD-EQ-6-CU-COVER-F	2	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
7	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	2	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	2	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	BKT-EM-ARM-1P-STL-SM-F	2	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	ARR-UB-10KV-F	2	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	2	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	2	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	BKT-EM-POLE-1P-FG-F	2	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
10	HDWR-MACH-SM-26IN-GALV-F	4	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
11	ARM-SGL-14-FBG-NB-F	2	1517219	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 14' LG, FBG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
11	HDWR-MACH-LG-26IN-GALV-F	4	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
12	GND-EQUIP-6-BOND-F	2	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
13	GND-POLE-CLIP-5/8-F	3	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
14	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
15	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
16	INSL-1RACK-SEC-PORC-F	1	157944	1	NSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
16	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GAL
17	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)
18	CONN-OH-(TYPE)-(SIZE)-F	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS - BASED ON NEUTRAL SIZE

NOTES:

1. SEE DWGS. 03.24-120A AND 03.24-120B FOR DESIGN SPECIFICATIONS.
2. INSTALL 10 FT. TANGENT ARM WITH "NUT" SIDE OF BOLTS ON THE GAIN BRACKET SIDE. THIS WILL ALLOW BONDING CLIP FOR ARRESTER GROUND BUS TO ATTACH AT LOWER BOLT OF GAIN BRACKET.
3. IF SIDE GUY IS REQUIRED, USE CU GUY PLATE SP FOR GUY ATTACHMENT POINT ON STEEL POLE. MOUNT GUY ATTACHMENT UPPER BOLT 4" BELOW LOWER BOLT OF GAIN BRACE.
4. AFTER DRILLING GALVANIZED POLE, USE ITEM # 420444 COLD GALVANIZING SPRAY TO TREAT METAL SURFACE.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BRUINS	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

DOUBLE CIRCUIT (OVER/UNDER) UNDERBUILD
ON STEEL TRANSMISSION POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.24-120C

DISTRIBUTION STANDARDS SECTION 03.25 IS INTENDED TO ADDRESS THE CONSTRUCTION OF VERTICAL DISTRIBUTION CIRCUITS UNDERBUILT ON STEEL TRANSMISSION POLES.

DISTRIBUTION FRAMING SHOULD START FROM THE GROUND UP. THE LOWEST POWER ATTACHMENT POINT (TYPICALLY THE NEUTRAL) SHOULD BE DETERMINED BASED ON GROUND CLEARANCE AND ANY JOINT USE REQUIREMENTS. THE SPACING UP TO THE HIGHEST POWER ATTACHMENT SHOULD BE MEASURED FROM THE LOWEST POINT UP IN ACCORDANCE WITH THE STANDARDS IN THIS SECTION. COORDINATION WITH TRANSMISSION ENGINEERING IS CRITICAL AND AT NO TIME SHALL THE DISTRIBUTION ATTACHMENT BE CLOSER THAN THE MINIMUM CLEARANCES DESCRIBED BELOW.

MINIMUM CLEARANCE BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS

FOR 69KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE HIGHEST DISTRIBUTION ATTACHMENT SHALL NOT BE LESS THAN 10' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY LOCAL TRANSMISSION ENGINEERING.

FOR 230KV LINES, THE VERTICAL CLEARANCE BETWEEN THE LEVEL OF THE LOWEST TRANSMISSION CONDUCTOR AND THE HIGHEST DISTRIBUTION ATTACHMENT SHALL NOT BE LESS THAN 11' - 6" FOR SPAN LENGTHS UP TO 250 FEET UNLESS APPROVED BY LOCAL TRANSMISSION ENGINEERING.

MINIMUM VERTICAL CLEARANCES BETWEEN TRANSMISSION AND DISTRIBUTION ATTACHMENTS VARY ACCORDING TO THE TRANSMISSION FRAMING, VOLTAGE, SPAN LENGTH, AND CONDUCTOR TENSION. CLEARANCES AT MID-SPAN MUST ALSO BE CONSIDERED. FOR OTHER TRANSMISSION VOLTAGES OR FOR SITUATIONS NOT ADDRESSED ABOVE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO DETERMINE THESE MINIMUM CLEARANCES.

SPECIAL SITUATIONS

IF EXTENUATING CIRCUMSTANCES EXIST THAT ABSOLUTELY PROHIBIT THE USE OF A STEEL TRANSMISSION POLE, COORDINATE WITH LOCAL TRANSMISSION ENGINEERING TO CONSIDER THESE OPTIONS:

1. PLACE A WOODEN TRANSMISSION POLE INSTEAD OF A STEEL POLE.
2. SET A SEPARATE WOODEN POLE FOR DISTRIBUTION. THIS CAN BE A WOODEN POLE ADJACENT TO THE STEEL TRANSMISSION POLE OR A SKIP SPAN / INTERMEDIATE POLE. THE USE OF SKIP SPAN / INTERMEDIATE POLES IS ACCEPTABLE AND ENCOURAGED WHERE APPROPRIATE.
3. RELOCATE THE OVERHEAD DISTRIBUTION LINE.
4. CONVERT THE OVERHEAD DISTRIBUTION LINE TO UNDERGROUND.

WHERE POSSIBLE AND PRACTICAL, THE PREFERRED METHOD IS TO NOT ATTACH DISTRIBUTION TO TRANSMISSION STEEL POLES.

GENERAL NOTES

1. WHEN UNDERBUILD IS ADDED TO A TRANSMISSION LINE, TRANSMISSION GUYS MUST BE INSULATED TO PREVENT TRANSMISSION VOLTAGE FROM TRANSFERRING TO THE DISTRIBUTION LINE AND TO KEEP DISTRIBUTION VOLTAGE FROM TRANSFERRING TO THE BOTTOM OF THE GUY SHOULD THE TRANSMISSION GUY BECOME SLACK OR BROKE.
2. FOR BONDING CONCRETE POLES, BOND ALL HARDWARE WITH #6 CU AND USE TAP CONS WHERE GROUND LENGTH EXCEEDS 12".
3. FAULT TAMERS AND ARRESTERS ARE REQUIRED ON ALL LINES **INSULATED** AT GREATER THAN 69KV.
4. NO EQUIPMENT SHALL BE MOUNTED ON DOUBLE CIRCUIT POLES.

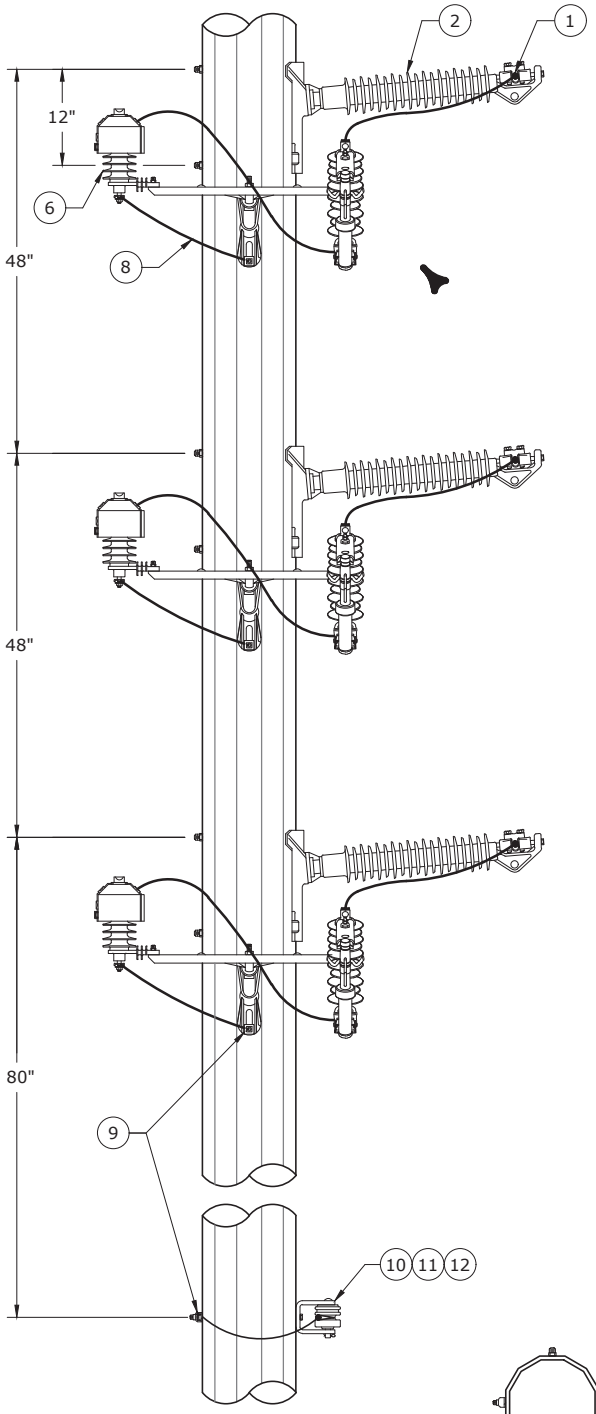
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/22/16	GORLEY	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

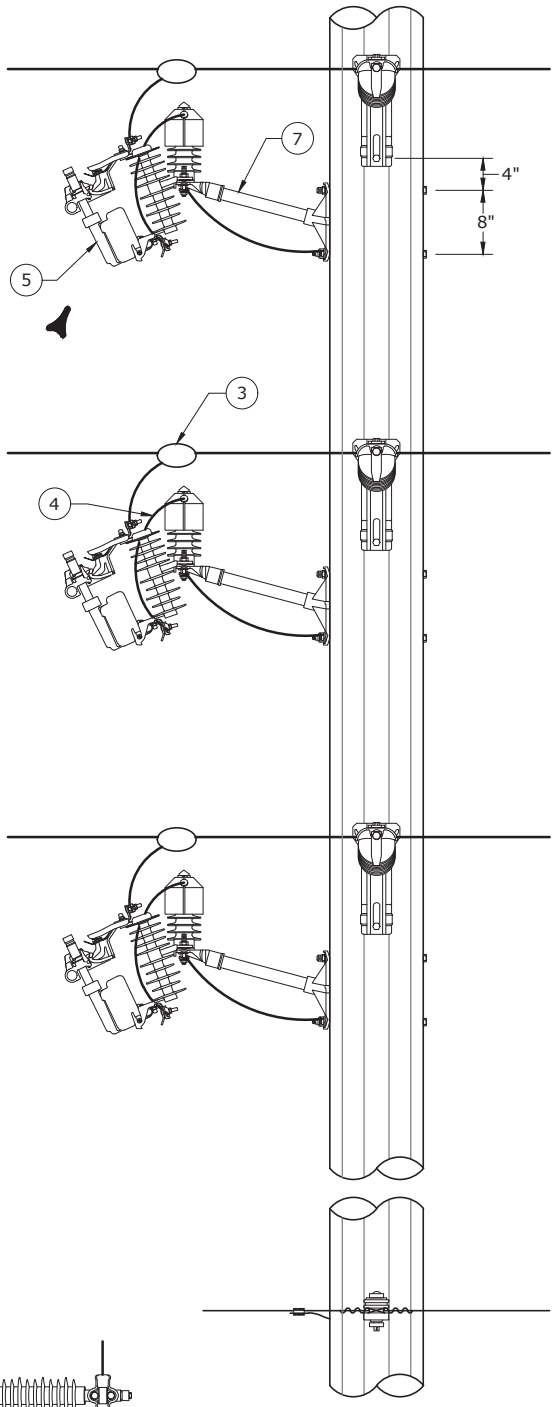
GENERAL INFORMATION -
VERTICAL ELECTRIC DISTRIBUTION ON
STEEL AND CONCRETE TRANSMISSION POLES

DEC	DEM	DEP	DEF
X	X	X	X

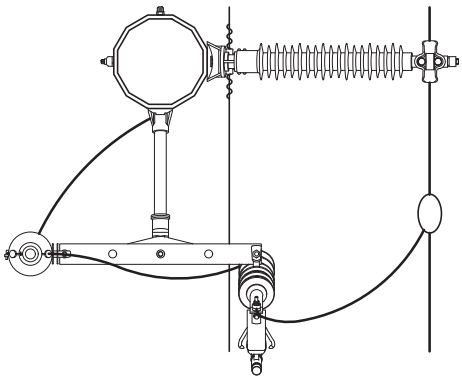
03.25-100



FRONT VIEW



SIDE VIEW



PLAN VIEW

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/29/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-102A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-69KV-POLY-HC-GB-F	3	4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
11	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
11	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
12	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

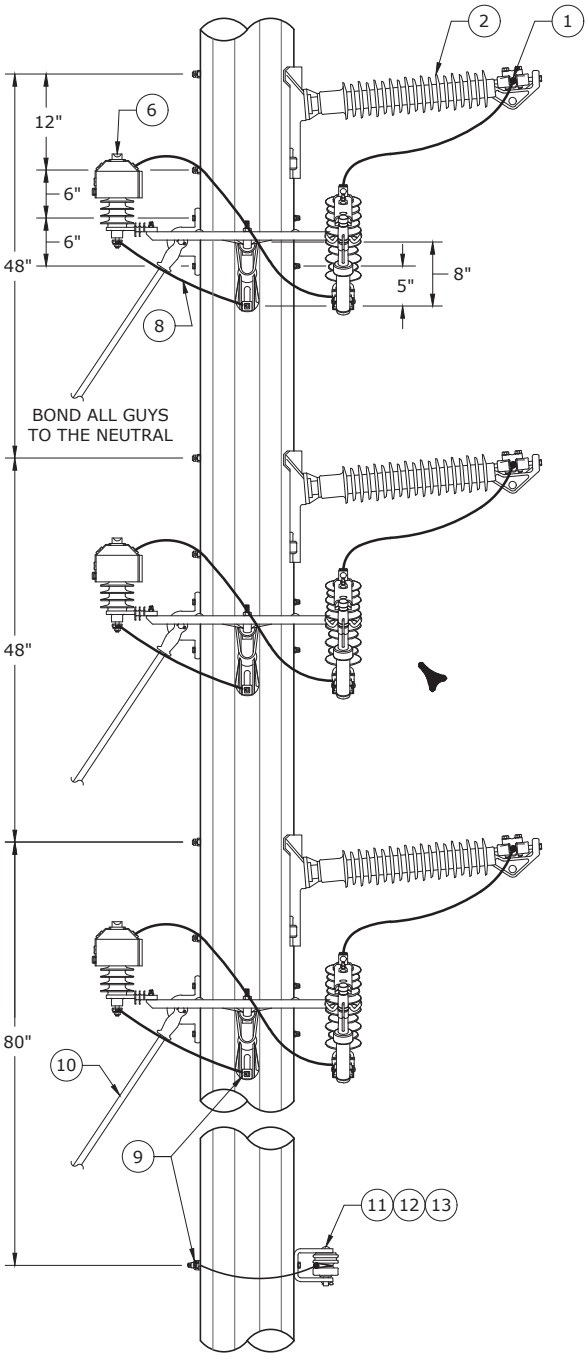
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

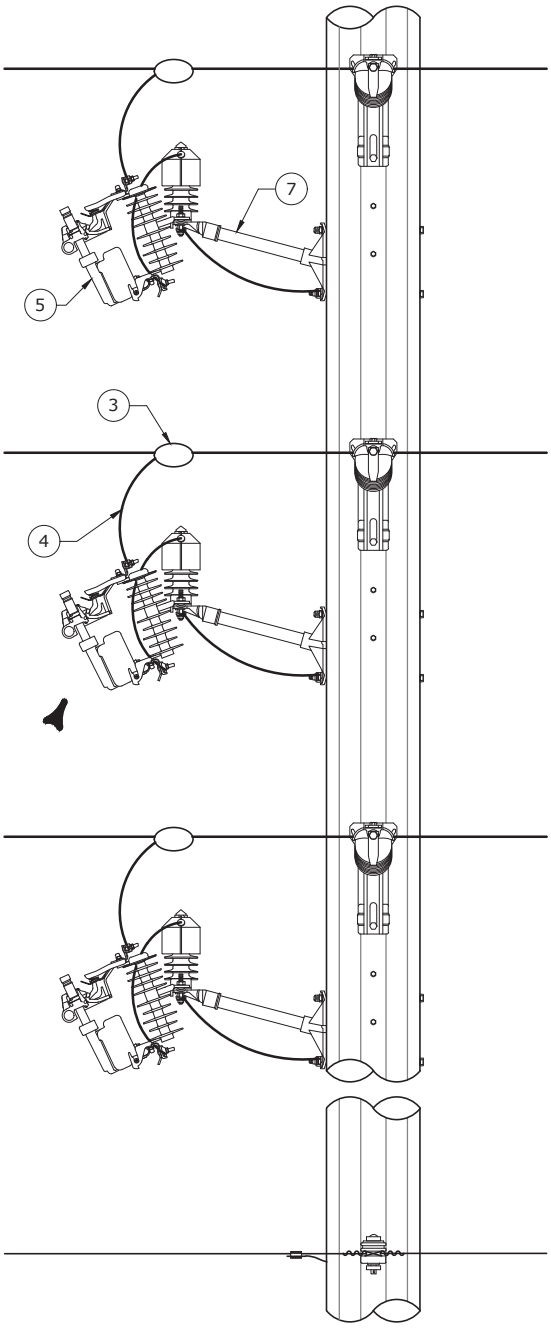
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-102B



FRONT VIEW



SIDE VIEW

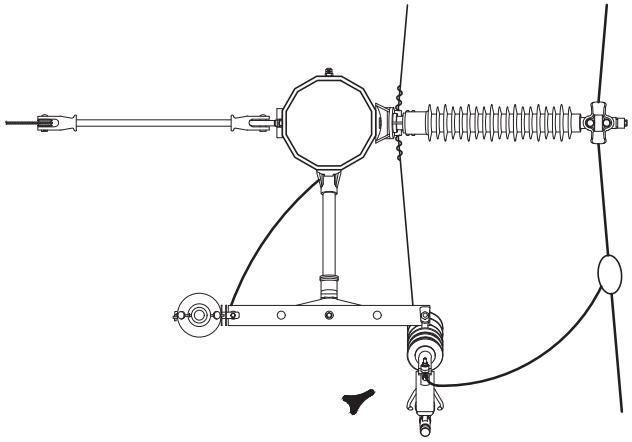
REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/29/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SMALL ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-105A



PLAN VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-69KV-POLY-HC-GB-F	3	4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
12	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
12	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
13	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

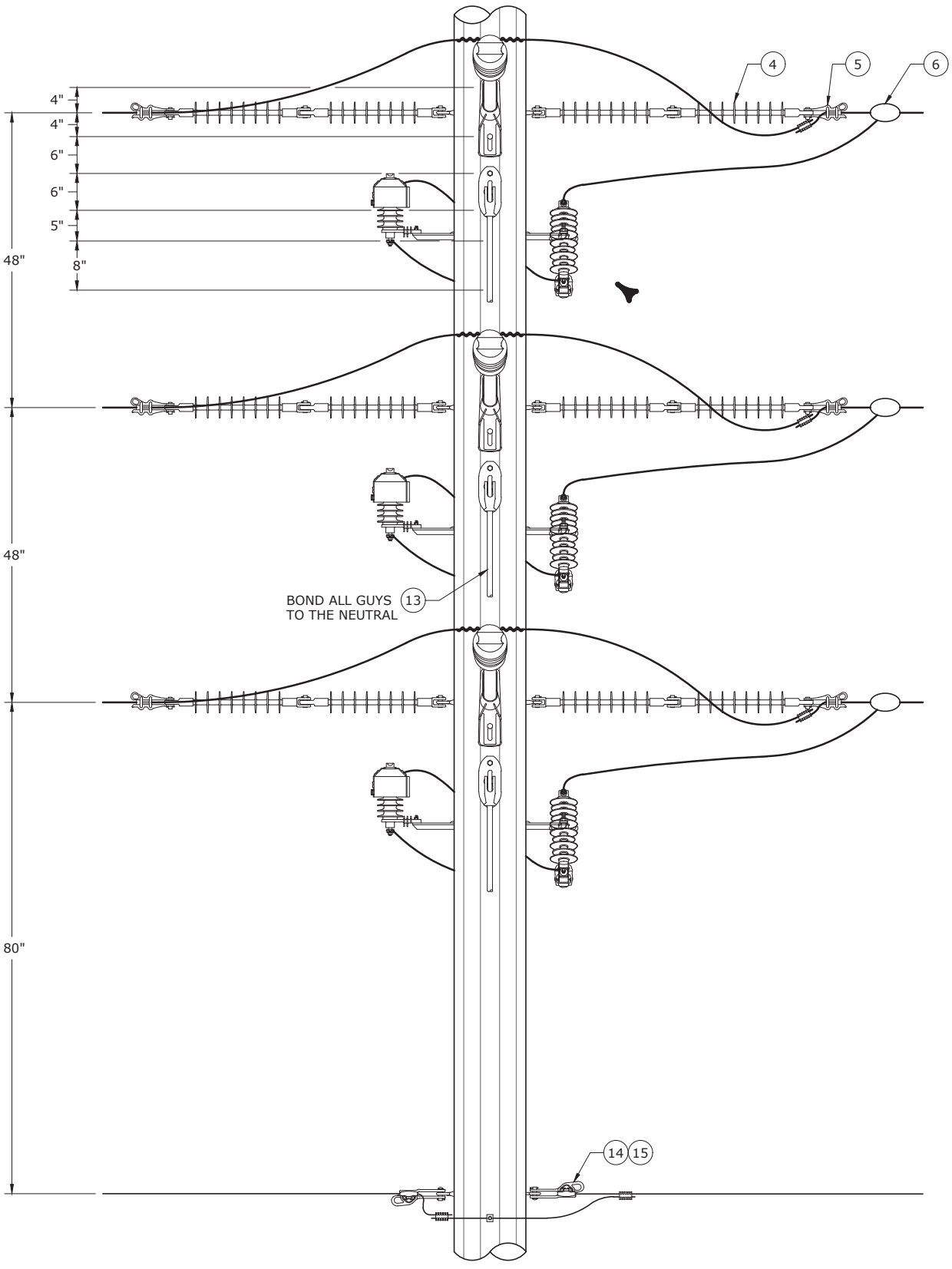
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SMALL ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-105B



FRONT VIEW

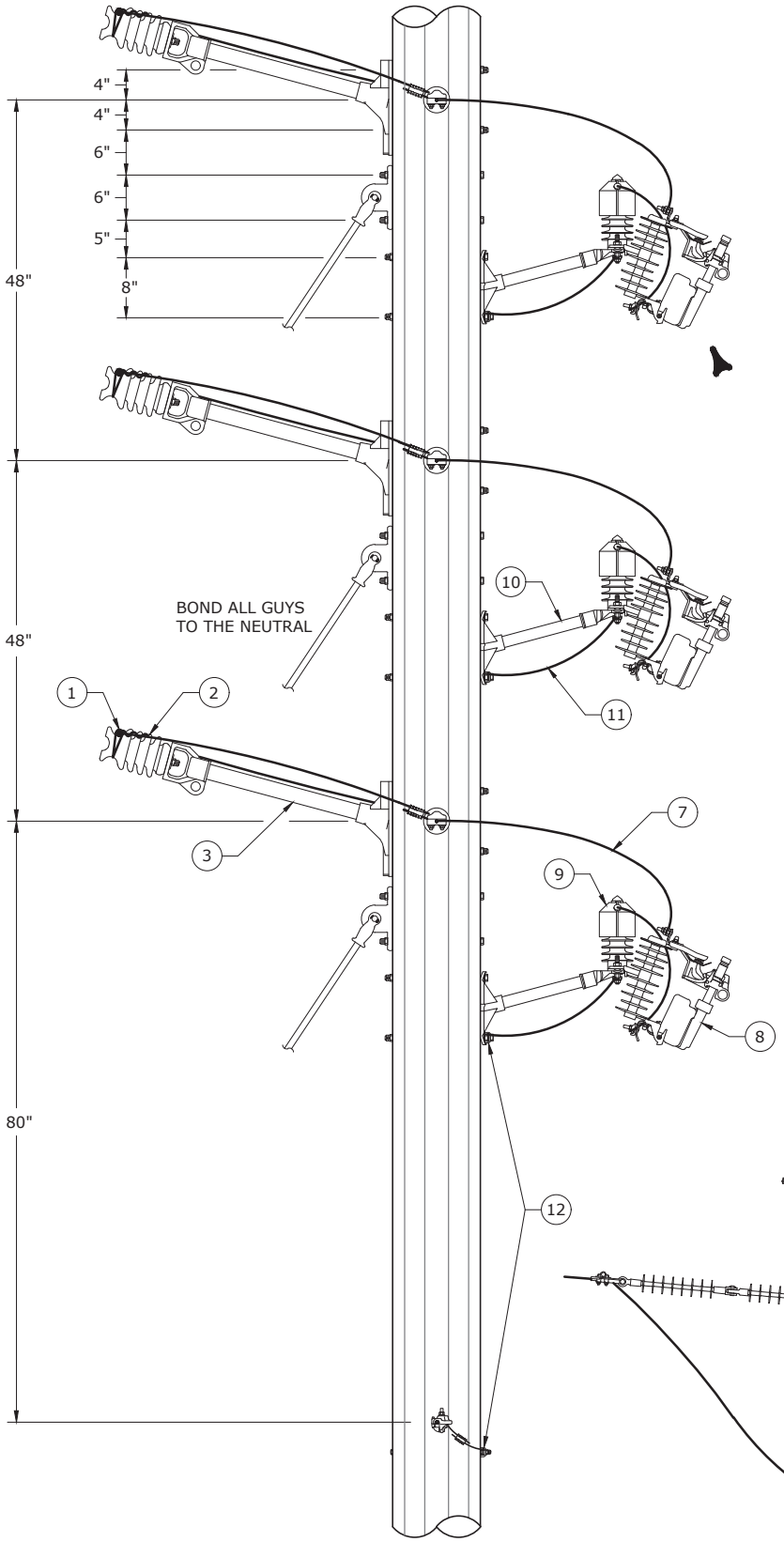
REVISED	BY	CHK'D	APPR.
4 4/30/18	BENDER	BURLISON	ADCOCK
3 8/7/17	BENDER	BURLISON	ADCOCK
2 12/22/16	GORLEY	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - MEDIUM ANGLE

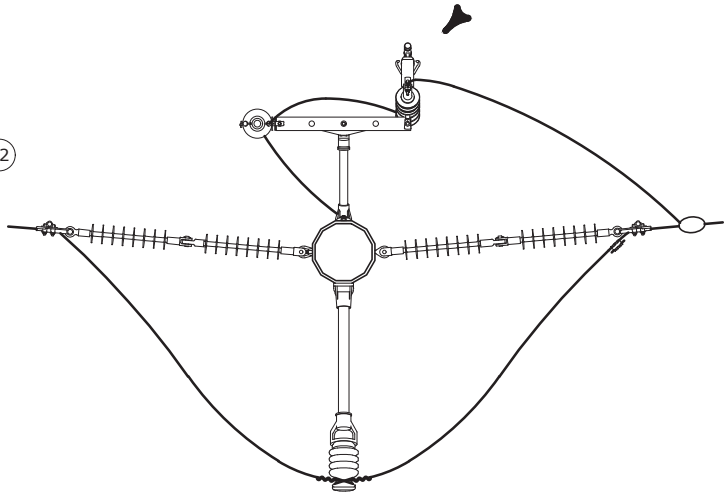
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-110A



SIDE VIEW



PLAN VIEW

4	4/30/18	BENDER	BURLISON	ADCOCK
3	8/7/17	BENDER	BURLISON	ADCOCK
2	12/22/16	GORLEY	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - MEDIUM ANGLE

DEC	DEM	DEP	DEF
X	X	X	X

03.25-110B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	1	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA,10" LG, 11 UNC, 6" THD LG, GALV STL
3	BKT-INSL-POST-POLE-LG-FG-F	3	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	3	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	6	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
11	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
14	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
14	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
15	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

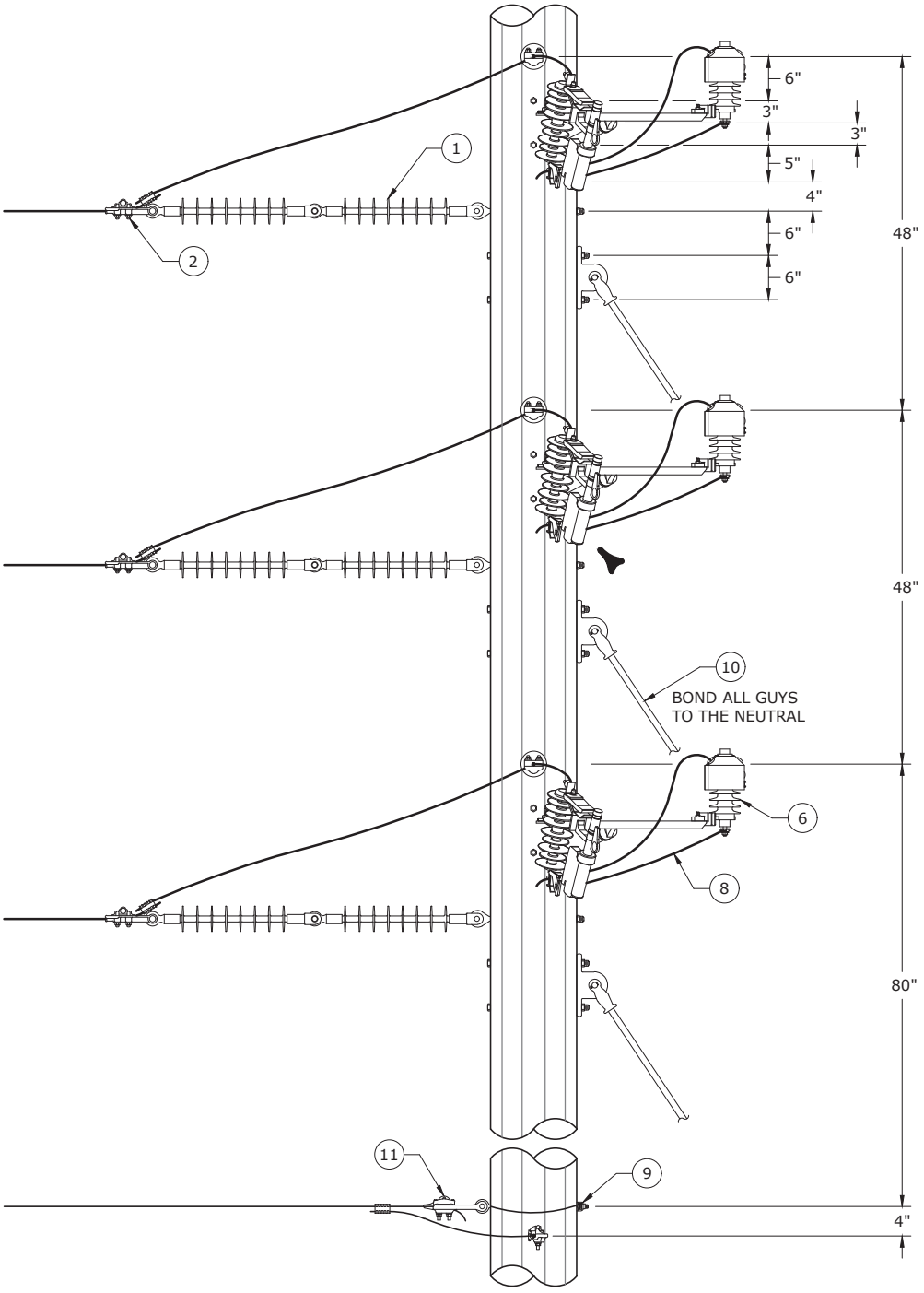
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
MEDIUM ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-110C



FRONT VIEW

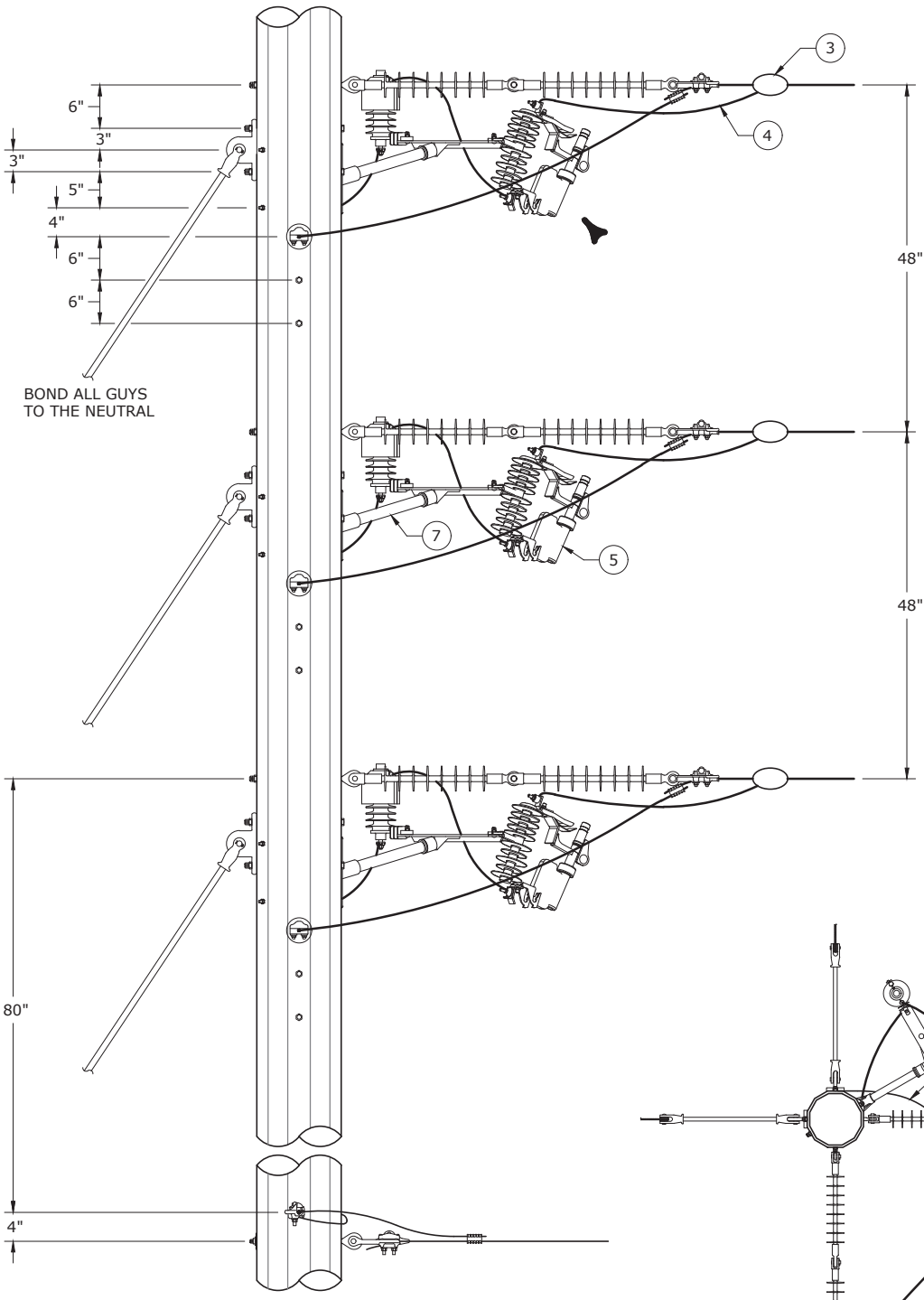
REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - LARGE ANGLE (RIGHT ANGLE)

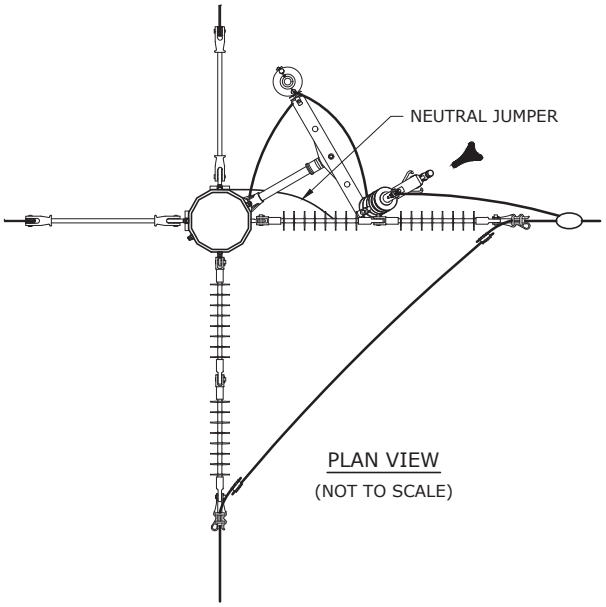
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-119A



SIDE VIEW



PLAN VIEW
(NOT TO SCALE)

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - LARGE ANGLE (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.25-119B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	6	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	6	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-DA-SM-28IN-GALV-F	2	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
11	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

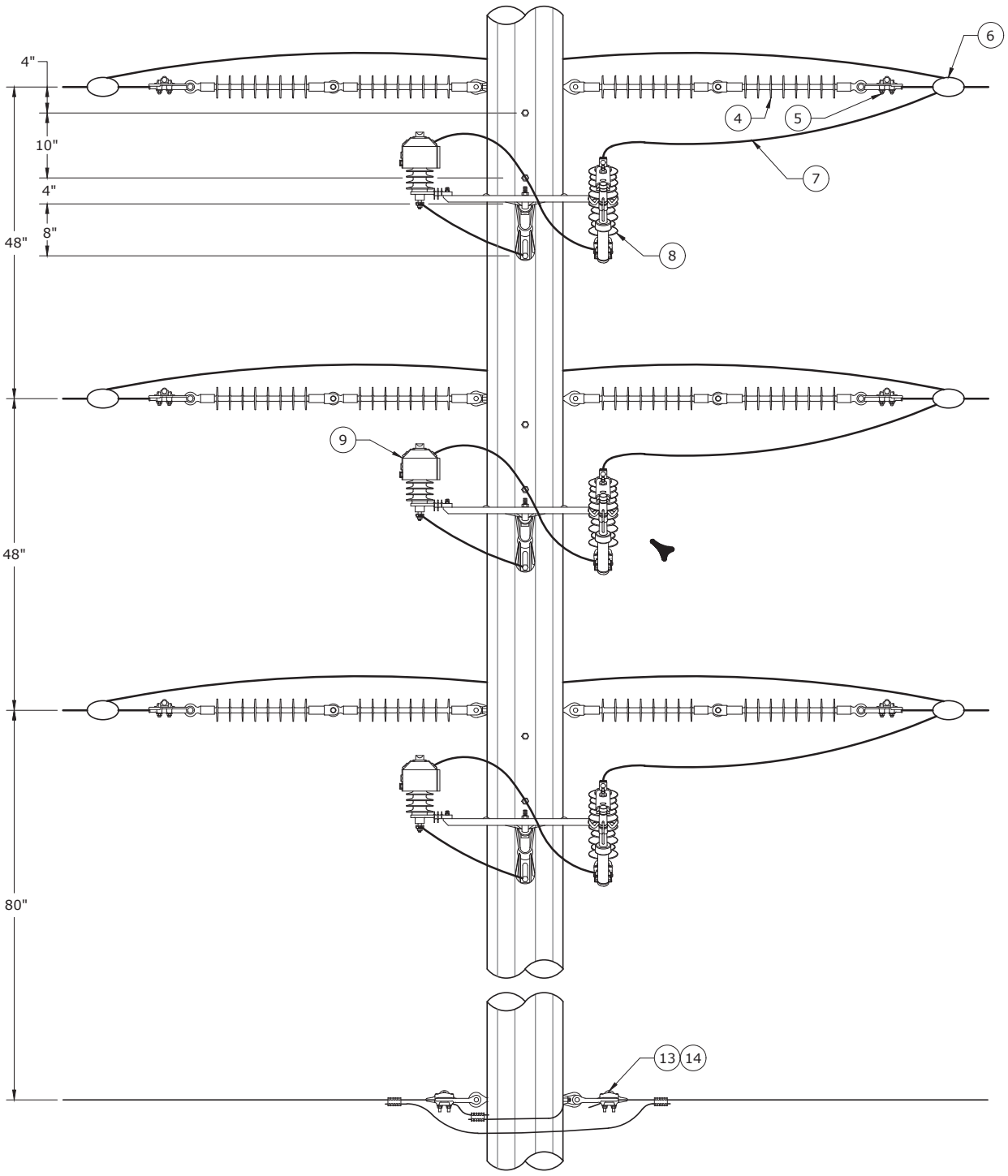
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
LARGE ANGLE (RIGHT ANGLE)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-119C



FRONT VIEW

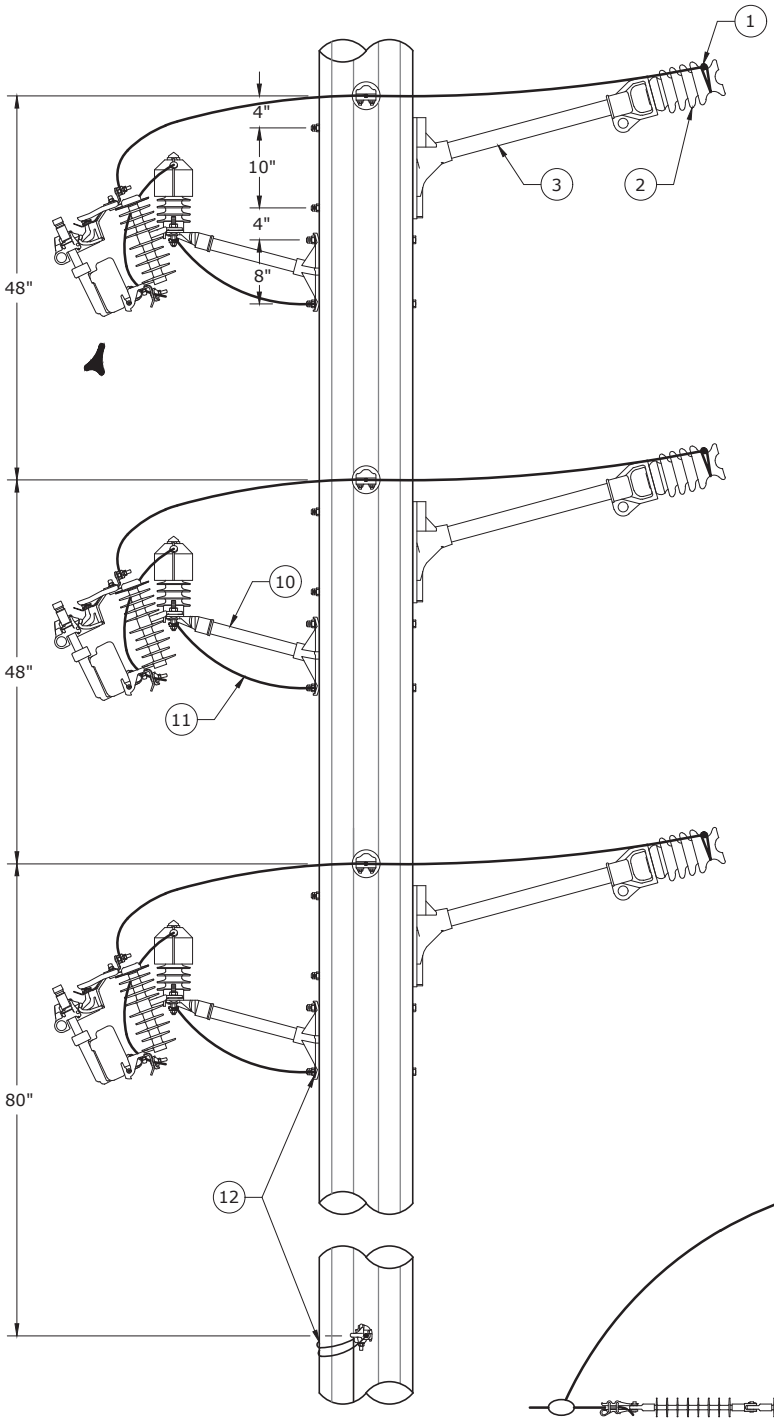
REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
DOUBLE DEADEND

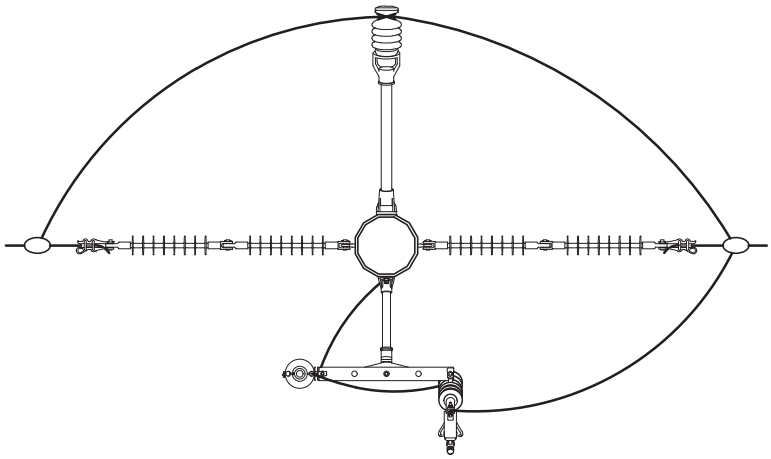
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-120A



SIDE VIEW



PLAN VIEW
(NOT TO SCALE)

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
DOUBLE DEADEND

DEC	DEM	DEP	DEF
X	X	X	X

03.25-120B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	3	4022333	1	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
2	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA,10" LG, 11 UNC, 6" THD LG, GALV STL
3	BKT-INSL-POST-POLE-LG-FG-F	3	930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			1513237	2	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
3	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
4	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	HDWR-DA-SM-28IN-GALV-F	3	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
4	HDWR-EYENUT-SM-GALV-F	6	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
5	CLAMP-DE-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
6	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
7	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
			406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
			406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
			406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
9	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
9	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
10	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
11	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
13	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
14	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

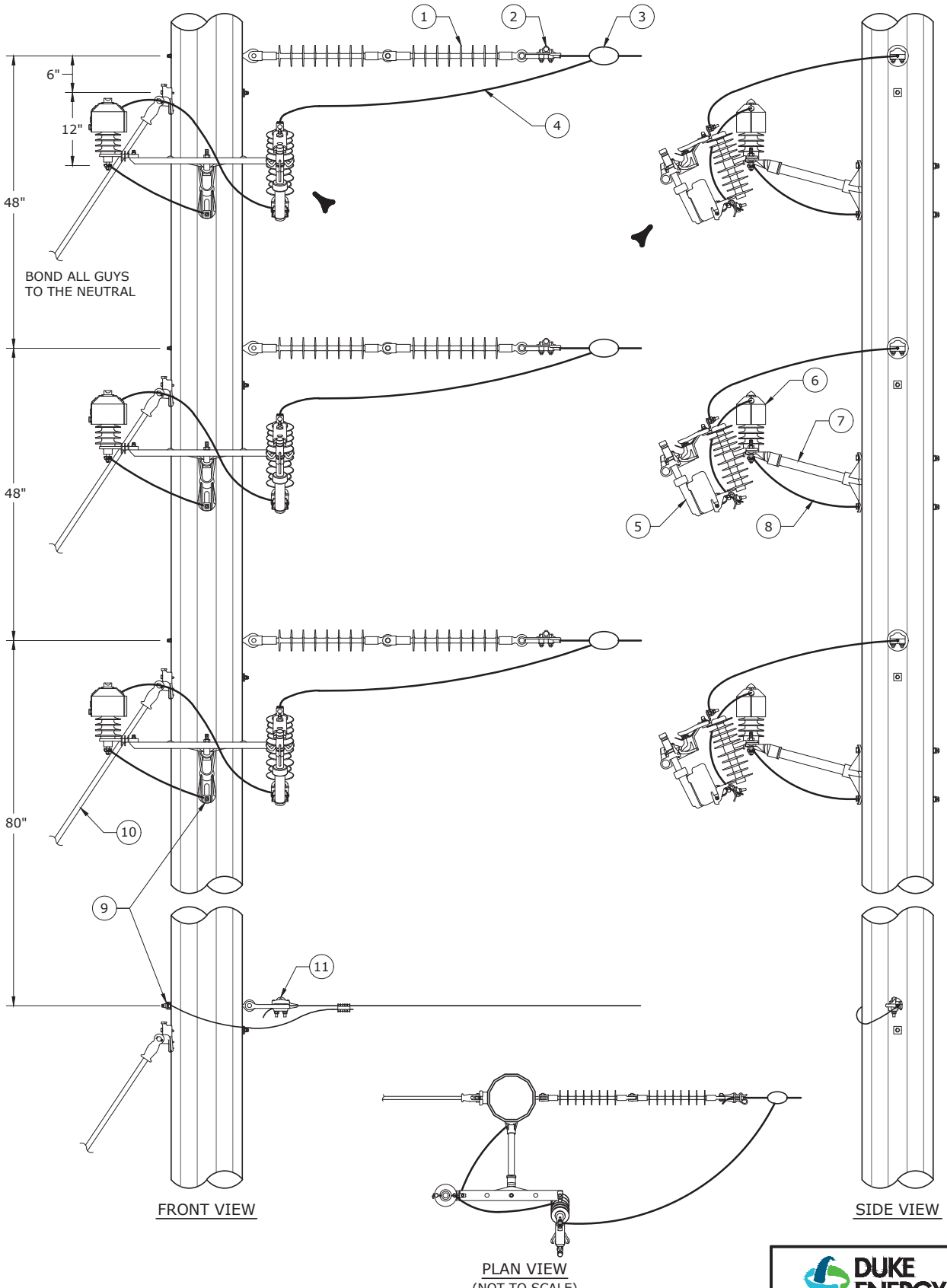
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
DOUBLE DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-120C



REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-127A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	3	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
3	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	3	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		3	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		3	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		3	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		3	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	3	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	3	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	3	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	3	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	3	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	4	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
11	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
11	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
11	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

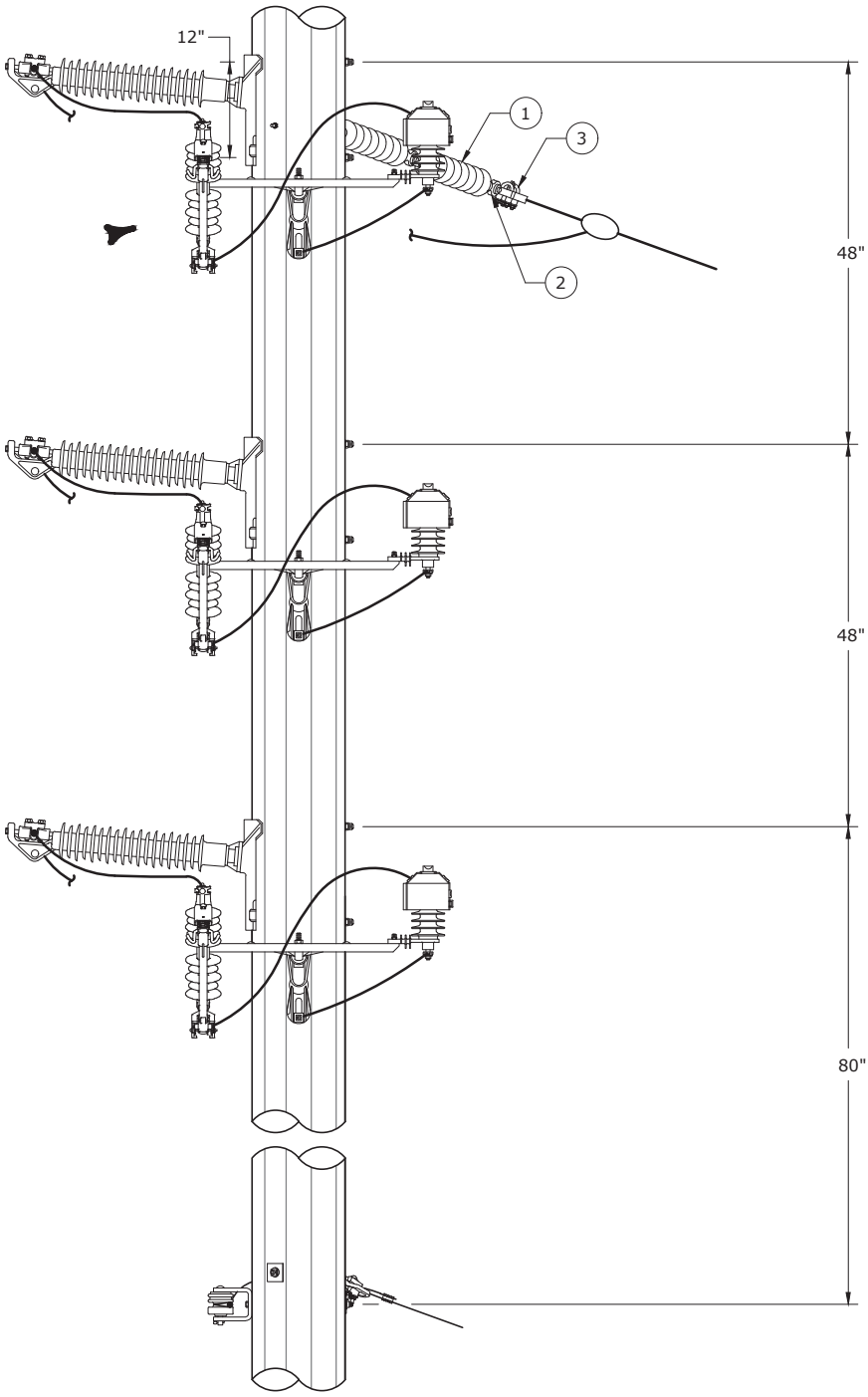
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - DEADEND

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-127B



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

NOTES:

1. TAP LINE MAY BE ON ANY PHASE.
2. TAP MUST BE SLACK SPAN.
3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

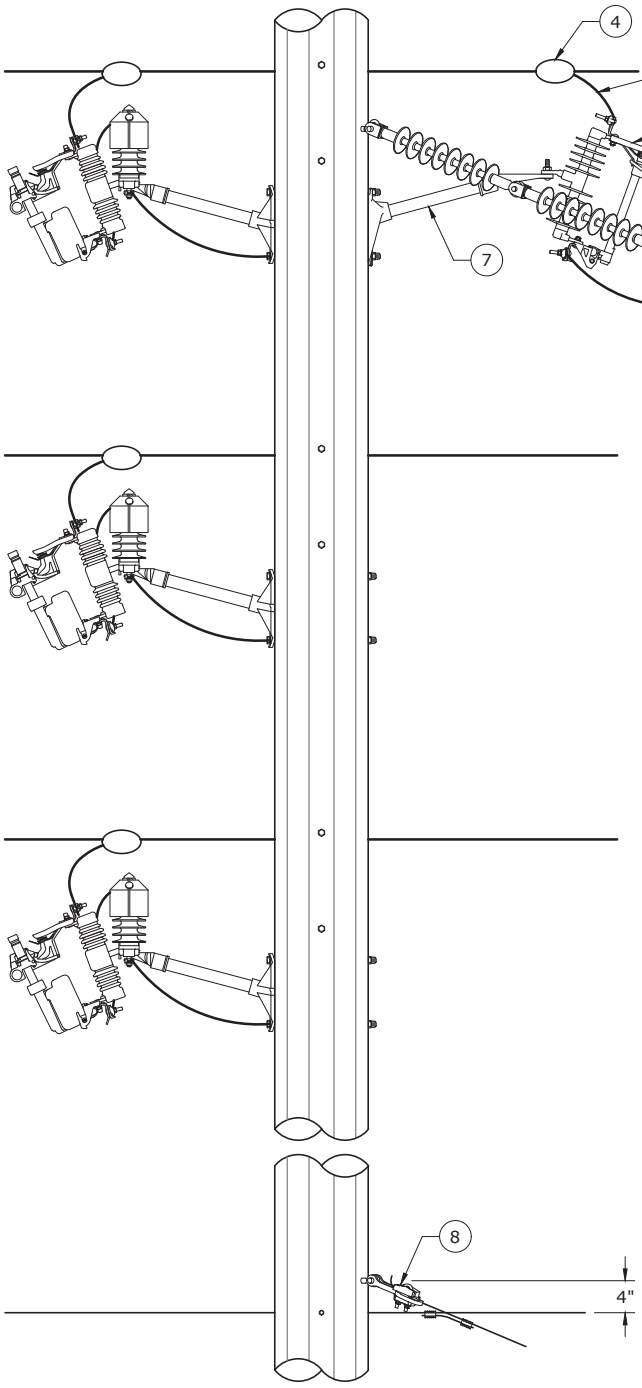
REVISED		BY	CHK'D	APPR.
3	4/30/18	BENDER	BURLISON	ADCOCK
2	8/29/17	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SINGLE-PHASE FUSED SLACK SPAN TAP

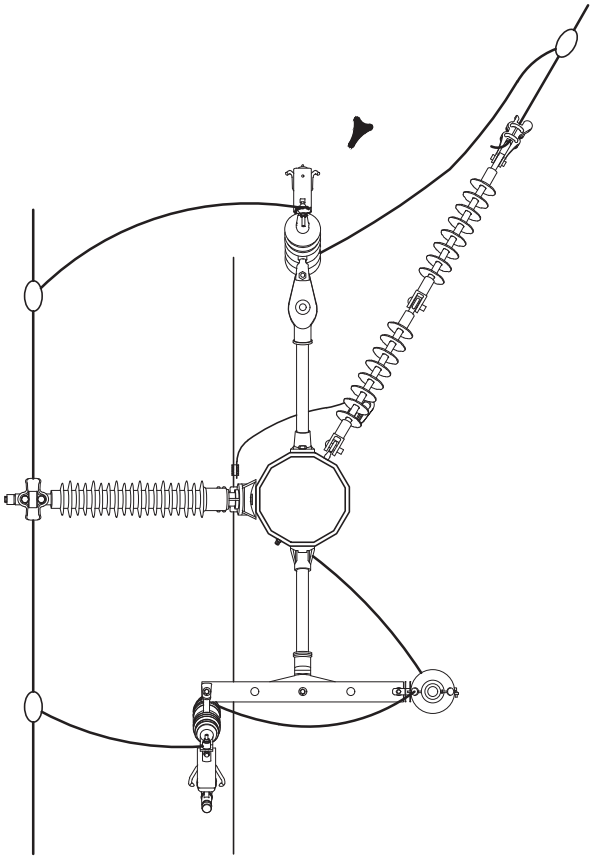
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-130A



SIDE VIEW



PLAN VIEW

NOTES:

1. TAP MUST BE SLACK SPAN.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
SINGLE-PHASE FUSED SLACK SPAN TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.25-130B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	2	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	INSL-CLIP-SHUNT-F	2	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	1	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	1	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

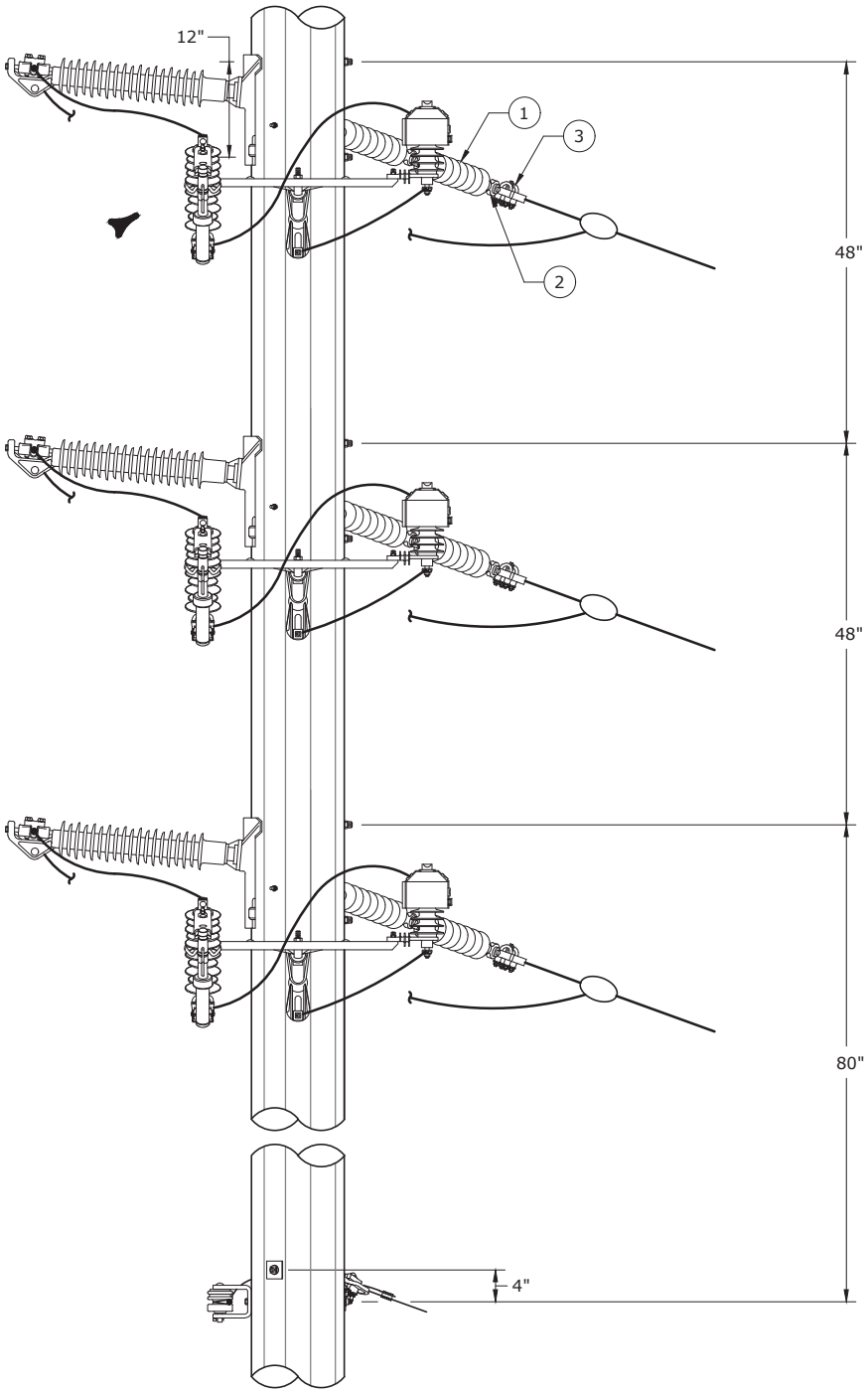
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/17/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SINGLE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-130C



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

NOTES:

1. TAP MUST BE SLACK SPAN.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

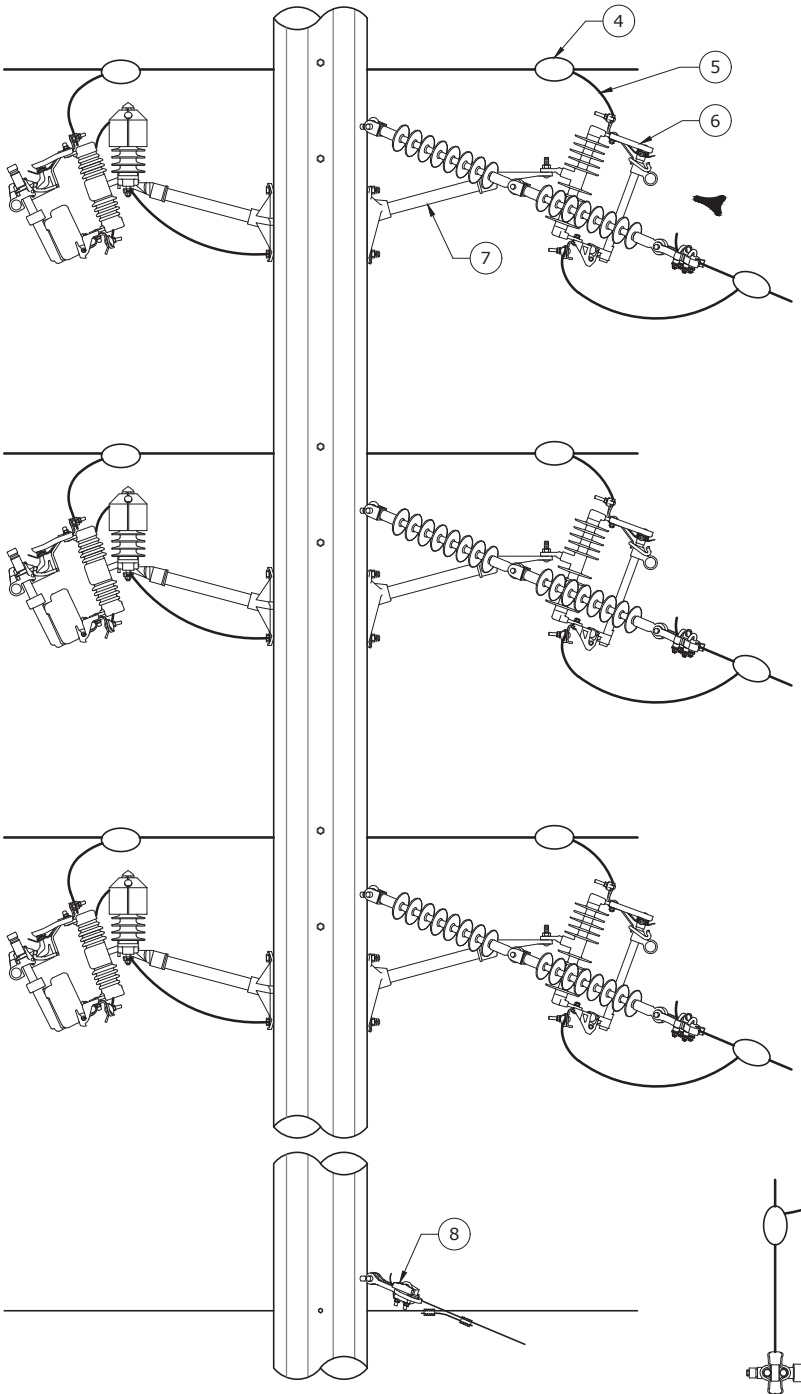
3	4/30/18	BENDER	BURLISON	ADCOCK
2	8/29/17	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - THREE-PHASE FUSED SLACK SPAN TAP

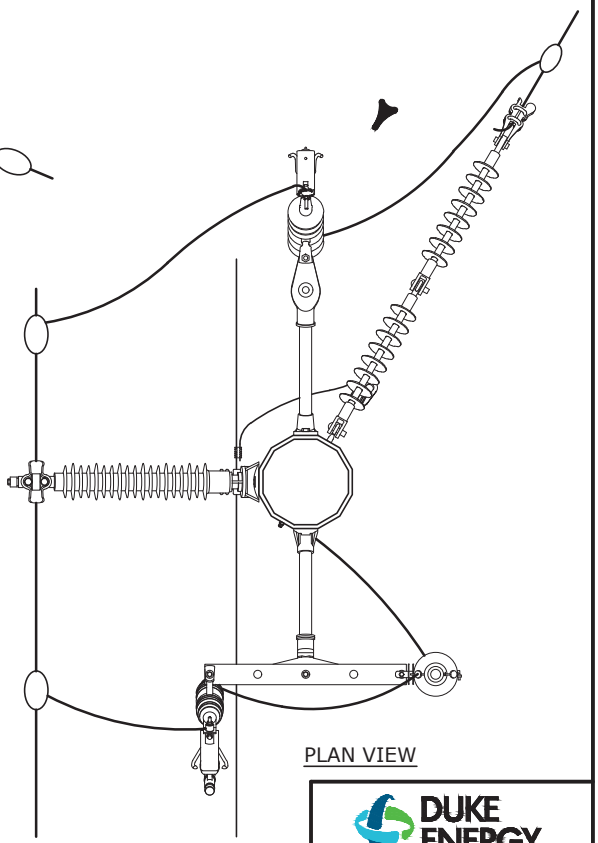
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-133A



SIDE VIEW



PLAN VIEW

NOTES:

1. TAP MUST BE SLACK SPAN.

2. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - THREE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-133B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-DE/S-35KV-POLY-F	6	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
1	HDWR-DA-SM-28IN-GALV-F	3	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
1	HDWR-EYENUT-SM-GALV-F	3	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
2	INSL-CLIP-SHUNT-F	6	57785	4	CLIP, SPRING, STL, SUSPENSION INSULATOR SHUNT
3	CLAMP-DE-(SIZE)-F	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
4	-	3	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
5	LEAD-EQ-2-CU-COVER-F	3	4192428	12	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL
6	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	3	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
7	BKT-EM-POLE-1P-FG-F	3	81207	1	BRACKET, CUTOUT, 18" LG, FIBERGLASS, EQUIPMENT MOUNTING
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
8	HDWR-DA-SM-28IN-GALV-F	1	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
8	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
8	CLAMP-DE-(SIZE)-F	1	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

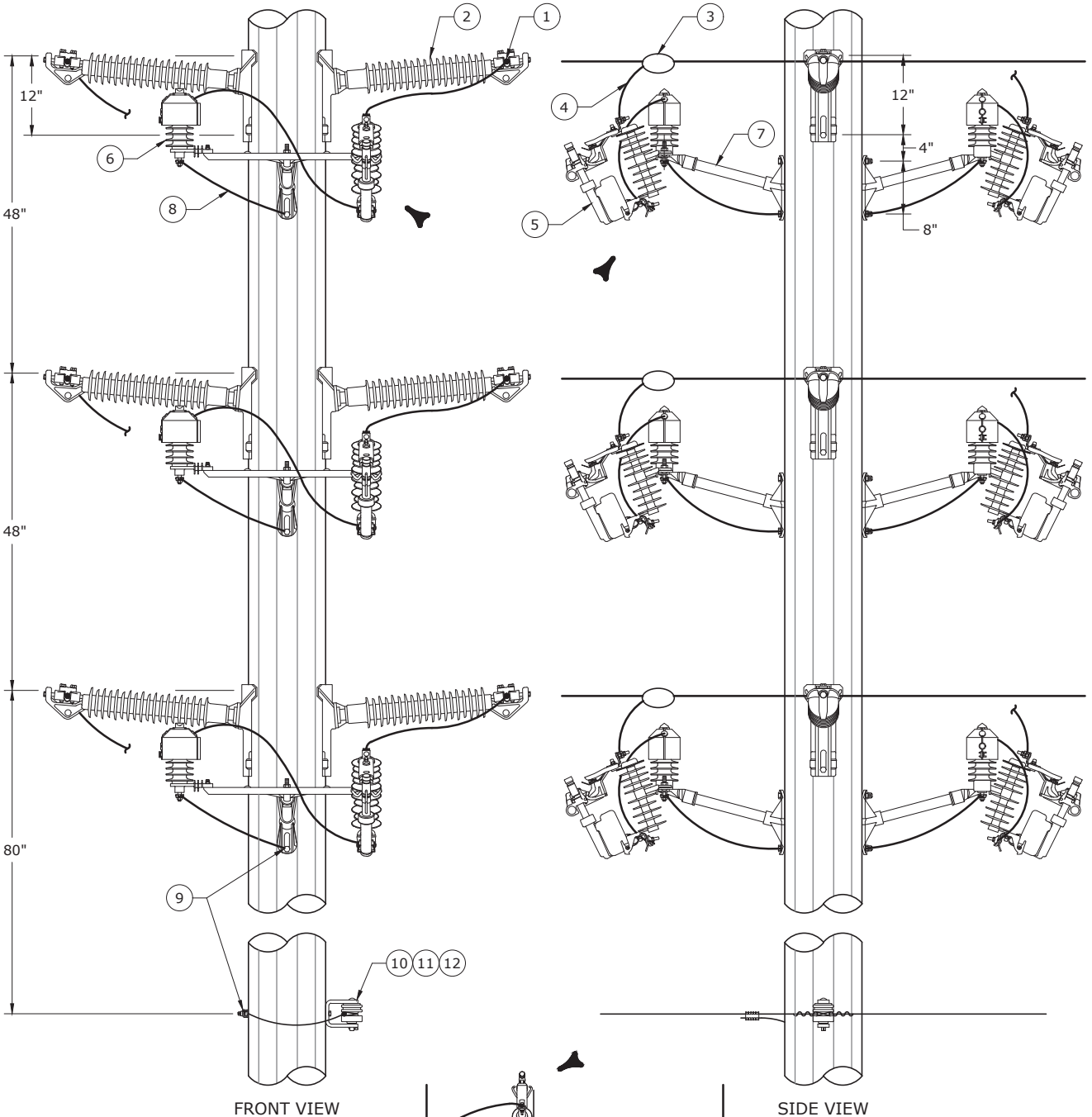
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL SINGLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES -
THREE-PHASE FUSED SLACK SPAN TAP

DUKE ENERGY.

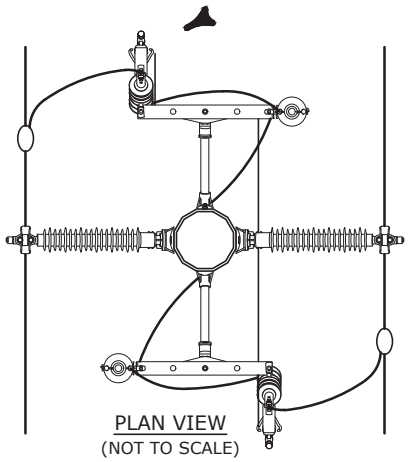
DEC	DEM	DEP	DEF
			X

03.25-133C



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

SIDE VIEW



PLAN VIEW
(NOT TO SCALE)

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-150A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CLAMP-TR-CUSHGRP-(SIZE)-F	6	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
2	INSL-POST-69KV-POLY-HC-GB-F	6	4022921	1	INSULATOR, POST, 69KV, SILICONE, HORZ GAIN BASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-26IN-GALV-F	12	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
3	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
4	LEAD-EQ-6-CU-COVER-F	6	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		6	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		6	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
5	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		6	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
6	ARR-UB-10KV-F	6	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	6	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
6	WG-BUSH-COV-SM-F	6	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
7	BKT-EM-POLE-2POS-FG-F	6	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
7	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
8	GND-EQUIP-6-BOND-F	6	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
9	GND-POLE-CLIP-5/8-F	7	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
10	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
11	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS, INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
11	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, GALV STL
12	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

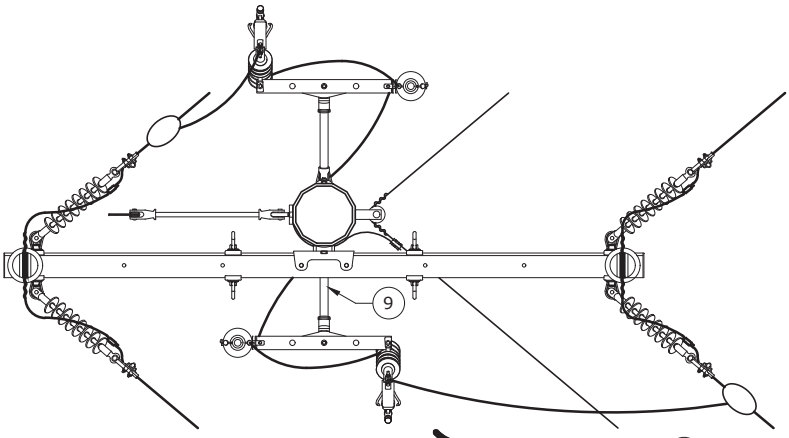
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - TANGENT

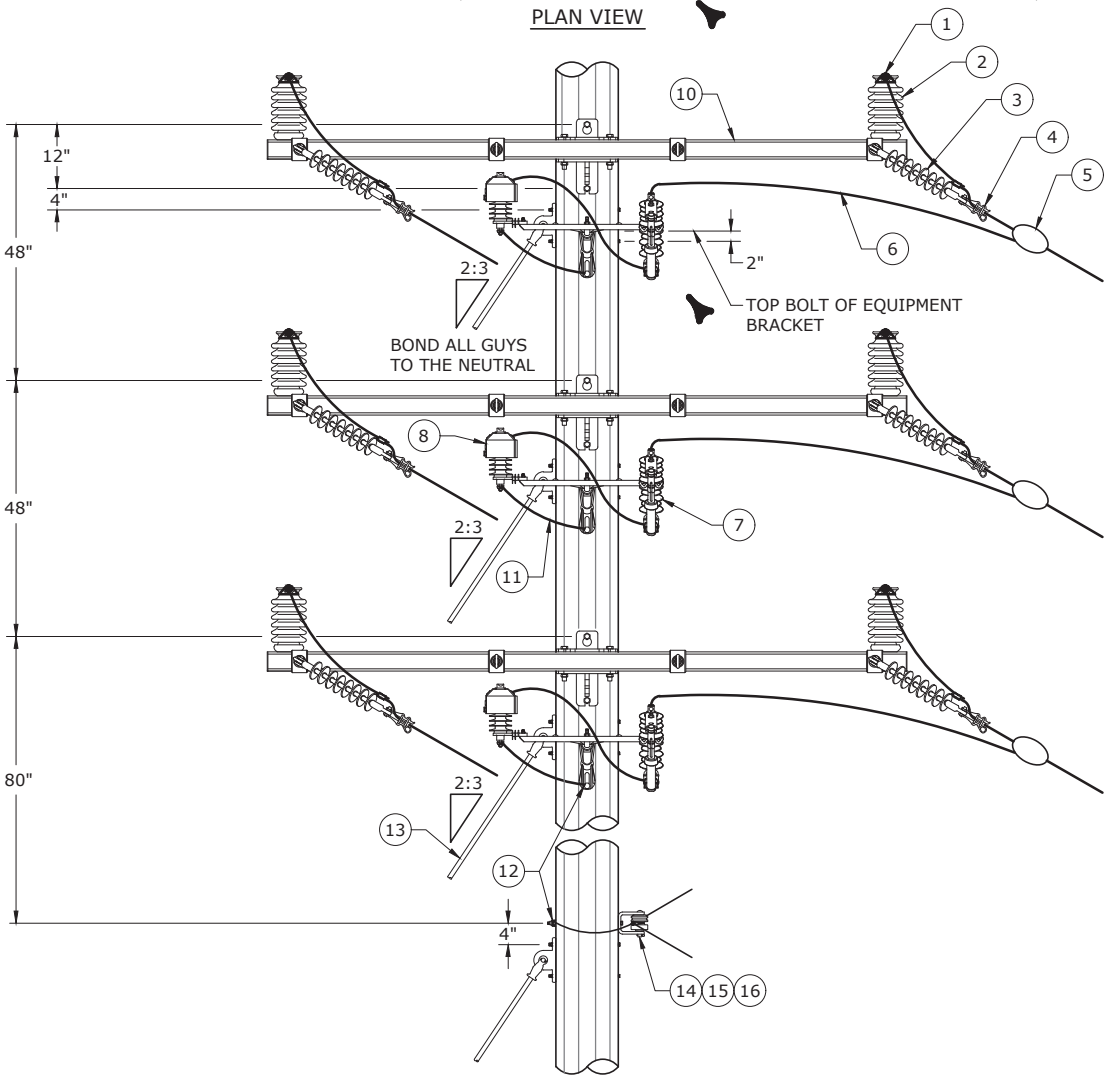
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-150B



PLAN VIEW



FRONT VIEW

(REAR ARRESTERS AND FAULT TAMERS REMOVED FOR CLARITY)

NOTES:

1. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.

2. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.

3. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3	4/30/18	BENDER	BURLISON	ADCOCK
2	8/7/17	BENDER	BURLISON	ADCOCK
1	11/30/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES SMALL AND MEDIUM ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-160A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	LEAD-EQ-6-CU-COVER-F	6	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
7	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		6	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		6	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		6	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	ARR-UB-10KV-F	6	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	6	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
8	WG-BUSH-COV-SM-F	6	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
9	BKT-EM-POLE-2POS-FG-F	6	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
9	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
10	ARM-SDE-10-FBG-NB-F	3	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-LG-26IN-GALV-F	6	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
11	GND-EQUIP-6-BOND-F	6	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	7	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
14	INSL-SP-SEC-PORC-F	1	934745	1	INSULATOR, SPOOL, 3-1/8" DIA X 3" LG, PORCELAIN, SECONDARY
15	INSL-1RACK-SEC-PORC-F	1	157944	1	CLEVIS,INSULATOR, SPOOL, GALV STL, 4" LG X 3-1/2" HT, 5/8" STL
			939033	1	WASHER, FLAT, 3/4" NOM, 2-1/4" SQ OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
15	HDWR-MACH-SM-12IN-GALV-F	1	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
16	TIE-SPOOL-(WIRE)-AL-F	1	-	1	SEE SECTION 03.04 FOR INSULATOR TIES (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

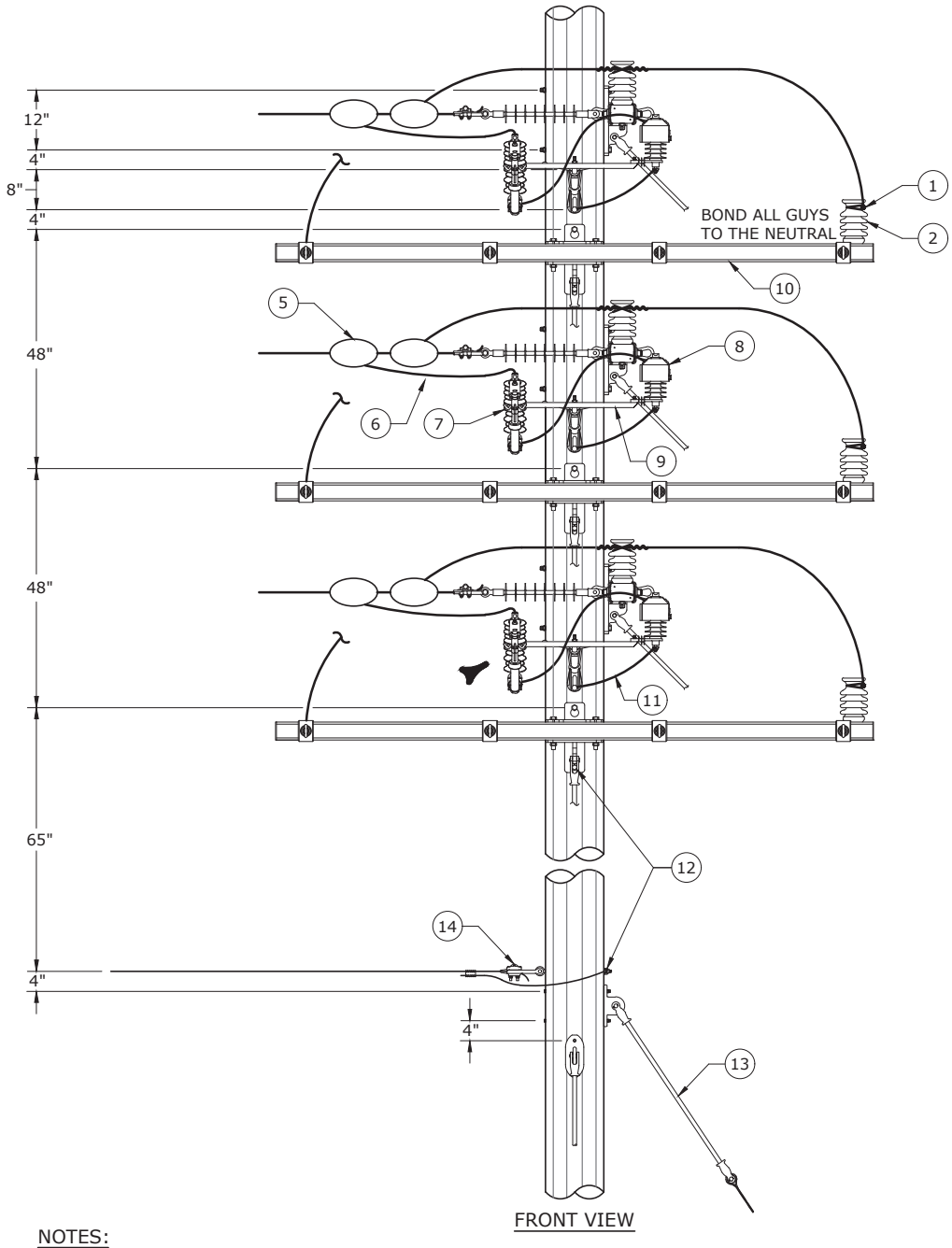
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
SMALL AND MEDIUM ANGLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.25-160B



FRONT VIEW

NOTES:

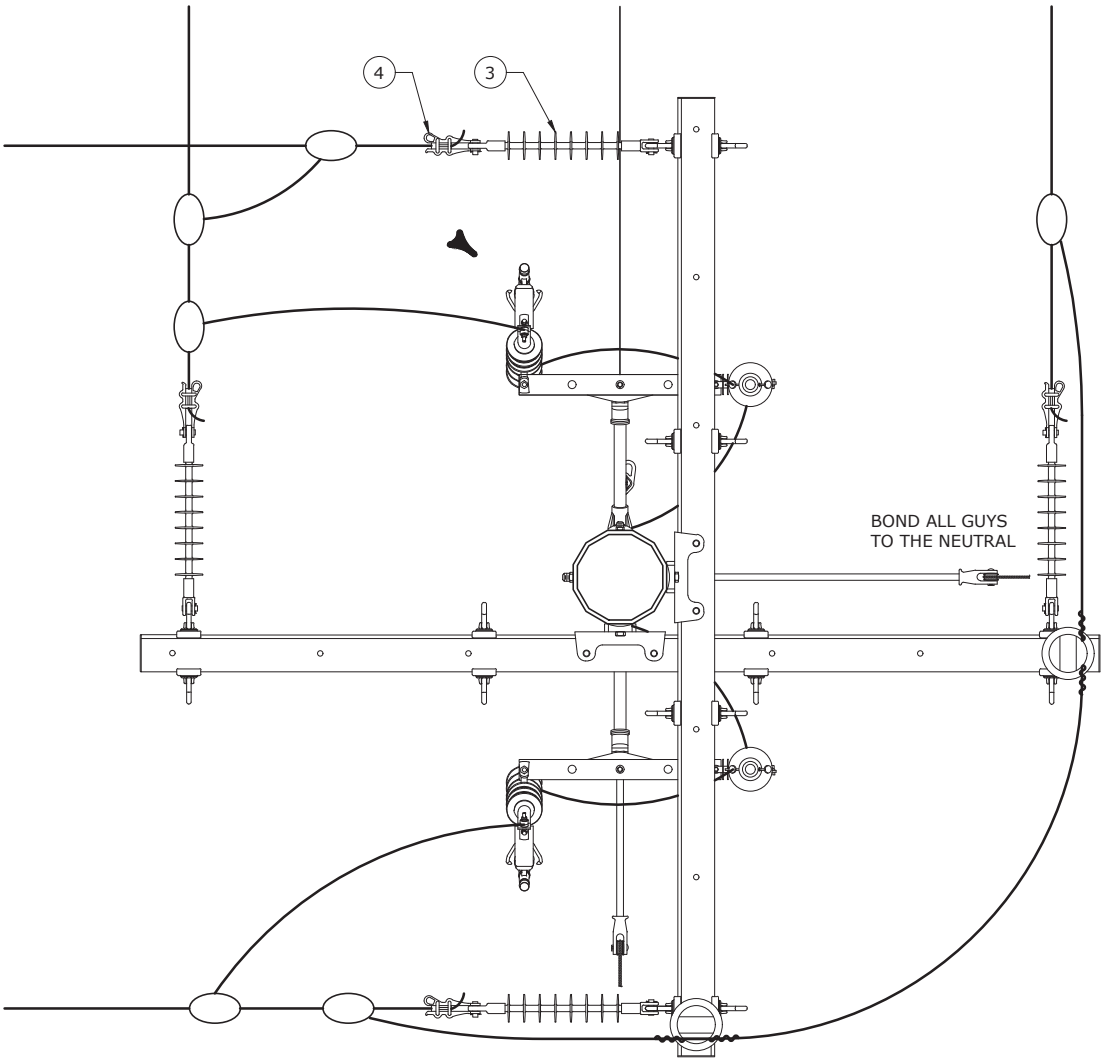
1. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.
2. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.
3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
4. POSITION OF JUMPER POSTS MAY BE ALTERED DUE TO FIELD CONDITIONS.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED	BY	CHK'D	APPR.
3 4/30/18	BENDER	BURLISON	ADCOCK
2 8/7/17	BENDER	BURLISON	ADCOCK
1 11/30/16	LOOSIER	BURLISON	ADCOCK
0 6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
X	X	X	X

03.25-169A



PLAN VIEW

NOTES:

1. PREFERRED CONSTRUCTION IS TO HAVE THE SAME PHASE CONDUCTORS ON THE SAME LEVEL. THIS IMPROVES THE STRUCTURE BIL.
2. GUY INSULATORS MUST BE A MINIMUM OF 8" FROM PRIMARY AND INSULATORS FOR 12KV, 12" FOR 25KV AND 14" FOR 35KV.
3. NUMBER OF GUYS SHALL BE DETERMINED BY DESIGNER.
4. POSITION OF JUMPER POSTS MAY BE ALTERED DUE TO FIELD CONDITIONS.
5. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
LARGE ANGLES (RIGHT ANGLE)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-169B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	TIE-HAND-4-AL-F	6	4022333	12	WIRE, TIE, 4 AWG, 500' LG, SOL, SOFT DRAWN ALUM
2	INSL-POST-25KV-PORC-TT-F	6	50125921	1	INSULATOR, LINE POST, 25KV, 5-1/2" DIA X 9" LG, PORCELAIN
2	INSL-STUD-STL-7IN-THD-F	6	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
3	INSL-DE/S-35KV-POLY-F	12	131781	1	INSULATOR, DEADEND, 35KV, 22" LG, POLYMER, W/ HEX PIN
4	CLAMP-DE-(SIZE)-F	12	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)
5	-	6	-	1	SEE SECTION 04 FOR PRIMARY CONNECTOR DETAILS (VARIES)
6	LEAD-EQ-6-CU-COVER-F	6	4192427	12	WIRE/CABLE, 6 AWG, CU CONDUCTOR, SOL SD, 600V
7	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		6	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
		6	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE 25KV CUTOUT
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	6	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		6	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		6	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
	FUSE-LINK-20-CL-FLIMITER-F	6	406677	1	FUSE, 20A, UP TO 25KV PH TO NEUTRAL, FAULT TAMER
8	ARR-UB-10KV-F	6	4003606	1	ARRESTER, ELECTRICAL, LIGHTNING, 10KV
	ARR-UB-18KV-F	6	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV
8	WG-BUSH-COV-SM-F	6	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT
9	BKT-EM-POLE-2POS-FG-F	6	4188317	1	BRACKET, CUTOUT MOUNTING, 24" LG, FIBERGLASS, 15 DEG ANGLED
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
9	HDWR-MACH-SM-26IN-GALV-F	6	931619	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 26" LG, SQ HEAD, HOT DIP GALV
10	ARM-SDE-10-FBG-NB-F	6	50117396	1	CROSSARM, POLE, 6" OR 7.5" X 4",10' LG, UV STABILIZED FOAM FILL
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
10	HDWR-MACH-LG-26IN-GALV-F	12	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
11	GND-EQUIP-6-BOND-F	6	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
12	GND-POLE-CLIP-5/8-F	7	50121452	1	CLIP, BONDING, GALV STL, 5/8" BOLT DIA, 5/16" MAX WIRE DIA
13	GUY-(VARIES)-F	-	-	-	SEE SECTION 02.04 FOR GUYING DETAILS (VARIES)
14	HDWR-DA-SM-28IN-GALV-F	2	930897	1	BOLT, DOUBLE ARMING, 5/8" DIA, 28" LG, GALV STL, W/ (4) SQ NUTS
14	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
14	CLAMP-DE-(SIZE)-F	2	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

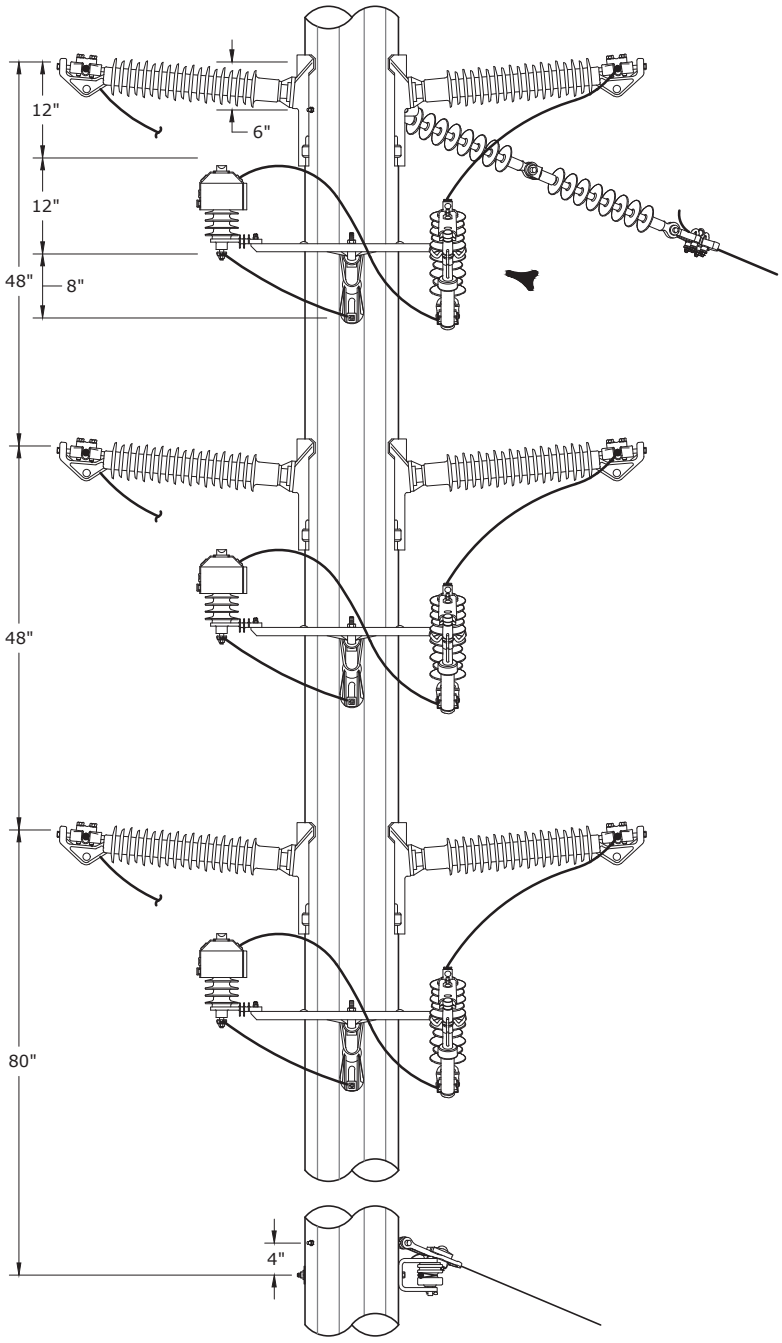
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD
TRANSMISSION STEEL AND CONCRETE POLES
LARGE ANGLES (RIGHT ANGLE)

DEC	DEM	DEP	DEF
			X

03.25-169C



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

NOTES:

1. TAP WILL BE FUSED ON FIRST POLE IN SPAN.
2. TAP MUST BE SLACK SPAN.
3. SEE DWG. 03.25-130C FOR BILL OF MATERIALS.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

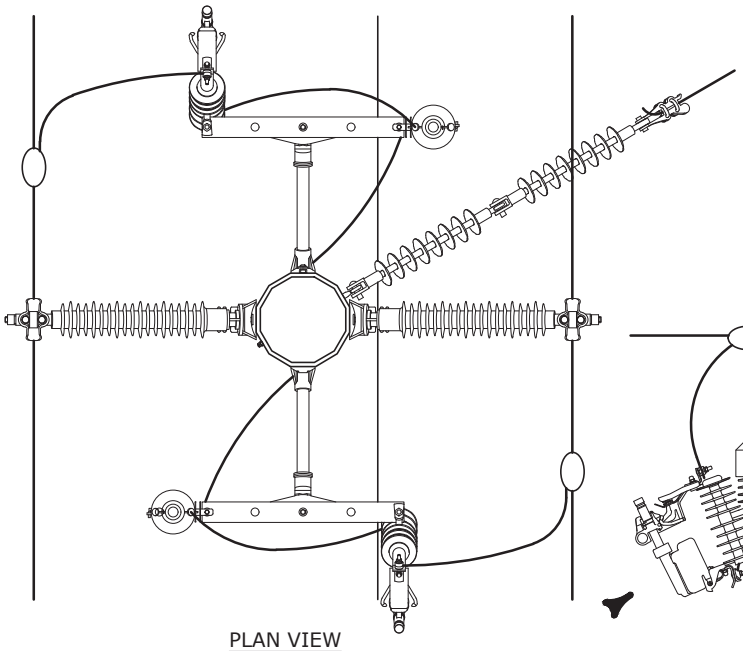
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SINGLE-PHASE FUSED TAP

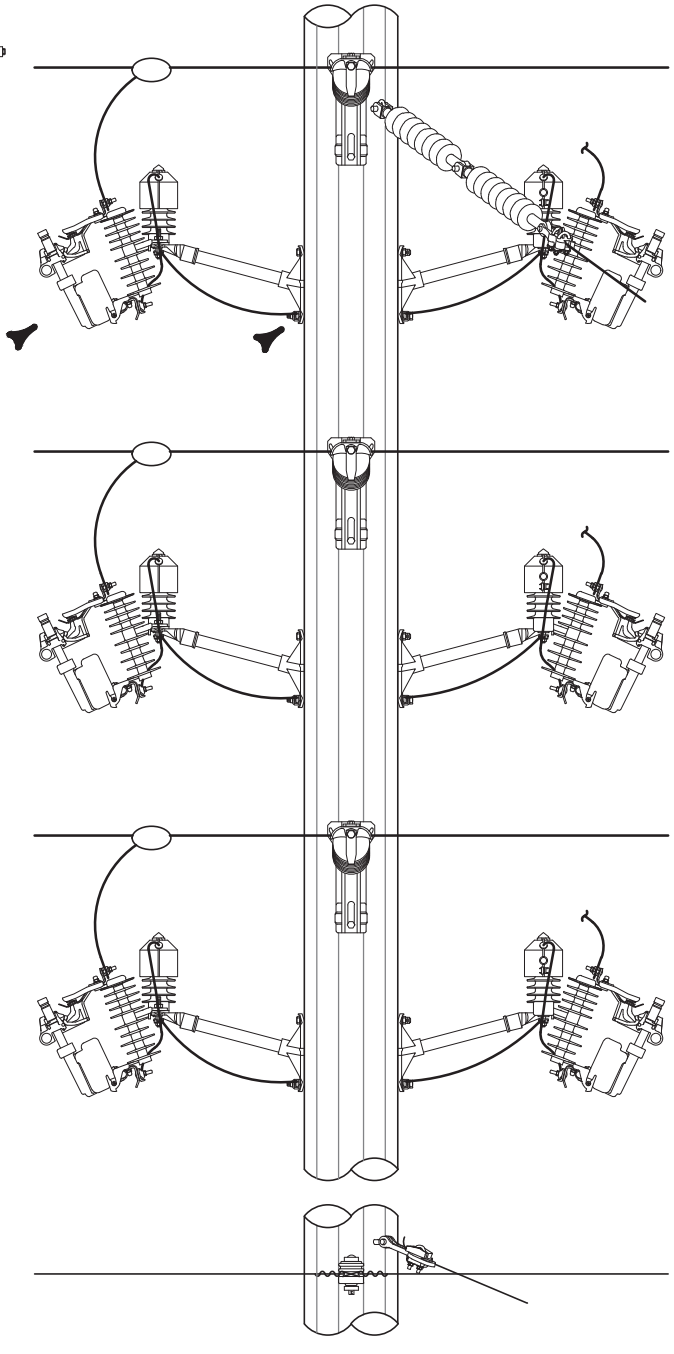
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-180A



PLAN VIEW



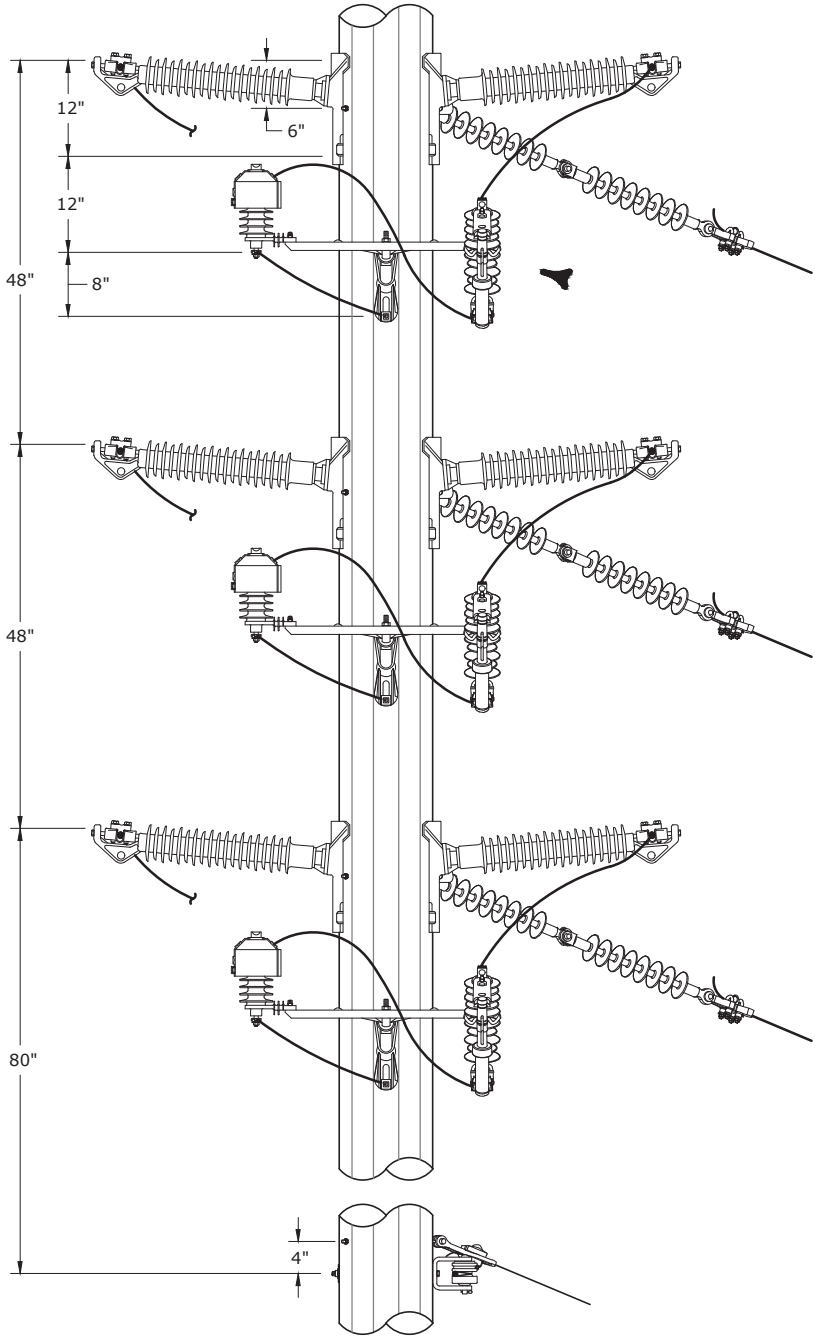
SIDE VIEW

REVISED		BY	CK'D	APPR.
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - SINGLE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.25-180B



FRONT VIEW
(REAR BRACKET NOT SHOWN FOR CLARITY)

NOTES:

1. TAP WILL BE FUSED ON FIRST POLE IN SPAN.
2. TAP MUST BE SLACK SPAN.
3. SEE DWG. 03.25-133C FOR BILL OF MATERIALS.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES.

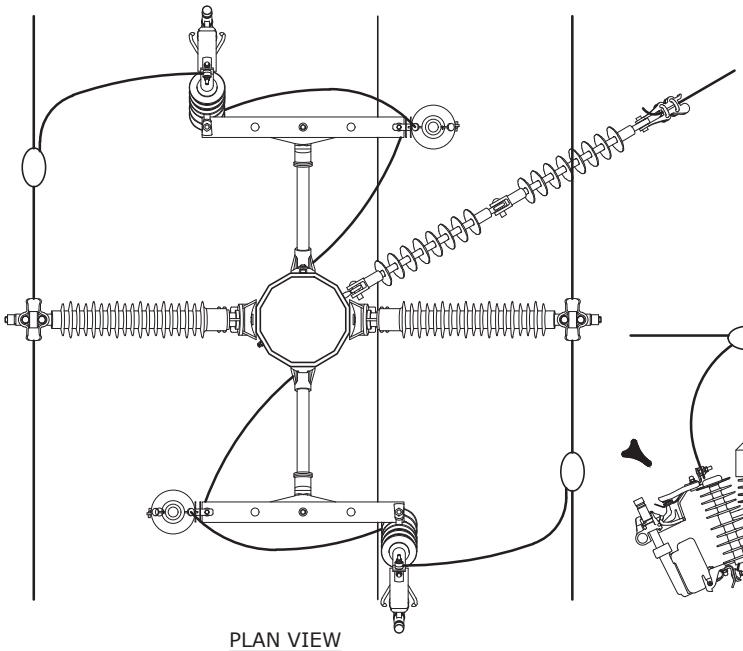
3				
2				
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - THREE-PHASE FUSED TAP

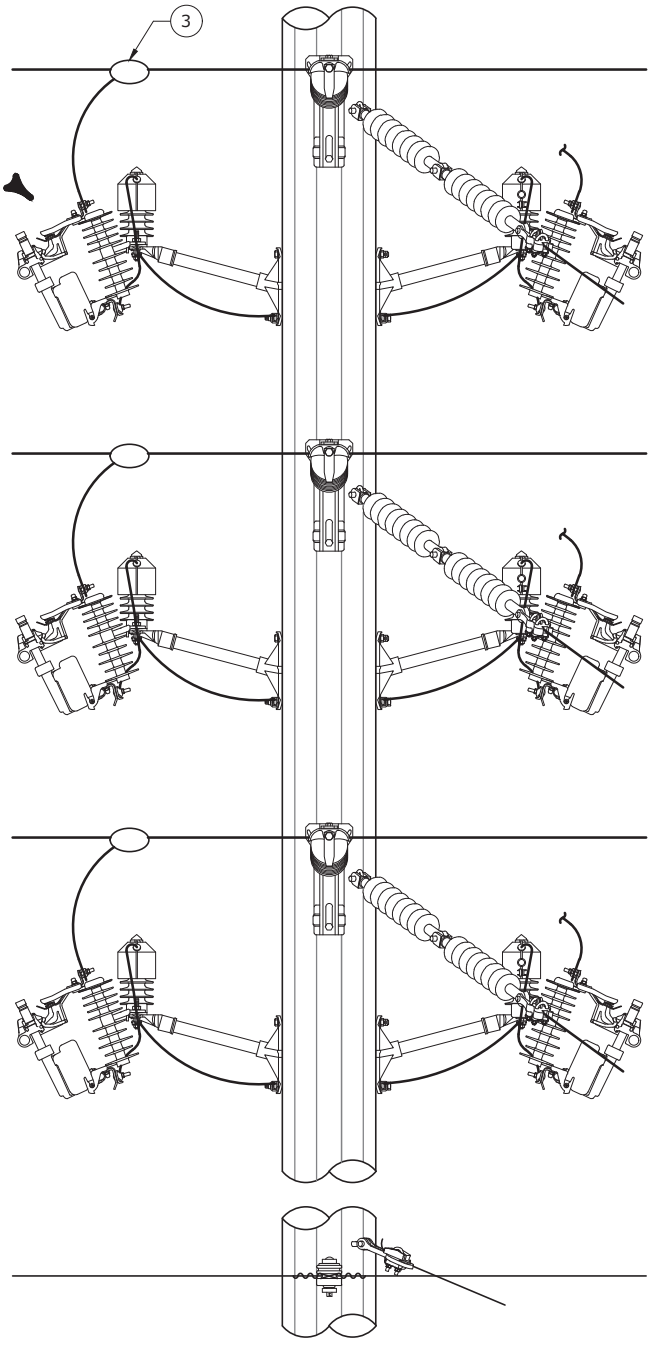
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.25-183A



PLAN VIEW



SIDE VIEW

REVISED	BY	CK'D	APPR.
3			
2			
1	4/30/18	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

VERTICAL DOUBLE CIRCUIT CONSTRUCTION UNDERBUILD TRANSMISSION STEEL AND CONCRETE POLES - THREE-PHASE FUSED TAP

DEC	DEM	DEP	DEF
X	X	X	X

03.25-183B

AVIAN PROTECTION

DUKE 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 COMPANY 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 DEPARTMENT FOR UNIQUE SITUATIONS. AVIAN CONSTRUCTION IS TO BE USED IN AREAS DESIGNATED "AVIAN AREAS OF CONCERN" BY ENVIRONMENTAL SERVICES. IN DEF, THESE AREAS ARE DENOTED IN GIS BY A GREEN OVERLAY. IN ALL OTHER JURISDICTIONS WITHIN DUKE ENERGY, THESE AREAS WILL BE DETERMINED ON A CASE BY CASE BASIS. THE CONSTRUCTION AND MAINTENANCE OF PRIMARY STANDARDS WILL BE FOLLOWED IN SUPPORT OF DUKE ENERGY'S AVIAN PROTECTION PLAN, ENSURING THE COMPANY REMAINS GOOD STEWARDS OF THE NATURAL RESOURCES ENTRUSTED TO OUR CARE. AVIAN PROTECTION IS NOT REQUIRED IF THERE IS NO PRIMARY ON THE POLE. 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 SERVICES, THE FOLLOWING GUIDELINES SHALL BE FOLLOWED:

NEW CONSTRUCTION

1. VERTICAL CONSTRUCTION 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 OR CONDUCTOR/ INSULATOR COVERS SHALL BE USED BETWEEN PHASES.

3. ALL DOUBLE CROSSARM POLES SHALL HAVE PERCH/NEST DETERRENTS ON THEM; OPTIONS INCLUDE THE TRIANGLE PERCH DETERRENT OR OTHER APPROVED PERCH DETERRENTS SHOWN IN THIS SPEC.

4. ALL PRIMARY POLES WITHOUT POLE TOP INSULATORS OR OTHER POLE TOP EQUIPMENT, SUCH AS ANTENNA, SHALL HAVE POLE TOP CAPS TO PREVENT PERCHING.

5. ALL CUTOUT SWITCHES SHALL HAVE AVIAN COVERS INSTALLED.

6. ALL **PRIMARY** TRANSFORMER, RECLOSER, SECTIONALIZER, ARRESTER, CAPACITOR, LINE FUSE, 200A AND 600A 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.

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. IN VERTICAL CONSTRUCTION, 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 THE BIRD PERCH DISCOURAGER.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	2/3/17	LOOSIER	BURLISON	ADCOCK
1	7/29/16	LOOSIER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

WILDLIFE/AVIAN PROTECTION

DEC	DEM	DEP	DEF
X	X	X	X

03.26-100

MAINTENANCE

1. WHEN PERFORMING MAINTENANCE CONSTRUCTION OF PRIMARY LINES, BRING STRUCTURE TO AVIAN STANDARD PER NEW CONSTRUCTION GUIDELINES IN AREAS DESIGNATED BY ENVIRONMENTAL SERVICES AS AVIAN AREAS OF CONCERN.

2. INSTALL NESTING PLATFORMS ON STRUCTURES THAT HAVE INACTIVE NEST. (ALTERNATIVE POLE MAY NEED TO BE SET). WHEN USING AN ALTERNATIVE POLE, NEST DETERRENTS SHOULD BE PLACED ON ORIGINAL STRUCTURE WHERE THE NEST OCCURRED.

   a. ACTIVE NEST SHOULD NOT BE MOVED UNTIL EGGS HATCH AND YOUNG FLEDGE, UNLESS ENVIRONMENTAL 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 BIRD FLIGHT DIVERTERS TO STOP NEST BUILDING AT LOCATION.

4. 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.

BFD'S SHALL 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. 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 DESIGNER. IF NEEDED, CONSULT ENVIRONMENTAL SERVICES FOR MORE GUIDANCE.

IT IS NOT DUKE ENERGY'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.

DUKE ENERGY.

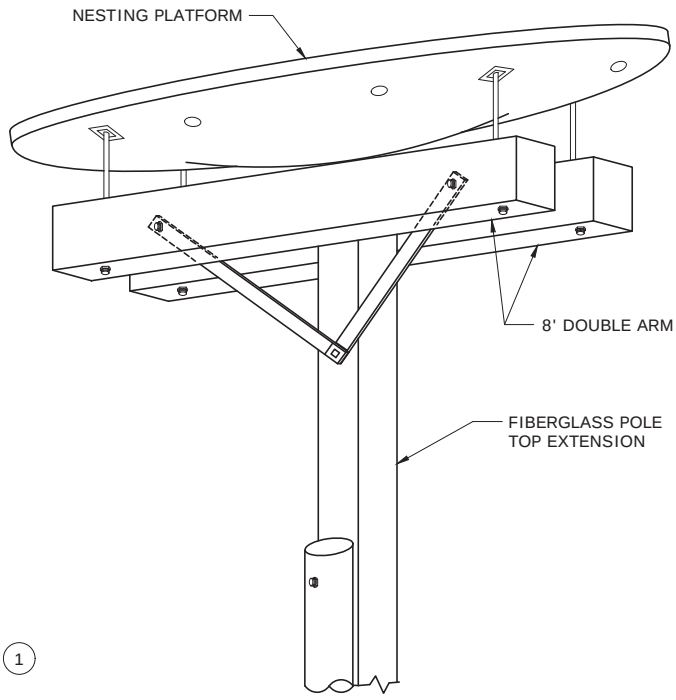
3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

WILDLIFE/AVIAN PROTECTION

DEC	DEM	DEP	DEF
X	X	X	X

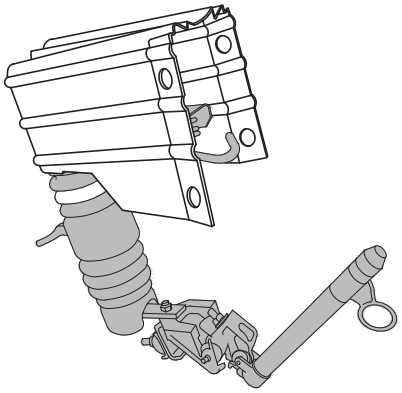
03.26-101

NESTING PLATFORM



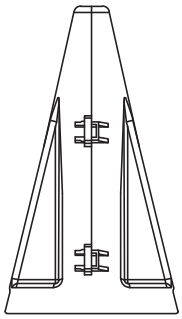
1

CUTOUT COVER



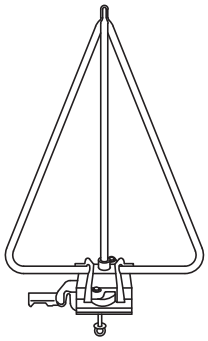
2

POLE TOP CAP
BIRD PERCH DETERRENT



3

TRIANGLE BIRD PERCH DETERRENT



4

SWITCH BRACKET DETERRENT

5

BIRD FLIGHT DIVERTER
FIREFLY CONDUCTOR FLAPPER

6

1/0 - 795

100' SPACING - TOP CONDUCTOR ONLY

BIRD FLIGHT DIVERTER
PLS DIVERTER

7

NOTES:

1. COORDINATE RAPTOR NEST RELOCATIONS WITH LOCAL ENVIRONMENTAL SPECIALIST.
2. SEE DWG. 03.26-100 AND DWG. 03.26-101 FOR GENERAL NOTES.

DUKE ENERGY.

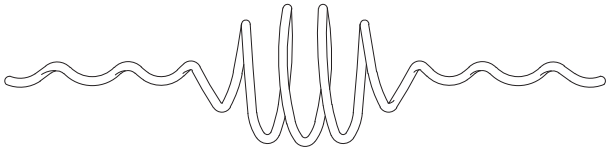
3				
2				
1	12/31/18	BURLISON	BENDER	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

AVIAN PROTECTION
DETERRENT ITEMS FOR DISTRIBUTION

DEC	DEM	DEP	DEF
X	X	X	X

03.26-104A

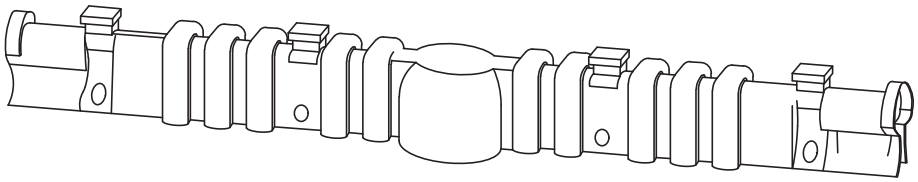
BIRD FLIGHT DIVERTER
CONDUCTOR PRE-FORM DIVERTERS



100' SPACING - TOP CONDUCTOR ONLY

8

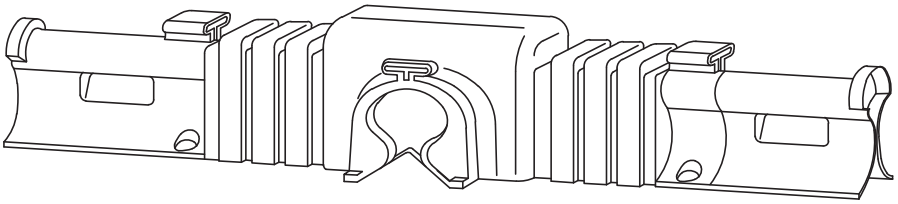
INSULATOR COVER
WIRE SIZE: #2 - 795



FOR USE IN HORIZONTAL CONSTRUCTION
(OR VERTICAL CONSTRUCTION WITH VERTICALLY MOUNTED INSULATORS ON CROSSARMS)

9

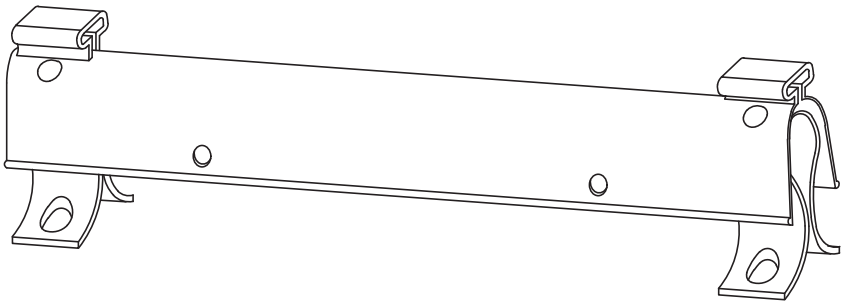
INSULATOR COVER
WIRE SIZE: #6 - 795



FOR USE IN VERTICAL CONSTRUCTION
(EXCEPT FOR VERTICAL CONSTRUCTION WITH VERTICALLY MOUNTED INSULATORS ON CROSSARMS)

10

COVER EXTENSION
WIRE SIZE: #2 - 795



USE WITH INSULATOR COVERS AS NEEDED

11

NOTES:

1. SEE DWG. 03.26-100 AND DWG. 03.26-101 FOR GENERAL NOTES.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	12/31/18	BURLISON	BENDER	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

AVIAN PROTECTION

DETERRENT ITEMS FOR DISTRIBUTION

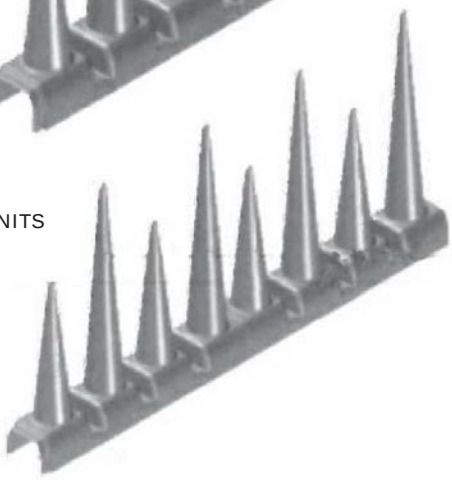
DEC	DEM	DEP	DEF
X	X	X	X

03.26-104B

BIRD PERCH DISCOURAGER

SINGLE UNIT

MULTIPLE UNITS



12

CONDUCTOR TUBING

13

NOTES:

1. THE BIRD DISCOURAGER MAY BE USED AS AN ALTERNATE TO THE DETERRENTS ON DWG. 03.26-104A. IT CAN BE SECURED TO CROSSARMS WITH NAILS. IT MAY BE CUT TO SIZE FOR SWITCH BRACKETS AND SECURED USING ZIP TIES.

REVISED		BY	CHK'D	APPR.
3				
2				
1	12/31/18	BURLISON	BENDER	ADCOCK
0	6/30/16	LOOSIER	BURLISON	ADCOCK

AVIAN PROTECTION

DETERRENT ITEMS FOR DISTRIBUTION

DEC	DEM	DEP	DEF
X	X	X	X

03.26-104C

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	WG-NEST-F	1	4004793	1	WILDLIFE GUARD NEST PLATFORM
2	WG-CUTOUT-COV-15KV-POLY-F	1	4197922	1	COVER, CUTOUT, FOR AVIAN PROTECTION ON FUSED CUTOUT, 15 KV
	WG-CUTOUT-COV-27KV-POLY-F	1	4197922	1	COVER, CUTOUT, FOR AVIAN PROTECTION ON FUSED CUTOUT, 27 KV
	WG-CUTOUT-COV-15KV-PORC-F	1	4186913	1	COVER, CUTOUT, FOR AVIAN PROTECTION ON FUSED CUTOUT, 15 KV
	WG-CUTOUT-COV-27KV-PORC-F	1	4197922	1	COVER, CUTOUT, FOR AVIAN PROTECTION ON FUSED CUTOUT, 27 KV
3	WG-PTOP-CAP-F	1	1529553	1	WILDLIFE GUARD POLE TOP PERCH DETER RAPTOR RESISTER
4	WG-ARM-TRI-F	1	4186920	1	PERCH, BIRD DETERRENT, TRIANGLE
5	WG-SWBKT-SPK-F	1	1573179	1	DEVICE, BIRD ANTI-PERCH DETERRENT, SWITCH BRACKET SPIKES, FITS 1/4" X 4" SWITCH BRACKETS
6	WG-FLTDIV-FLAP-F	1	4164106	1	DIVERTER, FLIGHT, FIREFLY, BOLTED FLAPPER
7	WG-FLTDIV-PLSFLAP-SM-F	1	1573248	1	BIRD FLIGHT DIVERTER, FLAPPER, 0.25"-0.58" DIA, PVC, F/ #4-4/0 AAAC & ACSR CONDUCTORS
	WG-FLTDIV-PLSFLAP-LG-F	1	1573250	1	BIRD FLIGHT DIVERTER, FLAPPER, 0.57"-1.08" DIA, PVC, F/ 336-795 AAC & 336-556 ACSR CONDUCTORS
8	WG-FLTDIV-PRFM-1/0-F	1	4006194	1	WILDLIFE GUARD FLIGHT DETERRENT YELLOW SPIRAL 1/0 AL
	WG-FLTDIV-PRFM-4/0-F	1	4006195	1	WILDLIFE GUARD FLIGHT DETERRENT YELLOW SPIRAL 4/0 AL
	WG-FLTDIV-PRFM-336-F	1	4161009	1	WILDLIFE GUARD FLIGHT DETERRENT YELLOW SPIRAL 336 AL
	WG-FLTDIV-PRFM-795-F	1	4187049	1	WILDLIFE GUARD FLIGHT DETERRENT YELLOW SPIRAL 795 AL
9	WG-INS-COV-HRZ-F	1	4189022	1	COVER, INSULATOR, BIRD DETERRENT, HORIZ PIN INSULATOR
10	WG-INS-COV-VRT-F	1	4189023	1	COVER, INSULATOR, BIRD DETERRENT, FOR LINE POST
11	WG-INS-COV-EXT-F	1	4189021	1	COVER, CONDUCTOR, BIRD DETERRENT, # 2 TO 795, EXTENSION
12	WG-ARM-SPK-F	1	4170052	1	WILDLIFE GUARD CROSSARM PERCH DETERRENT SPIKE STRIP
13	WG-TUBE-SM-F	1	4159685	1	WILDLIFE GUARD COND TUBING, SMALL #6, 50' ROLL
	WG-TUBE-MD-F	1	4159690	1	WILDLIFE GUARD TUBING SMALL 0.75" DIA (PER CONDUCTOR)
	WG-TUBE-LG-F	1	50123952	1	WILDLIFE GUARD TUBING LARGE 1.25" DIA (PER CONDUCTOR)

REVISED		BY	CHK'D	APPR.
3				
2				
1	12/31/18	BURLISON	BENDER	ADCOCK
0	11/13/17	LOOSIER	BURLISON	ADCOCK

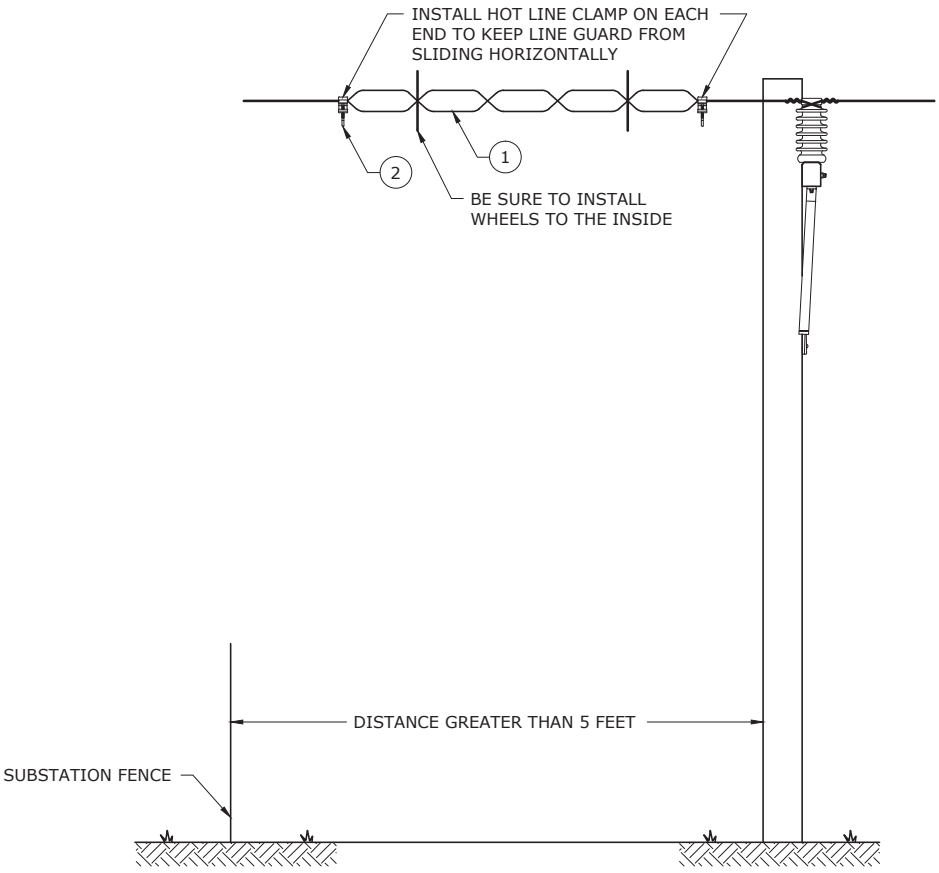
AVIAN PROTECTION

DETERRENT ITEMS FOR DISTRIBUTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

03.26-104D



NOTES:

1. SEE DWG. 03.26-110B OR NOTES AND BILL OF MATERIALS.

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

OVERHEAD FEEDER EXIT LINE GUARD - FIRST POLE OUTSIDE OF SUBSTATION IS GREATER THAN 5 FEET AWAY

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.26-110A

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	WG-CRITTER-LINE-STA-F	1	1533181	1	CRITTER LINE GUARD
2	CONN-OH-HLC-795AL-6AL-F	2	1488987	1	CLAMP, HOT LINE, ALUM, EXTRA LARGE, 795

NOTES:

1. SEE DWG. 03.26-110A FOR DESIGN SPECIFICATIONS.

2. INSTALL THE LINE GUARD ON ALL PHASES, NEUTRAL AND ANY CABLES THAT ALLOW AERIAL ACCESS TO THE SUBSTATION (SQUIRRELS).

3. THE KIT COMES WITH PLASTIC L BRACKETS AND SS HARDWARE. DO NOT USE. INSTEAD, INSTALL AN ALUMINUM HOT LINE CLAMP AT EACH END OF THE LINE GUARD TO PREVENT THE GUARD FROM SLIDING ALONG THE CONDUCTOR.

4. IF THE FIRST POLE OUT OF THE SUBSTATION IS 5' OR MORE FROM THE FENCE INSTALL THE LINE GUARD IN THAT SPAN.

5. IF THE FIRST POLE OUT OF THE SUBSTATION IS LESS THAN 5' FROM THE FENCE, INSTALL A POLE GUARD ON THAT POLE AND INSTALL THE LINE GUARD BEYOND THE FIRST POLE. SEE DWG. 03.26-112A.

DUKE ENERGY.

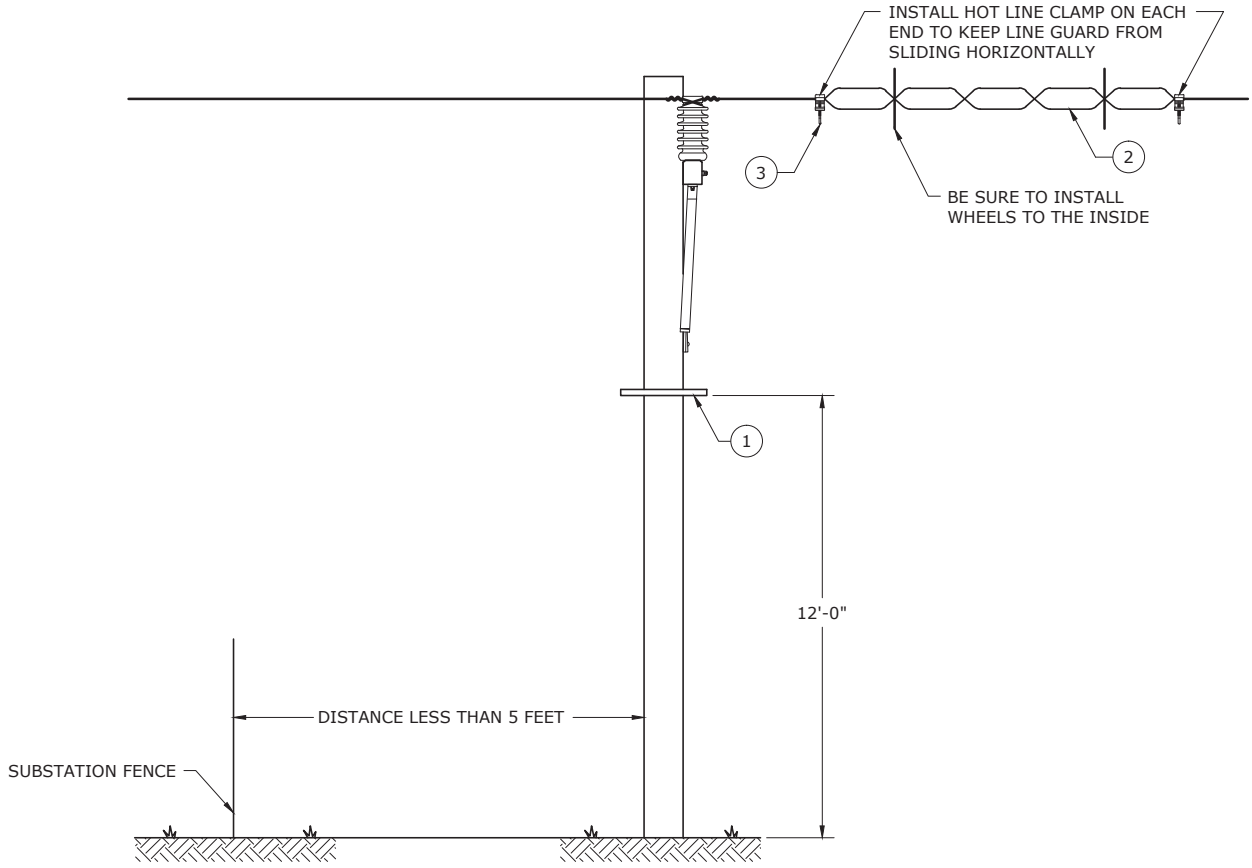
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

OVERHEAD FEEDER EXIT LINE GUARD - FIRST POLE OUTSIDE OF SUBSTATION IS GREATER THAN 5 FEET AWAY

DEC	DEM	DEP	DEF
			X

03.26-110B

POLE GUARD



NOTES:

1. SEE DWG. 03.26-112B FOR NOTES AND BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

OVERHEAD FEEDER EXIT POLE AND LINE GUARD - FIRST POLE OUTSIDE OF SUBSTATION IS LESS THAN 5 FEET AWAY

DEC	DEM	DEP	DEF
X	X	X	X

03.26-112A

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	WG-CRITTER-POLE-STA-F	1	527052	1	CRITTER POLE GUARD
2	WG-CRITTER-LINE-STA-F	1	1533181	1	CRITTER LINE GUARD
3	CONN-OH-HLC-795AL-6AL-F	2	1488987	1	CLAMP, HOT LINE, ALUM, EXTRA LARGE, 795

NOTES:

1. SEE DWG. 03.26-112A FOR DESIGN SPECIFICATIONS.

2. INSTALL POLE GUARD ON THE FIRST POLE OUTSIDE THE SUBSTATION IF THAT POLE IS WITHIN 5' OF THE FENCE. INSTALL 12' ABOVE GROUND.

3. INSTALL LINE GUARD BEYOND THE FIRST POLE. SEE DWG. 03.26-110A.

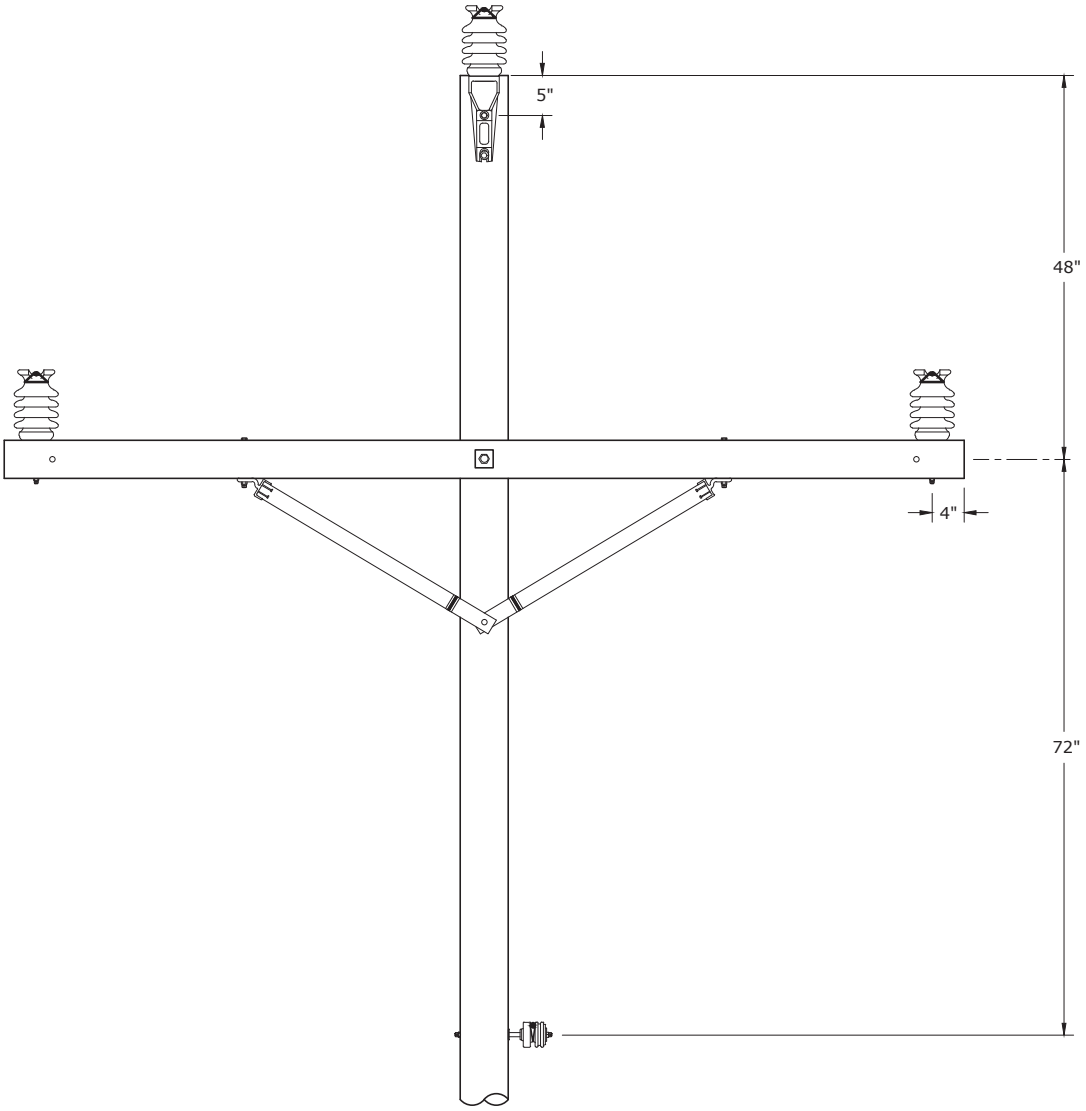
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	LOOSIER	BURLISON	ADCOCK

OVERHEAD FEEDER EXIT POLE AND LINE GUARD - FIRST POLE OUTSIDE OF SUBSTATION IS LESS THAN 5 FEET AWAY

DEC	DEM	DEP	DEF
			X

03.26-112B



FRONT VIEW

NOTES:

1. MAXIMUM SPAN IS 280'.

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

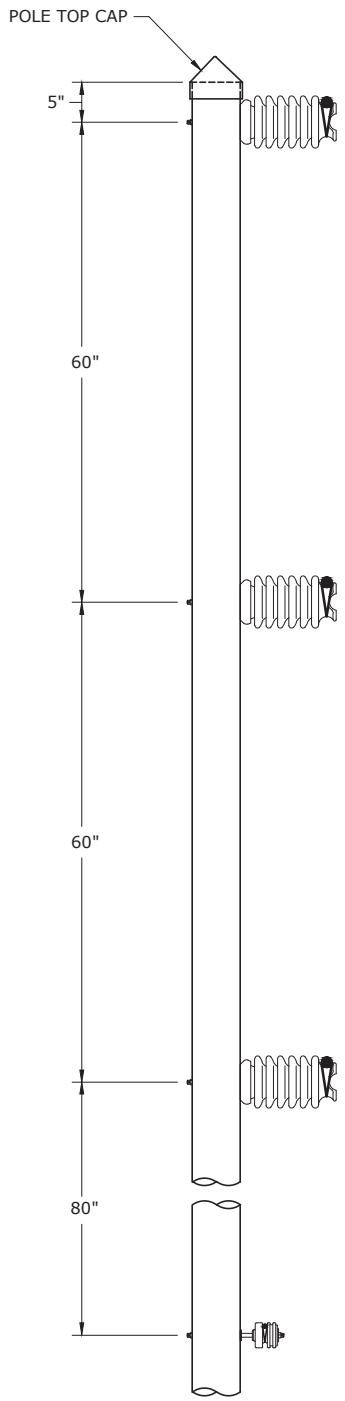
AVIAN PROTECTION

HORIZONTAL CONSTRUCTION - TANGENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

03.26-116



FRONT VIEW

NOTES:

1. MAXIMUM SPAN LENGTH IS 280 FEET.

3				
2				
1				
0	6/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

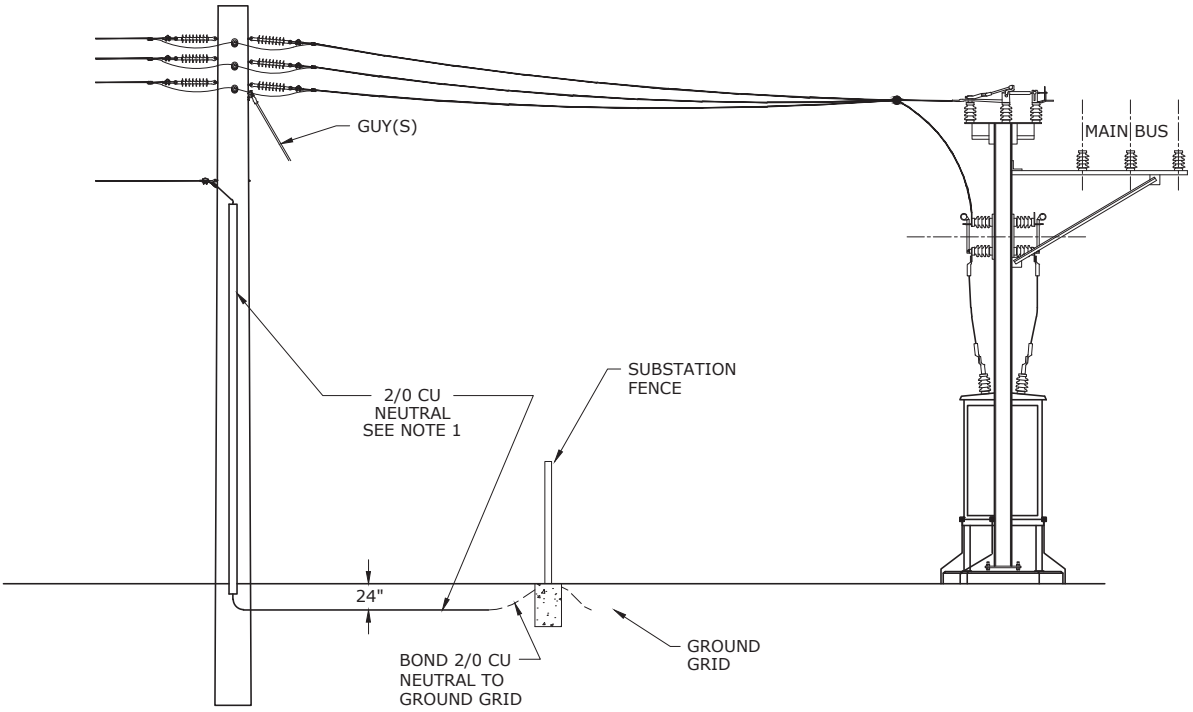
AVIAN PROTECTION

VERTICAL CONSTRUCTION - TANGENT

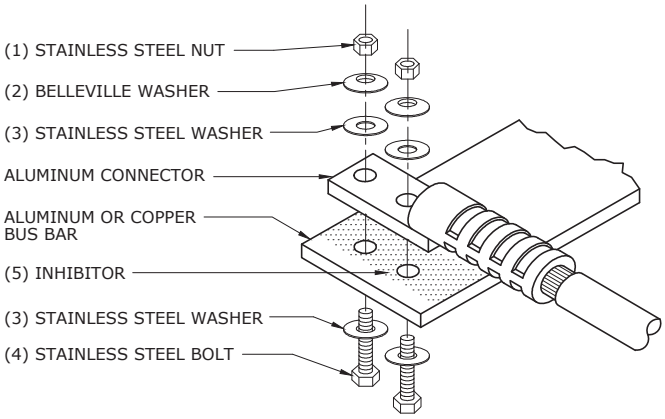
DEC	DEM	DEP	DEF
X	X	X	X

03.26-126

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.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

OVERHEAD FEEDER TERMINATION IN SUBSTATION WITH METAL BUS STRUCTURE

DEC	DEM	DEP	DEF
			X

03.28-100

REVISED		BY	CHK'D	APPR.
3				
2	12/19/18	KATIGBAK	BURLISON	ADCOCK
1	11/13/17	KATIGBAK	BURLISON	ADCOCK
0	11/14/16	KATIGBAK	BURLISON	ADCOCK

SECTION 4 -
OVERHEAD ELECTRICAL CONNECTORS
TABLE OF CONTENTS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

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 UNDER FULL TENSION. REDUCED TENSION SLEEVES MAY ONLY BE USED IN REDUCED TENSION (SLACK SPAN) APPLICATIONS.

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 THE TOOL IS NOT PROPERLY ADJUSTED, THE CONNECTOR WILL BE OVER OR UNDER DEFORMED RESULTING IN AN INEFFECTIVE CONNECTION.

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 CONNECTOR 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.

TIN PLATING ELIMINATES THE FORMATION OF ALUMINUM OXIDE ON CONDUCTORS. **DO NOT** WIRE BRUSH TIN PLATED SURFACES.

SEE DWG. 04.00-108 FOR DETAILS ON AVAILABLE WIRE BRUSHES.

DUKE ENERGY.

						DEC	DEM	DEP	DEF
3					INSTALLATION GUIDE FOR CONNECTORS				
2									
1						X	X	X	X
0	3/31/16	BRUINS	BURLISON	ADCOCK					
REVISED		BY	CK'D	APPR.		04.00-102			

INHIBITOR

INHIBITORS ARE USED AFTER WIRE BRUSHING. THE USE OF INHIBITORS, ALONG WITH WIRE BRUSHING, PROVIDES A GOOD FOUNDATION FOR THE CONNECTION.

TYPES OF INHIBITORS
PREFILLED CONNECTORS CONTAIN AN INHIBITOR WITH A CONDUCTIVE GRIT ADDED. AS THE CONNECTOR IS APPLIED TO THE LINE, THE GRIT PARTICLES ARE PUSHED INTO THE MATING SURFACES CAUSING THE METAL TO FORM CRATERS AROUND THEM. THIS RAISES NON-OXIDIZED METAL AROUND THE RIM OF THE CRATER FORMING A GOOD CONNECTION. IF INSUFFICIENT FORCE IS APPLIED, THE GRIT WILL NOT PENETRATE AND ACTUALLY SEPARATE THE CONNECTOR AND CONDUCTOR. THIS EXPLAINS THE IMPORTANCE OF PROPER COMPRESSION FOR GOOD CONDUCTIVITY AND CORROSION PREVENTION.

FLAT TO FLAT CONNECTIONS SHALL USE INHIBITORS WITHOUT GRIT. APPLY A VERY THIN LAYER ON THE CONNECTION BEFORE BOLTING TOGETHER.

THE APPLICATION OF THE INHIBITOR AND THE NUMBER OF CRIMPS PROPERLY INSTALLED WILL ENSURE GOOD CONTACT AND ENHANCE THE LONGEVITY OF THE CONNECTION.

BENEFITS OF USING INHIBITORS:
- INHIBITORS PREVENT OXIDATION AND CORROSION BY SEALING THE JOINT FROM AIR AND MOISTURE.
- INHIBITORS HELP MAINTAIN CONNECTION INTEGRITY OVER A WIDE TEMPERATURE RANGES.
- INHIBITORS WITH GRIT INCREASES PULLOUT STRENGTH AT THE CONNECTION-CONDUCTOR INTERFACE.
- INHIBITORS WITH GRIT PENETRATE THE REMAINING OXIDE LAYER TO HELP PRODUCE LOW INITIAL CONTACT RESISTANCE, RESULTING IN IMPROVED CONNECTION CONNECTIVITY.

CRIMPING:

APPLYING THE PROPER NUMBER OF CRIMPS ON A CONNECTOR CANNOT BE OVER-EMPHASIZED. ALL CRIMPS INDICATED ON THE CONNECTOR ARE REQUIRED IN ORDER TO MEET THE FULL ELECTRICAL CAPACITY.

ON SLEEVES, ALL CRIMPS ARE NECESSARY IN ORDER TO PASS TENSION REQUIREMENTS.

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 ENSURE 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. (BRUSHES ARE MADE TO ATTACH TO LIVE LINE TOOLS. DO THIS WHEN WORK STANDARDS REQUIRES USE OF LIVE LINE TOOLS.)

2. USE THE PROPER SIZE ALUMINUM CONNECTOR. INSPECT THE COMPRESSION CONNECTOR 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 GRIT INHIBITOR.**

3. POSITION THE CONDUCTORS SO THAT THE ALUMINUM CONDUCTOR IS LOCATED ABOVE THE COPPER CONDUCTOR TO PREVENT COPPER SALTS FROM CORRODING THE ALUMINUM CONDUCTOR. FOR STEEL GUY WIRES, IT IS PERMISSIBLE TO PLACE THE COPPER EITHER ABOVE OR BELOW SINCE THERE IS NO CORROSION CONCERN.

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. 04.02-102 AND 04.02-104.

DUKE ENERGY.

3				
2				
1	9/30/16	BENDER	BURLISON	ADCOCK
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

INSTALLATION GUIDE FOR CONNECTORS

DEC	DEM	DEP	DEF
X	X	X	X

04.00-104

INHIBITORS AND CONNECTIONS	
TYPE OF CONNECTION	TYPE OF INHIBITOR
NON-FLAT CONNECTIONS	INHIBITORS W/ METALLIC GRIT
FLAT TO FLAT CONNECTIONS	INHIBITORS W/ NO GRIT

INHIBITORS WITH METALLIC GRIT	
ITEM NUMBER	DESCRIPTION
50120434	INHIBITOR, CORROSION, 8 OZ PLASTIC DISPENSER BOTTLE, SPEC 118 (NON-PETROLEUM B)

INHIBITORS WITH NO METALLIC GRIT	
ITEM NUMBER	DESCRIPTION
663235	INHIBITOR, GALVANIC CORROSION, 7.92 OZ TUBE, ELECTRICAL JOINT COMPOUND #2

NOTES:

1. BE SURE TO BRUSH THE CONDUCTOR(S) BEFORE APPLYING INHIBITOR.
2. DO NOT USE PETROLEUM BASED INHIBITORS AROUND RUBBER OR POLYETHYLENE INSULATED CONDUCTORS.
3. SYNTHETIC BASED INHIBITORS ARE COMPATIBLE WITH RUBBER, POLYETHYLENE AND OTHER INSULATING MATERIALS.
4. DO NOT USE INHIBITORS WITH NON-METALLIC GRIT. THIS GRIT IS NOT CONDUCTIVE.
5. DO NOT USE INHIBITORS WITH MINERAL OIL. MINERAL OIL IS NOT CONDUCTIVE.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

DUKE ENERGY.

ELECTRIC CONTACT INHIBITORS

DEC	DEM	DEP	DEF
X	X	X	X

04.00-106

REPLACEMENT BRUSH
ITEM # 1534105

DOG BONE
ITEM # 1533576

FLAT ROUND
ITEM # 1514670

ITEM # 1530005

ITEM # 1530003

REPLACEMENT BRUSH
ITEM # 1532943

ITEM # 1534194

ITEM # 655894

BILL OF MATERIALS	
ITEM NUMBER	DESCRIPTION
655894	BRUSH, WIRE, CONDUCTOR CLEANING V, SS BRISTLE, W/ HANDLE
1514670	BRUSH, WIRE, FLATROUND, LINEMANS, 2 IN 1 TOOL, FLAT & ROUND UP TO 1590 MCM
1534105	BRUSH, WIRE, LINEMAN REPLACEMENT, LARGE, F/ DOGBONE & FLATROUND WIRE BRUSHES
1530005	BRUSH, WIRE, 3/4"-3" CLEANING SIZE IN, SS HARDWARE, V SHAPE, CONDUCTOR CLEANING
1530003	BRUSH, WIRE, 3"-11" CLEANING SIZE IN, SS HARDWARE, V SHAPE, CONDUCTOR CLEANING
1532943	PAD, REPLACEMENT, MED, F/ CONDUCTOR CLEANINIG BRUSH CAT ID 9220284636
1534194	BRUSH, WIRE, LINEMAN, DBL J DESIGN, WORKS W/ LIVE LINE TOOLS, SWIVELS, LOCKS IN 3 POSITIONS
1533576	BRUSH, WIRE, LINEMAN, SS BRISTLE, PLASTIC HANDLE, 2 BRUSHES IN 1 TOOL, RND HEAD END, 1 F/ CU & 1 F/ ALUM, UP

NOTES:

1. ALWAYS BRUSH CONDUCTORS BEFORE APPLYING INHIBITOR.
2. SEE WORK STANDARD 5.11.1 FOR MORE DETAIL.
3. ONE BRUSH MAY BE USED FOR BOTH ALUMINUM AND COPPER CONDUCTORS.
4. DO NOT BRUSH TINNED PLATED SURFACES.

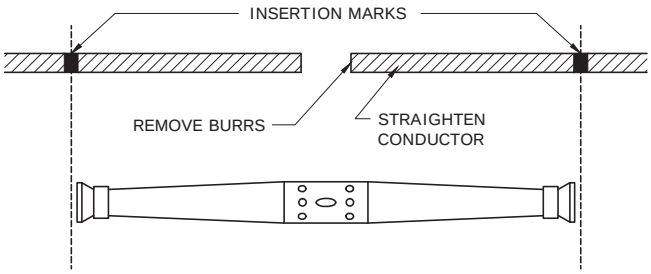
DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

CONDUCTOR CLEANING TOOLS

DEC	DEM	DEP	DEF
		X	X

04.00-108

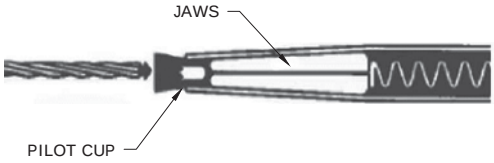


1. STRAIGHTEN THE CONDUCTOR TO REMOVE ANY COIL OR CURVATURE. CONDUCTOR **MUST** BE STRAIGHT FOR PROPER INSERTION.

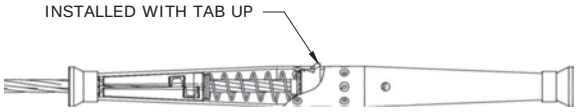
2. TAPE THE CONDUCTOR TO PREVENT UNWRAPPING OF STRANDS. USE CABLE CUTTERS TO CUT THE CONDUCTOR SQUARELY SO THAT ALL STRANDS ARE EVEN. REMOVE THE TAPE AFTER CUTTING. ENSURE END IS CLEAN AND FREE OF BURRS.

3. WIRE BRUSH CONDUCTOR THOROUGHLY (EVEN NEW CONDUCTOR!).

4. MEASURE AND MARK CONDUCTOR FOR INSERTION FROM THE KNURL TO END OF FUNNEL GUIDE. MARK WITH TAPE OR A MARKER. **DO NOT** SCORE WITH KNIFE!



5. FIT THE CONDUCTOR INTO THE PILOT CUP AND PUSH THE CONDUCTOR STRAIGHT IN A SINGLE SMOOTH MOTION UNTIL THE TAB POPS UP INDICATING FULL INSERTION. **DO NOT TWIST!**

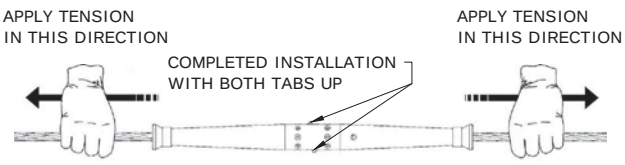


IF RESISTANCE IS FELT WHEN INSERTING THE CONDUCTOR, CONTINUE TO PUSH. **DO NOT PULL THE CONDUCTOR OUT AND ATTEMPT A SECOND INSERTION.**

IF YOU PULL OUT THE CONDUCTOR BEFORE A FULL INSERTION, USE A NEW SPLICE AND TRY AGAIN. DO NOT TWIST THE CONDUTOR OR SPLICE DURING INSERTION OR AFTER THE INSERTION.

6. WIPE OFF EXCESS INHIBITOR.

7. REPEAT ON THE OTHER SIDE.

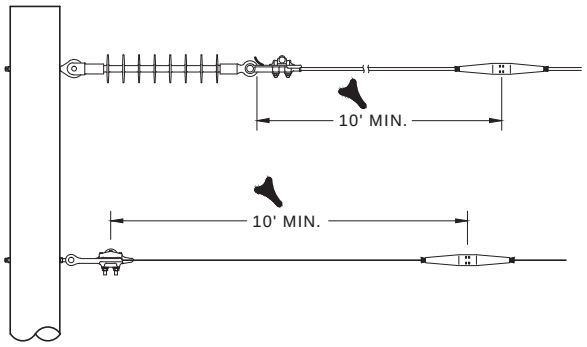


8. BEFORE TENSION IS APPLIED, IT IS EXTREMELY IMPORTANT THAT MOMENTARY TENSION IS APPLIED TO THE CONDUCTOR. HANDSET OR PULL DOWN THE INSTALLED SPLICE TO CREATE SOME TENSION. THIS WILL ENSURE A POSITIVE GRIP ON THE CONDUCTOR.

   DO NOT TAP OR STRIKE THE SPLICE TO SET THE JAWS. THIS CAN DAMAGE THE SPLICE.

AS LINE TENSION IS APPLIED, THERE WILL BE SOME MOVEMENT OF THE CONDUCTOR DUE TO THE SETTING MOTION OF THE JAWS. IF THE DISTANCE BETWEEN THE SPLICE AND THE MARK EXCEEDS 1", THEN START OVER WITH A NEW SPLICE.

AS LINE TENSION INCREASES, SO DOES THE GRIPPING FORCE OF THE JAWS.



CAUTION!

DO NOT RELEASE HOIST OR COME-A-LONG UNLESS BOTH TABS HAVE POPPED UP.

IF THE TABS HAVE NOT POPPED UP, REMOVE THE SPLICE AND START OVER WITH A NEW ONE.

DO NOT REUSE AUTOMATIC SPLICES. IT IS NOT POSSIBLE TO ADEQUATELY CLEAN INTERNAL COMPONENTS AFTER THEY HAVE BEEN EXPOSED TO SERVICE CONDITIONS.

NOTES:

1. NO AUTOMATIC SPLICE IS TO BE USED UNLESS THE CONDUCTOR IS UNDER TENSION (NO SLACK SPANS).

2. SPLICES NEVER BE CLOSER THAN 2' FROM POLE LINE HARDWARE. **10' FOR NEW CONSTRUCTION.**

3. LIMIT SPLICES TO TWO PER SPAN PER CONDUCTOR.

REVISED	BY	CK'D	APPR.
3 11/29/16	BRUINS	BURLISON	ADCOCK
2 10/3/16	BRUINS	BURLISON	ADCOCK
1 9/14/16	BRUINS	BURLISON	ADCOCK
0 3/31/16	BRUINS	BURLISON	ADCOCK

AUTOMATIC SPLICE INSTALLATION PROCEDURE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

04.02-102A

ALUMINUM			
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER	COLOR CODE
CONN-OH-SPL-AUTO-2AL-F	CONNECTOR OH SPLICE AUTOMATIC 2AL-4AL	327627	ORANGE/RED
CONN-OH-SPL-AUTO-1/0AL-F	CONNECTOR OH SPLICE AUTOMATIC 1/0AL	300116	YELLOW
CONN-OH-SPL-AUTO-2/0AL-F	CONNECTOR OH SPLICE AUTOMATIC 2/0AL	937161	GRAY/YELLOW
CONN-OH-SPL-AUTO-4/0AL-F	CONNECTOR OH SPLICE AUTOMATIC 4/0AL	300117	PINK
CONN-OH-SPL-AUTO-336AL-F	CONNECTOR OH SPLICE AUTOMATIC 336AL	937163	GREEN
CONN-OH-SPL-AUTO-556AL-F	CONNECTOR OH SPLICE AUTOMATIC 556AL-477AL	937164	BLUE/AQUA
CONN-OH-SPL-AUTO-795AL-F	CONNECTOR OH SPLICE AUTOMATIC 795AL	116724	NATURAL

COPPER		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-SPL-AUTO-6ACWC-F	CONNECTOR OH SPLICE AUTOMATIC 6ACWC	300106
CONN-OH-SPL-AUTO-6CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 6CUSOL	937186
CONN-OH-SPL-AUTO-4CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 4CUSOL	937185
CONN-OH-SPL-AUTO-2CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 2CUSOL	937173
CONN-OH-SPL-AUTO-2CU-F	CONNECTOR-AUTOMATIC SPLICE 2CUSTR	937171
CONN-OH-SPL-AUTO-1/0CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 1/0CUSOL-1CU	937177
CONN-OH-SPL-AUTO-2/0CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 2/0CUSOL-1/0CU	50062577
CONN-OH-SPL-AUTO-2/0CU-F	CONNECTOR OH SPLICE AUTOMATIC 2/0CU	937188
CONN-OH-SPL-AUTO-4/0CU-F	CONNECTOR OH SPLICE AUTOMATIC 4/0CU	937179
CONN-OH-SPL-AUTO-4/0CUSOL-F	CONNECTOR OH SPLICE AUTOMATIC 4/0CUSOL-3/0CU	50062583

DUKE ENERGY.

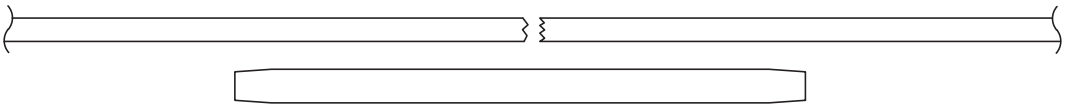
REVISED	BY	CHK'D	APPR.
3			
2			
1			
0	11/13/17	BURLISON	BENDER	ADCOCK

AUTOMATIC SPLICE INSTALLATION

DEC	DEM	DEP	DEF
			X

04.02-102B

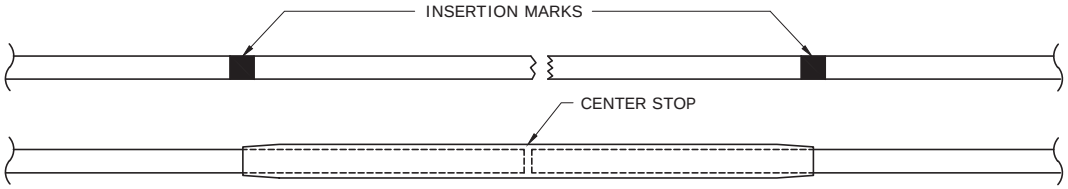
STEP 1: SEE TABLES ON DWG. 04.02-104B FOR SLEEVE ITEM NUMBERS. SLEEVES ARE MARKED TO INDICATE CONDUCTOR AND DIE SIZE.



NOTES:

1. ENSURE CONDUCTOR ENDS ARE CLEAN, SQUARE AND FREE OF BURRS.
2. WIRE BRUSH CONDUCTOR THOROUGHLY.

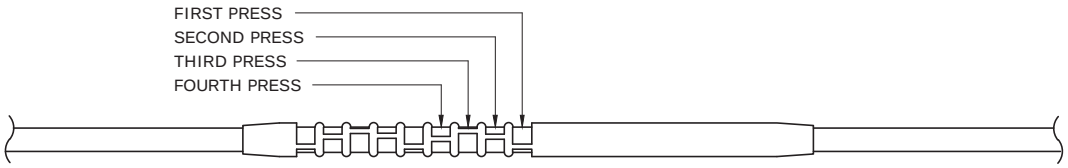
STEP 2



NOTES:

1. MEASURE AND MARK CONDUCTOR FOR INSERTION FROM THE CENTER STOP TO THE SLEEVE END.
2. SLIP SLEEVE OVER THE CONDUCTOR UNTIL IT REACHES THE CENTER STOP.

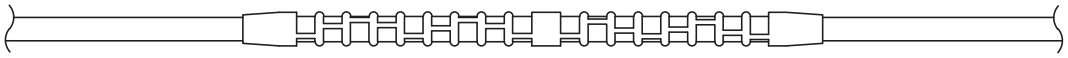
STEP 3



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. SEMI-TENSION SLEEVES ARE RATED AT 40% OF CONDUCTOR STRENGTH. THEY CAN ONLY BE USED IN JUMPERS AND SLACK SPANS.
2. TENSION SLEEVES MAY ALSO BE USED IN SLACK SPANS.
3. REPAIR SLEEVES ARE DESIGNED TO RESTORE FULL CURRENT RATING AND MECHANICAL REINFORCEMENT TO AAC AND ACSR CONDUCTORS WITH 50% OR LESS CROSS-SECTIONAL AREA DAMAGE TO ALUMINUM STRANDS. **REPAIR SLEEVES ARE NOT DESIGNED TO SPLICE CONDUCTOR.**
4. SEE DWG. 04.02-104B FOR BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ONE PIECE COMPRESSION SPLICE

DEC	DEM	DEP	DEF
X	X	X	X

04.02-104A

COPPER TENSION SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	ITEM NUMBER
CONN-OH-SPL-TENS-6CU-F	CONNECTOR OH SPLICE TENSION 6CU	937117
CONN-OH-SPL-TENS-6CUSOL-F	CONNECTOR OH SPLICE TENSION 6CUSOL	937110
CONN-OH-SPL-TENS-4CUSOL-F	CONNECTOR OH SPLICE TENSION 4CUSOL	937125
CONN-OH-SPL-TENS-4ACWC-F	CONNECTOR OH SPLICE TENSION 4ACWC	937142
CONN-OH-SPL-TENS-2CU-F	CONNECTOR OH SPLICE TENSION 2CU	937160
CONN-OH-SPL-TENS-2CUSOL-F	CONNECTOR OH SPLICE TENSION 2CUSOL	937154
CONN-OH-SPL-TENS-2ACWC-F	CONNECTOR OH SPLICE TENSION 2ACWC	937180
CONN-OH-SPL-TENS-1CUSOL-F	CONNECTOR OH SPLICE TENSION 1CUSOL	937182
CONN-OH-SPL-TENS-1/0CU-F	CONNECTOR OH SPLICE TENSION 1/0CU	365992
CONN-OH-SPL-TENS-1/0CUSOL-F	CONNECTOR OH SPLICE TENSION 1/0CUSOL	937184
CONN-OH-SPL-TENS-2/0CU-F	CONNECTOR OH SPLICE TENSION 2/0CU	937200
CONN-OH-SPL-TENS-2/0CUSOL-F	CONNECTOR OH SPLICE TENSION 2/0CUSOL	1529381
CONN-OH-SPL-TENS-3/0CU-F	CONNECTOR OH SPLICE TENSION 3/0CU	113249
CONN-OH-SPL-TENS-4/0CU-F	CONNECTOR OH SPLICE TENSION 4/0CU	291024
CONN-OH-SPL-TENS-4/0CUSOL-F	CONNECTOR OH SPLICE TENSION 4/0CUSOL	1529382

ALUMINUM TENSION SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	ITEM NUMBER
CONN-OH-SPL-TENS-4AL-F	CONNECTOR OH SPLICE TENSION 4AL	50096873
CONN-OH-SPL-TENS-2AL-F	CONNECTOR OH SPLICE TENSION 2AL	937079
CONN-OH-SPL-TENS-1/0AL-F	CONNECTOR OH SPLICE TENSION 1/0AL	50062585
CONN-OH-SPL-TENS-2/0AL-F	CONNECTOR OH SPLICE TENSION 2/0AL	291030
CONN-OH-SPL-TENS-3/0AL-F	CONNECTOR OH SPLICE TENSION 3/0AL	937146
CONN-OH-SPL-TENS-4/0AL-F	CONNECTOR OH SPLICE TENSION 4/0AL	291031
CONN-OH-SPL-TENS-336AL-F	CONNECTOR OH SPLICE TENSION 336AL	112936
CONN-OH-SPL-TENS-795AL-F	CONNECTOR OH SPLICE TENSION 795AL	1482362

ALUMINUM NON-TENSION SLEEVES		
COMP. UNIT	CONDUCTOR SIZE	ITEM NUMBER
CONN-OH-SPL-NTENS-336AL-F	CONNECTOR OH SPLICE NON-TENSION 336AL	112949
CONN-OH-SPL-NTENS-795AL-F	CONNECTOR OH SPLICE NON-TENSION 795AL	4002764
CONN-OH-SPL-NTENS-3/0AL-1/0AL-F	CONNECTOR OH SPLICE NON-TENSION 3/0AL TO 1/0AL REDUCING	117269
CONN-OH-SPL-NTENS-4/0AL-1/0AL-F	CONNECTOR OH SPLICE NON-TENSION 4/0AL TO 1/0AL REDUCING	933923
CONN-OH-SPL-NTENS-4/0AL-2/0AL-F	CONNECTOR OH SPLICE NON-TENSION 4/0AL TO 2/0AL REDUCING	935046
CONN-OH-SPL-NTENS-2/0AL-1/0AL-F	CONNECTOR OH SPLICE NON-TENSION 2/0AL TO 1/0AL REDUCING	4158522
CONN-OH-SPL-NTENS-336AL-1/0AL-F	CONNECTOR OH SPLICE NON-TENSION 336AL TO 1/0AL REDUCING	4002719
CONN-OH-SPL-NTENS-350AL-F	CONNECTOR OH SPLICE NON-TENSION 350AL	193071
CONN-OH-SPL-NTENS-500AL-F	CONNECTOR OH SPLICE NON-TENSION 500AL	4002720

NOTES:

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

2. SEE DWG. 04.02-104A FOR SPLICE INSTRUCTIONS.

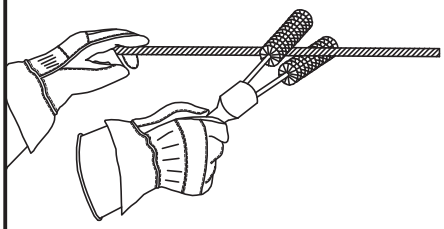
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

COMPRESSION SPLICES

DEC	DEM	DEP	DEF
			X

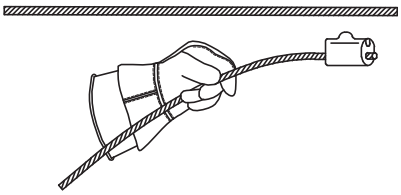
04.02-104B

STEP 1



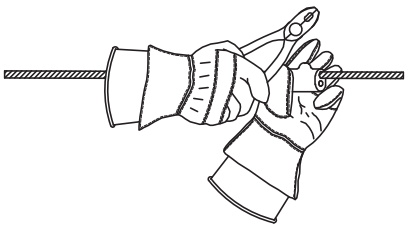
CLEAN BOTH CONDUCTORS THOROUGHLY BY WIRE BRUSHING

STEP 2



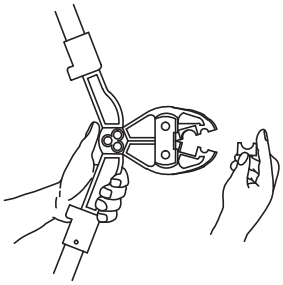
INSERT TAP CONDUCTOR IN TAP SIDE AND BEND TAB OVER CONDUCTOR IF USING DOUBLE TAB PARALLEL GROOVE CONNECTOR

STEP 3



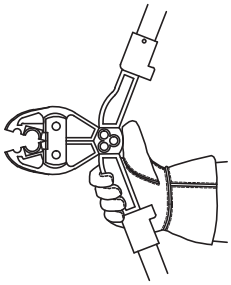
PLACE CONNECTOR ON LINE CONDUCTOR AND BEND TAB OVER CONDUCTOR

STEP 4



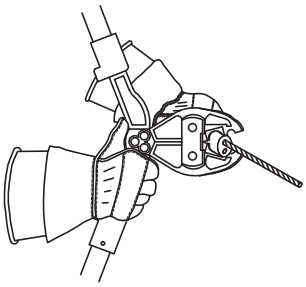
INSERT PROPER DIE TOOL FOR CONNECTOR BEING COMPRESSED

STEP 5



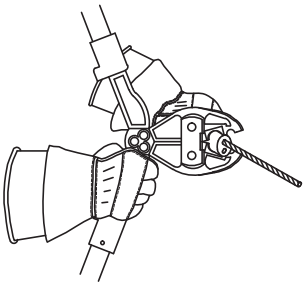
GRIP TOOL WITH THUMB POSITIONED AS SHOWN

STEP 6



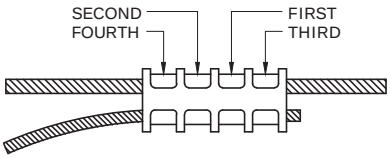
SLIDE TOOL OVER CONNECTOR AND POSITION TOOL TO MAKE CENTER COMPRESSION FIRST

STEP 7



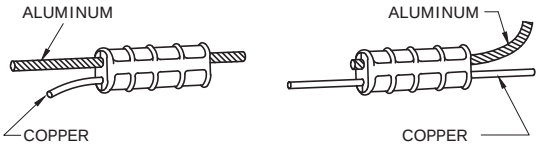
RELEASE THUMB PRESSURE SO THAT TOOL GRIPS CONNECTOR

STEP 8



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

STEP 9



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

NOTES:

1. THE SAME GENERAL PROCEDURE SHOULD BE FOLLOWED FOR INSTALLING PARALLEL GROOVE CONNECTORS WITH THE BATTERY OR HYDRAULIC PRESSES, EXCEPT FEWER COMPRESSIONS WILL BE REQUIRED AND THE ENTIRE LENGTH OF THE CONDUCTOR IS TO BE COMPRESSED.

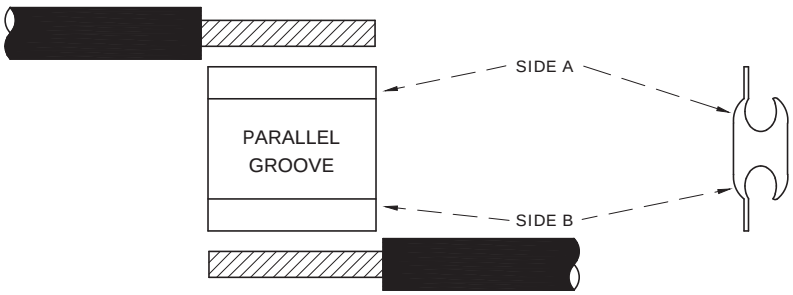
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK

INSTALLATION OF PARALLEL GROOVE COMPRESSION CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

04.06-102



ALUMINUM COMPRESSION CONNECTORS							
SIDE	CONDUCTOR RANGE	DIAMETER RANGE [MIN] - [MAX]	CONNECTOR ITEM NUMBER	DIE SIZE			
				BURNDY	KEARNEY	ALCOA	HUSKIE
A B	6 SOL - 2 STR 14 STR - 8 STR	.162 - .316 .064 - .146	933292	W-BG	5/8	5/8	HT58G
A B	6 SOL - 2 ACSR 6 SOL - 2 ACSR	.162 - .332 .162 - .332	934509	O	O	O	HT58AK
A B	2 STR - 2/0 STR 14 SOL - 8 STR	.250 - .419 .064 - .162	933381	O	O	O	HT58AK
A B	2 STR - 1/0 ACSR 6 SOL - 1 STR	.258 - .420 .162 - .332	933366	O	O	O	HT58AK
A B	1/0 ACSR - 3/0 STR 6 SOL - 1STR	.362 - .470 .162 - .332	933368	D	D	(D)	D
A B	1/0 STR - 3/0 STR 1/0 STR - 2/0 ACSR	.362 - .470 .362 - .470	933367	D	D	(D)	D
A B	3/0 ACSR - 4/0 ACSR 6 SOL - 1 STR	.464 - .563 .162 - .325	933394	D	D	(D)	D
A B	3/0 STR - 4/0 ACSR 1/0 STR - 2/0 ACSR	.464 - .563 .316 - .470	933401	D	D	(D)	D
A B	3/0 STR - 4/0 ACSR 3/0 STR - 4/0 ACSR	.464 - .563 .464 - .563	933404	D	D	(D)	D

COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-PLGV-4AL-6AL-F	CONNECTOR OH PARALLEL GROOVE 4AL SIDE A TO 6AL SIDE B	933292
CONN-OH-PLGV-2AL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 2AL-6AL SIDE A TO 2AL-6CUSOL SIDE B	934509
CONN-OH-PLGV-1/0AL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 1/0AL-4AL SIDE A TO 6CUSOL SIDE B	933381
CONN-OH-PLGV-1/0AL-6CU-F	CONNECTOR OH PARALLEL GROOVE 1/0AL-4AL SIDE A TO 1/0CUSOL-6CU SIDE B	933366
CONN-OH-PLGV-2/0AL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 2/0AL-1/0AL SIDE A TO 1/0CUSOL-6CUSOL SIDE B	933368
CONN-OH-PLGV-2/0AL-2/0CUSOL-F	CONNECTOR OH PARALLEL GROOVE 2/0AL-1AL SIDE A TO 4/0CUSOL-2/0CUSOL SIDE B	933367
CONN-OH-PLGV-4/0AL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 4/0AL-3/0AL SIDE A TO 1/0CUSOL-6CUSOL SIDE B	933394
CONN-OH-PLGV-4/0AL-1/0AL-F	CONNECTOR OH PARALLEL GROOVE 4/0AL-3/0AL SIDE A TO 2/0CU-1/0AL SIDE B	933401
CONN-OH-PLGV-4/0AL-3/0AL-F	CONNECTOR OH PARALLEL GROOVE 4/0AL-3/0AL SIDE A TO 4/0AL-3/0AL SIDE B	933404

NOTES:

1. W-BG, 5/8, O, HT58G, HT58AK, AND D INDICATE DIES TO USE IN MANUAL AND 6T PRESSES. (D) INDICATES DIES TO USE WITH A 12T PRESS.

2. USE ALUMINUM CONNECTORS FOR ALUMINUM-TO-ALUMINUM, ALUMINUM-TO-COPPER, AND ALUMINUM-TO-STEEL CONNECTIONS.

3. 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.

4. SEE DWG. 03.02-107C FOR SECONDARY COVERS.

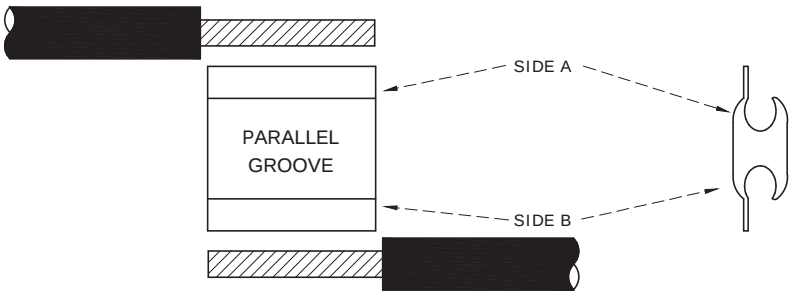
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

PARALLEL GROOVE COMPRESSION CONNECTORS AND DIE SIZES FOR ALUMINUM CONNECTORS

04.06-104A



COPPER COMPRESSION CONNECTORS		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-PLGV-4CUSOL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 4CUSOL-6CUSOL SIDE A TO 4CUSOL-6CUSOL SIDE B	933363
CONN-OH-PLGV-2CUSOL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 2CUSOL-6CUSOL SIDE A TO 2CUSOL-6CUSOL SIDE B	933361
CONN-OH-PLGV-2/0CUSOL-1CU-F	CONNECTOR OH PARALLEL GROOVE 2/0CUSOL-2CU SIDE A TO 2/0CUSOL-1CU SIDE B	933371
CONN-OH-PLGV-2/0CUSOL-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 2/0CUSOL-1CUSOL SIDE A TO 2CUSOL-6CUSOL SIDE B	933370
CONN-OH-PLGV-4/0CU-6CUSOL-F	CONNECTOR OH PARALLEL GROOVE 4/0CU-2/0CU SIDE A TO 2CUSOL-6CUSOL SIDE B	933372
CONN-OH-PLGV-4/0CU-1CU-F	CONNECTOR OH PARALLEL GROOVE 4/0CU-2/0CU SIDE A TO 2/0CUSOL-1CU SIDE B	933374
CONN-OH-PLGV-4/0CU-2/0CU-F	CONNECTOR OH PARALLEL GROOVE 4/0CU-2/0CU SIDE A TO 4/0CU-2/0CU SIDE B	933375

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. ONLY USE COPPER PARALLEL GROOVE CONNECTORS FOR COPPER-TO-COPPER CONNECTIONS.

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. SEE DWG. 03.02-107C FOR SECONDARY COVERS.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

DUKE ENERGY.

COMPRESSION CONNECTORS AND DIE SIZES FOR COPPER CONNECTORS

DEC	DEM	DEP	DEF
			X

04.06-104B

COMPRESSION STIRRUPS - ALUMINUM		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-STRP-COMP-2AL-F	CONNECTOR OH STIRRUP COMPRESSION 2AL-4AL LINE	4002695
CONN-OH-STRP-COMP-1/0AL-F	CONNECTOR OH STIRRUP COMPRESSION 1/0AL-2AL LINE	4002695
CONN-OH-STRP-COMP-2/0AL-F	CONNECTOR OH STIRRUP COMPRESSION 2/0AL-2AL LINE	1532473
CONN-OH-STRP-COMP-4/0AL-F	CONNECTOR OH STIRRUP COMPRESSION 4/0AL-3/0AL LINE	203620

NOTES:

1. FACTORY STIRRUPS INCLUDE ONE OR TWO PARALLEL GROOVE CONNECTORS.
2. CLEAN BOTH THE TAP LINE AND THE STIRRUP CONDUCTORS THOROUGHLY BY WIRE BRUSHING BEFORE INSTALLING PARALLEL GROOVE CONNECTORS. APPLY INHIBITOR AS REQUIRED.
3. STIRRUPS SHOULD BE PLACED 12" MIN. FROM ANY SUPPORT HARDWARE TO ALLOW FOR RESAGGING OF CONDUCTORS.

DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

COMPRESSION STIRRUPS

DEC	DEM	DEP	DEF
			X

04.06-106

FLAT TO FLAT CONNECTIONS

THERE ARE THREE TYPES OF FLAT TO FLAT ELECTRICAL CONNECTIONS IN DISTRIBUTION:

1. TRANSFORMER SPADE TO LAYIN-CONNECTOR OR CABLE LUG (FIG. 1)
2. TRANSFORMER/RECLOSER/REGULATOR NEMA SPADE TO CABLE LUG (FIG. 2).
3. JUMPER SWITCH TO BOLTED WEDGE PADTAP CONNECTOR (FIG. 3).

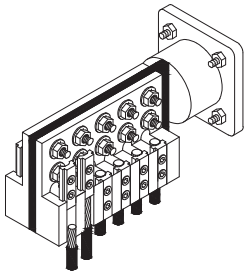


FIG. 1

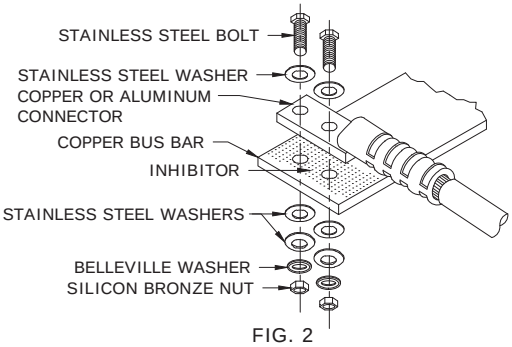


FIG. 2

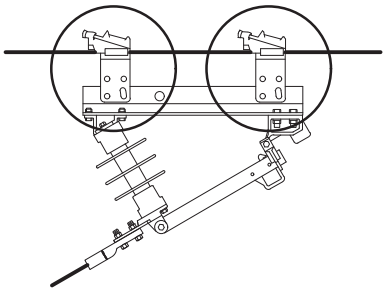


FIG. 3

THE HARDWARE FOR THESE CONNECTIONS SHALL CONSIST OF STAINLESS STEEL BOLTS, STAINLESS STEEL FLAT WASHERS, STAINLESS STEEL BELLEVILLE (DISC SPRING) WASHER AND A SILICON BRONZE NUT. THE SAME HARDWARE IS USED FOR COPPER TO COPPER, COPPER TO ALUMINUM AND ALUMINUM TO ALUMINUM. SEE TABLE BELOW.

RECOMMENDED HARDWARE MATERIALS) QUANTITY PER BOLT)				
MATERIALS BEING JOINED	BOLT	NUT (1)	FLAT WASHER (3)	BELLEVILLE WASHER (1)
COPPER TO COPPER	SS	SB	SS	SS
COPPER TO ALUMINUM	SS	SB	SS	SS
ALUMINUM TO ALUMINUM	SS	SB	SS	SS

KEY:
SB SILICON BRONZE
SS STAINLESS STEEL

SURFACE PREPARATION

ALL CONTACT SURFACES MUST BE FREE OF CONTAMINANTS. USE AN ABRASIVE CLOTH WHEN CLEANING POLISHED SURFACES. NEVER BRUSH PLATED SURFACES SUCH AS TRANSFORMER SECONDARY SPADES (FIGURE1). **ALWAYS** BRUSH THE PADS ON BOLTED WEDGE PADTAPS CONNECTORS (FIGURE 3).

INHIBITORS ENSURE GOOD CONTACT AND ENHANCE THE LONGEVITY OF THE CONNECTION BY LOWERING CONTACT RESISTANCE AND PREVENTING CORROSION BY SEALING THE JOINT FROM AIR AND CONTAMINANTS

APPLY A THIN FILM OF **NON-GRIT** INHIBITOR TO THE SURFACE, JUST ENOUGH TO EVENLY COAT THE SURFACES BEING JOINED. REMOVE ANY EXCESS INHIBITOR IN THE BOLT HOLES TO PREVENT CONTAMINATING THE BOLT THREADS. PROMPTLY MAKE THE CONNECTION BEFORE THE INHIBITOR DRIES. BECAUSE INHIBITOR IS CONDUCTIVE IT IS CRITICAL THAT ALL EXCESS INHIBITOR BE CLEANED FROM THE CONNECTOR EDGES AND FROM INSULATION ON UNDERGROUND PRIMARY CABLE TO PREVENT CONTAMINATING THE INTERNAL SURFACE OF SPLICE HOUSINGS AND ELBOWS.

INSTALLATION OF HARDWARE

1. PLACE A FLAT WASHER UNDER THE BOLT HEAD AND MOVE THE BOLT INTO POSITION.

2. PLACE 2 OR MORE FLAT WASHERS OVER THE BOLT THREADS. THE TOTAL THICKNESS OF THE FLAT WASHERS SHOULD BE TWICE AS THICK AS THE BELLEVILLE WASHER. ENSURE THERE IS NO INTERFERENCE WITH THE WASHERS OF ADJACENT BOLTS AND NO OVERHANG OVER SURFACE EDGES. SEE DWG. 04.07-100B FOR HARDWARE DETAILS.

3. SLIDE THE CUPPED END OF THE BELLEVILLE WASHER ONTO THE BOLT.

4. TIGHTEN THE NUT ON THE BOLT UNTIL A SUDDEN NOTICEABLE INCREASE IN TORQUE IS REQUIRED TO CONTINUE AND THE BELLEVILLE WASHER BECOMES FLAT. ONCE THE BELLEVILLE WASHER IS FLAT, THE TIGHTENING TORQUE WILL ABRUPTLY INCREASE.
   STOP! THE BOLT ASSEMBLY IS COMPLETE. THERE IS NO NEED TO BACK OFF THE NO TORQUE WRENCH IS REQUIRED.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	12/31/18	BRUINS	BURLISON	ADCOCK

BOLTED CONNECTIONS
FLAT-TO-FLAT
GENERAL INFORMATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

04.07-100A

INSTALLATION OF HARDWARE CONTINUED

WHERE MULTIPLE BOLTS ARE NEEDED TO JOIN TWO LARGE SURFACE AREAS, TIGHTEN THE BOLTS IN ALTERNATING ORDER TO EVENLY PULL THE PARTS TOGETHER. THIS IS PARTICULARLY IMPORTANT IF THERE ARE A NUMBER OF BOLTS, LIKE ON LARGE THREE-PHASE TRANSFORMER SPADE CONNECTORS.

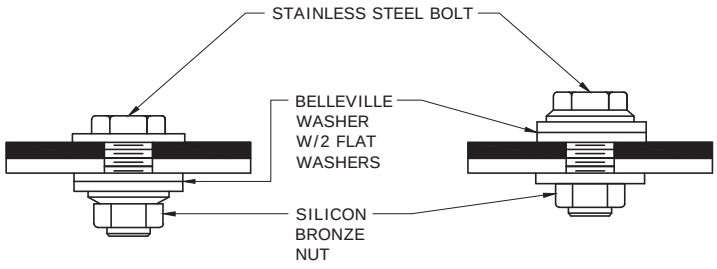
HARDWARE DETAILS

FLAT WASHER SPECIFICATIONS

0.505" ID
1.25" OD
300 SERIES STAINLESS STEEL

BELLEVILLE WASHER SPECIFICATIONS:

0.505" ID
1.063" OD
LOADING - 1500 LBF MINIMUM
3000 LBF MAXIMUM



HARDWARE 1/2"	ITEM NUMBER	DIMENSIONS	DESCRIPTION
BOLT	94540	1/2" - 2" X 13	HEX BOLT, STAINLESS STEEL
BOLT	91509	1/2" - 2-1/2" X 13	HEX BOLT, STAINLESS STEEL
BOLT	91511	1/2" - 3" X 13	HEX BOLT, STAINLESS STEEL
WASHER - BELLEVILLE	90121	1/2", 1" OD	BELLEVILLE WASHER, STAINLESS STEEL
WASHER - FLAT	1421012	1/2", 1.25 OD	FLAT WASHER, STAINLESS STEEL
NUT	93787	1/2" - 13	HEX NUT, SILICON BRONZE

BOLTED WEDGES - ALUMINUM TO ALUMINUM		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-TAP-BLTWDG-2/0AL-1/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 2/0AL LINE TO 1/0AL TAP	4003413
CONN-OH-TAP-BLTWDG-4/0AL-1/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 4/0AL-3/0AL LINE TO 1/0AL TAP	117295
CONN-OH-TAP-BLTWDG-4/0AL-4/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 4/0AL LINE TO 4/0AL TAP	116160
CONN-OH-TAP-BLTWDG-336AL-2AL-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 2AL TAP	4003415
CONN-OH-TAP-BLTWDG-336AL-1/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 1/0AL TAP	4003417
CONN-OH-TAP-BLTWDG-336AL-4/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 4/0AL TAP	4003419
CONN-OH-TAP-BLTWDG-336AL-336AL-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 336AL TAP	111444
CONN-OH-TAP-BLTWDG-556AL-2AL-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 2AL TAP	111442
CONN-OH-TAP-BLTWDG-556AL-1/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 1/0AL TAP	111447
CONN-OH-TAP-BLTWDG-556AL-4/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 4/0AL TAP	111448
CONN-OH-TAP-BLTWDG-556AL-336AL-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 336AL TAP	111449
CONN-OH-TAP-BLTWDG-556AL-556AL-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 556AL TAP	111451
CONN-OH-TAP-BLTWDG-795AL-1/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 1/0AL TAP	117296
CONN-OH-TAP-BLTWDG-795AL-4/0AL-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 4/0AL TAP	111452
CONN-OH-TAP-BLTWDG-795AL-336AL-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 336AL TAP	117297
CONN-OH-TAP-BLTWDG-795AL-556AL-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 556AL TAP	111453
CONN-OH-TAP-BLTWDG-795AL-795AL-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 950AL-795AL TAP	111120

BOLTED WEDGES - ALUMINUM TO COPPER		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-TAP-BLTWDG-1/0AL-2CU-F	CONNECTOR OH TAP BOLTED WEDGE 1/0AL LINE TO 2CU TAP	1534249
CONN-OH-TAP-BLTWDG-1/0AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 1/0AL LINE TO 2/0CU TAP	117294
CONN-OH-TAP-BLTWDG-2/0AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 2/0AL LINE TO 2/0CU TAP	4003413
CONN-OH-TAP-BLTWDG-4/0AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 4/0AL LINE TO 2/0CU TAP	117295
CONN-OH-TAP-BLTWDG-4/0AL-4/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 4/0AL-3/0AL LINE TO 4/0CU TAP	116160
CONN-OH-TAP-BLTWDG-336AL-6CU-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 2CUSOL-6CU TAP	111440
CONN-OH-TAP-BLTWDG-336AL-2CU-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 2CU TAP	4003415
CONN-OH-TAP-BLTWDG-336AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 4/0CUSOL-2/0CU TAP	4003417
CONN-OH-TAP-BLTWDG-336AL-4/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 4/0CU TAP	4003419
CONN-OH-TAP-BLTWDG-336AL-350CU-F	CONNECTOR OH TAP BOLTED WEDGE 336AL LINE TO 350CU TAP	111444
CONN-OH-TAP-BLTWDG-556AL-4CU-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 2CU-4CU TAP	111441
CONN-OH-TAP-BLTWDG-556AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 2/0CU TAP	111447
CONN-OH-TAP-BLTWDG-556AL-4/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 4/0CU TAP	111448
CONN-OH-TAP-BLTWDG-556AL-350CU-F	CONNECTOR OH TAP BOLTED WEDGE 556AL-477AL LINE TO 350CU TAP	111449
CONN-OH-TAP-BLTWDG-795AL-2/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 2/0CU TAP	117296
CONN-OH-TAP-BLTWDG-795AL-4/0CU-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 4/0CU TAP	111452
CONN-OH-TAP-BLTWDG-795AL-350CU-F	CONNECTOR OH TAP BOLTED WEDGE 795AL LINE TO 350CU TAP	111453

BOLTED WEDGE PADTAPS		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-PADTAP-BLTWDG-795AL-4H-F	CONNECTOR OH PADTAP BOLTED WEDGE 795AL LINE TO 4H PAD	4003434

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.
5. USE A COPPER CONNECTOR FOR COPPER-TO-COPPER CONNECTIONS.

REVISED		BY	CHK'D	APPR.
3				
2				
1	1/31/19	BRUINS	BURLISON	ADCOCK
0	11/13/17	BURLISON	BENDER	ADCOCK

BOLTED WEDGE CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

04.08-102A

BOLTED WEDGES - COPPER TO COPPER		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
-	CONNECTOR OH TAP BOLTED WEDGE 2/0CU LINE TO 2/0CU TAP	-
-	CONNECTOR OH TAP BOLTED WEDGE 4/0CU LINE TO 2/0CU TAP	-
-	CONNECTOR OH TAP BOLTED WEDGE 4/0CU LINE TO 4/0CU TAP	-

NOTES:

1. BRUSH BOTH CONDUCTORS THOROUGHLY.
2. TIGHTEN BOLT UNTIL TORQUE CONTROL NUT SHEARS OFF.
3. USE A COPPER CONNECTOR FOR COPPER TO COPPER CONNECTIONS.
4. NEW CONNECTORS COME WITH INHIBITOR.
5. SEE DWG. 04.08-102A FOR ALUMINUM TO ALUMINUM AND ALUMINUM TO COPPER CONNECTORS.
6. NOT SET UP IN STOREROOMS. IF FIELD DETERMINES A NEED, PLEASE CONTACT DISTRIBUTION STANDARDS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	11/14/16	LOOSIER	BURLISON	ADCOCK
0	3/31/16	BRUINS	BURLISON	ADCOCK

BOLTED CONNECTORS FOR COPPER

DEC	DEM	DEP	DEF
		X	X

04.08-102B

REVISED	BY	CHK'D	APPR.
0 11/13/17	BURLISON	BENDER	ADCOCK
1 1/31/19	BRUINS	BURLISON	ADCOCK
2			
3			

BOLTED WEDGE TAP REFERENCE CHART

ALUMINUM TO ALUMINUM, ALUMINUM TO COPPER											
MAIN CONDUCTOR		TAP CONDUCTOR									
		#4A	2AL	1/0CU-7 1/0AAC-7	1/0AAAC-7 1/0ACSR-6/1	2/0AL	3/0ACSR-6/1	4/0AL 4/0CU-7	336.4ACSR-18/1	477AL	795AAC-37
TYPE	DIA.	0.250"	0.316"	0.368"	0.398"	0.447" - 0.520"	0.502"	0.522" - 0.563"	0.684"	0.777" - 0.858"	1.026"
2/0AAAC-7	0.447"			4003413							
2/0ACSR-6/1											
3/0AAAC-7	0.502"										
3/0ACSR-6/1				117295				116160			
4/0AAAC-7	0.563"										
336.4ACSR-18/1	0.684"		4003415	4003416		4003417		4003419	111444		
477AAC-19	0.793"		111442	111447				111448	111449	111451	
477ACSR 18/1	0.814"										
795AAC-37	1.026"		4003426	117296		111452			117297	111453	111120

NOTES:

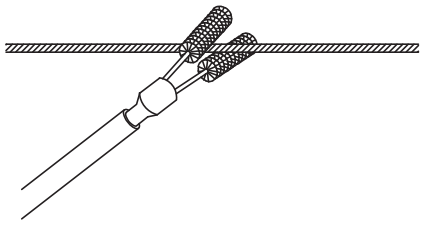
1. COMPATIBLE UNITS AND DESCRIPTIONS MAY BE FOUND ON DWG. 04.08-102A.

DEC	DEM	DEP	DEF
		X	X

DUKE ENERGY®

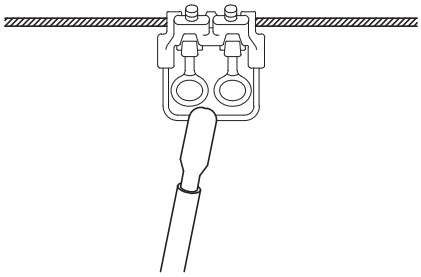
04.08-102C

STEP 1



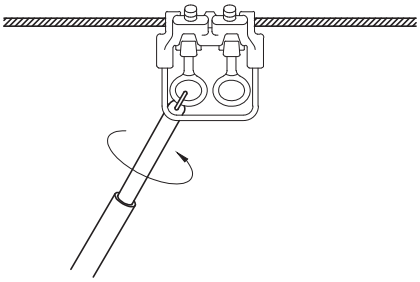
CLEAN BOTH CONDUCTORS THOROUGHLY BY WIRE BRUSHING.

STEP 2



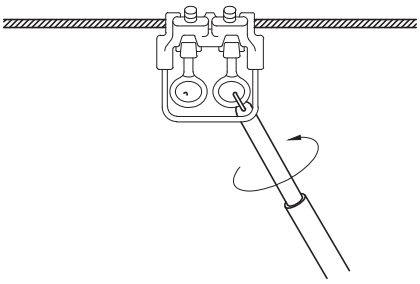
SECURE THE BOLTED CONNECTOR WITH THE LIVE LINE TOOL AND PLACE IT ONTO THE CONDUCTOR WHERE IT WAS BRUSHED.

STEP 3



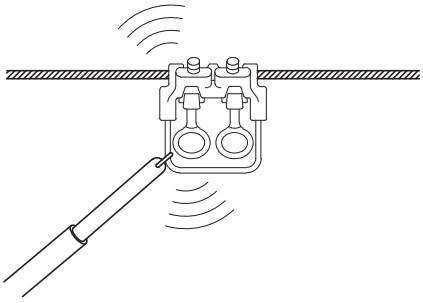
TIGHTEN THE BOLTED CONNECTOR ONTO THE LINE.

STEP 4



ALTERNATE BETWEEN THE TWO EYE-BOLTS TO ENSURE BOTH ARE SECURELY FASTENED TO THE LINE. DO NOT OVER-TIGHTEN.

STEP 5



WIGGLE THE CONNECTOR WITH THE LIVE LINE TOOL TO ENSURE THE CONNECTOR DOES NOT SLIP ON THE LINE. TIGHTEN BOTH EYE-BOLTS IF NECESSARY.

NOTES:

1. USE ALUMINUM BOLTED STIRRUPS ON ALUMINUM WIRE AND BRONZE BOLTED STIRRUPS ON COPPER WIRE.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
4. SEE DWGS. 04.08-104A AND 04.08-104B FOR DETAILED INFORMATION ON BOLTED CONNECTORS.

DUKE ENERGY.

3				
2				
1				
0	11/14/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

INSTALLATION OF REMOVABLE CONNECTORS WITH LIVE LINE TOOLS

DEC	DEM	DEP	DEF
X	X	X	X

04.08-103

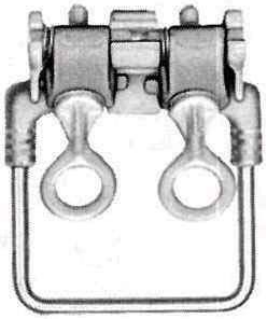
BOLTED WEDGE STIRRUPS

BOLTED WEDGE STIRRUPS - ALUMINUM		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-STRP-BLTWDG-336AL-F	CONNECTOR OH STIRRUP BOLTED WEDGE 336AL LINE	4002696
CONN-OH-STRP-BLTWDG-795AL-F	CONNECTOR OH STIRRUP BOLTED WEDGE 795AL LINE	4002697

NOTES:

1. BOLTED WEDGE STIRRUPS ARE TO BE USED WHERE:
   A. LOCATIONS ARE BUCKET TRUCK ACCESSIBLE
   B. TOOLING LIMITS COMPRESSION STIRRUPS
   C. STIRRUP NEEDS TO BE REMOVABLE.
2. WIRE BRUSH THE LINE CONDUCTOR THOROUGHLY.
3. STIRRUPS SHOULD BE PLACED 12" MIN. FROM ANY SUPPORT HARDWARE TO ALLOW FOR RESAGGING OF CONDUCTORS.
4. SEE SECTION 04.09 (CONNECTOR APPLICATION GUIDE) FOR PERMISSIBLE USES.

BOLTED STIRRUPS



BOLTED STIRRUPS - ALUMINUM		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-STRP-BLT-4/0AL-F	CONNECTOR OH STIRRUP BOLTED 4/0AL-4AL LINE	113922
CONN-OH-STRP-BLT-556AL-F	CONNECTOR OH STIRRUP BOLTED 556AL-336AL LINE	113923
CONN-OH-STRP-BLT-795AL-F	CONNECTOR OH STIRRUP BOLTED 795AL LINE	936722

NOTES:

1. BOLTED STIRRUPS MAY BE USED WHERE COMPRESSION TOOLS CANNOT BE USED AND STIRRUP MUST BE APPLIED WITH A LIVE LINE TOOL.
2. ALUMINUM STIRRUPS FOR ALUMINUM CONDUCTORS AND COPPER STIRRUPS FOR COPPER CONDUCTORS.
3. WIRE BRUSH LINE CONDUCTOR AND THE BAIL OF THE STIRRUP THOROUGHLY. APPLY INHIBITOR TO GROOVE OF STIRRUP IF NECESSARY. DO NOT BRUSH BAILS IF THEY ARE TINNED.
4. STIRRUPS SHOULD BE PLACED A MINIMUM OF 12" FROM ANY SUPPORT HARDWARE TO ALLOW FOR RESAGGING OF CONDUCTORS.
5. SEE SECTION 04.09 (CONNECTOR APPLICATION GUIDE) FOR PERMISSIBLE USES.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

ALUMINUM REMOVABLE STIRRUPS

DEC	DEM	DEP	DEF
			X

04.08-104A

BOLTED STIRRUPS

#6 - 2/0

2/0 - 4/0

BOLTED STIRRUPS - COPPER		
COMPATIBLE UNIT	DESCRIPTION	ITEM NUMBER
CONN-OH-STRP-BLT-2/0CU-F	CONNECTOR OH STIRRUP BOLTED 2/0CU-6CU LINE	936723
CONN-OH-STRP-BLT-4/0CU-F	CONNECTOR OH STIRRUP BOLTED 4/0CU-2/0CU LINE	203615

NOTES:

1. BOLTED STIRRUPS MAY BE USED WHERE COMPRESSION TOOLS CANNOT BE USED AND STIRRUP MUST BE APPLIED WITH A LIVE LINE TOOL.
2. ALUMINUM STIRRUPS FOR ALUMINUM CONDUCTORS AND COPPER STIRRUPS FOR COPPER CONDUCTORS.
3. WIRE BRUSH LINE CONDUCTOR AND THE BAIL OF THE STIRRUP THOROUGHLY. APPLY INHIBITOR TO GROOVE OF STIRRUP IF NECESSARY. DO NOT BRUSH BAILS IF THEY ARE TINNED.
4. STIRRUPS SHOULD BE PLACED A MINIMUM OF 12" FROM ANY SUPPORT HARDWARE TO ALLOW FOR RESAGGING OF CONDUCTORS.
5. SEE SECTION 04.09 (CONNECTOR APPLICATION GUIDE) FOR PERMISSIBLE USES.

DUKE ENERGY.

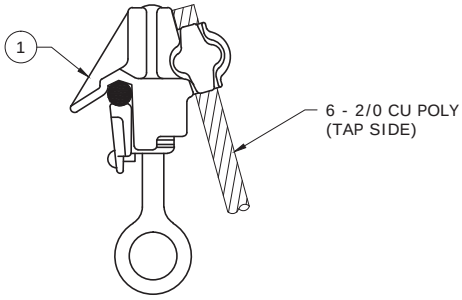
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

COPPER REMOVABLE STIRRUPS

DEC	DEM	DEP	DEF
			X

04.08-104B

HOT LINE CLAMP
(STIRRUP REQUIRED)



BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	CONN-OH-HLC-2/0CU-8CUSOL-F	1	933034	1	CONNECTOR OH HOT LINE CLAMP 2/0CU-8CUSOL LINE TO 2/0CU-8CUSOL TAP

NOTES:

1. SALVAGE AND RE-USE WITH A STIRRUP.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

HOT LINE CLAMPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

04.08-106

BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

ALUMINUM

*COMPRESSION STIRRUP
#4 - 4/0 (DEC,DEM,DEF)
#4 - 477 (DEP)

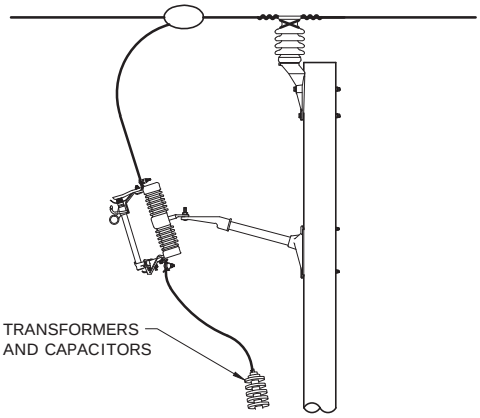
*2-BOLT STIRRUP
336 - 795

COPPER

BOLTED STIRRUP
#6 - 2/0

BOLTED STIRRUP
4/0

*BOLTED WEDGE STIRRUP
#4-795
MAY BE USED IN PLACE OF
THE COMPRESSION STIRRUP
OR THE 2-BOLT STIRRUP



USE BRONZE HOTLINE
CLAMP WITH THE STIRRUP

NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

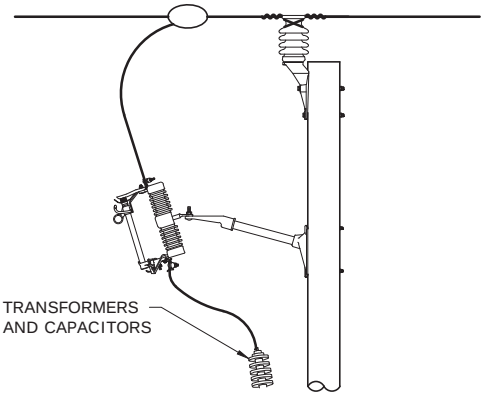
ALUMINUM

BOLTED STIRRUP
#4 - 795

COPPER

BOLTED STIRRUP
#6 - 2/0

BOLTED STIRRUP
4/0



USE BRONZE HOTLINE
CLAMP WITH THE STIRRUP

NOTES:

1. COMPRESSION AND BOLTED WEDGE CONNECTORS ARE PREFERRED OVER DOUBLE (OR SINGLE) BOLTED STIRRUPS BECAUSE IT IS NOT POSSIBLE TO INSTALL THE BOLTED STIRRUPS IN A PRECISE AND CALIBRATED MANNER.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
4. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

LEADS TO TRANSFORMERS AND CAPACITORS
ALL SIZES OF AL AND CU

DEC	DEM	DEP	DEF
X	X	X	X

04.09-102

BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

ALUMINUM

PARALLEL GROOVE
#4 - 4/0

COMPRESSION
STIRRUP
#4 - 4/0

BOLTED WEDGE
1/0 - 795

BOLTED WEDGE STIRRUP
#4 - 795

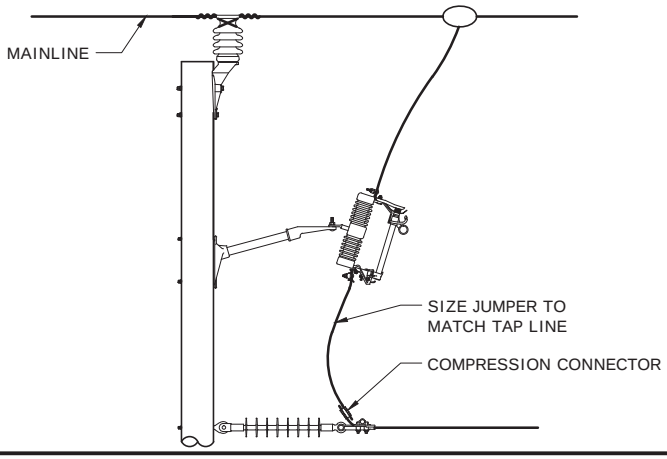
COPPER

PARALLEL GROOVE
#6 - 4/0

BOLTED STIRRUP
#6 - 2/0

BOLTED STIRRUP
4/0

USE A BRONZE HOTLINE
CLAMP WITH THE STIRRUP



NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

ALUMINUM

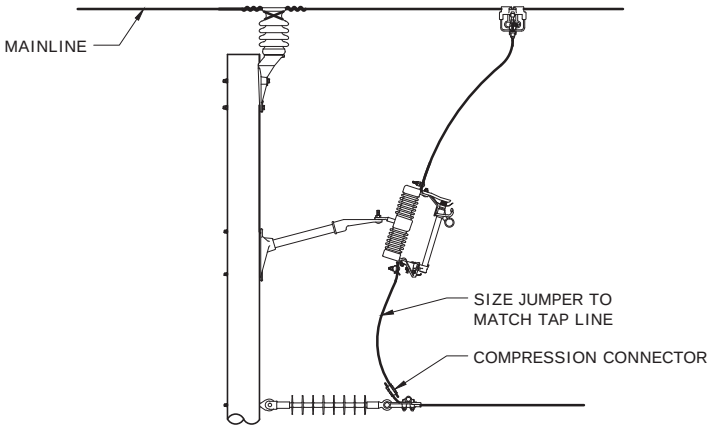
BOLTED STIRRUP
#4 - 795

COPPER

BOLTED STIRRUP
#6 - 2/0

BOLTED STIRRUP
4/0

USE A BRONZE HOTLINE
CLAMP WITH THE STIRRUP



NOTES:

1. COMPRESSION AND BOLTED WEDGE CONNECTORS ARE PREFERRED OVER DOUBLE (OR SINGLE) BOLTED STIRRUPS BECAUSE IT IS NOT POSSIBLE TO INSTALL THE BOLTED STIRRUPS IN A PRECISE AND CALIBRATED MANNER.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
4. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

FUSED LINE TAPS
(UP TO 200A)

DEC	DEM	DEP	DEF
X	X	X	X

04.09-104

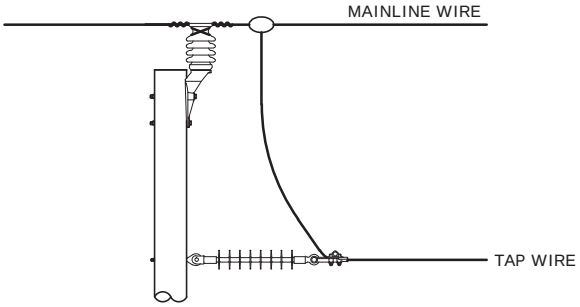
BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

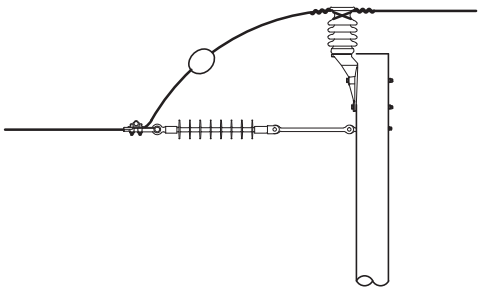
ALUMINUM

PARALLEL GROOVE
336-477 (DEP)
#4 - 4/0

BOLTED-WEDGE
1/0 - 795

COMPRESSION SPLICE
#4 - 795





NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

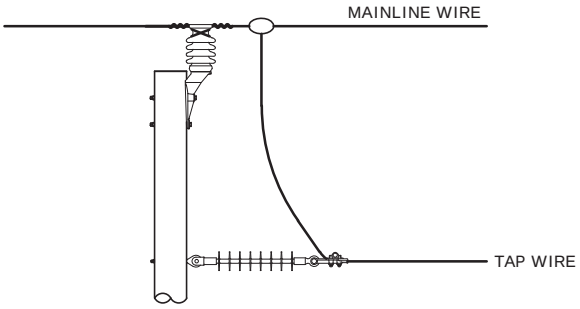
ALUMINUM

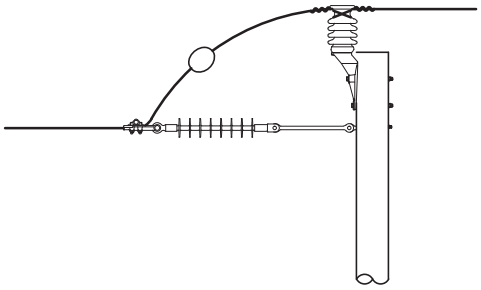
2-BOLT STIRRUP
FOR 4/0 AND
SMALLER TAPS
SEE NOTE 2

PARALLEL GROOVE
336-477 (DEP)
#4 - 4/0

BOLTED-WEDGE
1/0 - 795

COMPRESSION SPLICE
#4 - 795





POLE WORK SHALL BE DE-ENERGIZED UNLESS WORK PRACTICES ALLOW OTHERWISE.

NOTES:

1. COMPRESSION AND BOLTED WEDGE CONNECTORS ARE PREFERRED OVER DOUBLE (OR SINGLE) BOLTED STIRRUPS BECAUSE IT IS NOT POSSIBLE TO INSTALL THE BOLTED STIRRUPS IN A PRECISE AND CALIBRATED MANNER.
2. THE 2-BOLT STIRRUP MAY BE USED FOR ALUMINUM TAPS OF 4/0 AND SMALLER.
3. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
4. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
5. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK

TAPS AND JUMPERS

ALUMINUM

DEC	DEM	DEP	DEF
X	X	X	X

04.09-106

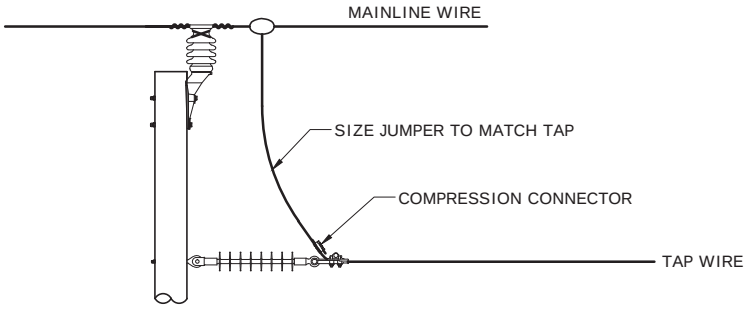
BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

COPPER

PARALLEL GROOVE
2/0 & 4/0

2-BOLT CLAMP

BOLTED WEDGE



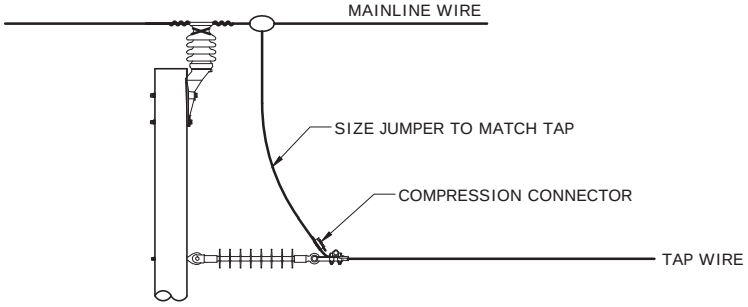
NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

COPPER

PARALLEL GROOVE
2/0 & 4/0

2-BOLT CLAMP

BOLTED WEDGE



POLE WORK SHALL BE DE-ENERGIZED UNLESS WORK METHODS ALLOW OTHERWISE.

NOTES:

1. COMPRESSION CONNECTORS ARE PREFERRED OVER BOLTED CONNECTORS.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
4. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

COPPER TO COPPER - 2/0 AND 4/0 TAPS

DEC	DEM	DEP	DEF
X	X	X	X

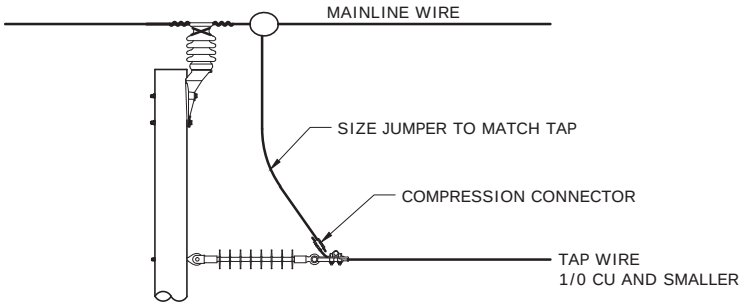
04.09-114

BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

COPPER

*PARALLEL GROOVE
#6 - 1/0

*MAY USE A BOLTED STIRRUP IF
CONNECTION NEEDS TO BE REMOVABLE

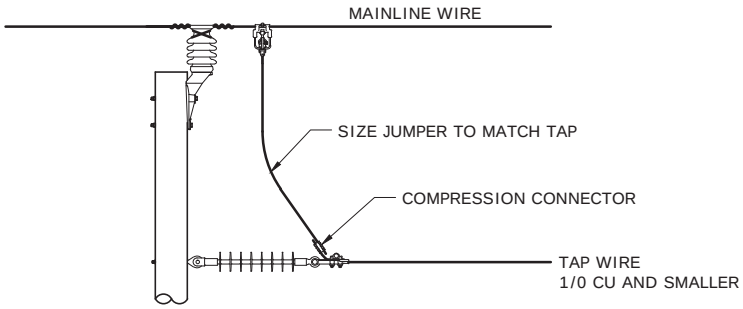


NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

COPPER

BOLTED STIRRUP
#6 - 2/0

USE A BRONZE HOTLINE
CLAMP WITH THE STIRRUP



NOTES:

1. COMPRESSION CONNECTORS ARE PREFERRED OVER BOLTED CONNECTORS.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR TO PRIMARY.
4. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

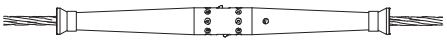
COPPER TO COPPER - 1/0 AND SMALLER -
NON-FUSED TAPS

DEC	DEM	DEP	DEF
X	X	X	X

04.09-116

BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

ALUMINUM



MACLEAN VIP-CRS AUTOSPLICE
WITH POP-UP TABS

COMPRESSION SPLICE
SPLICE SIZE DEPENDENT ON TOOLING AVAILABILITY

COPPER

AUTOMATICS WITHOUT
POP-UP TABS FOR CU

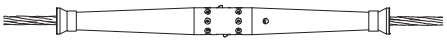
TINNED COPPER COMPRESSION SPLICE

AUTOMATIC SPLICES ARE FOR CONDUCTORS UNDER TENSION (**NO SLACK SPANS**). 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. EMERGENCY REPAIRS MAY BE MADE CLOSER TO THE STRUCTURE THAN 2'.

NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

ALUMINUM



MACLEAN VIP-CRS AUTOSPLICE
WITH POP-UP TABS

COMPRESSION SPLICE
SPLICE SIZE DEPENDENT ON TOOLING AVAILABILITY

COPPER

AUTOMATICS WITHOUT
POP-UP TABS FOR CU

COPPER COMPRESSION SPLICE

CONDUCTOR SHALL BE DE-ENERGIZED. SPLICE MAY BE WORKED FROM THE POLE OR FROM THE GROUND AND THEN RAISED INTO POSITION.

NOTES:

1. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
2. SPLICE SHALL NEVER BE CLOSER THAN 2' FROM POLE LINE HARDWARE. 10' FOR NEW LINES.
3. LIMIT SPLICES TO TWO PER SPAN PER CONDUCTOR.
4. DO NOT PLACE SPLICES IN CONTROLLED ACCESS HIGHWAY AND RAILROAD CROSSINGS.
5. SEE SECTION 04.02 FOR INSTALLATION DETAILS AND ITEM NUMBERS.

DUKE ENERGY.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

TENSION SPLICES

DEC	DEM	DEP	DEF
X	X	X	X

04.09-120A

BUCKET TRUCK ACCESSIBLE (NOT INCLUDING DEM 35KV)

TENSION COMPRESSION SLEEVES MAY BE USED IN SLACK SPANS

AUTOMATICS SHALL NOT BE USED IN ANY SLACK SPANS

REDUCED TENSION - (40% RATED BREAKING STRENGTH OF THE CONDUCTOR)

REDUCED TENSION SPLICES (SOMETIMES REFERRED TO AS PARTIAL OR SEMI-TENSION SPLICES) ARE SLEEVES FOR USE WHEN SPLICING JUMPERS OR SLACK SPANS.

REDUCED TENSION AND FULL TENSION SPLICES MAY BE USED FOR REPAIRS IN SLACK SPANS.

COMPRESSION 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.

NOT BUCKET TRUCK ACCESSIBLE (OR DEM 35KV)

TENSION SLEEVES MAY BE USED IN SLACK SPANS

AUTOMATICS SHALL NOT BE USED IN ANY SLACK SPANS

CONDUCTOR SHALL BE DE-ENERGIZED. SPLICE MAY BE WORKED FROM THE POLE OR FROM THE GROUND AND THEN CONDUCTOR RAISED INTO POSITION.

NOTES:

1. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
2. SPLICE SHALL NEVER BE CLOSER THAN 2' FROM POLE LINE HARDWARE. 10' FOR NEW LINES.
3. LIMIT SPLICES TO TWO PER SPAN PER CONDUCTOR.
4. SPLICE SIZE IS DEPENDENT ON TOOLING AVAILABILITY.
5. DO NOT PLACE SPLICES IN CONTROLLED ACCESS HIGHWAY AND RAILROAD CROSSINGS.
6. SEE DWGS. 04.02-102 AND 04.02-104 FOR INSTALLATION DETAILS AND ITEM NUMBERS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	12/31/17	BENDER	BURLISON	ADCOCK
0	3/31/16	BRUINS	BURLISON	ADCOCK

SLACK SPAN SPLICES

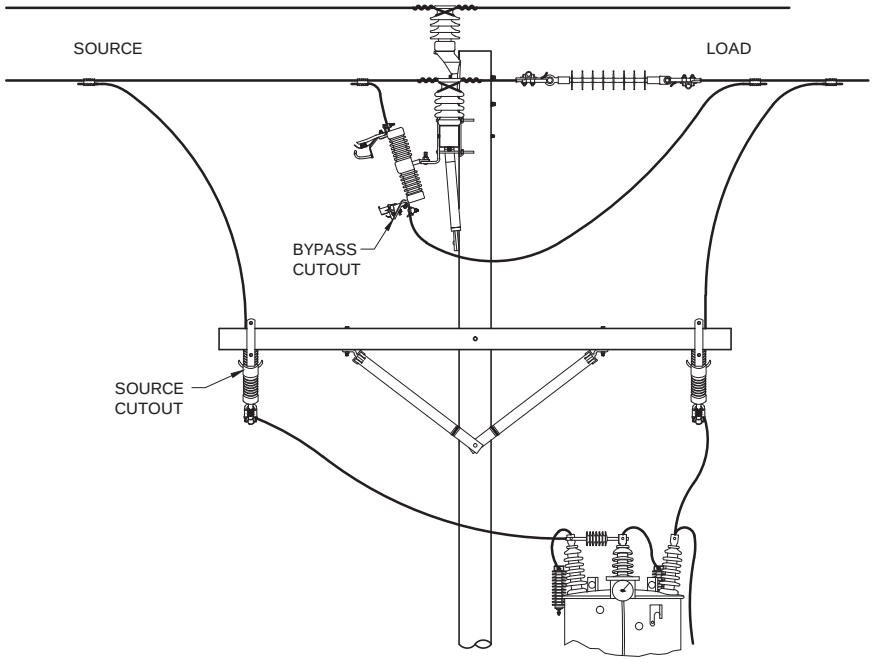
DEC	DEM	DEP	DEF
X	X	X	X

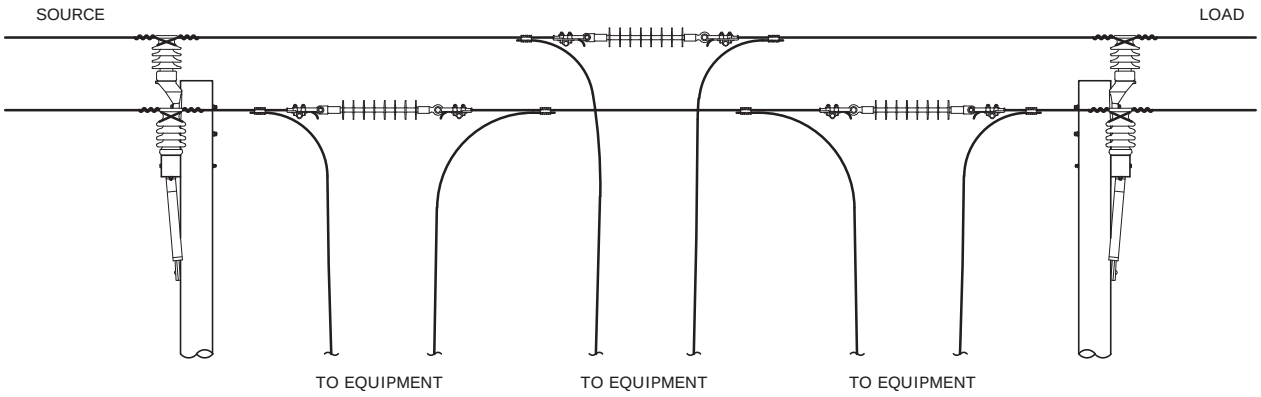
04.09-120B

PARALLEL GROOVE
#2 - #4/0
#2 -477 (DEP)

BOLTED-WEDGE
336 - 795
(ALL MW 35KV)
#4 - 795

FOR REGULATORS WITH ISOLATION SWITCHES, COMPRESSION CONNECTORS OR BOLTED-WEDGES ARE TO BE USED.





NOTES:

1. COMPRESSION CONNECTORS ARE PREFERRED OVER BOLTED CONNECTIONS.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/9/17	BRUINS	BURLISON	ADCOCK
0	3/31/16	BRUINS	BURLISON	ADCOCK

REGULATOR CONNECTIONS

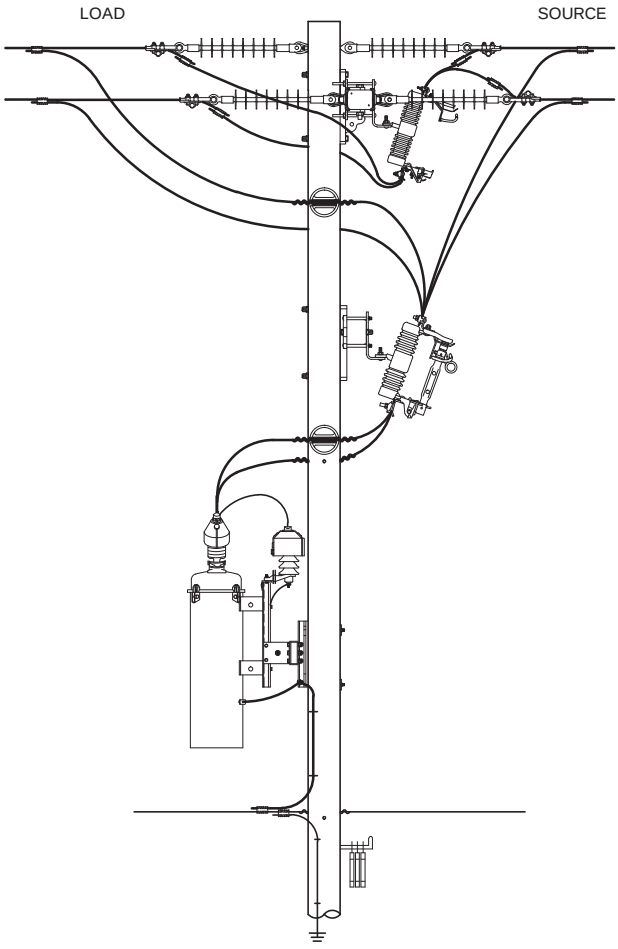
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

04.09-122

PARALLEL GROOVE
#2 - #4/0
#2 -477 (DEP)

BOLTED-WEDGE
336 - 795
(ALL MW 35KV)
#4 - 795



SIDE VIEW

NOTES:

1. COMPRESSION CONNECTORS ARE PREFERRED OVER BOLTED CONNECTIONS.
2. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.
3. SEE SECTION 04.06 FOR COMPRESSION CONNECTION ITEM NUMBERS AND SECTION 04.08 FOR BOLTED CONNECTION ITEM NUMBERS.

3				
2				
1	5/9/17	BRUINS	BURLISON	ADCOCK
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

RECLOSER CONNECTIONS

DEC	DEM	DEP	DEF
X	X	X	X

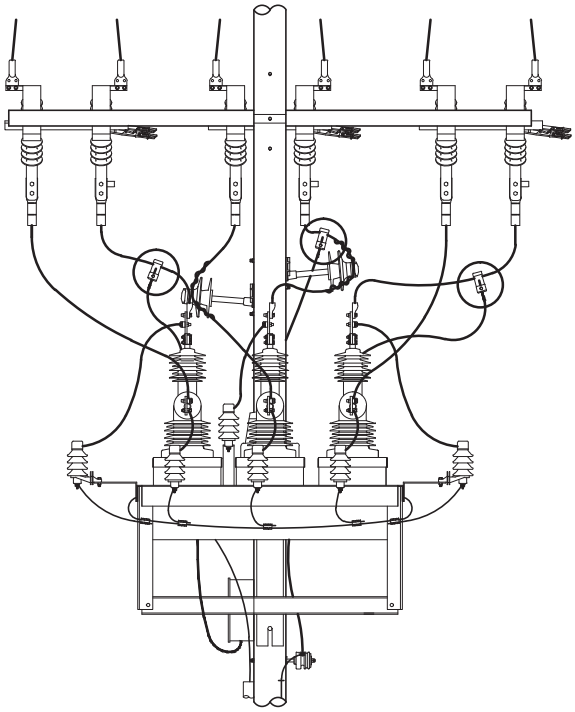
04.09-123

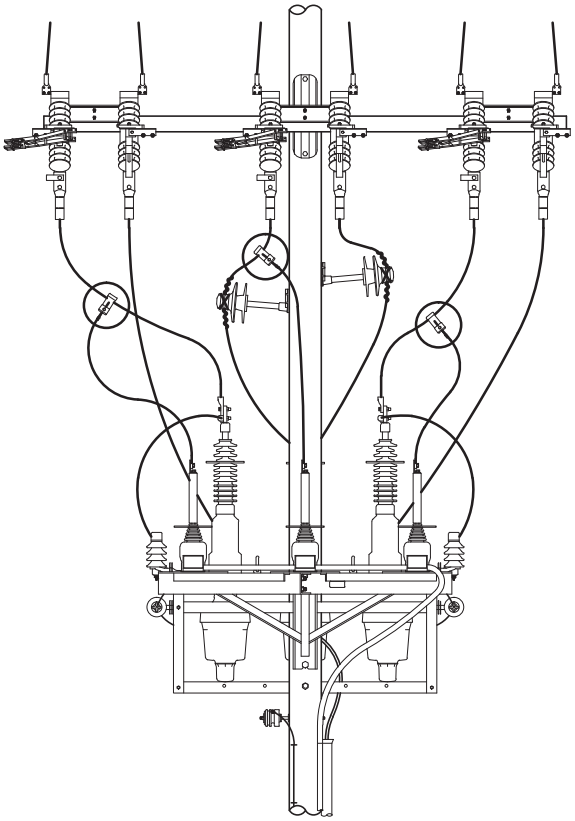
ALUMINUM

HOTLINE TAP
CLAMP
#2 - 795

COPPER

HOTLINE TAP
CLAMP
#6 - 2/0





NOTES:

1. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.

2. BRUSH CONDUCTOR AND RE-APPLY INHIBITOR TO CONNECTOR EACH TIME BEFORE RE-ATTACHING CONNECTOR.

3. SEE DWG. 04.08-106 FOR ITEM NUMBERS.

3				
2				
1				
0	3/31/16	BRUINS	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ARRESTER AND PT CONNECTIONS
TO EQUIPMENT LEADS

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

04.09-124

05.00 GENERAL

05.01 WIRE AND CABLE DATA

05.02 SAG AND TENSION TABLES FOR PRIMARY CONDUCTORS

05.04 SAG TENSION TABLES FOR SECONDARY AND SERVICE CABLES

05.06 SLACK SPAN SAG TABLES

GENERAL:

THE SPECIFICATIONS FOR DUKE ENERGY DISTRIBUTION OVERHEAD CONDUCTORS AND CABLE WERE COMBINED AND UPDATED IN 2013 TO HARMONIZE THE SPECIFICATIONS ACROSS THE DUKE ENERGY SYSTEM. ALL ACSR CONDUCTOR, INCLUDING NEUTRALS IN DUPLEX, TRIPLEX AND QUADRUPLEX CABLES HAVE BEEN CHANGED TO EITHER AAAC OR AAC CONDUCTORS.

AAAC CONDUCTORS ARE REFERENCED AS MCM IN SIZE BY THE MANUFACTURER/INDUSTRY. FOR PRACTICAL PURPOSES, THESE CONDUCTORS WILL CONTINUE TO BE REFERENCED IN THE DUKE ENERGY SYSTEM BY THEIR EQUIVALENT ACSR SIZE. FOR ALL PRACTICAL PURPOSES, THE AAAC CONDUCTORS ARE EQUIVALENT TO THE ACSR SIZES IN ALL ASPECTS. THE SPLICES, CONNECTORS AND TERMINAL LUGS PREVIOUSLY USED ON ACSR CONDUCTORS ARE TO BE USED ON THE AAAC CONDUCTORS AS WELL.

SECTION 5 CONTAINS COMPANY ITEM NUMBERS, TECHNICAL DATA, MAXIMUM CONDUCTOR LOADING AND NEW SAG AND TENSION TABLES DEVELOPED FOR ALL OVERHEAD CONDUCTORS AND CABLES USED IN EACH REGION.

NESC LOADING ZONES

DUE TO DIFFERENT WEATHER CONDITIONS IN THE UNITED STATES, THE NESC HAS DEFINED THREE WEATHER LOADINGS THAT ARE DIVIDED INTO ZONES AS FOLLOWS:

LIGHT LOADING ZONE - STRUCTURES AND EQUIPMENT MUST HAVE THE STRENGTH TO WITHSTAND 9 LBS. OF WIND AT 30°F

MEDIUM LOADING ZONE - STRUCTURES AND EQUIPMENT MUST HAVE THE STRENGTH TO WITHSTAND 4 LBS. OF WIND AND 1/4 INCH ICE AT 15°F

HEAVY LOADING ZONE - STRUCTURES AND EQUIPMENT MUST HAVE THE STRENGTH TO WITHSTAND 4 LBS. OF WIND AND 1/2 INCH ICE AT 0°F

THE DUKE ENERGY SERVICE TERRITORY SPANS ALL THREE OF THE NESC LOADING ZONES. THE INDIANA SERVICE AREA IS LOCATED IN THE NESC HEAVY LOADING ZONE. THE FLORIDA SERVICE AREA IS LOCATED IN THE NESC LIGHT LOADING ZONE. THE REMAINING SERVICE AREAS ARE IN THE MEDIUM LOADING ZONE. ALL THE APPROPRIATE SAG AND TENSION TABLES ARE INCLUDED IN THE CORRESPONDING SERVICE AREA MANUAL.

NORMAL SAG AND TENSION TABLES FOR OVERHEAD BARE CONDUCTORS

NORMAL SAG AND TENSION TABLES ARE USED FOR STANDARD DESIGNS AND INSTALLATION OF PRIMARY PHASE AND NEUTRAL CONDUCTORS. PRIMARY CONDUCTORS MAY BE INSTALLED WITH GREATER TENSIONS THAN NEUTRAL CONDUCTORS IN ORDER TO OBTAIN THE DESIRED CONDUCTOR ELECTRICAL LOADING WHILE MAINTAINING MINIMUM NESC CLEARANCES BETWEEN UPPER AND LOWER CONDUCTORS THROUGHOUT MAXIMUM LOADING CONDITIONS FOR THE APPROPRIATE NESC LOADING ZONE. WITH THE EXCEPTION OF FLORIDA, ALL NORMAL SAG AND TENSION TABLES ARE DIVIDED INTO THREE RULING SPAN TABLES, 150, 280 AND 400 FOOT. FLORIDA RULING SPAN TABLES ARE 150 AND 200 FOOT FOR THE LARGER CONDUCTORS. ALL OVERHEAD CONSTRUCTION STANDARDS (SPACING ON THE POLE) AND MAXIMUM CONDUCTOR LOADING IS BASED ON THE 280 FOOT RULING SPAN TABLES AND FLORIDA'S 200 FOOT RULING SPAN TABLES FOR THE LARGER CONDUCTORS. FOR SPANS BEYOND MAXIMUM LENGTHS IN THE NORMAL RULING SPAN TABLES, TABLES ARE PROVIDED FOR REQUIRED INCREASED SPACING ON THE POLE AND GUYING REQUIREMENTS AGAINST THE DIFFERENCE IN TENSION TO ENSURE PROPER CLEARANCES ARE MAINTAINED THOUGHT-OUT LINE LOADING CONDITIONS.

LINES DESIGNS WITH CONTINUOUS SPAN LENGTHS FOUND IN THE 400 FOOT RULING SPAN TABLES WILL REQUIRE EVALUATIONS IN POLE FOREMAN TO ENSURE SPACING ON THE POLE MEETS NESC CLEARANCE REQUIREMENT.

REDUCED TENSION SAG AND TENSION TABLES FOR NORMAL SPAN LENGTH OVERHEAD NEUTRAL CONDUCTORS

BECAUSE SOME CONDUCTORS MAY BE USED AS BOTH A NEUTRAL AND A PHASE CONDUCTOR, TWO DIFFERENT SAG AND TENSION TABLES ARE PROVIDED FOR THESE CONDUCTORS. REDUCED TENSION TABLES ARE PROVIDED FOR THESE CONDUCTORS WHEN THEY ARE USED AS A NEUTRAL. FULL TENSION TABLES ARE PROVIDE FOR THESE SAME CONDUCTORS WHEN THEY ARE TO BE USED AS PRIMARY PHASE CONDUCTORS. HAVING A REDUCED TENSION TABLE FOR A NEUTRAL PERMITS IT TO BE SAGGED THE SAME AS THE PRIMARY CONDUCTOR THROUGHOUT THE PRIMARY CONDUCTOR "LOADED" TEMPERATURE RANGE.

LONG SPAN (500-800 FEET) SAG AND TENSION TABLES FOR OVERHEAD BARE CONDUCTORS

THESE LONG SPAN SAG AND TENSION TABLES ARE PROVIDED FOR UNUSUAL SITUATIONS WHERE INDIVIDUAL SPANS LONGER THAN NORMAL CONSTRUCTION SPANS ARE NEEDED. AREAS SUCH AS RIVER CROSSINGS, LONG SPANS ACROSS INTERSTATE HIGHWAYS , ETC. THESE SAG AND TENSION TABLES ARE TO BE COORDINATED WITH SPECIFIC POLE FRAMING REQUIREMENTS FOUND IN SECTION 3 OF THE MANUAL. THESE POLE FRAMING DESIGNS ARE ONLY FOR SINGLE SPANS THAT ARE DEAD-ENDED AND GUYED AT EACH END.

SAG AND TENSION TABLES FOR OVERHEAD TRIPLEX AND QUADRUPLEX

POLE TO POLE AND POLE TO BUILDING SAG AND TENSION TABLES ARE PROVIDED FOR STANDARD SIZES OF DUPLEX, TRIPLEX AND QUADRUPLEX CABLES.

THE POLE TO POLE TABLES ARE DESIGNED WITH TENSIONS THAT REQUIRE GUYING AT THE END OF EACH SPAN. THE POLE TO BUILDING TENSIONS ARE DESIGNED TO LIMIT MAXIMUM TENSION ON STANDARD OVERHEAD SERVICE RISERS FOUND ON MOST RESIDENTIAL HOMES.

SLACK SPAN CONSTRUCTION

SLACK SPAN CONSTRUCTION SHOULD BE AVOIDED WHEREVER POSSIBLE. HOWEVER, IT IS RECOGNIZED THAT CONGESTION SOMETIMES LIMIT THE ABILITY TO GUY FULL TENSION SPANS OF CONDUCTOR AND CABLE. TABLES ARE PROVIDE FOR SLACK SPAN CONSTRUCTION WITH REQUIREMENTS OF MAXIMUM SPAN LENGTHS AND REQUIRED POLE CLASSES. THE SPAN LIMITS AND POLE CLASSES PROVIDED IS INTENDED TO LIMIT STRESS ON POLES THAT CAUSE POLE TO LEAN OVER, AND CAUSE EXCESSIVE POLE TOP DEFLECTION.

CONDUCTOR AMPACITY

THE AMPACITY VALUES IN TABLES ON DWGS. 05.01-100 AND 05.01-105 ENSURE THAT THE CONDUCTOR DOES NOT EXCEED A TEMPERATURE OF 185°F (167°F FOR COVERED CONDUCTORS). MAINTAINING THE OPERATING TEMPERATURE AT OR BELOW 185°F WILL PREVENT EXCESSIVE CONDUCTOR ANNEALING. THESE VALUES SHOULD NOT BE EXCEEDED AND SHALL BE UTILIZED FOR ALL NEW CONSTRUCTION BUILT TO THE DUKE ENERGY ENTERPRISE WIDE CONSTRUCTION SPECIFICATIONS ISSUED IN 2016.

FOR LEGACY LINES BUILT TO CONSTRUCTION STANDARDS PRIOR TO THE 2016 SPECIFICATIONS:

- LEGACY AMPACITIES BASED ON 185° F OR LESS SHALL CONTINUE TO BE USED.
- THESE LINES MAY BE RE-RATED TO THE 185°F VALUES THROUGH EVALUATION AND MODIFICATIONS SUCH AS INCREASED SPACING OR SPAN LENGTH REDUCTION.
- LEGACY AMPACITIES BASED ON AN OPERATING TEMPERATURE GREATER THAN 185°F - USE TABLES SHOWN ON DWGS. 05.01-100 AND 05.01-105.
- DO NOT OPERATE LINES IN EXCESS OF 185°F.
- IF STITUATIONS ARE ENCOUNTERED WHERE AMPACITIES LISTED IN TABLES SHOWN ON DWGS. 05.01-100 OR 05.01-105 NEED TO BE EXCEEDED OR THE LINE NEEDS TO BE OPERATED ABOVE 185°F, CONTACT LOCAL ENGINEERING IMMEDIATELY FOR GUIDANCE.

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/31/17	BURLISON	WHITE	ADCOCK
0	6/30/16	ROBESON	BURLISON	ADCOCK

DISTRIBUTION OVERHEAD CONDUCTORS AND CABLE

DEC	DEM	DEP	DEF
			X

05.00-100B

CONDUCTOR SIZE	CODE NAME	STRANDING	OUTSIDE DIAMETER (INCHES)	WEIGHT (LBS PER FT)	BREAKING STRENGTH (LBS)	AMPACITY RATINGS						
						SUMMER	INTERMEDIATE AMBIENT TEMPERATURES			NESC WINTER LOADING ZONE TEMPERATURES		
										LIGHT	MEDIUM	HEAVY
						104°F	80°F	60°F	40°F	30°F	15°F	0°F
ALL ALUMINUM ALLOY CONDUCTOR (AAAC) BARE												
#2	AMES	7	0.316	0.0722	2800	179	206	225	243	252	264	276
#1/0	AZUSA	7	0.398	0.1157	4460	239	277	303	326	338	354	370
#4/0	ALLIANCE	7	0.563	0.2302	8560	370	430	471	507	524	550	574
ALL ALUMINUM CONDUCTOR (AAC) BARE												
#1/0	POPPY	7	0.368	0.0090	1990	231	277	303	315	325	341	356
#2/0	ASTER	7	0.414	0.1250	2510	267	308	337	365	377	395	413
#3/0	PHLOX	7	0.464	0.1575	3040	309	356	390	422	437	458	478
#4/0	OXLIP	7	0.522	0.1980	3830	358	412	452	489	506	530	554
336.4	TULIP	19	0.666	0.3150	6150	480	558	611	654	681	714	745
397.5	CANNA	19	0.723	0.3720	7110	533	616	677	731	757	794	829
477	COSMOS	19	0.792	0.4770	8360	597	695	762	821	838	891	930
556.5	DAHLIA	19	0.856	0.5210	9750	658	766	840	904	924	982	1025
795	ARBUTUS	37	1.026	0.7450	13,900	822	854	1047	1132	1172	1229	1284
COVERED LINE CONDUCTOR												
#4 AAC	APRICOT	7	0.285	0.0510	790	109	N/A	N/A	N/A	N/A	N/A	N/A
#2 AAC	PEACH	7	0.373	0.0840	1220	140	170	186	201	209	219	229
#1/0 AAC	QUINCE	7	0.477	0.1360	1790	190	229	251	270	283	293	307
#4/0 AAC	OLIVE	7	0.626	0.2530	3440	306	356	390	420	434	456	476
#1/0 HWLW	ALMOND	6/1	0.518	0.1910	4160	189	229	251	270	283	293	307
336.4 HWLW	NONE	18/1	0.765	0.6350	8950	404	463	507	542	572	592	618
556.5 HWLW	NONE	19	0.992	0.7580	8775	548	635	697	750	766	815	850
ALUMINUM CONDUCTOR STEEL REINFORCED (ACSR) BARE												
#6	TURKEY	6/1	0.198	0.0360	1190	97	112	122	132	136	143	148
#4	SWAN	6/1	0.250	0.0570	1860	129	148	162	175	181	190	198
#2	SPARROW	6/1	0.316	0.0913	2850	170	196	215	232	240	251	263
#1/0	RAVEN	6/1	0.398	0.1452	4380	224	259	283	306	317	332	347
#2/0	QUAIL	6/1	0.477	0.1831	5310	257	296	325	351	363	381	398
#3/0	PIGEON	6/1	0.502	0.2309	6620	295	340	373	403	417	437	456
#4/0	PENGUIN	6/1	0.563	0.2911	8350	337	389	427	462	478	501	523
266.8	WAXWING	18/1	0.609	0.2890	6880	415	480	527	569	589	618	645
336.4	MERLIN	18/1	0.684	0.3653	8680	485	561	616	665	689	722	754
336.4	LINNET	26/7	0.720	0.4639	14,100	492	571	628	678	702	736	769
397.5	IBIS	26/7	0.783	0.5469	16,300	546	635	698	754	781	819	855
477	HAWK	26/7	0.858	0.6550	19,500	616	713	783	847	877	920	960
556.5	PARAKEET	24/7	0.914	0.7170	19,800	674	781	858	928	961	1008	1052
795	DRAKE	26/7	1.107	1.0930	31,500	849	984	1083	1171	1213	1272	1328

NOTES:

1. THESE AMPACITIES ARE FOR CONDUCTORS IN SPANS. FOR EQUIPMENT LEAD WIRES SEE DWG. 05.01-107.

2. AAAC, AAC AND ACSR BARE CONDUCTOR AMPACITIES ARE BASED ON THE FOLLOWING:
   - MAXIMUM CONDUCTOR OPERATING TEMPERATURE= 85°C/185°F
   - WIND SPEED = 2 FT/SEC

3. COVERED CONDUCTOR AMPACITIES ARE BASED ON THE FOLLOWING:
   - MAXIMUM CONDUCTOR OPERATING TEMPERATURE= 75°C/167°F
   - WIND SPEED = 2 FT/SEC

THE AMPACITY VALUES IN THESE TABLES ENSURE THAT THE CONDUCTOR DOES NOT EXCEED A TEMPERATURE OF 185°F. MAINTAINING THE OPERATING TEMPERATURE AT OR BELOW 185°F WILL PREVENT EXCESSIVE CONDUCTOR ANNEALING. THESE VALUES SHOULD NOT BE EXCEEDED AND SHALL BE UTILIZED FOR ALL NEW CONSTRUCTION BUILT TO THE DUKE ENERGY ENTERPRISE WIDE CONSTRUCTION SPECIFICATIONS ISSUED IN 2016.

FOR LEGACY LINES BUILT TO CONSTRUCTION STANDARDS PRIOR TO THE 2016 SPECIFICATIONS:

- LEGACY AMPACITIES BASED ON 185°F OR LESS SHALL CONTINUE TO BE USED.
- THESE LINES MAY BE RE-RATED TO THE 185°F VALUES THROUGH EVALUATION AND MODIFICATIONS SUCH AS INCREASED SPACING OR SPAN LENGTH REDUCTION.
- LEGACY AMPACITIES BASED ON AN OPERATING TEMPERATURE GREATER THAN 185°F - USE TABLES SHOWN ABOVE AND ON DWG. 05.01-105.
- DO NOT OPERATE LINES IN EXCESS OF 185°F.
- IF SITUATIONS ARE ENCOUNTERED WHERE AMPACITIES LISTED IN TABLES SHOWN ABOVE OR ON DWG. 05.01-105 NEED TO BE EXCEEDED OR THE LINE NEEDS TO BE OPERATED ABOVE 185°F, CONTACT LOCAL ENGINEERING IMMEDIATELY FOR GUIDANCE.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/31/17	BURLISON	WHITE	ADCOCK
0	6/30/16	ROBESON	BURLISON	ADCOCK

ALUMINUM WIRE PHYSICAL DATA AND AMPACITY RATINGS/SPAN WIRES

DEC	DEM	DEP	DEF
X	X	X	X

05.01-100

CONDUCTOR SIZE	CODE NAME	STRANDING	OUTSIDE DIAMETER (INCHES)	WEIGHT (LBS PER FT)	BREAKING STRENGTH (LBS)	AMPACITY RATINGS						
						SUMMER	INTERMEDIATE AMBIENT TEMPERATURES			NESC WINTER LOADING ZONE TEMPERATURES		
						104°F	80°F	60°F	40°F	LIGHT	MEDIUM	HEAVY
										30°F	15°F	0°F
BARE COPPER - HARD DRAWN CONDUCTOR												
#8	-	1	0.129	0.049	826	89	103	113	122	126	133	139
#6	-	1	0.162	0.079	1280	119	137	151	163	169	177	185
#4	-	1	0.204	0.126	1970	159	184	202	218	226	237	248
#4	-	7	0.232	0.129	1940	163	188	207	224	232	243	254
#2	-	1	0.258	0.201	3003	213	246	271	292	303	318	332
#2	-	3	0.320	0.202	2913	224	259	285	307	318	334	349
#2	-	7	0.292	0.205	3045	218	252	277	299	310	325	340
#1	-	3	0.360	0.255	3620	259	299	329	355	368	386	403
#1	-	7	0.328	0.258	3800	252	291	320	346	358	376	392
#1/0	-	7	0.368	0.325	4750	291	336	370	399	413	434	453
#2/0	-	7	0.414	0.419	5927	337	389	428	462	479	503	525
#3/0	-	7	0.464	0.518	7366	390	450	495	535	554	582	607
#4/0	-	7	0.522	0.653	9154	451	521	573	619	641	673	702
250	-	19	0.574	0.772	11,360	502	580	638	689	713	749	782
300	-	19	0.692	0.926	13,510	563	650	715	772	799	839	876
350	-	19	0.679	1.080	15,590	619	715	787	849	879	923	964
500	-	37	0.813	1.544	21,950	773	894	983	1062	1099	1154	1206
750	-	61	0.998	2.316	34,090	990	1147	1262	1363	1411	1481	1547
1000	-	61	1.152	3.080	45,030	1174	1362	1498	1621	1678	1760	1838
BARE COPPER - SOFT DRAWN CONDUCTOR												
#6	-	1	0.162	0.079	763	119	137	151	163	169	177	185
500	-	37	0.813	1.544	14,530	773	894	983	1062	1099	1154	1205
750	-	61	0.998	2.316	21,790	990	1147	1262	1363	1411	1481	1547
1000	-	61	1.152	3.080	30,500	1174	1362	1498	1621	1678	1760	1838
WEATHERPROOF/COVERED CONDUCTOR												
#6	-	1	0.238	0.087	1060	98	113	125	136	140	147	154
#4	-	1 & 7	0.285	0.143	1872	131	156	167	181	187	147	206
#2	-	1 & 7	0.373	0.230	2893	180	209	224	243	251	270	282
#1/0	-	7	0.477	0.368	4513	241	279	307	331	343	360	376
#2/0	-	7	0.522	0.458	5631	280	323	355	384	397	417	436
#3/0	-	7	0.570	0.572	6103	324	374	410	444	460	483	504
#4/0	-	7	0.626	0.715	8696	374	432	475	514	532	558	583
300	-	19	0.729	0.996	11,057	467	540	593	640	663	697	727
500	-	37	0.950	1.648	15,260	642	742	815	882	913	958	1000
750	-	61	1.128	2.481	22,880	822	952	1047	1131	1171	1229	1284
1000	-	61	1.307	3.260	30,500	974	1130	1243	1345	1393	1461	1526

NOTES:

1. THESE AMPACITIES ARE FOR CONDUCTORS IN SPANS. FOR EQUIPMENT LEAD WIRES SEE DWG. 05.01-107.

2. COPPER HD BARE CONDUCTOR AMPACITIES ARE BASED ON THE FOLLOWING:
   - MAXIUM CONDUCTOR OPERATING TEMPERATURE= 85° C/185°F
   - WIND SPEED = 2 FT/SEC

3. COVERED CONDUCTOR AMPACITIES ARE BASED ON THE FOLLOWING:
   - MAXIUM CONDUCTOR OPERATING TEMPERATURE= 75° C/167° F
   - WIND SPEED = 2 FT/SEC

THE AMPACITY VALUES IN THESE TABLES ENSURE THAT THE CONDUCTOR DOES NOT EXCEED A TEMPERATURE OF 185°F. MAINTAINING THE OPERATING TEMPERATURE AT OR BELOW 185°F WILL PREVENT EXCESSIVE CONDUCTOR ANNEALING. THESE VALUES SHOULD NOT BE EXCEEDED AND SHALL BE UTILIZED FOR ALL NEW CONSTRUCTION BUILT TO THE DUKE ENERGY ENTERPRISE WIDE CONSTRUCTION SPECIFICATIONS ISSUED IN 2016.

FOR LEGACY LINES BUILT TO CONSTRUCTION STANDARDS PRIOR TO THE 2016 SPECIFICATIONS:
- LEGACY AMPACITIES BASED ON 185°F OR LESS SHALL CONTINUE TO BE USED.
- THESE LINES MAY BE RE-RATED TO THE 185°F VALUES THROUGH EVALUATION AND MODIFICATIONS SUCH AS INCREASED SPACING OR SPAN LENGTH REDUCTION.
- LEGACY AMPACITIES BASED ON AN OPERATING TEMPERATURE GREATER THAN 185°F - USE TABLES SHOWN ABOVE AND ON DWG. 05.01-100.
- DO NOT OPERATE LINES IN EXCESS OF 185°F.
- IF STITUATIONS ARE ENCOUNTERED WHERE AMPACITIES LISTED IN TABLES SHOWN ABOVE OR ON DWG. 05.01-100 NEED TO BE EXCEEDED OR THE LINE NEEDS TO BE OPERATED ABOVE 185°F, CONTACT LOCAL ENGINEERING IMMEDIATELY FOR GUIDANCE.

DUKE ENERGY.

3				
2				
1				
0	7/31/17	BURLISON	WHITE	ADCOCK
REVISED		BY	CK'D	APPR.

COPPER WIRE PHYSICAL DATA AND AMPACITY RATINGS/SPAN WIRES

DEC	DEM	DEP	DEF
X	X	X	X

05.01-105

APPROVED FOR NEW CONSTRUCTION			
CONDUCTOR SIZE	COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
ALL ALUMINUM ALLOY CONDUCTOR (AAC) BAR			
#2	WIRE-PRI-2-AAAC-F	4022240	#2 AAAC, 7 STR, AMES
#1/0	WIRE-PRI-1/0-AAAC-F	4033009	#1/0 AAAC, 7 STR, AZUSA
ALL ALUMINUM CONDUCTOR (AAC) BARE			
336.4	WIRE-PRI-336-AAC-F	4033012	336.4 AAC, 19 STR, TULIP
795	WIRE-PRI-795-AAC-F	4192430	795 AAC, 37 STR, ARBUTUS

LEGACY CONDUCTORS - NOT APPROVED FOR NEW CONSTRUCTION			
CONDUCTOR SIZE	COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
ALL ALUMINUM ALLOY CONDUCTOR (AAAC) BARE			
#4	WIRE-PRI-4-AAAC-F	4022240	#4 AAAC, 7 STR, ALTON
#4/0	WIRE-PRI-4/0-AAAC-F	4033010	#4/0 AAAC, 7 STR, ALLIANCE
ALUMINUM CONDUCTOR STEEL REINFORCED (ACSR) BARE			
795	WIRE-PRI-795-ACSR-F	1523270	795 ACSR, 26/7 STR, DRAKE
BARE COPPER - HARD DRAWN CONDUCTOR			
#6	WIRE-PRI-6-CUHD-F	4022251	#6 HARD DRAWN BARE COPPER, SOLID
#4	WIRE-PRI-4-CUHD-F	4022252	#4 HARD DRAWN BARE COPPER, SOLID
#2	WIRE-PRI-2-CUHD-F	4022254	#2 HARD DRAWN BARE COPPER, SOLID
#2/0	WIRE-PRI-2/0-CUHD-F	4022284	#2/0 HARD DRAWN BARE COPPER, 7 STR
#4/0	WIRE-PRI-4/0-CUHD-F	4022267	#4/0 HARD DRAWN BARE COPPER, 7 STR

NOTES:

1. LEGACY CONDUCTOR SHOWN ARE FOR MAINTENANCE OR REMOVAL AND SUPPORTED BY THE WORK MANAGEMENT SYSTEM FOR USE IN PREPARING WORK REQUESTS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

COMMON PRIMARY/NEUTRAL CONDUCTORS

COMPATIBLE UNITS AND ITEM NUMBERS

DEC	DEM	DEP	DEF
			X

05.01-106

CONDUCTOR SIZE	STRANDING	COVER THICKNESS (INCHES)	COVER RATINGS °C/°F)	AMPACITY		COMPATIBLE UNIT	ITEM NUMBER
				SUMMER @ AMBIENT 104°F	WINTER @ AMBIENT 32°F		
COVERED ALUMINUM							
#4/0 AAC	19	0.800	90/194	366	505	LEAD-EQ-4/0-AL-COVER-F	4003569
500 AAC	37	0.075	90/194	623	862	LEAD-EQ-500-AL-COVER-F	4003570
	COVERED COPPER						
#6	SOLID	0.030	75/167	108	164	LEAD-EQ-6-CU-COVER-F	4192427
#4	SOLID	0.030	75/167	143	218	LEAD-EQ-4-CU-COVER-F	4022282
#2	SOLID	0.045	75/167	188	290	LEAD-EQ-2-CU-COVER-F	4192428

NOTES:

1. EQUIPMENT LEADS ARE COVERED FOR ANIMAL PROTECTION.
2. MAXIMUM OPERATING TEMPATURE EQUAL TO COVER RATING.
3. AMBIENT TEMPATURE: 40°C/104°F SUMMER, 0°C/32°F WINTER.
4. WIND: 2FT/SEC AT 90 DEGREES, SUN: 98.62 WATTS/SQ FT, ATOMOSPHERE: CLEAR
5. NORTH LATUTUDE: 35 DEGREES, AZIMUTH OF THE SUN: 90 DEGREES (E-W), ALTITUDE: 900 FT.
6. COEFFICENT OF EMISSIVITY: 0.8, COEFFICENT OF ABSORPTION: 0.8.

DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

AVAILABLE LEAD WIRES AND THEIR AMPACITIES

DEC	DEM	DEP	DEF
			X

05.01-107

MULTIPLEX CABLE SIZES	MESSENGER/ NEUTRAL SIZE	AMPACITY BELOW IS BASED ON 104°F AMBIENT AND CONDUCTOR TEMPERATURE ON 194°	WEIGHT PER 1000 FOOT (LBS.)	BREAKING STRENGTH (LBS.)
DUPLEX (XLPE)				
6	6	85	65	1110
4	4	115	103	1760
TRIPLEX (XLPE)				
6	6	85	107	1110
4	4	115	160	1760
2	2	150	243	2800
1/0	1/0	205	390	4460
2/0	1/0	235	483	4460
4/0	1/0	315	728	4460
350	1/0	432	992	4460
500	4/0	535	1454	8560
QUADRUPLEX				
1/0	1/0	161	567	4460
4/0	1/0	274	918	4460
350	1/0	378	1576	4460
500	4/0	510	2065	8560
1000	336 AAC	726	3747	6150

AMBIENT TEMPERATURE CORRECTION FACTORS	
AMBIENT TEMPERATURE °F	MULTIPLIER
32	1.34
50	1.26
68	1.18
86	1.10
104	1.00
122	0.90

NOTES:

1. 350 AND LARGER CABLES MAY BE AVAILABLE AS SINGLE CABLE ONLY REQUIRING THE TRIPLEX OR QUADRUPLEX TO BE BUNDLED AND WRAPPED TO THE APPROPRIATE MESENGER/NEUTRAL.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	BENDER	BURLISON	ADCOCK
1	3/31/18	BENDER	BURLISON	ADCOCK
0	6/30/16	ROBESON	BURLISON	ADCOCK

OVERHEAD CABLE DATA -

600 VOLT PHYSICAL DATA

DEC	DEM	DEP	DEF
X	X	X	X

05.01-108

APPROVED FOR NEW CONSTRUCTION				
CONDUCTOR		COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
PHASE(S)	NEUTRAL			
DUPLEX CABLES				
#6 AAC	#6 AAAC	WIRE-SEC-6-AL-DX-F, WIRE-SVC-6-AL-DX-F, WIRE-LGT-6-AL-DX-F	1506243	#6 DUPLEX, VIZSLA
#4 AAC	#4 AAAC	WIRE-SEC-4-AL-DX-F, WIRE-SVC-4-AL-DX-F, WIRE-LGT-4-AL-DX-F	4003562	#4 DUPLEX, WHIPPET
#1/0 AAC	#1/0 AAAC	WIRE-SEC-1/0-AL-DX-RT-F, WIRE-SVC-1/0-AL-DX-F, WIRE-LGT-1/0-AL-DX-RT-F	4003561	#1/0 DUPLEX, AFGHAN, AERIAL, WITH MOUSING
TRIPLEX CABLES				
#2 AAC	#2 AAAC	WIRE-SEC-2-AL-TX-F, WIRE-SVC-2-AL-TX-F, WIRE-LGT-2-AL-TX-F	4205787	#2 TRIPLEX, SHRIMP
#1/0 AAC	#1/0AAAC	WIRE-SEC-1/0-AL-TX-F, WIRE-SVC-1/0-AL-TX-F, WIRE-LGT-1/0-AL-TX-F	4205783	#1/0 TRIPLEX, GAMMARUS
#1/0 AAC	#1/0AAAC	WIRE-SEC-1/0-AL-TX-RT-F, WIRE-SVC-1/0-AL-TX-RT-F WIRE-LGT-1/0-AL-TX-RT-F	4003563	#1/0 TRIPLEX, AUBURN, AERIAL, WITH MOUSING
#4/0 AAC	#4/0 AAC	WIRE-SEC-4/0-AL-TX-F, WIRE-SVC-4/0-AL-TX-F, WIRE-LGT-4/0-AL-TX-F	4003489	#4/0 TRIPLEX, PORTUNAS
#4/0 AAC	#1/0 AAAC	WIRE-SEC-4/0-AL-TX-RT-F, WIRE-SVC-4/0-AL-TX-RT-F	4003564	#4/0 TRIPLEX, AERIAL, WITH MOUSING
QUADRUPLEX CABLE				
#1/0 AAC	#1/0 AAAC	WIRE-SEC-1/0-AL-QX-RT-F, WIRE-SVC-1/0-AL-QX-F	4003565	1/0 QUADRUPLEX, GALLEY, AERIAL, WITH MOUSING
#4/0 AAC	#1/0 AAAC	WIRE-SEC-4/0-AL-QX-RT-F, WIRE-SVC-4/0-AL-QX-RT-F	4003566	4/0 QUADRUPLEX, AERIAL WITH MOUSING

LEGACY CONDUCTORS- NOT APPROVED FOR NEW CONSTRUCTION			
CONDUCTOR SIZE	COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
ALUMINUM			
#4	WIRE-SEC-4-AL-F, WIRE-SVC-4-AL-F	-	REM ONLY-OPEN WIRE SERVICE #4
#2	WIRE-SEC-2-AL-1/C-F, WIRE-SVC-2-AL-F	4022240	OPEN WIRE SECONDARY/SERVICE #2 AAAC
#2	WIRE-SEC-2-AL-QX-F, WIRE-SVC-2-AL-QX-F	-	REM ONLY #2 QUADRUPLEX
#1/0	WIRE-SEC-1/0-AL-F, WIRE-SVC-1/0-AL-F	4033009	OPEN WIRE SECONDARY/SERVICE #1/0 AAAC
336.4	WIRE-SEC-336-AL-F, WIRE-SVC-336-AL-F	4022243	OPEN WIRE SERVICE 336.4 ACSR
336.4	WIRE-SEC-336-AL-QX-F, WIRE-SVC-336-AL-QX-F	4003492	336.4 QUADRUPLEX, AERIAL, WITH MOUSING
COPPER			
#6	WIRE-SEC-6-CUHD-F, WIRE-SVC-6-CUHD-F	4022251	OPEN WIRE SECONDARY/SERVICE #6 CU
#4	WIRE-SEC-4-CUHD-F, WIRE-SVC-4-CUHD-F	4022252	OPEN WIRE SECONDARY/SERVICE #4 CU
#2	WIRE-SEC-2-CUHD-F, WIRE-SVC-2-CUHD-F	4022254	OPEN WIRE SECONDARY/SERVICE/LIGHTING #2 CU
#4/0	WIRE-SEC-4/0-CUHD-F, WIRE-SVC-4/0-CUHD-F	4022267	OPEN WIRE SECONDARY/LIGHTING #4/0 CU

DUKE ENERGY.

3				
2				
1				
O	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

OVERHEAD WIRE AND CABLE INFORMATION

DEC	DEM	DEP	DEF
			X

05.01-112

GENERAL

THE INFORMATION ON THIS PAGE APPLIES TO PRIMARY, SECONDARY AND SERVICE CONDUCTOR/CABLE SAG CHARTS.

BARE OVERHEAD CONDUCTORS

EACH CONDUCTOR CHART IS FORMATTED AS AN "A" AND A "B" DRAWING.

INITIAL SAGS (DRAWING "A"):
THESE SAGS VALUES ARE USED DURING CONSTRUCTION FOR THE INITIAL INSTALLATION OF CONDUCTORS.

FINAL SAGS AND HORIZONTAL SWINGS (DRAWING "B"):
THESE ARE DESIGN SAG VALUES USED TO DETERMINE GROUND CLEARANCES, CLEARANCES FROM OTHER CONDUCTORS AND OBJECTS.

ALL SAG VALUES LISTED IN CHARTS ARE IN INCHES UNLESS NOTED; TENSION VALUES ARE IN POUNDS.

THE RULING SPANS USED ARE 150 FT. (SHORT SPANS), 280 FT. (MEDIUM SPANS), AND 400 FT. OR 450 FT. (LONG SPANS) WHICH VARIES WITH CONDUCTOR SIZE. THERE IS AN EXCEPTION TO THESE RULING SPANS FOR DEF. THE 336.4 AAC, 795 AAC AND REDUCED TENSION #1/0 AAAC NEUTRAL SAG AND TENSION TABLES HAVE RULING SPANS OF 150, 200, 300 AND 440 FEET.

LLT (LIGHT LOADING TENSION), MLT (MEDIUM LOADING TENSION) AND HLT (HEAVY LOADING TENSION) IN THE CHARTS REFER TO THE MAXIMUM DESIGN TENSION USED FOR THE NESC LOADING ZONES.

SECONDARY AND SERVICE CABLE

SECONDARY CABLES:

SECONDARY CABLE SAG AND TENSION CHARTS ARE SHOWN AT THE TOP OF EACH DRAWING PER CABLE SIZE. THESE SAG AND TENSIONS ARE DESIGNED TO BE USED BETWEEN POLES THAT ARE GUYED ON EACH END OF THE CABLE RUN.

SERVICE CABLE:

SERVICE CABLE SAG AND TENSION CHARTS ARE SHOWN AT THE BOTTOM OF EACH DRAWING PER CABLE SIZE. THESE SAG AND TENSIONS ARE DESIGNED TO BE USED BETWEEN LIFT POLES AND POLE TO BUILDING WITHOUT GUYING. TENSION IS LIMITED TO MAXIMUM TENSION PERMITTED ON A TYPICAL SERVICE MAST.

FOR CONDUCTOR SAG CHARTS NOT SHOWN IN THE SPECIFICATIONS, CONTACT DISTRIBUTION STANDARDS.

NOTES

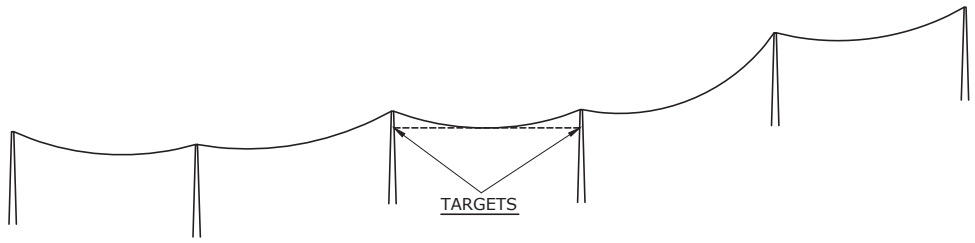
1. SAG CONDUCTORS PER DWG. 05.02-104.
2. WHEN SELECTING SAGS FROM CHARTS, ENTER THE CHART AT THE CALCULATED CLOSEST RULING SPAN AND INTERPOLATE TO DETERMINE VALUES THAT ARE BETWEEN THE ACTUAL TEMPERATURE AND SPAN.
3. DO NOT INTERPOLATE FOR SPANS BETWEEN 340 FT. AND 360 FT. THE MEDIUM SPANS AND LONG SPANS HAVE DIFFERENT RULING SPANS. FOR THE 350 FT. SAG, ADD ONE HALF OF THE DIFFERENCE BETWEEN THE 320 FT. SAG AND THE 340 FT. SAG TO THE 340 FT. SAG.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SAG AND TENSION GENERAL NOTES

DEC	DEM	DEP	DEF
X	X	X	X

05.02-100

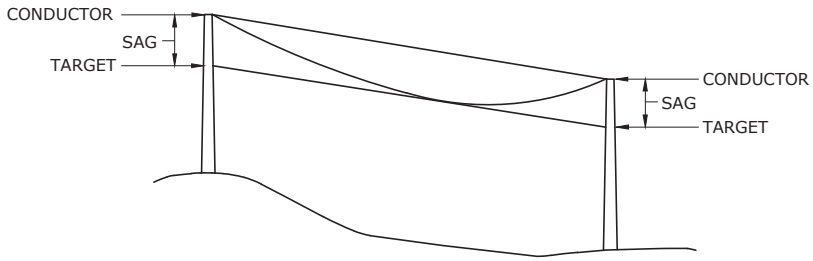


SELECT SPAN NEAR CENTER OF SECTION BEING SAGGED. SELECT SPAN WHOSE SUPPORTS ARE NEAR THE SAME ELEVATION.

FIVE SPANS OR LESS

SELECT AT LEAST TWO SPANS, ONE NEAR EACH END OF SECTION BEING SAGGED. MEASURE ONLY SPANS OF AVERAGE LENGTH IN SECTION BEING SAGGED.

OVER FIVE SPANS



NOTES:

1. INSTALL CONDUCTOR IN FREE-RUNNING ADEQUATE SIZE BLOCKS. SAG THE CONDUCTOR TO APPROXIMATE SAG WHILE INSTALLING, ADJUST GUYS AS NEEDED, THEN SAG TO EXACT SAG USING PROPER TABLE, CONDUCTOR TEMPERATURE AND SPAN LENGTH. THEN TIE IN. OBSERVE CLEARANCES, MEASURE ANY THAT ARE CLOSE TO MINIMUM AND ADVISE ENGINEER OF DETAILS OF TEMPERATURE AND SAG OF ANY SPAN WHICH HAS QUESTIONABLE CLEARANCE.

2. USE SAG TABLES IN SECTION 05 UNLESS OTHERWISE SPECIFIED. USE SHORT SPAN SAGS FOR LINES UNDER 200' MAXIMUM SPAN. USE MEDIUM SPAN SAGS FOR LINES AVERAGING 200' - 350' SPANS WITH 350' MAXIMUM SPAN. USE LONG SPAN FOR LENGTHS WITH MAXIMUM SPANS ABOVE 350'.

3. IF NECESSARY TO USE SECTION OF LINE OR DEAD-END SPAN WITH SHORTER SPANS THAN IN SAG TABLE, DETERMINE SAG BY USING DOUBLE SPAN LENGTH AND DIVIDING BY 4. OR USE SAG OF QUADRUPLE SPAN DIVIDED BY 16. AVOID INSTALLING SUCH SHORT SPANS WHENEVER POSSIBLE.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SELECTING SPANS AND MEASURING SAGS

DEC	DEM	DEP	DEF
X	X	X	X

05.02-104

REVISED	BY	CK'D	APPR.
0 6/30/16	ROBESON	BURLISON	ADCOCK
1			
2			
3			

CONDUCTOR SAG AND TENSION - TREE WIRE

1/0 AAAC TREE WIRE												
WIRE SIZE	STRINGING CONDITIONS	TEMP. IN °F	SAG AND TENSION FOR VARIOUS RULING SPANS									
			50' SPAN		100' SPAN		150' SPAN		200' SPAN		250' SPAN	
			TENSION	SAG	TENSION	SAG	TENSION	SAG	TENSION	SAG	TENSION	SAG
#1/0 AAAC	INITIAL	30°	1450	1"	1450	2"	1450	5"	1450	10"	1450	1'3"
		60°	1190	1"	1190	3"	1190	7"	1190	1'0"	1190	1'7"
		90°	895	1"	895	4"	895	9"	895	1'4"	895	2'0"
		120°	660	1"	660	5"	660	1'0"	660	1'10"	660	2'10"
NOTE: #1/0 AAAC 10/64" HDPE - MAXIMUM TENSION FROM LIGHT LOADING PER 1984 EDITION OF NESC (9 LBS. WIND AND CONSTANT AT 30°F.) = 1,030 LBS. SAG DATA BASED ON RULING SPAN OF 200 FT.												

336.4 TREE WIRE												
WIRE SIZE	STRINGING CONDITIONS	TEMP. IN °F	SAG AND TENSION FOR VARIOUS RULING SPANS									
			50' SPAN		100' SPAN		150' SPAN		200' SPAN		250' SPAN	
			TENSION	SAG	TENSION	SAG	TENSION	SAG	TENSION	SAG	TENSION	SAG
336.4 MCM AAC	INITIAL	30°	1882	1"	1882	4"	1882	9"	1882	1'4"	1882	2'0"
		60°	1460	1"	460	5"	1460	11"	1460	1'7"	1460	2'6"
		90°	1035	2"	1035	7"	1035	1'4"	1035	2'4"	1035	3'7"
		120°	795	2"	795	9"	795	1'8"	795	3'0"	795	4'8"
NOTE: 336 MCM AAC 10/64" HDPE. MAXIMUM TENSION FROM LIGHT LOADING PER 1984 EDITION OF NESC (9 LBS. WIND AND CONSTANT AT 30°F.) = 2,155 LBS. SAG DATE BASED ON RULING SPAN OF 200 FT.												

NOTES:

1. SEE DWG. 05.02-100 FOR GENERAL NOTES.

DUKE ENERGY®

DEC	DEM	DEP	DEF
			X

05.02-108

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - #2 AAAC AMES

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN						
		100	120	140	150	160	180	200
30° F	746	1	2	3	3	4	5	6
40° F	689	2	2	3	4	4	5	6
50° F	633	2	2	3	4	4	6	7
60° F	577	2	3	4	4	5	6	7
70° F	522	2	3	4	5	5	7	8
80° F	468	2	3	5	5	6	7	9
90° F	416	3	4	5	6	7	8	10
104° F	346	3	4	6	7	8	10	12

CONDUCTOR TEMPERATURE	TENSION LBS	280 FOOT RULING SPAN							
		200	220	240	260	280	300	320	340
30° F	898	5	6	7	8	9	11	12	14
40° F	842	5	6	7	9	10	12	13	15
50° F	786	6	7	8	9	11	12	14	16
60° F	730	6	7	9	10	12	13	15	17
70° F	675	6	8	9	11	13	14	16	18
80° F	621	7	8	10	12	14	16	18	20
90° F	569	8	9	11	13	15	17	19	22
104° F	497	9	11	13	15	17	20	22	25

CONDUCTOR TEMPERATURE	TENSION LBS	450 FOOT RULING SPAN								
		360	380	400	420	440	450	460	480	500
30° F	900	16	17	19	21	23	24	25	28	30
40° F	846	17	18	20	23	25	26	27	29	32
50° F	792	18	20	22	24	26	28	29	31	34
60° F	739	19	21	23	26	28	30	31	34	37
70° F	687	20	23	25	28	30	32	33	36	39
80° F	637	22	24	27	30	33	34	36	39	42
90° F	588	24	27	29	32	36	37	39	42	46
104° F	524	27	30	33	36	40	42	44	47	52

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
#2 AAAC AMES

DEC	DEM	DEP	DEF
			X

05.02-112A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - 2 AAAC AMES

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-800 LBS.)						
		100	120	140	150	160	180	200
30° F, 9 PSF WIND	683	7	9	13	15	17	21	26
30° F, NO WIND	592	2	3	4	4	5	6	7
32° F	578	2	3	4	4	5	6	7
40° F	523	2	3	4	5	5	7	8
50° F	455	2	3	5	5	6	8	10
60° F	389	3	4	5	6	7	9	11
60° F, 6PSF WIND	449	6	8	11	13	15	19	23
70° F	325	3	5	7	7	9	11	13
80° F	267	4	6	8	9	10	13	16
90° F	216	5	7	10	11	13	16	20
104° F	161	7	10	13	15	17	22	27
120° F	123	9	13	17	20	23	28	35
185° F	68	16	23	31	36	41	52	64
HORIZONTAL SWING	449	3	5	6	6	8	10	12

CONDUCTOR TEMPERATURE	TENSION LBS	280 FOOT RULING SPAN (LLT-1015 LBS.)							
		200	220	240	260	280	300	320	340
30° F, 9 PSF WIND	885	20	24	29	34	40	45	52	58
30° F, NO WIND	700	6	7	9	10	12	14	16	18
32° F	687	6	8	9	11	12	14	16	18
40° F	633	7	8	10	12	13	15	17	20
50° F	568	8	9	11	13	15	17	19	22
60° F	505	9	10	12	14	17	19	22	25
60° F, 6PSF WIND	613	17	21	24	29	33	38	44	49
70° F	444	10	12	14	16	19	22	25	28
80° F	388	11	13	16	19	22	25	29	32
90° F	337	13	16	18	22	25	29	33	37
104° F	277	16	19	22	26	31	35	40	45
120° F	226	19	23	28	32	38	43	49	55
185° F	131	33	40	48	56	65	74	85	96
HORIZONTAL SWING	613	15	19	22	26	30	35	40	45

CONDUCTOR TEMPERATURE	TENSION LBS	450 FOOT RULING SPAN (LLT-1134 LBS.)								
		360	380	400	420	440	450	460	480	500
30° F, 9 PSF WIND	1036	56	62	69	76	83	87	91	99	108
30° F, NO WIND	700	20	22	25	27	30	31	33	36	39
32° F	688	20	23	25	28	30	32	33	36	39
40° F	639	22	24	27	30	33	34	36	39	42
50° F	580	24	27	30	33	36	38	39	43	47
60° F	525	27	30	33	36	40	42	44	47	51
60° F, 6PSF WIND	714	47	53	58	64	71	74	77	84	91
70° F	474	30	33	36	40	44	46	48	52	57
80° F	428	33	36	40	45	49	51	53	58	63
90° F	387	36	40	45	49	54	57	59	64	70
104° F	338	41	46	51	56	62	65	68	74	80
120° F	293	48	53	59	65	71	75	78	85	92
185° F	194	72	80	89	98	108	113	118	128	139
HORIZONTAL SWING	714	43	48	53	58	65	67	70	76	83

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	ROBESON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
2 AAAC AMES

DEC	DEM	DEP	DEF
			X

05.02-112B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - REDUCED TENSION 1/0 AAAC AZUZA FEEDER NEUTRAL

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-642 LBS.)										
		100	110	120	130	140	150	160	170	180	190	200
30° F	474	4	4	5	6	7	8	9	11	12	13	15
40° F	405	4	5	6	7	8	10	11	12	14	15	17
50° F	344	5	6	7	8	10	11	13	14	16	18	20
60° F	292	6	7	9	10	12	13	15	17	19	21	24
70° F	249	7	8	10	12	14	16	18	20	22	25	28
80° F	215	8	10	12	14	16	18	21	23	26	29	32
90° F	188	9	11	13	16	18	21	23	27	30	33	37
95° F	177	10	12	14	16	19	22	25	28	32	35	39
104° F	161	11	13	15	18	21	24	27	31	35	39	43

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN- (LLT-720 LBS.)										
		150	160	170	180	190	200	210	220	230	240	250
30° F	489	8	9	10	11	13	14	16	17	19	20	22
40° F	426	9	10	12	13	15	16	18	20	21	23	25
50° F	370	10	12	13	15	17	19	21	23	25	27	29
60° F	323	12	14	15	17	19	21	24	26	28	31	33
70° F	284	14	16	18	20	22	24	27	29	32	35	38
80° F	252	15	18	20	22	25	27	30	33	36	39	43
90° F	226	17	20	22	25	28	31	34	37	40	44	48
95° F	215	18	21	23	26	29	32	35	39	42	46	50
104° F	198	20	22	25	28	31	35	38	42	46	50	54

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
REDUCED TENSION 1/0 AAAC AZUZA FEEDER NEUTRAL

DEC	DEM	DEP	DEF
			X

05.02-120A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - REDUCED TENSION 1/0 AAAC AZUZA FEEDER NEUTRAL

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-642 LBS.)										
		100	110	120	130	140	150	160	170	180	190	200
30° F, 9 PSF WIND	632	9	11	13	15	17	20	22	25	28	32	35
30° F, NO WIND	413	4	5	6	7	8	9	11	12	14	15	17
32° F	396	4	5	6	7	9	10	11	13	14	16	17
40° F	334	5	6	7	9	10	12	13	15	17	19	21
50° F	272	6	8	9	11	12	14	16	18	21	23	25
60° F	225	8	9	11	13	15	17	20	22	25	28	31
60° F, 6PSF WIND	356	10	12	14	16	19	22	25	28	31	35	39
70° F	192	9	11	13	15	18	20	23	26	29	32	36
80° F	169	10	12	15	17	20	23	26	30	33	37	41
90° F	151	11	14	16	19	22	26	29	33	37	41	46
95° F	144	12	15	17	20	24	27	31	35	39	43	48
104° F	133	13	16	19	22	25	29	33	38	42	47	52
120° F	118	15	18	21	25	29	33	37	42	47	53	59
HORIZONTAL SWING	356	9	10	12	14	16	19	22	24	27	30	34

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN (LLT-720 LBS.)										
		150	160	170	180	190	200	210	220	230	240	250
30° F, 9 PSF WIND	704	18	20	23	26	28	32	35	38	42	45	49
30° F, NO WIND	413	9	11	12	14	15	17	18	20	22	24	26
32° F	399	10	11	13	14	16	17	19	21	23	25	27
40° F	347	11	13	14	16	18	20	22	24	26	29	31
50° F	295	13	15	17	19	21	23	26	28	31	34	36
60° F	256	15	17	19	22	24	27	30	33	36	39	42
60° F, 6PSF WIND	414	19	21	24	27	30	33	37	40	44	48	52
70° F	226	17	20	22	25	28	30	34	37	40	44	48
80° F	203	19	22	25	27	31	34	37	41	45	49	53
90° F	186	21	24	27	30	34	37	41	45	49	54	58
95° F	178	22	25	28	31	35	39	43	47	51	56	61
104° F	166	23	27	30	34	37	42	46	50	55	60	65
120° F	150	26	30	33	37	42	46	51	56	62	66	72
HORIZONTAL SWING	414	16	18	21	23	26	29	32	35	38	42	45

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
REDUCED TENSION 1/0 AAAC AZUZA FEEDER NEUTRAL

DEC	DEM	DEP	DEF
			X

05.02-120B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - 1/0 AAAC AZUZA

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN						
		100	120	140	150	160	180	200
30° F	920	2	3	4	4	5	6	8
40° F	833	2	3	4	5	5	7	8
50° F	747	2	3	5	5	6	7	9
60° F	664	3	4	5	6	7	8	10
70° F	584	3	4	6	7	8	10	12
80° F	508	3	5	7	8	9	11	14
90° F	437	4	6	8	9	10	13	16
104° F	348	5	7	10	11	13	16	20

CONDUCTOR TEMPERATURE	TENSION LBS	280 FOOT RULING SPAN							
		200	220	240	260	280	300	320	340
30° F	1355	5	6	7	9	10	11	13	15
40° F	1265	5	7	8	9	11	12	14	16
50° F	1177	6	7	8	10	11	13	15	17
60° F	1089	6	8	9	11	12	14	16	18
70° F	1003	7	8	10	12	13	15	18	20
80° F	918	8	9	11	13	15	17	19	22
90° F	836	8	10	12	14	16	19	21	24
104° F	726	10	11	14	16	19	21	24	27

CONDUCTOR TEMPERATURE	TENSION LBS	400 FOOT RULING SPAN							
		360	380	400	420	440	460	480	500
30° F	1342	17	19	21	23	25	27	30	32
40° F	1255	18	20	22	24	27	29	32	34
50° F	1170	19	21	24	26	29	31	34	37
60° F	1086	21	23	25	28	31	34	37	40
70° F	1004	22	25	27	30	33	36	40	43
80° F	925	24	27	30	33	36	39	43	47
90° F	849	26	29	33	36	39	43	47	51
104° F	749	30	33	37	41	45	49	53	58

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	ROBESON	BURLISON	ADCOCK	
REVISED		BY	CK'D	APPR.	

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
1/0 AAAC AZUZA

DEC	DEM	DEP	DEF
			X

05.02-124A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - 1/0 AAAC AZUZA

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-1000 LBS.)						
		100	120	140	150	160	180	200
30° F, 9 PSF WIND	879	6	9	12	14	16	20	25
30° F, NO WIND	752	2	3	5	5	6	7	9
32° F	731	2	3	5	6	6	8	9
40° F	646	3	4	5	6	7	9	11
50° F	543	3	5	6	7	8	10	13
60° F	448	4	6	8	9	10	12	15
60° F, 6PSF WIND	542	6	9	12	14	16	21	25
70° F	363	5	7	9	10	12	15	19
80° F	294	6	8	12	13	15	19	23
90° F	242	7	10	14	16	18	23	29
104° F	192	9	13	18	20	23	29	36
120° F	157	11	16	22	25	28	36	44
185° F	99	17	25	34	39	45	57	70
HORIZONTAL SWING	542	5	8	10	12	14	18	22

CONDUCTOR TEMPERATURE	TENSION LBS	280 FOOT RULING SPAN (LLT-1483 LBS.)							
		200	220	240	260	280	300	320	340
30° F, 9 PSF WIND	1269	17	21	25	30	34	39	45	51
30° F, NO WIND	1059	7	8	9	11	13	15	17	19
32° F	1037	7	8	10	11	13	15	17	19
40° F	953	7	9	10	12	14	16	19	21
50° F	851	8	10	12	14	16	18	21	23
60° F	752	9	11	13	16	18	21	23	27
60° F, 6PSF WIND	881	16	19	23	26	31	35	40	45
70° F	660	10	13	15	18	21	24	27	30
80° F	574	12	15	17	20	24	27	31	35
90° F	499	14	17	20	23	27	31	35	40
104° F	412	17	20	24	28	33	38	43	48
120° F	339	20	25	29	34	40	46	52	59
185° F	202	34	41	49	58	67	77	87	99
HORIZONTAL SWING	881	14	16	20	23	27	30	35	39

CONDUCTOR TEMPERATURE	TENSION LBS	400 FOOT RULING SPAN (LLT-1571 LBS.)							
		360	380	400	420	440	460	480	500
30° F, 9 PSF WIND	1391	52	58	64	70	77	84	92	100
30° F, NO WIND	1047	21	24	26	29	32	35	38	41
32° F	1027	22	24	27	30	33	36	39	42
40° F	949	24	26	29	32	35	38	42	45
50° F	856	26	29	32	36	39	43	46	50
60° F	768	29	32	36	40	43	58	52	56
60° F, 6PSF WIND	968	46	51	57	63	69	75	82	89
70° F	688	33	36	40	43	48	53	58	63
80° F	615	36	40	45	49	54	59	65	70
90° F	552	40	45	50	55	60	66	72	78
104° F	479	47	52	58	64	70	76	83	90
120° F	413	54	60	67	74	81	88	96	104
185° F	272	82	92	101	112	123	134	146	158
HORIZONTAL SWING	968	40	44	49	55	60	65	71	77

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1	11/29/16	ROBESON	BURLISON	ADCOCK
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
1/0 AAAC AZUZA

DEC	DEM	DEP	DEF
			X

05.02-124B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - REDUCED TENSION, #1/0 AAAC AZUZA FEEDER NEUTRAL

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN (MLT - 965 LBS.)						
		250	270	290	310	330	350	370
30° F	662	16	19	22	25	28	32	36
40° F	594	18	21	24	28	32	36	40
50° F	533	20	24	27	31	35	40	44
60° F	477	23	26	30	35	39	44	49
70° F	429	25	29	34	39	44	49	55
80° F	387	28	32	37	43	49	55	61
90° F	352	31	36	41	47	53	60	67
104° F	311	35	40	47	53	60	68	76

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN (MLT - 1101 LBS.)						
		380	400	420	440	460	480	500
30° F	644	39	43	47	52	57	62	67
40° F	591	42	47	51	57	62	67	73
50° F	544	46	51	56	61	67	73	79
60° F	501	50	55	61	67	73	79	86
70° F	464	54	59	66	72	79	86	93
80° F	432	58	64	70	77	85	92	100
90° F	404	62	68	75	83	90	99	107
104° F	370	67	75	82	90	99	107	117

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	ROBESON	BURLISON	ADCOCK	
REVISED		BY	CK'D	APPR.	

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION - REDUCED TENSION
#1/0 AAAC AZUZA FEEDER NEUTRAL

DEC	DEM	DEP	DEF
			X

05.02-126A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - REDUCED TENSION, #1/0 AAAC AZUZA FEEDER NEUTRAL

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN- (LLT-965 LBS.)						
		250	270	290	310	330	350	370
30° F, 9 PSF WIND	922	38	44	51	58	66	74	82
30° F, NO WIND	539	20	23	27	31	35	39	44
32° F	525	21	24	28	32	36	40	45
40° F	472	23	27	31	35	40	45	50
50° F	416	26	30	35	40	45	51	57
60° F	370	29	34	39	45	51	57	64
60° F, 6PSF WIND	576	37	44	50	58	65	73	82
70° F	332	32	38	44	50	57	64	71
80° F	302	36	42	48	55	62	70	78
90° F	278	39	45	52	60	68	76	85
104° F	250	43	50	58	66	75	84	94
120° F	226	48	56	64	73	83	93	104
185° F	169	64	74	86	98	111	125	140
HORIZONTAL SWING	576	32	38	43	50	56	63	71

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN- (LLT-1101 LBS.)						
		380	400	420	440	460	480	500
30° F, 9 PSF WIND	1062	75	84	92	101	111	120	131
30° F, NO WIND	531	47	52	57	63	69	75	81
32° F	522	48	53	58	64	70	76	83
40° F	485	51	57	63	69	75	82	89
50° F	446	56	62	68	75	82	89	97
60° F	412	60	67	74	81	89	96	105
60° F, 6PSF WIND	678	73	81	90	99	108	117	127
70° F	384	65	72	79	87	95	104	112
80° F	360	69	77	85	93	101	110	120
90° F	339	73	81	90	99	108	117	127
104° F	314	79	88	97	106	116	127	137
120° F	291	86	95	105	115	125	137	148
185° F	230	108	120	133	145	159	173	188
HORIZONTAL SWING	678	63	70	78	86	94	101	110

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION - REDUCED TENSION
#1/0 AAAC AZUZA FEEDER NEUTRAL

DEC	DEM	DEP	DEF
			X

05.02-126B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - 336.4-AAC TULIP

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-2243 LBS.)										
		100	110	120	130	140	150	160	170	180	190	200
30° F	2153	2	3	3	4	4	5	6	6	7	8	9
40° F	1950	2	3	3	4	5	5	6	7	8	9	10
50° F	1745	3	3	4	5	5	6	7	8	9	10	11
60° F	1539	3	4	4	5	6	7	8	9	10	11	12
70° F	1335	4	4	5	6	7	8	9	10	11	13	14
80° F	1140	4	5	6	7	8	9	11	12	13	15	17
90° F	959	5	6	7	8	10	11	13	14	16	18	20
95° F	877	5	7	8	9	11	12	14	16	17	19	22
104° F	747	6	8	9	11	12	14	16	18	20	23	25

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN- (LLT-2301 LBS.)										
		150	160	170	180	190	200	210	220	230	240	250
30° F	2152	5	6	6	7	8	9	10	11	12	13	14
40° F	1956	5	6	7	8	9	10	11	12	13	14	15
50° F	1758	6	7	8	9	10	11	12	13	14	15	17
60° F	1562	7	8	9	10	11	12	13	15	16	17	19
70° F	1371	8	9	10	11	12	14	15	17	18	20	22
80° F	1192	9	10	11	13	14	16	17	19	21	23	25
90° F	1031	10	12	13	15	17	18	20	22	24	26	29
95° F	958	11	13	14	16	18	20	22	24	26	28	31
104° F	842	13	14	16	18	20	22	25	27	30	32	35

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
336.4-AAC TULIP

DEC	DEM	DEP	DEF
			X

05.02-136A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - 336.4 AAC-TULIP

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-2243 LBS.)										
		100	110	120	130	140	150	160	170	180	190	200
30° F, 9 PSF WIND	1661	6	7	8	10	11	13	15	17	19	21	23
30° F, NO WIND	1439	3	4	5	6	6	7	8	9	11	12	13
32° F	1387	3	4	5	6	7	8	9	10	11	12	14
40° F	1188	4	5	6	7	8	9	10	12	13	14	16
50° F	966	5	6	7	8	10	11	13	14	16	18	20
60° F	785	6	7	9	10	12	14	15	17	20	22	24
60° F, 6PSF WIND	947	7	9	10	12	14	16	19	21	24	26	29
70° F	649	7	9	10	12	14	16	19	21	24	26	29
80° F	550	9	10	12	15	17	19	22	25	28	31	34
90° F	479	10	12	14	17	19	22	25	29	32	36	39
95° F	451	10	13	15	18	21	24	27	30	34	38	42
104° F	410	12	14	17	20	23	26	30	33	37	42	46
185° F	247	19	23	28	32	37	43	49	55	62	69	77
HORIZONTAL SWING	947	5	7	7	9	10	12	14	15	17	19	21

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN (LLT-2301 LBS.)										
		150	160	170	180	190	200	210	220	230	240	250
30° F, 9 PSF WIND	1729	13	14	16	18	20	22	25	27	29	32	35
30° F, NO WIND	1392	8	9	10	11	12	14	15	16	18	20	21
32° F	1346	8	9	10	11	13	14	15	17	19	20	22
40° F	1173	9	10	12	13	15	16	18	20	21	23	25
50° F	988	11	12	14	16	17	19	21	23	25	28	30
60° F	840	13	14	16	18	20	23	25	27	30	32	35
60° F, 6PSF WIND	1044	15	17	19	21	24	26	29	32	35	38	41
70° F	726	15	17	19	21	24	26	29	32	34	38	41
80° F	639	17	18	21	24	27	30	33	36	39	43	46
90° F	572	19	21	24	27	30	33	36	40	44	48	52
95° F	545	20	22	25	28	31	35	38	42	46	50	54
104° F	503	21	24	27	30	34	38	41	46	50	54	59
185° F	320	33	38	43	48	53	59	65	72	78	85	92
HORIZONTAL SWING	1044	11	12	14	15	17	19	21	23	25	28	30

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
336.4 AAC-TULIP

DEC	DEM	DEP	DEF
			X

05.02-136B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - 336.4-AAC TULIP

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN- (LLT-2351 LBS.)						
		250	270	290	310	330	350	370
30° F	2048	14	17	19	22	25	28	32
40° F	1866	16	18	21	24	28	31	35
50° F	1688	17	20	24	27	30	34	38
60° F	1519	19	23	26	30	34	38	43
70° F	1362	22	25	29	33	38	42	47
80° F	1221	24	28	33	37	42	47	53
90° F	1097	27	31	36	41	47	53	59
104° F	952	31	36	42	48	54	61	68

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN- (LLT-2548 LBS.)						
		380	400	420	440	460	480	500
30° F	2048	33	37	41	45	49	53	58
40° F	1890	36	40	44	48	53	58	62
50° F	1742	39	43	48	53	57	63	68
60° F	1603	43	47	52	57	62	68	74
70° F	1476	46	51	56	62	68	74	80
80° F	1363	50	55	61	67	73	80	87
90° F	1262	54	60	66	73	79	86	94
104° F	1141	60	66	73	80	88	95	104

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
336.4-AAC TULIP

DEC	DEM	DEP	DEF
			X

05.02-137A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - 336.4 AAC-TULIP

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN- (LLT-2351 LBS.)						
		250	270	290	310	330	350	370
30° F, 9 PSF WIND	1840	33	38	44	50	57	64	72
30° F, NO WIND	1294	23	27	31	35	40	45	50
32° F	1261	23	27	32	36	41	46	51
40° F	1141	26	30	35	40	45	51	57
50° F	1016	29	34	39	45	51	57	64
60° F	914	32	38	43	50	56	63	71
60° F, 6PSF WIND	1186	36	42	49	56	63	71	79
70° F	832	36	41	48	55	62	70	78
80° F	764	39	45	52	59	67	76	85
90° F	708	42	49	56	64	73	82	91
104° F	645	46	53	62	70	80	90	100
120° F	588	50	59	68	77	87	98	110
185° F	449	66	77	89	101	115	129	144
HORIZONTAL SWING	1186	26	31	36	41	46	52	57

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN- (LLT-2548 LBS.)						
		380	400	420	440	460	480	500
30° F, 9 PSF WIND	2073	67	74	82	90	98	107	116
30° F, NO WIND	1328	51	57	63	69	75	82	89
32° F	1306	52	58	64	70	77	83	91
40° F	1222	56	62	68	75	82	89	97
50° F	1131	60	67	74	81	88	96	105
60° F	1054	65	72	79	87	95	103	112
60° F, 6PSF WIND	1398	71	79	87	95	104	113	123
70° F	987	69	77	84	93	101	110	120
80° F	930	73	81	90	98	108	117	127
90° F	881	77	86	95	104	114	124	134
104° F	822	83	92	101	111	122	133	144
120° F	765	89	99	109	120	131	142	154
185° F	613	111	124	136	149	163	178	193
HORIZONTAL SWING	1398	52	57	63	69	76	82	89

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
336.4 AAC-TULIP

DEC	DEM	DEP	DEF
			X

05.02-137B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION -795 AAC ARBUTUS

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-4500 LBS)										
		100	110	120	130	140	150	160	170	180	190	200
30° F	4387	3	3	4	4	5	6	7	7	8	9	10
40° F	3936	3	3	4	5	6	6	7	8	9	10	11
50° F	3481	3	4	5	5	6	7	8	9	10	12	13
60° F	3029	4	4	5	6	7	8	9	11	12	13	15
70° F	2952	4	5	6	7	8	10	11	12	14	16	17
80° F	2187	5	6	7	9	10	12	13	15	17	18	20
90° F	1834	6	7	9	10	12	14	16	18	20	22	24
95° F	1683	7	8	10	11	13	15	17	19	22	24	27
104° F	1452	8	9	11	13	15	17	20	22	25	28	31

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN- (LLT-5005 LBS)										
		150	160	170	180	190	200	210	220	230	240	250
30° F	4849	5	6	7	7	8	9	10	11	12	13	14
40° F	4419	6	6	7	8	9	10	11	12	13	15	16
50° F	3985	6	7	8	9	10	11	12	14	15	16	18
60° F	3553	7	8	9	10	11	13	14	15	17	18	20
70° F	3133	8	9	10	12	13	14	16	17	19	21	22
80° F	2734	9	10	12	13	15	16	18	20	22	24	26
90° F	2372	11	12	14	15	17	19	21	23	25	27	29
95° F	2209	11	13	15	16	18	20	22	24	27	29	32
104° F	1948	13	15	17	19	21	23	25	28	30	33	36

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
795 AAC ARBUTUS

DEC	DEM	DEP	DEF
			X

05.02-184A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION -795 AAC ARBUTUS

CONDUCTOR TEMPERATURE	TENSION LBS	150 FOOT RULING SPAN- (LLT-4500 LBS.)										
		100	110	120	130	140	150	160	170	180	190	200
30° F, 9 PSF WIND	3487	5	6	7	8	9	11	12	14	16	17	19
30° F, NO WIND	3239	3	4	5	6	7	8	9	10	11	12	14
32° F	3124	4	4	5	6	7	8	9	10	12	13	14
40° F	2685	4	5	6	7	8	9	11	12	13	15	17
50° F	2200	5	6	7	9	10	11	13	15	16	18	20
60° F	1803	6	8	9	10	12	14	16	18	20	22	25
60° F, 6PSF WIND	1985	7	8	10	12	13	15	18	10	22	25	27
70° F	1502	7	9	11	13	15	17	19	22	24	27	30
80° F	1282	9	11	13	15	17	20	22	25	28	31	35
90° F	1121	10	12	14	17	20	22	26	29	32	36	40
95° F	1057	11	13	15	18	21	24	27	31	34	38	42
104° F	962	12	14	17	20	23	26	30	34	38	42	47
185° F	584	19	23	28	32	38	43	49	55	62	69	77
HORIZONTAL SWING	1985	4	5	6	7	7	9	10	11	12	14	15

CONDUCTOR TEMPERATURE	TENSION LBS	200 FOOT RULING SPAN (LLT-5005 LBS)										
		150	160	170	180	190	200	210	220	230	240	250
30° F, 9 PSF WIND	3824	10	11	13	14	16	18	19	21	23	25	28
30° F, NO WIND	3475	7	8	9	10	12	13	14	16	17	19	20
32° F	3367	7	9	10	11	12	13	15	16	18	19	21
40° F	2956	9	10	11	12	14	15	17	18	20	22	24
50° F	2504	10	11	13	14	16	18	20	22	24	26	28
60° F	2129	12	13	15	17	19	21	23	25	28	30	33
60° F, 6PSF WIND	2352	13	15	17	19	21	23	25	28	31	33	36
70° F	1832	14	16	18	20	22	24	27	30	32	35	38
80° F	1603	16	18	20	23	25	28	31	34	37	40	44
90° F	1427	18	20	23	25	28	31	35	38	41	45	49
95° F	1354	19	21	24	27	30	33	36	40	44	48	52
104° F	1243	20	23	26	29	32	36	40	44	48	52	56
185° F	774	33	37	42	47	52	58	64	70	76	83	90
HORIZONTAL SWING	2352	7	9	10	11	12	13	14	16	18	19	20

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
795 AAC ARBUTUS

DEC	DEM	DEP	DEF
			X

05.02-184B

NESC LIGHT LOADING ZONE INITIAL CONDUCTOR SAG AND TENSION - #795 AAC ARBUTUS

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN (MLT - 5173 LBS.)						
		250	270	290	310	330	350	370
30° F	4865	14	17	19	22	25	28	31
40° F	4465	16	18	21	24	27	31	34
50° F	4072	17	20	23	26	30	34	38
60° F	3690	19	22	25	29	33	37	41
70° F	3328	21	24	28	32	37	41	46
80° F	2995	23	27	31	36	41	46	51
90° F	2695	26	30	35	40	45	51	57
104° F	2340	30	35	40	46	52	59	65

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN (MLT - 5341 LBS.)						
		380	400	420	440	460	480	500
30° F	4864	33	37	41	44	49	53	57
40° F	4515	36	40	44	48	52	57	62
50° F	4180	39	43	47	52	57	62	67
60° F	3864	42	46	51	56	61	67	72
70° F	3570	45	50	55	61	66	72	78
80° F	3302	49	54	60	66	72	78	85
90° F	3061	53	58	64	71	77	84	91
104° F	2767	58	65	71	78	85	93	101

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK

NESC LIGHT LOADING ZONE
INITIAL CONDUCTOR SAG AND TENSION -
#795 AAC ARBUTUS

DEC	DEM	DEP	DEF
			X

05.02-188A

NESC LIGHT LOADING ZONE FINAL CONDUCTOR SAG AND TENSION - #795 AAC ARBUTUS

CONDUCTOR TEMPERATURE	TENSION LBS	300 FOOT RULING SPAN- (LLT-5173 LBS.)						
		250	270	290	310	330	350	370
30° F, 9 PSF WIND	3989	26	31	35	41	46	52	58
30° F, NO WIND	3388	21	24	28	32	36	40	45
32° F	3303	21	25	28	33	37	41	46
40° F	2988	23	27	31	36	41	46	51
50° F	2649	26	31	35	41	46	52	58
60° F	2368	29	34	40	45	51	58	65
60° F, 6PSF WIND	2674	32	37	43	49	55	62	70
70° F	2138	33	38	44	50	57	64	72
80° F	1950	36	42	48	55	62	70	78
90° F	1795	39	45	52	60	68	76	85
104° F	1621	43	50	58	66	75	84	94
120° F	1467	48	56	64	73	83	93	104
185° F	1097	64	74	86	98	111	125	140
HORIZONTAL SWING	2674	18	21	24	28	31	35	40

CONDUCTOR TEMPERATURE	TENSION LBS	440 FOOT RULING SPAN- (LLT-5409 LBS.)						
		380	400	420	440	460	480	500
30° F, 9 PSF WIND	4278	57	63	69	76	83	91	98
30° F, NO WIND	3402	47	53	58	64	70	76	82
32° F	3342	48	54	59	65	71	77	84
40° F	3117	52	57	63	69	76	83	90
50° F	2874	56	62	69	75	82	90	97
60° F	2665	61	67	74	81	89	97	105
60° F, 6PSF WIND	3059	64	71	78	86	94	102	111
70° F	2486	65	72	79	87	95	104	112
80° F	2332	69	77	85	93	101	110	120
90° F	2199	73	81	90	98	108	117	127
104° F	2041	79	88	97	106	116	126	137
120° F	1892	85	95	104	114	125	136	148
185° F	1494	108	120	132	145	158	173	187
HORIZONTAL SWING	3059	36	40	44	49	53	58	63

NOTES:

1. ALL SAG VALUES LISTED ON CHART ARE IN INCHES; TENSION IS IN POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LIGHT LOADING ZONE
FINAL CONDUCTOR SAG AND TENSION -
#795 AAC ARBUTUS

DEC	DEM	DEP	DEF
			X

05.02-188B

SERVICE	ITEM NUMBER	SAGS FOR OVERHEAD AERIAL CABLE USED AS SERVICES (INCHES)																			TENSION *
		SPAN (FEET)																			
		0-20'	30'	40'	50'	60'	70'	80'	90'	100'	110'	120'	130'	140'	150'	160'	170'	180'	190'	195'	
1/0 DPX	201102	24	24	24	24	24	26	39	49	59	72	-	-	-	-	-	-	-	-	-	70
1/0 TPX AUBURN	201106	24	24	24	24	24	28	45	56	68	84	-	-	-	-	-	-	-	-	-	85
1/0 QPX GALLEY	201109	24	24	24	24	33	42	54	68	-	-	-	-	-	-	-	-	-	-	-	104
4/0 TPX	201107	24	24	24	24	36	47	-	-	-	-	-	-	-	-	-	-	-	-	-	108
4/0 QPX	201111	24	24	24	28	42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	122

* INDICATES LONGEST SPAN STRINGING TENSION (LBS.)

NOTES:

1. SAGS ARE STRINGING SAGS FOR NORMAL STRINGING TEMPERATURES. WHEN STRUNG AS ABOVE, SAGS GIVEN MAY ALSO BE USED AS APPROXIMATE 60° FINAL SAGS AT MID-SPAN. FOR SLOPED SPANS, CABLE IS LOWER NEAR LOW END OF SPAN THAN AT MID-SPAN. SEE DWG. 05.02-104.

2. THESE STANDARD SAGS ARE BASED ON 200 LB. CONDUCTOR TENSION, WHICH IS ALLOWABLE PULL ON 2" STEEL SERVICE MAST OF **4 FT. OR LESS LENGTH ABOVE** SOLID SUPPORT (ROOF). GREATER LENGTHS OF MAST REQUIRE MAST GUYING OR BRACING, LARGER MAST OR SPECIAL SAG.

   THE SAGS ARE BASED ON THE 200 LB. LIMIT APPLIED AT LIGHT LOAD TENSION.

3. USE SPECIAL SAGS WHEN SPECIFIED ON WORK ORDER BY ENGINEER.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SAGS FOR OVERHEAD AERIAL CABLE USED AS SERVICES

DEC	DEM	DEP	DEF
			X

05.04-100

2 CONDUCTOR ALUMINUM ASC												
PHASE WIRE SIZE	STRINGING CONDITIONS	TEMP °F	SAG FOR VARIOUS SPANS									TENSION
			50	100	150	200	250	300	350	400	450	500	
4	INITIAL	30	1"	3"	6"	11"	1'5"	2'0"	2'9"	3'7"	4'7"	5'7"	555
		60	1"	3"	7"	1'1"	1'8"	2'5"	3'3"	4'4"	5'6"	6'8"	460
		90	1"	4"	9"	1'4"	2'1"	3'0"	4'1"	5'4"	6'11"	8'5"	373
		120	1"	5"	11"	1'7"	2'6"	3'8"	4'11"	6'5"	8'3"	10'0"	304
4	FINAL	30	1"	3"	8"	1'2"	1'9"	2'7"	3'6"	4'7"	5'10"	7'2"	436
		60	1"	4"	10"	1'6"	2'3"	3'3"	4'5"	5'10"	7'5"	9'1"	342
		90	1"	5"	1'0"	1'10"	2'10"	4'1"	5'1"	7'4"	9'3"	11'5"	371
		120	2"	7"	1'3"	2'3"	3'6"	5'0"	6'9"	8'11"	11'4"	13'11"	223
1/0	INITIAL	30	1"	3"	6"	10"	1'4"	1'11"	2'8"	3'5"	4'4"	5'5"	1453
		60	1"	3"	7"	1'1"	1'8"	2'5"	3'4"	4'4"	5'5"	6'9"	1165
		90	1"	4"	10"	1'6"	2'4"	3'4"	4'7"	6'0"	7'7"	9'4"	838
		120	1"	6"	1'1"	2'0"	3'1"	4'5"	6'0"	7'11"	10'0"	12'4"	636
1/0	FINAL	30	1"	3"	8"	1'1"	1'9"	2'6"	3'5"	4'5"	5'8"	6'11"	1128
		60	1"	4"	10"	1'5"	2'2"	3'2"	4'4"	5'8"	7'2"	8'10"	891
		90	1"	6"	1'1"	1'11"	3'0"	4'3"	5'10"	7'3"	9'7"	11'10"	661
		120	2"	7"	1'4"	2'4"	3'8"	5'4"	7'3"	9'6"	12'0"	14'10"	529

NOTE: #4 BARE NEUTRAL AAAC WITH #4 AAC PHASE CONDUCTOR AND 1/0 AAAC NEUTRAL WITH 1/0 AAC PHASE CONDUCTOR.

MAXIMUM TENSION FROM LIGHT LOADING PER SIXTH EDITION OF NESC (9 LBS WIND + CONSTANT @ 30°F). SAG DATA BASED ON 300 FOOT RULING SPAN. TENSIONS SHOWN ASSUME NO ICE OR WIND. MAXIMUM TENSIONS: #4 - 902 POUNDS, 1/0 - 2,230 POUNDS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK

DUKE ENERGY.

SAGS FOR OVERHEAD

TWO CONDUCTOR AERIAL CABLE

DEC	DEM	DEP	DEF
			X

05.04-104

3 CONDUCTOR ALUMINUM ASC										
PHASE WIRE SIZE	STRINGING CONDITIONS	TEMP °F	SAG FOR VARIOUS SPANS							TENSION
			50	100	150	200	250	300	350	400	
1/0	INITIAL	30	1"	4"	9"	1'5"	2'2"	3'1"	4'2"	5'6"	1435
		60	1"	5"	11"	1'8"	2'7"	3'9"	5'2"	6'9"	1190
		90	2"	6"	1'2"	2'0"	3'2"	4'7"	6'2"	8'1"	972
		120	2"	7"	1'5"	2'6"	3'11"	5'7"	7'7"	9'11"	800
1/0	FINAL	30	1"	5"	1'0"	1'10"	2'10"	4'1"	5'6"	7'2"	1104
		60	2"	7"	1'3"	2'3"	3'6"	5'0"	6'10"	8'11"	885
		90	2"	8"	1'7"	2'10"	4'5"	6'4"	8'8"	11'4"	708
		120	3"	10"	1'11"	3'5"	5'4"	7'8"	10'5"	13'7"	589
4/0	INITIAL	30	2"	7"	1'3"	2'3"	3'6"	-	-	-	1375
		60	2"	8"	1'5"	2'7"	4'0"	-	-	-	1184
		90	2"	9"	1'8"	3'0"	4'8"	-	-	-	1012
		120	3"	10"	1'11"	3'5"	5'5"	-	-	-	881
4/0	FINAL	30	2"	8"	1'6"	2'9"	4'3"	-	-	-	1104
		60	2"	10"	1'10"	3'3"	5'0"	-	-	-	937
		90	3"	11"	2'1"	3'9"	4'3"	-	-	-	809
		120	3"	1'1"	2'5"	4'3"	6'8"	-	-	-	710

NOTE: 1/0 AAAC BARE NEUTRAL WITH TWO 1/0 OR TWO 4/0 AAC PHASE CONDUCTORS. MAXIMUM TENSION FROM LIGHT LOADING PER SIXTH EDITION OF NESC (9 LBS WIND + CONSTANT @ 30°F). SAG DATA BASED ON 300 FOOT RULING SPAN. TENSIONS SHOWN ASSUME NO ICE OR WIND. MAXIMUM TENSIONS: 1/0 - 1,767 POUNDS, 4/0 - 1,679 POUNDS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

SAGS FOR OVERHEAD

THREE CONDUCTOR AERIAL CABLE

DEC	DEM	DEP	DEF
			X

05.04-106

4 CONDUCTOR ALUMINUM ASC										
PHASE WIRE SIZE	STRINGING CONDITIONS	TEMP °F	SAG FOR VARIOUS SPANS							TENSION
			50	100	150	200	250	300	350	400	
1/0	INITIAL	30	3"	6"	1'1"	1'10"	3'0"	4'6"	6'7"	9'7"	1390
		60	3"	7"	1'4"	2'3"	3'6"	5'1"	7'6"	10'10"	1190
		90	3"	8"	1'6"	2'7"	4'0"	5'10"	8'3"	11'6"	1000
		120	4"	10"	1'10"	3'2"	4'7"	6'4"	8'7"	12'3"	850
1/0	FINAL	30	3"	7"	1'5"	2'5"	3'9"	5'5"	7'8"	11'5"	1110
		60	3"	10"	1'8"	2'10"	4'4"	6'1"	8'6"	12'2"	920
		90	6"	1'1"	2'1"	3'5"	5'0"	6'10"	9'3"	13'0"	780
		120	9"	1'5"	2'6"	4'0"	5'7"	7'6"	10'0"	14'1"	680
4/0	INITIAL	30	2"	10"	1'10"	3'2"	5'0"	-	-	-	1312
		60	3"	11"	2'0"	3'7"	5'8"	-	-	-	1171
		90	3"	12"	2'3"	4'1"	6'4"	-	-	-	1048
		120	3"	1'1"	2'6"	4'6"	7'	-	-	-	946
4/0	FINAL	30	3"	12"	2'2"	3'10"	6'0"	-	-	-	1104
		60	3"	1'1"	2'5"	4'4"	6'9"	-	-	-	985
		90	4"	1'2"	2'8"	4'9"	7'5"	-	-	-	893
		120	4"	1'4"	2'11"	5'2"	8'2"	-	-	-	820

NOTE: 1/0 AAAC BARE NEUTRAL WITH THREE 1/0 OR THREE 4/0 AAC PHASE CONDUCTORS. MAXIMUM TENSION FROM LIGHT LOADING PER SIXTH EDITION OF NESC (9 LBS WIND + CONSTANT @ 30°F). SAG DATA BASED ON 300 FOOT RULING SPAN. TENSIONS SHOWN ASSUME NO ICE OR WIND. MAXIMUM TENSIONS: 1/0 - 1,880 POUNDS, 4/0 - 1,706 POUNDS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/16	ROBESON	BURLISON	ADCOCK

SAGS FOR OVERHEAD

FOUR CONDUCTOR AERIAL CABLE

DEC	DEM	DEP	DEF
			X

05.04-107

SECONDARY - POLE TO POLE

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	200 FOOT RULING SPAN SAG IS IN INCHES AT GIVEN SPAN LENGTHS										
		INITIAL STRINGING SAGS - POLE TO POLE										
		50'	75'	100'	125'	150'	175'	200'	225'	250'	275'	300'
0°	1053	1	2	3	5	8	11	14	18	22	26	31
15°	974	1	2	4	6	8	11	15	19	23	28	34
30°	896	1	2	4	6	9	12	16	21	25	31	37
40°	846	1	2	4	7	10	13	17	22	27	33	39
60°	748	1	2	5	8	11	15	20	25	30	37	44
80°	657	1	3	6	9	12	17	22	28	35	42	50
100°	574	2	4	6	10	14	19	25	32	40	48	57
120°	502	2	4	7	11	16	22	29	37	45	55	65

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	200 FOOT RULING SPAN SAG IS IN INCHES AT GIVEN SPAN LENGTHS										
		FINAL SAGS - POLE TO POLE										
		50'	75'	100'	125'	150'	175'	200'	225'	250'	275'	300'
0°	873	1	2	4	7	9	13	17	21	26	32	38
15°	748	1	3	5	7	10	14	19	24	29	35	42
30°	700	1	3	5	8	12	16	21	26	33	39	47
40°	648	1	3	6	9	13	17	23	29	35	43	51
60°	553	2	4	7	10	15	20	26	33	41	50	59
80°	475	2	4	8	12	17	24	31	39	48	58	69
100°	412	2	5	9	14	20	27	35	45	55	67	80
120°	363	3	6	10	16	23	31	40	51	63	76	90
167°	285	3	7	13	20	29	39	51	65	80	97	115
185°	265	3	8	14	22	31	42	55	70	86	104	124
FINAL SAG AND TENSION - LIGHT LOADING ZONE WITH WIND												
30°, 9 LBS WIND	1023	3	6	10	16	23	32	41	52	64	78	93

NESC CABLE LOADING LIMIT: FINAL TENSION, 25%, 30°, NO WIND (700 LBS)

SERVICE - POLE TO BUILDING

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	INITIAL SAG AND TENSION SERVICE DROP DISTANCE (FT) POLE TO BUILDING							
		50'	60'	70'	80'	90'	100'	110'	120'
0°	188	5	7	10	12	16	19	24	28
15°	168	5	8	11	14	18	22	26	31
30°	153	6	9	12	15	19	24	29	34
40°	144	6	9	12	16	21	25	31	36
60°	130	7	10	14	18	23	28	34	40
80°	119	8	11	15	20	25	31	37	44
100°	110	8	12	16	21	27	33	40	48
120°	103	9	13	17	23	29	35	43	51
167°	91	10	15	20	26	33	40	49	58
185°	87	11	15	21	27	34	42	51	61
FINAL SAG AND TENSION - LIGHT LOADING ZONE WITH WIND									
30°, 9 LBS WIND	349	8	11	15	19	24	30	37	43

MAXIMUM LOADING AT 30°, 9 LBS WIND. MAXIMUM LOAD IS LIMITED TO 350 LBS; THE RECOMMENDED MAXIMUM TENSION ON A 2 INCH SERVICE MAST. IF GREATER CABLE TENSION, LESS SAG IS REQUIRED, THE SERVICE MAST MUST BE BRACED AGAINST THE INCREASED TENSION.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	ROBESON	BURLISON	ADCOCK	
REVISED		BY	CK'D	APPR.	

#2 TRIPLEX FULL NEUTRAL (SHRIMP)
SECONDARY AND SERVICE SAG AND TENSION DATA
NESC LIGHT LOADING ZONE

DEC	DEM	DEP	DEF
			X

05.04-108

SECONDARY - POLE TO POLE

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	200 FOOT RULING SPAN SAG IS IN INCHES AT GIVEN SPAN LENGTHS										
		INITIAL STRINGING SAGS - POLE TO POLE										
		50'	75'	100'	125'	150'	175'	200'	225'	250'	275'	300'
0°	1613	1	2	4	6	8	11	15	18	23	27	33
15°	1489	1	2	4	6	9	12	16	20	25	30	35
30°	1367	1	2	4	7	10	13	17	22	27	32	39
40°	1288	1	3	5	7	10	14	18	23	28	34	41
60°	1136	1	3	5	8	12	16	21	26	32	39	46
80°	996	1	3	6	9	13	18	24	30	37	44	53
100°	871	2	4	7	11	15	21	27	34	42	51	60
120°	763	2	4	8	12	17	23	31	39	48	58	69

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	200 FOOT RULING SPAN SAG IS IN INCHES AT GIVEN SPAN LENGTHS										
		FINAL SAGS - POLE TO POLE										
		50'	75'	100'	125'	150'	175'	200'	225'	250'	275'	300'
0°	1338	1	2	4	7	10	13	17	22	27	33	39
15°	1199	1	3	5	8	11	15	20	25	30	37	44
30°	1070	1	3	5	9	12	17	22	28	34	41	49
40°	990	1	3	6	9	13	18	24	30	37	45	53
60°	847	2	4	7	11	16	21	28	35	43	52	62
80°	729	2	5	8	13	18	25	32	41	50	61	72
100°	636	2	5	9	14	21	28	37	47	58	70	83
120°	563	3	6	10	16	23	32	42	53	65	79	94
167°	636	3	7	13	20	29	39	51	65	80	97	115
185°	563	4	8	14	22	31	42	55	70	86	104	124
FINAL SAG AND TENSION - LIGHT LOADING ZONE WITH WIND												
30°, 9 LBS WIND	1456	2	5	9	15	21	29	38	48	59	71	85

NESC CABLE LOADING LIMIT: FINAL TENSION, 25%, 30°, NO WIND (1070 LBS)

SERVICE - POLE TO BUILDING

CONDUCTOR TEMPERATURE IN °F	TENSION (LBS)	INITIAL SAG AND TENSION SERVICE DROP DISTANCE (FT) POLE TO BUILDING							
		50'	60'	70'	80'	90'	100'	110'	120'
0°	177	8	12	16	21	27	33	40	48
15°	168	9	13	17	22	28	35	42	50
30°	160	9	13	18	23	30	37	44	53
40°	156	9	14	18	24	30	38	46	54
60°	148	10	14	19	25	32	40	48	57
80°	141	10	15	20	27	34	42	50	60
100°	134	11	16	21	28	35	44	53	63
120°	129	11	16	22	29	37	45	55	66
167°	118	12	18	24	32	40	50	60	71
185°	115	13	18	25	33	41	51	62	74
FINAL SAG AND TENSION - LIGHT LOADING ZONE WITH WIND									
30°, 9 LBS WIND	348	10	14	19	25	32	39	48	57

MAXIMUM LOADING AT 30°, 9 LBS WIND. MAXIMUM LOAD IS LIMITED TO 350 LBS; THE RECOMMENDED MAXIMUM TENSION ON A 2 INCH SERVICE MAST. IF GREATER CABLE TENSION, LESS SAG IS REQUIRED, THE SERVICE MAST MUST BE BRACED AGAINST THE INCREASED TENSION.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	ROBESON	BURLISON	ADCOCK	
REVISED		BY	CK'D	APPR.	

#1/0 TRIPLEX FULL NEUTRAL (GAMMARUS)
SECONDARY AND SERVICE SAG AND TENSION DATA
NESC LIGHT LOADING ZONE

DEC	DEM	DEP	DEF
			X

05.04-116

SINGLE, TWO AND THREE-PHASE
SLACK SPAN POLE CLASS AND SAG REQUIRMENTS

MAXIMUM SPAN LENGTH (FT)	CONDUCTORS	MINIMUM POLE CLASS REQUIRED				INITIAL STRINGING SAGS (INCHES)
		40 FOOT	45 FOOT	50 FOOT	55 FOOT	
25	336 AND SMALLER	5	4	3	3	12
	795 PRI - #1/0 NEU	4	3	3	3	
50	#1/0 PRI - #1/0 NEU AND SMALLER	5	4	3	3	
	336 PRI - #1/0 NEU	4	4	3	3	24
	795 PRI - #1/0 NEU	4	3	2	2	36
75	#1/0 PRI - #1/0 NEU AND SMALLER	4	4	3	3	
	336 PRI - #1/0 NEU	3	3	2	2	
	795	NOT PERMITTED				
100	#1/0 PRI - #1/0 NEU AND SMALLER	4	4	3	2	
	336 - 795	NOT PERMITTED				

NOTES:

1. THE POLES IN THESE TABLES ARE DESIGNED TO BE SELF-SUPPORTING STRUCTURES AT THE END OF A SINGLE SPAN. IF THE TAKE-OFF POLE CANNOT BE SUPPORTED WITH DOWN GUYS AND ANCHORS, IT MUST BE EVALUATED AS A SELF-SUPPORTING STRUCTURE. IF ADDITIONAL LOAD IS ADDED TO THE POLES IN THESE TABLES, THE POLES MUST BE RE-EVALUATED FOR STRENGTH REQUIREMENTS TO PREVENT POLE DEFECTION OVER TIME.
2. SAGS ARE AT 60° F. SAGS WILL NOT VARY MORE THAN 2 INCHES BETWEEN 30° F AND 90° F.
3. POLE CLASSES DESIGNED FOR NO MORE THAT 1.5% DEFLECTION AT 60° F.
4. SOME POLE CLASSES LISTED MAY EXCEED THE CLASS POLE REQUIRED FOR STRENGTH BECAUSE A LOWER CLASS POLE IS NOT A STOCK ITEM.
5. DO NOT USE AUTOMATIC SPLICES IN SLACK SPANS.

DUKE ENERGY.

3					
2					
1					
0	6/30/16	ROBESON	BURLISON	ADCOCK	
REVISED		BY	CK'D	APPR.	

SLACK SPAN SAG TABLE
NESC LIGHT LOADING ZONE

DEC	DEM	DEP	DEF
			X

05.06-100

06.00 POLE TYPE TRANSFORMERS- GENERAL

06.01 FUSING

06.02 FUSING

06.03 CONDUCTORS AND CONNECTIONS

06.04 CUTOUTS AND MOUNTING BRACKETS

06.06 INSTALLATIONS AND POLICIES

06.07 BANKING CONNECTIONS

06.08 MOUNTING PLATFORMS

DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3			
2	3/13/18	KATIGBAK	BURLISON	ADCOCK
1	11/21/13	KATIGBAK	DANNA	ADCOCK
0	11/23/10	CECCONI	GUINN	ELKINS

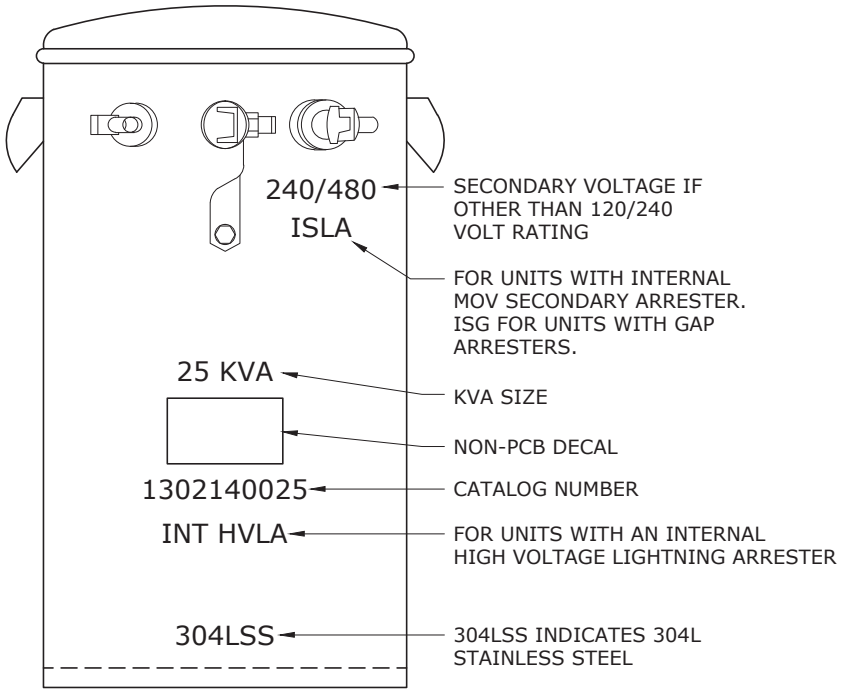
SECTION 6 - POLE MOUNTED TRANSFORMERS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

06.10 POLARITY

06.15 OPERATING PROCEDURES



NOTES:

1. NAMEPLATE LOCATED ON UPPER HANGER BRACKET.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

POLEMOUNT TRANSFORMER MARKINGS

Duke Energy®

FLA

DWG. 06.00-01

COMPATIBLE UNIT	CATALOG NUMBER	KVA	HV	LV	TAPS	FEATURES
*TFO10SM12CF	1301110010	10	12470GRDY/7200	120/240	NT	1HV HVLA
TFO15SM12CF	9220126116	15	12470GRDY/7200	120/240	NT	1HV HVLA
TFO25SM12CF	1301110025	25	12470GRDY/7200	120/240	NT	1HV HVLA
TFO50SM12CF	1301110050	50	12470GRDY/7200	120/240	NT	1HV HVLA
TFO25DTM12CF	1301140025	25	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO50DTM12CF	1301140050	50	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO75DTM12CF	1301140075	75	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO100DTM12CF	1301140100	100	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO167DTM12CF	1301140167	167	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO250DTM12CF	1301140250	250	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO333DTM12CF	1301140333	333	7200/12470Y	120/240	2 2-1/2% A&BN	2HV CONV
*TFO15DTM12DF	1302140015	15	7200/12470Y	240/480	2 2-1/2% A&BN	2HV CONV
TFO25DTM12DF	1302140025	25	7200/12470Y	240/480	2 2-1/2% A&BN	2HV CONV
TFO50DTM12DF	1302140050	50	7200/12470Y	240/480	2 2-1/2% A&BN	2HV CONV
TFO100DTM12DF	1302140100	100	7200/12470Y	240/480	2 2-1/2% A&BN	2HV CONV
TFO333DTM12DF	1302140333	333	7200/12470Y	240/480	2 2-1/2% A&BN	2HV CONV
TFO100DTM12FF	1303140100	100	7200/12470Y	277/480Y	2 2-1/2% A&BN	2HV CONV
TFO167DTM12FF	1303140167	167	7200/12470Y	277/480Y	2 2-1/2% A&BN	2HV CONV
TFO250DTM12FF	1303140250	250	7200/12470Y	277/480Y	2 2-1/2% A&BN	2HV CONV
TFO333DTM12FF	1303140333	333	7200/12470Y	277/480Y	2 2-1/2% A&BN	2HV CONV
TFO15STM12FF	1303150015	15	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO25STM12FF	1303150025	25	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO50STM12FF	1303150050	50	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO100STM12FF	1303150100	100	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO167STM12FF	1303150167	167	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO250STM12FF	1303150250	250	12470GRDY/7200	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO25DTM25CF	1701140025	25	14400/24940Y	120/240	4 2-1/2% BN	2HV CONV
TFO50DTM25CF	1701140050	50	14400/24940Y	120/240	4 2-1/2% BN	2HV CONV
TFO100DTM25CF	1701140100	100	14400/24940Y	120/240	4 2-1/2% BN	2HV CONV
TFO25STM25FF	1703150025	25	24940GRDY/14400	277/480Y	4 2-1/2% BN	1HV CONV
TFO50STM25FF	1703150050	50	24940GRDY/14400	277/480Y	4 2-1/2% BN	1HV CONV
TFO100STM25FF	1703150100	100	24940GRDY/14400	277/480Y	4 2-1/2% BN	1HV CONV
TFO167STM25FF	1703150167	167	24940GRDY/14400	277/480Y	4 2-1/2% BN	1HV CONV
TFO250STM25FF	1703150250	250	24940GRDY/14400	277/480Y	4 2-1/2% BN	1HV CONV
TFO10DTM13CF	1401140010	10	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO25DTM13CF	1401140025	25	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO50DTM13CF	1401140050	50	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO75DTM13CF	1401140075	75	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO100DTM13CF	1401140100	100	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO167DTM13CF	1401140167	167	7620/13200Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO15STM13FF	1403150015	15	13200GRDY/7620	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO25STM13FF	1403150025	25	13200GRDY/7620	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO50STM13FF	1403150050	50	13200GRDY/7620	277/480Y	2 2-1/2% A&BN	1HV CONV
TFO25DTM4CF	1101140025	25	2400/4160Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO50DTM4CF	1101140050	50	2400/4160Y	120/240	2 2-1/2% A&BN	2HV CONV
TFO50DM4CF	1101120050	50	2400/4160Y	120/240	NT	2HV CONV
TFO3SM12CF	9220214651	3	12470GRDY/7200	120/240	NT	1HV CONV
TFO3SM25CF	9220250777	3	24940GRDY/14400	120/240	NT	1HV CONV

* NEW UNITS NO LONGER PURCHASED. CHECK ON AVAILABILITY PRIOR TO ORDERING.

NOTES:

1. SEE DWG. 12.06-01 FOR STAINLESS STEEL POLE TYPE TRANSFORMERS. THESE UNITS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS.

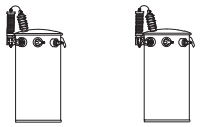
REVISED		BY	CK'D	APPR.
4	8/9/13	SIMMONS	DANNA	ADCOCK
3	2/20/13	SIMMONS	DANNA	ADCOCK
2	8/27/12	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

POLE MOUNTED TRANSFORMER CATALOG NUMBERS

DUKE ENERGY.

FLA

DWG. 06.00-02

TRANSFORMERS	VOLTAGE	TYPE	FRAMING	GENERAL NOTES	FUSE, SIZE, TYPE
130111---- 	120/240 1Ø	SINGLE BUSHING WITH EXTERNAL MOV ARRESTER	CUTOUTS ONLY ON "L" BRACKET	STANDARD SINGLE BUSHING CONVENTIONAL TRANSFORMER WITH EXTERNAL MOV ARRESTER	USE STANDARD FUSING CHART FOR ALL TRANSFORMERS -DCS- NOTE SECONDARY INTERNAL ARRESTER WILL COME ON SOME UNITS. THESE UNITS WILL HAVE ISLA OR ISG STENCILLED ON THE TANK AROUND THE KVA SIZE STICKER. DO NOT MISTAKE THES ISLA OR ISG FOR THE HVLA. PREVIOUSLY, TRANSFORMERS WERE PURCHASED WITH INTERNAL HIGH VOLTAGE ARRESTERS (UNDER OIL). THESE UNITS HAD "HVLA" STENCILED ON THE TANK. ALL NEW OVERHEAD TRANSFORMERS SHOULD HAVE A MOV ARRESTER MOUNTED EXTERNALLY ON THE TRANSFORMER. EXTERNAL MOV ARRESTER TRANSFORMERS DO NOT NEED A POLE ARRESTER WITH THE CUTOUT. HVLA = HIGH VOLTAGE LIGHTNING ARRESTER (INTERNAL UNDER OIL) ISLA = INTERNAL SECONDARY LIGHTNING ARRESTER ISGA = INTERNAL SECONDARY GAP ARRESTER SEE ATTACHED SHEET
130114---- 	120/240 1Ø	DOUBLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARRESTER	CUTOUTS ONLY ON "L" BRACKETS	STANDARD DOUBLE BUSHING CONVENTIONAL TRANSFORMER WITH EXTERNAL MOV ARRESTER	
130111---- 	120/240 3Ø OPEN DELTA	SINGLE BUSHING WITH EXTERNAL MOV ARRESTER	CUTOUTS ONLY ON BACK TO BACK "L" BRACKETS	SINGLE BUSHING EXTERNAL MOV, TRANSFORMERS. CAN BE USED IN OPEN DELTA BANKS, CAN MIX OR MATCH. DO NOT MIX WITH STANDARD SINGLE BUSHING WITHOUT ARRESTER.	
130114---- 	120/240 3Ø CLOSED DELTA	DOUBLE BUSHING CONVENTIONAL TRANSFORMER MOV ARRESTERS TO BE LOCATED ON SOURCE SIDE OF CUTOUTS. (SEE DWG. 06.07-10A)	CUTOUTS AND ARRESTERS ON 3Ø SWITCH ARM	STANDARD DOUBLE BUSHING CONVENTIONAL IN 3 POT BANK Y-DELTA-"CLOSED DELTA." DO NOT USE SINGLE BUSHING TRANSFORMERS IN CLOSED DELTA BANK.	
130111---- 	208Y/120 3Ø Y/Y	SINGLE BUSHING WITH EXTERNAL MOV ARRESTER	CUTOUTS ONLY ON 3Ø SWITCH ARM	STANDARD SINGLE BUSHING W/ EXTERNAL MOV ARRESTER TRANSFORMER.	
130315---- 	480Y/277 3Ø Y/Y	SINGLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARRESTER	CUTOUTS ONLY ON 3Ø SWITCH ARM	SINGLE BUSHING CONVENTIONAL WITH EXTERNAL MOV ARRESTER TRANSFORMER. USED IN 277/480 Y/Y BANK.	USE STANDARD FUSING CHART FOR ALL TRANSFORMERS -DCS-

NOTES:

1. NOTE: ANY TRANSFORMER THAT DOES NOT HAVE AN EXTERNAL MOV ARRESTER (ATTACHED TO THE TRANSFORMER) MUST HAVE ONE ADDED ADJACENT TO H1 BUSHING EXCEPT ON FLOATING WYE-DELTA BANKS (SEE DWG. 06.07-10A).

DUKE ENERGY.

REVISED	BY	CK'D	APPR.
3 4/10/15	LOOSIER	BURLISON	ADCOCK
2 8/1/14	LOOSIER	DANNA	ADCOCK
1 3/17/14	SIMMONS	DANNA	ADCOCK
0 11/23/10	SIMMONS	GUINN	ELKINS

STANDARD OVERHEAD DISTRIBUTION TRANSFORMERS

DEC	DEM	DEP	DEF
			X

06.00-03

THIS CODE NUMBER IS ASSEMBLED AS FOLLOWS:

XX — PHASE AND PRIMARY VOLTAGE

XX — SECONDARY VOLTAGE

XX — TYPE AND SPECIAL FEATURE

XXXX — KVA SIZE

CODE	PRIMARY VOLTAGE
	1/0
05	7.2 X 14.4 Y DUAL
06	7.8 X 7.2 Y DUAL
07	2.4 X 7.2 Y DUAL
08	2.4 X 4.8 Y DUAL
11	2.4/4.16 Y
12	4.8/8.32 Y
13	7.2/12.47 Y
14	7.6/13.2 Y
15	12.5
16	13.2
17	14.4/24.94
18	7.2 X 7.6 Y DUAL
	2Ø
23	12.47 GRD Y/7.2
	3Ø
33	12.47 GRD Y/7.2
34	8.32 X 12.47
	GRD/Y DUAL
35	12.5
36	13.2
37	24.84 GRD Y/14.4

CODE	SECONDARY VOLTAGE		
	1Ø	2Ø	3Ø
01	120/240	120/240	208Y/120
02	240/480		
03	277		480Y
04			216Y/125
10	2400/4800		2400A
11	2400		4160 GRD Y/2400
12	4800		
13	7200		
14	7620		

TYPICAL EXAMPLE

TRANSFORMER CODE NO. 13-01-14-0025

THIS TRANSFORMER CODE NO. DESCRIBES:

(13)	SINGLE-PHASE 12.47 GRD Y/7.2
(01)	120/240 VOLT
(14)	POLE MOUNTED DOUBLE BUSHING CONV. WITH TAPS
(0025)	25 KVA TRANSFORMER

CODE		TYPE
OIL	SILICONE	POLE MOUNT
11	71	1 BUSHING CONV. WITHOUT TAPS
12	72	2 BUSHING CONV. WITHOUT TAPS
13	73	1 BUSHING CSP
14	74	2 BUSHING CONV. WITH TAPS
15	75	1 BUSHING CONV. WITH TAPS
17	77	1 BUSHING CONV. SPECIAL FINISH
18	78	2 BUSHING CONV. SPECIAL FINISH
OIL	SILICONE	PAD MOUNT
21	81	LIVE FRONT WITH SWITCH
22	82	LIVE FRONT WITHOUT SWITCH
23	83	DEADFRONT LOOP
24	84	DEADFRONT RADIAL
25	85	DEADFRONT LOOP STAINLESS
26		DEADFRONT MOV UNDER OIL
OIL	SILICONE	PCB / VAULT/NETWORK
68	65	61 VAULT 1Ø
69	66	62 PAD 3Ø
70	67	63 NETWORK 3Ø

CODE	KVA SIZE		
	1Ø	2Ø	3Ø
0001	1.5		
0003	3		
0005	5		
0007	7.5		
0010	10		
0015	15		
0025	25		
0037	37.5	37/10	
0050	50		
0075	75		75
0100	100		
0112	112.5		
0150			150
0157	157		
0225			
0300			
0500	500		500
0750			750
0833	833		
1000			1000
1500			1500
2000			2000
3000			3000

NOTE: THE FOLLOWING EXPERIMENTAL TRANSFORMER PART NUMBERS ARE FOR DFIS USE ONLY. DO NOT USE FOR STOCKING OR STORES. SEE LONG PART DESCRIPTION IN DISTRIBUTION MATERIAL LIST FOR DETAILS.

130153	1Ø PAD WITH EXTERNAL SECONDARY ARRESTER
130154	1Ø PAD WITH INTERLACED WINDINGS
130156	1Ø PAD WITH EXTERNAL GAP ARRESTER
130192	POLE TYPE WITH INTERNAL MOV ARRESTER (ISLA)
130191	POLE TYPE WITH EXTERNAL GAP ARRESTER (ELSA)
130155	POLE TYPE WITH INTERLACE WINDINGS
130193	POLE TYPE TOROLORM CORE
130194	POLE TYPE WITH INTERNAL H.V. ARRESTER
130195	POLE TYPE WITH MAGNAX INTERRUPTER
130199	POLE TYPE WITH AMORPHOUS CORE

OIL	SILICONE	SPECIAL TYPE
31		SUBMERSIBLE PIT WITH SWITCH
32		SUBMERSIBLE PIT WITHOUT SWITCH
33		SUBMERSIBLE DEADFRONT LOOP
41		DEADFRONT DRY TYPE
51		1 BUSH W/ PLUG FOR CAPACITOR BANK
52		2 BUSH W/ PLUG FOR CAPACITOR BANK

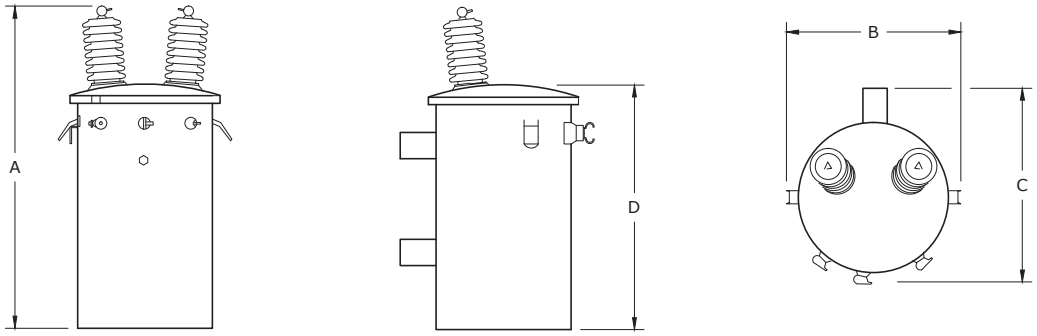
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS

TRANSFORMER CODE DESCRIPTION

Duke Energy®

FLA

DWG. 06.00-04



TRANSFORMER DIMENSIONS (INCHES)								
KVA	12470 AND 13200 VOLT 120/240 VOLTS				24940 120/240 VOLTS			
	A	B	C	D	A	B	C	D
3	29	15	17	20	33	14	18	21
10	31	24	20	22	-	-	-	-
15	33	24	20	26	-	-	-	-
25	38	22	23	29	42	23	24	29
50	35	26	27	25	40	26	27	26
75	45	28	32	33	-	-	-	-
100	43	33	35	32	48	31	34	33
167	47	37	35	37	59	33	35	45
250	57	45	36	49	59	41	36	45
333	62	43	37	53	-	-	-	-
500	69	46	40	60	-	-	-	-

TRANSFORMER WEIGHT (POUNDS) AND OIL CAPACITY (GALLONS)				
KVA	12470 AND 13200 VOLT 120/240 VOLTS		24940 120/240 VOLTS	
	WEIGHT (LBS.)	OIL CAPACITY (GALLONS)	WEIGHT (LBS.)	OIL CAPACITY (GALLONS)
3	131	4	141	5
10	216	8	-	-
15	247	9	-	-
25	409	12	440	14
50	565	15	568	15
75	841	30	-	-
100	1057	46	1062	39
167	1388	51	1472	70
250	1845	70	1910	65
333	2394	81	-	-
500	3316	117	-	-

NOTES:

1. THE DIMENSIONS, WEIGHTS AND OIL CAPACITIES LISTED ABOVE WILL VARY WITH THE MAKES AND STYLES OF TRANSFORMERS. CONTACT DISTRIBUTION STANDARDS FOR INFORMATION ON DESIGNS FOR SECONDARY VOLTAGES OTHER THAN 120/240 VOLTS.

2. "B" AND "C" DIMENSIONS INCLUDE COOLING FINS WHEN APPLICABLE.

3. APPROXIMATE NET WEIGHTS INCLUDE WEIGHT OF OIL.

REVISED		BY	CK'D	APPR.
3				
2				
1	11/21/13	SIMMONS	DANNA	ADCOCK
0	11/23/10	SIMMONS	GUINN	ELKINS

TYPICAL TRANSFORMER DIMENSIONS, WEIGHTS AND OIL CAPACITIES

DUKE ENERGY.

FLA

DWG. 06.00-12

TYPES OF COMMERCIAL AND INDUSTRIAL BUSINESSES			
TYPE OF BUSINESS	PEAK DEMAND DURATION (HOURS)	TYPE OF BUSINESS	PEAK DEMAND DURATION (HOURS)
FAST FOOD	8	CONVENIENCE STORES	4
SUPERMARKETS	8	HOTELS	4
LARGE & SMALL RETAIL STORES	8	SMALL OFFICE BUILDINGS	4
LARGE OFFICE BUILDINGS	8	RESTAURANTS	4
		SCHOOLS	4

MAXIMUM KVA LOADING					
SINGLE-PHASE COMMERCIAL OVERHEAD CONVENTIONAL & CSP TRANSFORMERS					
TRANSFORMER SIZE	SUMMER (100%)	WINTER (140%)	TRANSFORMER SIZE	SUMMER (100%)	WINTER (140%)
10	10	14	50	50	70
15	15	21	75	75	105
25	25	35	100	100	140
37.5	37.5	52	167	167	233

MAXIMUM KVA LOADING					
SINGLE-PHASE RESIDENTIAL OVERHEAD TRANSFORMERS					
TRANSFORMER SIZE	SUMMER 130%	WINTER 160%	TRANSFORMER SIZE	SUMMER 130%	WINTER 160%
10	13	16	50	65	80
15	19	24	75	97	120
25	32	40	100	130	160
37.5	49	60	167	217	267

MAXIMUM KVA LOADING								
THREE-PHASE OVERHEAD CSP TRANSFORMER BANKS								
HOSPITALS AND SPECIAL CARE FACILITIES			INDUSTRIALS AND VAULTS					
BANK SIZE	SUMMER 100%	WINTER 140%	SUMMER 100%	WINTER 140%	4 HOUR PEAK		8 HOUR PEAK	
					SUMMER	WINTER	SUMMER	WINTER
45	45	63	45	63	54	73	46	63
75	75	105	75	105	90	122	77	105
112	112	156	112	156	134	181	115	157
150	150	210	150	210	180	243	155	210

3					
2					
1					
0	7/9/10	SIMMONS	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

MAXIMUM TRANSFORMER LOADING (OH)

Progress Energy

PGN

DWG. 06.00-14A

MAXIMUM KVA LOADING (CONTINUED)

THREE-PHASE OVERHEAD CONVENTIONAL TRANSFORMER BANKS								
BANK SIZE OR TRANSFORMER SIZE	HOSPITAL AND SPECIAL CARE FACILITIES		INDUSTRIALS AND VAULTS		4 HOUR PEAK		8 HOUR PEAK	
	SUMMER 100%	WINTER 140%	SUMMER 100%	WINTER 140%	SUMMER	WINTER	SUMMER	WINTER
45	45	63	45	63	54	73	46	65
75	75	105	75	105	90	122	77	110
112	112	156	112	156	134	172	115	160
150	150	210	150	210	180	225	155	215
225	225	315	225	315	270	313	232	320
300	300	420	300	420	360	450	309	425
500	500	700	500	700	600	668	515	710
750	750	1,050	750	1,050	900	1,125	773	1,060
1,000	1,000	1,400	1,000	1,400	1,200	1,335	1,030	1,420
1,500	1,500	2.100	1,500	2,100	1,800	2,000	1,545	2,125

NOTES:

1. SELECT THE TYPE OF BUSINESS. THE CORRESPONDING DEMAND DURATION IS HOW LONG THE CUSTOMER'S DEMAND LASTS ON PEAK DAYS BASED ON DATA FROM LOAD RESEARCH STUDIES. THE CUSTOMER'S DEMAND TYPICALLY DROPS TO 75% OF THE MAXIMUM DURING ALL OTHER TIMES.

2. NOTE THAT TRANSFORMER LOADING IS GIVEN IN KVA. ADJUSTMENTS FOR POWER FACTOR NEED TO BE DEFINED BY THE ENGINEER.

3. HIGHLY FLUCTUATING INTERMITTENT LOADS (HFIL): TAKE THE SUM OF THE HFILS AND DIVIDE BY THREE (ΣHFIL/3), AND ADD TO THE CONSTANT LOAD. FUSE CURVES NEED TO BE CHECKED BY USING THE SUM OF THE HFIL (NOT DERATED BY 3) AND THE CONSTANT LOAD DUE TO FUSE PERFORMANCE.

3				
2				
1				
0	7/9/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MAXIMUM TRANSFORMER LOADING (OH)

Progress Energy

PGN DWG. 06.00-14B

REPLACEMENT POLICY

DISTRIBUTION TRANSFORMERS ARE PRIMARY COST COMPONENTS IN PROVIDING CUSTOMER SERVICE. THE ESTIMATED SERVICE LIFE FOR TRANSFORMERS IS 30 YEARS. TRANSFORMERS SHOULD NOT BE REPLACED UNLESS ABSOLUTELY NECESSARY.

DO NOT REPLACE A TRANSFORMER UNLESS:

- PHYSICAL DAMAGE OCCURS THAT CANNOT BE FIELD REPAIRED SUCH AS BROKEN BUSHINGS, RUSTING, LEAKING OIL, PROBLEMS WITH SECONDARY BREAKER, ETC.
- THE CONDITION OF THE TRANSFORMER IS AN IMMEDIATE SAFETY HAZARD.
- THE TRANSFORMER IS OVERLOADED.
- THE TRANSFORMER IS UNDERLOADED AND CAN BE ECONOMICALLY DOWNSIZED.
- THE TRANSFORMER IS KNOWN TO HAVE A PCB CONCENTRATION OF 50 PPM OR MORE.

REINSTALLATION POLICY

ONLY NON-PCB TRANSFORMERS (LESS THAN 50 PPM) AS SHOWN BY BLUE DOT, BLUE NON-PCB LABEL, OR NAMEPLATE SHOULD BE INSTALLED. ANY TRANSFORMER OF UNKNOWN PCB CONTENT THAT HAS BEEN REMOVED FROM SERVICE SHOULD HAVE A "PCB ARTICLE STORAGE FOR REUSE" LABEL PLACED ON IT (CN 440230) AND SENT TO THE WILDWOOD TRANSFORMER SHOP. THE LABEL MUST BE PLACED ON THE TRANSFORMER AS SOON AS IT ARRIVES AT THE L&S YARD.

NON-PCB TRANSFORMERS IN OPERABLE CONDITION SHOULD BE RESTOCKED AND RE-USED. DO NOT SEND OPERABLE TRANSFORMERS TO THE TRANSFORMER SHOP UNLESS THEY NEED REPAIR, PAINTING, TESTING, OR HAVE A KNOWN OR ASSUMED PCB CONTENT OF 50 PPM OR MORE.

A POLE MOUNT TRANSFORMER OF UNKNOWN PCB CONTENT MAY NOT BE TRANSFERRED FROM ONE POLE TO ANOTHER IN THE FIELD.

CSP UNITS

ANY CSP UNITS BEING INSTALLED OR REINSTALLED SHOULD HAVE A FUSED CUTOUT. IF AN ARRESTER IS BEING REPLACED ON A CSP UNIT AND A FUSED CUTOUT IS NOT ALREADY INSTALLED, THEN A FUSED CUTOUT SHOULD BE ADDED AT THE TIME THE ARRESTER IS REPLACED. FUSE THE CUTOUT WITH THE SAME FUSE SIZE REQUIRED FOR A SIMILAR CONVENTIONAL TRANSFORMER.

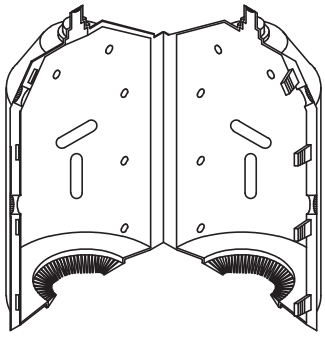
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

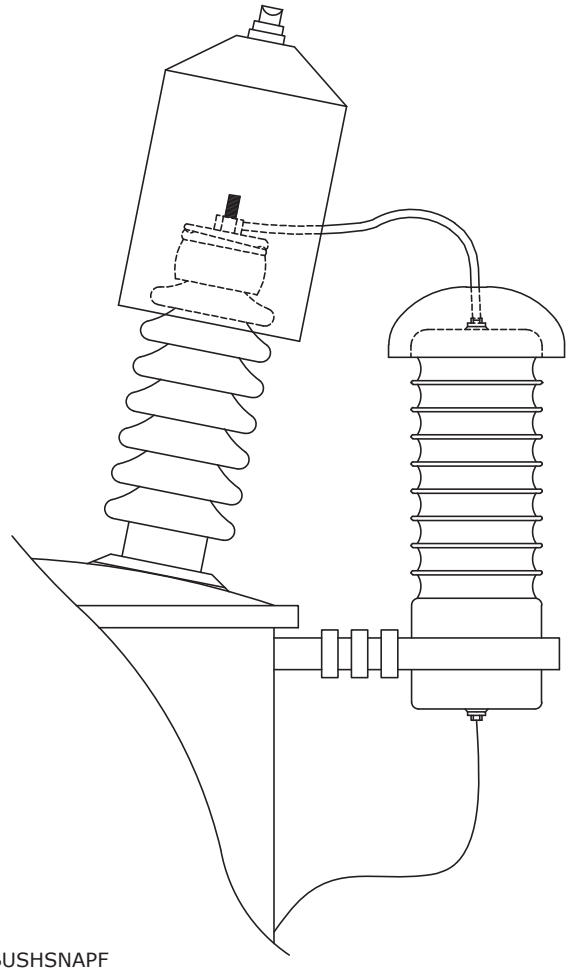
DISTRIBUTION TRANSFORMER POLICIES

Duke Energy®

FLA

DWG. 06.00-20





CU WGEQBUSHSNAPF
CN 470114

NOTES:

1. USE ON ALL NEW INSTALLATIONS
2. INSTALL WILDLIFE GUARD ON TOP OF TRANSFORMER PRIMARY BUSHING BETWEEN THE FIRST AND SECOND SKIRT.
3. ON DIRECT CONNECTED ARRESTERS, LEAD SHOULD BE BROUGHT OUT SIDE SLOT (KNOCKOUT) OF THE WILDLIFE GUARD. ON GAPPED ARRESTER INSTALLATIONS, REMOVE SIDE KNOCKOUT.
4. ANY "SOFT TYPE" WILDLIFE GUARDS WHICH ARE REMOVED, SHALL BE SCRAPPED AND NOT REINSTALLED.

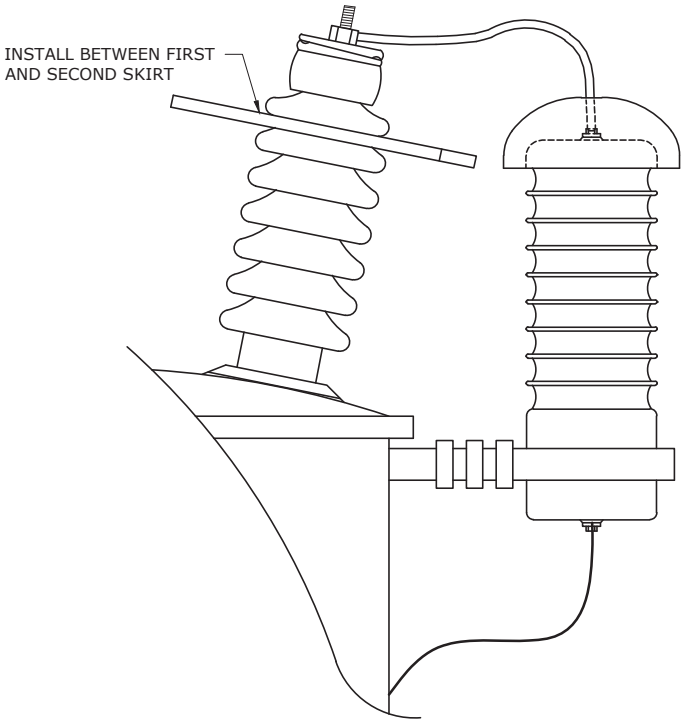
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

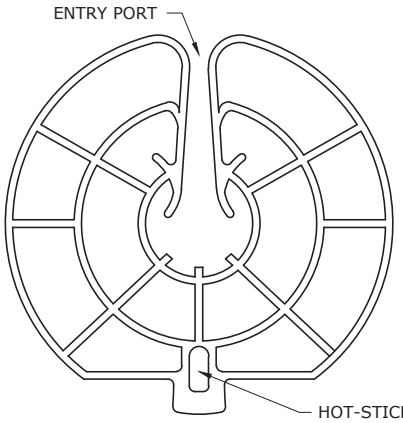
APPLICATION OF WILDLIFE GUARDS
ON TRANSFORMER BUSHINGS

Duke Energy®

FLA

DWG.
06.00-23





CU WGTRBUSHDSKF
CN 470112

NOTES:

1. USE THESE GUARDS ONLY WHEN AN ANIMAL GUARD MUST BE STICK APPLIED.
2. INSPECT CONDITION OF INSULATOR PRIOR TO INSTALLATION. DO NOT INSTALL ON AN INSULATOR THAT IS SUSPECT.
3. USE ON SINGLE BUSHING TRANSFORMERS OR ON PRIMARY BUSHING ON A DOUBLE BUSHING TRANSFORMER.
4. INSTALL WITH THE SPLIT OPENING POINTING TOWARDS THE LIGHTNING ARRESTER.
5. INSTALL WITH THE FLAT SIDE DOWN.
6. WHEN INSTALLED, THE OUTER EDGES SHOULD BE AT LEAST 1-1/2 INCHES FROM THE LIGHTNING ARRESTER LEAD AND 2-1/2 INCHES FROM THE ARRESTER INSULATOR. ALSO MAINTAIN AT LEAST 2-1/2 INCHES FROM THE POLE, OTHER INSULATORS OR ANY OTHER GROUNDED OBJECT.
7. DO NOT CUT OR ALTER THE GUARD TO MEET CLEARANCE REQUIREMENTS.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ELECTROSTATIC WILDLIFE GUARDS

Duke Energy®

FLA

DWG. 06.00-25

OH TRANSFORMER FAULT TAMER EXPULSION FUSE CARTRIDGE TABLE				
TRANSFORMER SIZE (KVA)	15KV AMPS	ITEM NUMBER	25KV AMPS	ITEM NUMBER
5	3	444758	3	444758
10	3	444758	3	444758
15	3	444758	3	444758
25	5	444757	3	444758
37.5	7	444756	5	444757
50	10	444755	5	444757
75	15	444754	7	444756
100	20	406677	10	444755
167	N/A	-	15	444754

NOTES:

1. FAULT TAMERS ARE INSTALLED ON TRANSFORMERS TO PROTECT THEM FROM CATASTROPHIC FAULTS IN HIGH CURRENT AREAS.

2. INSTALL FOR OH TRANSFORMER PROTECTION (15 AND 25 KV SYSTEMS ONLY) WHEN THE TRANSFORMER IS LOCATED WITHIN THE DESIGNATED "HIGH FAULT CURRENT" AREA. THE EFFECTIVE AREA FOR APPLICATION IS WHERE AVAILABLE LINE-GROUND FAULT CURRENT IS 2,000 AMPS OR GREATER ON 25 KV SYSTEMS, AND 3,500 AMPS OR GREATER ON 15 KV SYSTEMS. PQR&I WILL CREATE AND MAINTAIN A DATABASE TO IDENTIFY THE "HIGH FAULT CURRENT" AREAS WITHIN EACH OPERATIONS CENTER.

3. THE FAULT TAMER IS NOT REQUIRED ON 35KV SYSTEMS BECAUSE 35KV TRANSFORMERS ARE PROVIDED WITH INTERNAL CURRENT LIMITING FUSES.

4. THE FAULT TAMER IS VOLTAGE SPECIFIC. THE FAULT LIMITER MUST MATCH THE CORRECT VOLTAGE CLASS OF THE SYSTEM IT IS BEING USED ON (15 KV OR 25 KV). THE FUSE CARTRIDGE IS NOT VOLTAGE SPECIFIC. THEREFORE, THE SAME FUSE CARTRIDGE CAN BE USED ON 15KV OR 25KV SYSTEMS

5. ON LOW MAGNITUDE FAULTS, ONLY THE FUSE CARTRIDGE OPERATES, SIMILAR TO A CONVENTIONAL EXPULSION FUSE. FOR HIGH-MAGNITUDE FAULTS, GREATER THAN 800-1000 AMPS, BOTH THE FUSE CARTRIDGE AND THE BACKUP LIMITER OPERATE. THE FUSE CARTRIDGE MUST BE REPLACED AFTER EACH OPERATION HOWEVER; THE BACKUP LIMITER IS REPLACED ONLY AFTER A HIGH-MAGNITUDE FAULT CLEARING OPERATION.

6. SEE DWG. 08.01-125A THROUGH DWG. 08.01-125D FOR FAULT TAMER INSTALLATION AND OPERATION INFORMATION AND DETAILS.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

OVERHEAD TRANSFORMER

FAULT TAMER EXPULSION FUSE CARTRIDGE TABLE

DEC	DEM	DEP	DEF
X		X	X

06.01-104A

OH TRANSFORMER FAULT TAMER EXPULSION FUSE ITEM NUMBERS AND CU'S				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	AMPS
FUSE-LINK-3-CL-FLIMITER-F	1	444758	1	3
FUSE-LINK-5-CL-FLIMITER-F	1	444757	1	5
FUSE-LINK-7-CL-FLIMITER-F	1	444756	1	7
FUSE-LINK-10-CL-FLIMITER-F	1	444755	1	10
FUSE-LINK-15-CL-FLIMITER-F	1	444754	1	15
FUSE-LINK-20-CL-FLIMITER-F	1	406677	1	20

NOTES:

1. MINIMUM TAP-LINE FUSE FOR COORDINATION IS 40K. QUESTIONS ON UNIQUE INSTALLATIONS SHOULD BE REFERRED TO LOCAL PQR&I ENGINEER OR CAPACITY PLANNING ENGINEER.

2. SEE DWG. 06.02-01 FOR EXPULSION FUSE TO BE UTILIZED IN "LOW FAULT CURRENT" AREAS.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

OVERHEAD TRANSFORMER

FAULT TAMER EXPULSION FUSE CARTRIDGE TABLE

DEC	DEM	DEP	DEF
			X

06.01-104B

TRANSFORMER SIZE	FUSE SIZE	
	WYE CONNECTED PRIMARY	
	PRIMARY VOLTAGE Ø-GROUND	
	7200/7620	14400
3	1 MS	1 MS
5	1 MS	1 MS
10	2 MS	1 MS
15	3 MS	2 MS
25	5 MS	2 MS
37.5	7 MS	3 MS
50	10 MS	5 MS
75	15 MS	7 MS
100	25 K	10 MS
167	40 K	15 MS
250	50 K	30 K
333	65 K	40 K
500	80 K	65 K

NOTES:

1. FOR INSTALLATIONS NOT COVERED BY THIS TABLE CONTACT DISTRIBUTION STANDARDS.
2. WHEN ONE FUSE IS BLOWN ON A THREE-PHASE BANK, ALL FUSES SHALL BE REPLACED.
3. FUSE SIZES 1-15 AMPS ARE S SPEED FUSES. DEPENDING ON MANUFACTURER, THESE ARE LABELED S, MS, OR KS. FUSE SIZES 20-80 AMPS ARE K SPEED FUSES. K SPEED IS AN INDUSTRY STANDARD SO ALL MANUFACTURERS WILL LABEL THE SAME.

REVISED		BY	CK'D	APPR.
3				
2	1/30/13	GUINN	GUINN	ADCOCK
1	11/1/12	HOFFMAN	DANNA	ADCOCK
0	10/19/10	SIMMONS	GUINN	ELKINS

TRANSFORMER FUSE TABLE

Duke Energy®

FLA

DWG. 06.02-01

SINGLE-PHASE, WYE BANK OR OPEN DELTA BANK RISERS

TRANSFORMER SIZE KVA	SECONDARY			PRIMARY
	120/208V 3Ø WYE	120/240V 1Ø OR 3Ø 277/480V 3Ø WYE	480V 1Ø	2.4, 7.2 OR 14.4 KV 1Ø
	AL	AL	AL	CU
5	1/0	1/0	1/0	6 WP
10	1/0	1/0	1/0	6 WP
15	1/0	1/0	1/0	6 WP
25	4/0	1/0	1/0	6 WP
37.5	500	1/0	1/0	6 WP
50	500	4/0	1/0	6 WP
75	2-500	500	1/0	6 WP
100	2-500	500	4/0	6 WP
167	3-500	2-500	500	6 WP

CLOSED DELTA BANK RISERS

TRANSFORMER SIZE KVA	SECONDARY		PRIMARY	
	120/240V 3Ø	480V 3Ø	2.4 KV 3Ø	4.16, 12.5 OR 24.9 KV 3Ø
	AL	AL	CU	CU
5-5-5	1/0	1/0	6 WP	6 WP
10-10-10	1/0	1/0	6 WP	6 WP
15-15-15	1/0	1/0	6 WP	6 WP
25-25-25	4/0	1/0	6 WP	6 WP
37.5-37.5-37.5	4/0	1/0	6 WP	6 WP
50-50-50	500	4/0	6 WP	6 WP
75-75-75	2-500	500	2 WP	6 WP
100-100-100	2-500	500	2 WP	6 WP
167-167-167	3-500	2-500	2 WP	6 WP

NOTES:

1. ALL SECONDARY TRANSFORMER HOTLEG LEADS ARE 600 VOLT ALUMINUM CABLE WITH CROSS-LINKED POLYETHYLENE INSULATION. OVERHEAD NEUTRAL CONDUCTOR CAN BE BARE ALUMINUM.

2. SINGLE SERVICE CONNECTION TO TRANSFORMERS 50KVA AND BELOW SHALL USE STEM CONNECTORS. FOR MULTIPLE SERVICES, USE SECONDARY CONNECTOR (CN 153529). FOR TRANSFORMERS ABOVE 75 KVA, LEADS ARE NOT NECESSARY IF THE SERVICES WILL BE CONNECTED DIRECTLY TO THE SECONDARY BUSHINGS. MULTIPLE UNDERGROUND SERVICES SHALL BE FED BY A SINGLE RISER. SEE DWG. 21.04-01.

3. FOR OPEN DELTA-CONNECTED BANKS, EITHER 120/240 OR 240/480 VOLTS, LEADS NOT COMMON TO TWO TRANSFORMERS ARE TO BE SELECTED FROM THE SINGLE PHASE TABLE ABOVE ACCORDING TO THE SIZE OF EACH TRANSFORMER.

4. FOR CLOSED DELTA AND OPEN DELTA-CONNECTED BANKS MADE UP OF UNEQUAL SIZED TRANSFORMERS, LEADS AND JUMPERS COMMON TO TWO TRANSFORMERS ARE TO BE SIZED ACCORDING TO THE LARGER TRANSFORMER. USE TOP TABLE FOR OPEN DELTA CONNECTED BANKS AND BOTTOM TABLE FOR CLOSED DELTA CONNECTED BANKS.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRANSFORMER RISER SIZES

Progress Energy

PGN

DWG. 06.03-01A

TRANSFORMER SIZE KVA	DELTA BANK LEADS BETWEEN BUSHINGS	
	SECONDARY	
	120/240V 3Ø	480V 3Ø
	AL	AL
5-5-5	1/0	1/0
10-10-10	1/0	1/0
15-15-15	1/0	1/0
25-25-25	1/0	1/0
37.5-37.5-37.5	4/0	1/0
50-50-50	4/0	1/0
75-75-75	500	1/0
100-100-100	500	4/0
167-167-167	2-500	500

NOTES:

1. ALL SECONDARY TRANSFORMER HOTLEG LEADS ARE 600 VOLT ALUMINUM CABLE WITH CROSS-LINKED POLYETHYLENE INSULATION. OVERHEAD NEUTRAL CONDUCTOR CAN BE BARE ALUMINUM.

2. SINGLE SERVICE CONNECTION TO TRANSFORMERS 50KVA AND BELOW SHALL USE STEM CONNECTORS. FOR MULTIPLE SERVICES, USE SECONDARY CONNECTOR (CN 153529). FOR TRANSFORMERS ABOVE 75 KVA, LEADS ARE NOT NECESSARY IF THE SERVICES WILL BE CONNECTED DIRECTLY TO THE SECONDARY BUSHINGS. MULTIPLE UNDERGROUND SERVICES SHALL BE FED BY A SINGLE RISER. SEE DWG. 21.04-01.

3. FOR OPEN DELTA-CONNECTED BANKS, EITHER 120/240 OR 240/480 VOLTS, LEADS NOT COMMON TO TWO TRANSFORMERS ARE TO BE SELECTED FROM THE SINGLE-PHASE TABLE ABOVE ACCORDING TO THE SIZE OF EACH TRANSFORMER.

4. FOR CLOSED DELTA AND OPEN DELTA-CONNECTED BANKS MADE UP OF UNEQUAL SIZED TRANSFORMERS, LEADS AND JUMPERS COMMON TO TWO TRANSFORMERS ARE TO BE SIZED ACCORDING TO THE LARGER TRANSFORMER.

3				
2				
1				
O	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DELTA SECONDARY TRANSFORMER BUS SIZES

Progress Energy

PGN

DWG. 06.03-01B

NOTES:

1. FOR TRANSFORMERS 75 KVA AND ABOVE, NO SECONDARY LEADS ARE NECESSARY. CONNECT SERVICES DIRECTLY TO THE SECONDARY BUSHINGS.

2. SINGLE SERVICE CONNECTION TO TRANSFORMERS 50KVA AND BELOW SHALL USE STEM CONNECTORS. FOR MULTIPLE SERVICES, USE SECONDARY CONNECTOR (CN 153529).

3. ALL STEM CONNECTOR TERMINATIONS TO UNDERGROUND INSULATED CONDUCTORS ARE TO BE AQUA-SEALED AND TAPED TO PREVENT WATER INTRUSION INTO THE CABLE.

4. WHEN THE LARGEST SERVICE CABLE BEING RUN FROM THE TRANSFORMER IS EQUAL TO OR LARGER THAN THE REQUIRED SECONDARY SIZE, THE SERVICE CABLE WITH A STEM CONNECTOR SHOULD BE USED FOR THE SECONDARY LEAD.

STEM CONNECTORS				DIES REQUIRED	
CATALOG NUMBER	CONDUCTOR SIZE	COLOR CODE	STEM SIZE	BURNDY	KEARNEY
9220195899	#6 STR AL	BLUE	#4	W-BG	5/8
9220106044	#4 STR AL	ORANGE	#4 SOLID	W-BG	5/8
153503	#2 STR AL	RED	#4 SOLID	W-BG	5/8
153508	#1/0 STR AL	YELLOW	#2 SOLID	W-BG	840
-	#2/0 STR AL	GRAY	#1/0 SOLID	W-K840	840
153516	#4/0 STR AL	PINK	#1/0 SOLID	W-K840	840
153521	336.4 ACSR AL & 350 MCM AL	GREEN	1/2" DIA	W-K840	-
153523	500 MCM	PINK	1/2" DIA	U34ART	1-1/8 - 1

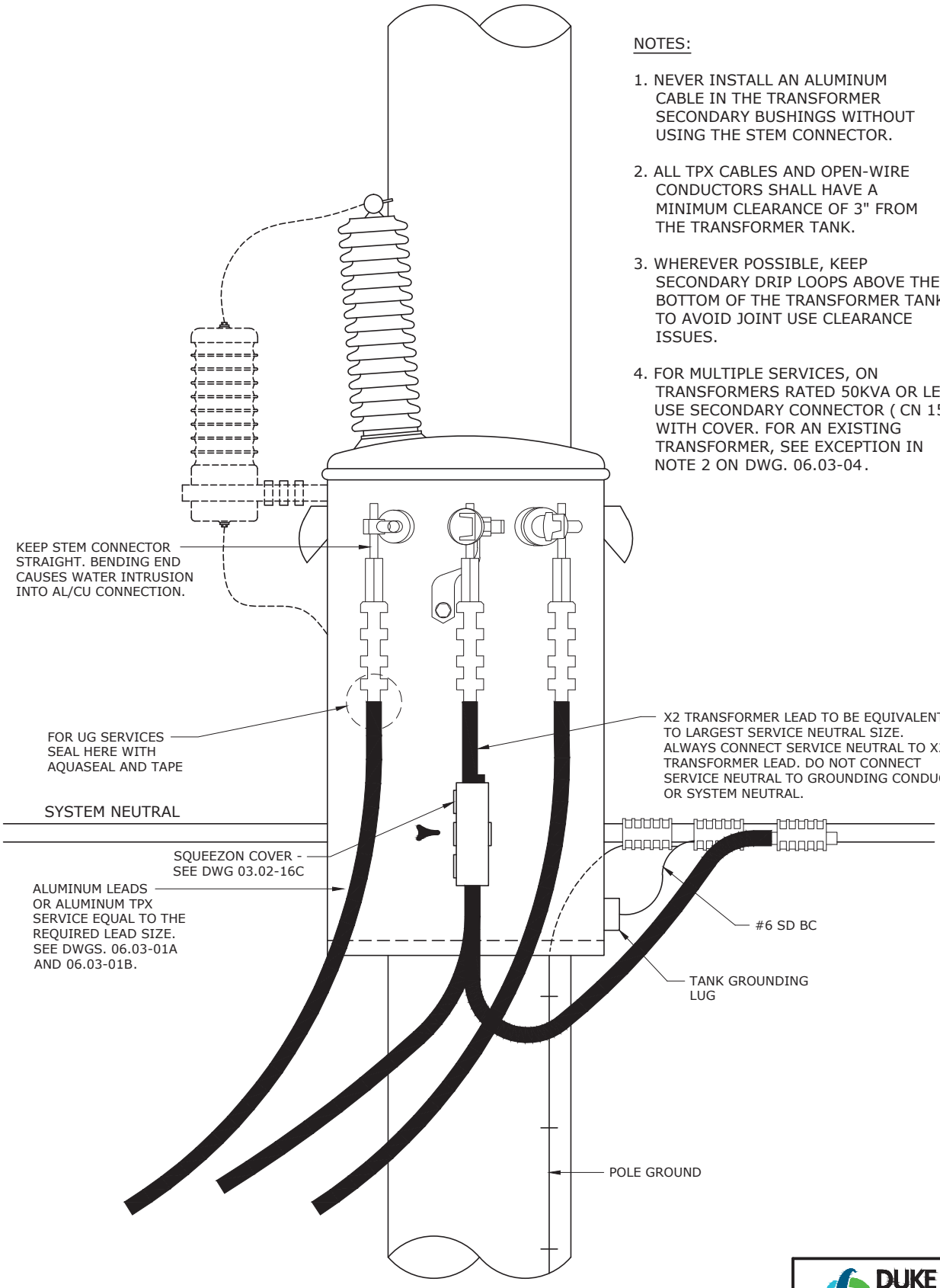
3				
2				
1	3/8/13	DANNA	DANNA	ADCOCK
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY LEAD SPECIFICATIONS

Duke Energy®

FLA

DWG. 06.03-04



NOTES:

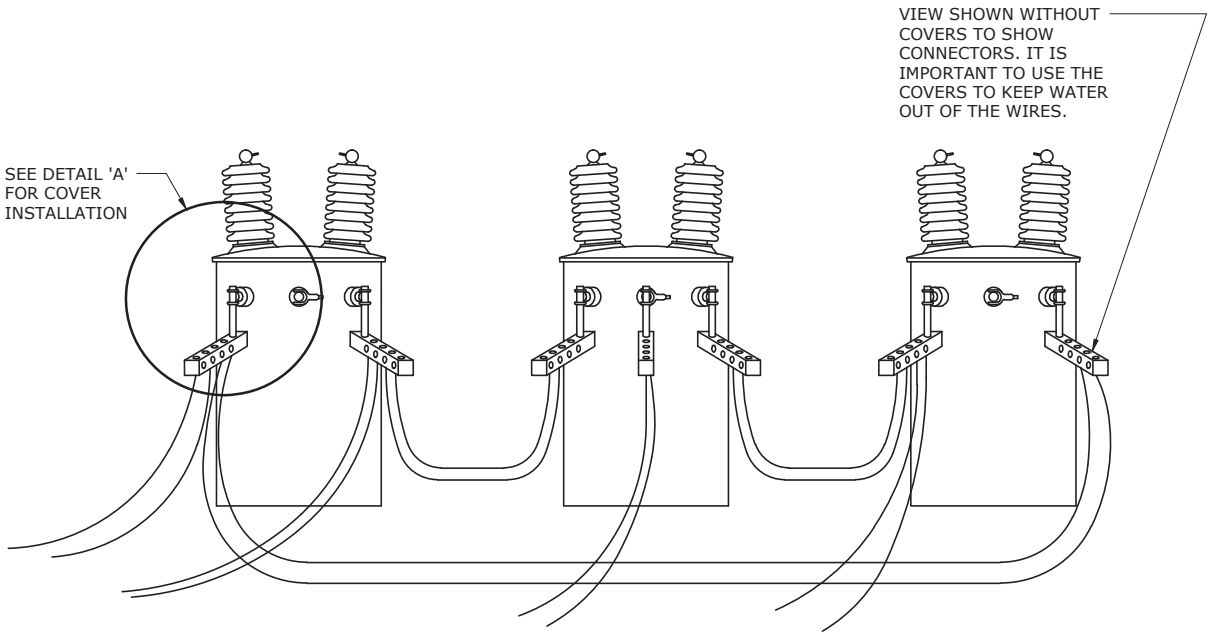
1. NEVER INSTALL AN ALUMINUM CABLE IN THE TRANSFORMER SECONDARY BUSHINGS WITHOUT USING THE STEM CONNECTOR.
2. ALL TPX CABLES AND OPEN-WIRE CONDUCTORS SHALL HAVE A MINIMUM CLEARANCE OF 3" FROM THE TRANSFORMER TANK.
3. WHEREVER POSSIBLE, KEEP SECONDARY DRIP LOOPS ABOVE THE BOTTOM OF THE TRANSFORMER TANK TO AVOID JOINT USE CLEARANCE ISSUES.
4. FOR MULTIPLE SERVICES, ON TRANSFORMERS RATED 50KVA OR LESS, USE SECONDARY CONNECTOR (CN 153529) WITH COVER. FOR AN EXISTING TRANSFORMER, SEE EXCEPTION IN NOTE 2 ON DWG. 06.03-04.

REVISED	BY	CK'D	APPR.
3 12/1/14	SIMMONS	DANNA	ADCOCK
2 4/4/13	DANNA	DANNA	ADCOCK
1 1/31/13	SIMMONS	GUINN	ADCOCK
0 11/23/10	SIMMONS	GUINN	ELKINS

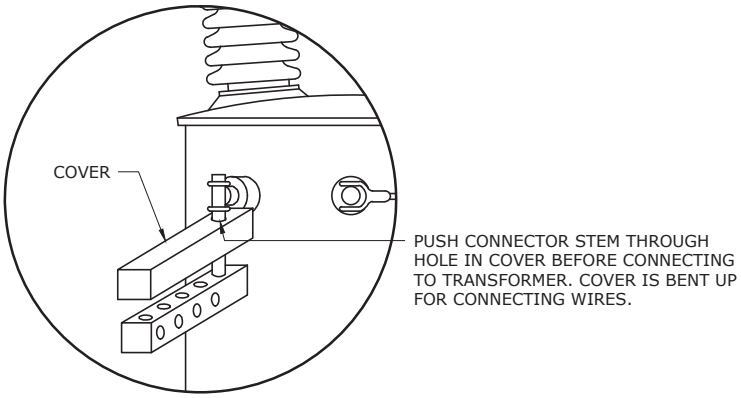
TRANSFORMER SECONDARY CONNECTION DETAILS

DEC	DEM	DEP	DEF
		X	X

06.03-05



CU KTSTUD4H50ALF CN 153529 - STEM, 4-HOLE, 500 KCM, FOUR HOLE ALUMINUM SET SCREW BLOCK WITH TINNED COPPER 1/2 IN STUD, WITH COVER



DETAIL 'A'

NOTES:

1. USE THESE CONNECTORS ON THREE-PHASE BANKS OR SINGLE-PHASE TRANSFORMERS WITH MULTIPLE SERVICES. TRANSFORMER UNITS MUST BE 50KVA OR SMALLER. LARGER UNITS WILL HAVE SECONDARY SPADES.

2. ALL BANK LEADS MUST BE FULLY INSULATED. SIZE PER DWGS. 06.03-01A AND 06.03-01B.

3. PUSH CONNECTOR STEM THROUGH COVER HOLE. CONNECT CONNECTOR STEM IN TRANSFORMER LUG. CLEAN WIRE AND APPLY INHIBITOR. INSERT WIRE IN BOTTOM OF CONNECTOR.

4. BEND WIRE AS NEEDED BEFORE INSERTING IN CONNECTOR.

5. MAINTAIN AT LEAST 3" CLEARANCE FROM TANK TO INSULATED LEAD.

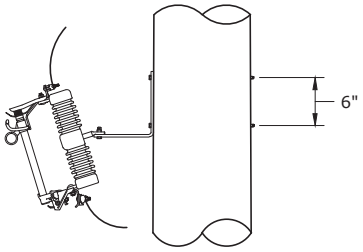
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE TRANSFORMER BANK SECONDARY CONNECTORS

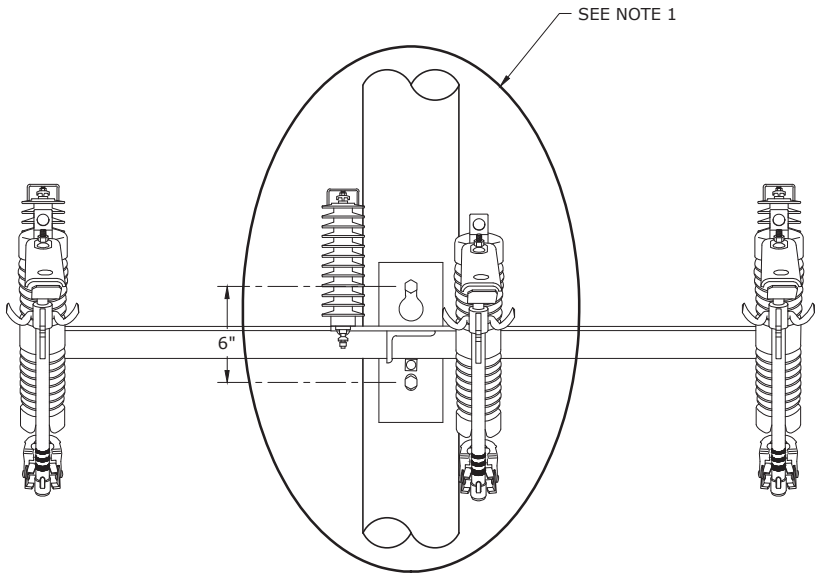
Duke Energy

FLA

DWG. 06.03-07



12KV TRANSFORMER CUTOUT BRACKET
BKTCOLASNGSTLF (CN 311263)



STANDARD THREE-PHASE CUTOUT BRACKET
BKTCOLATRISTLF (CN 070104)

NOTES:

1. IF ARRESTER MOUNTING PROVISION EXISTS ON THE TRANSFORMER TANK, THE ARRESTERS SHOULD BE MOUNTED ON THE TANK UNLESS IT IS A 3-TRANSFORMER FLOATING WYE-DELTA BANK. LOCATE ARRESTERS FOR 3-TRANSFORMER FLOATING WYE-DELTA BANKS ON SOURCE SIDE OF CUTOUT. IF ARRESTERS COME ON TRANSFORMER TANK, RELOCATE TO SOURCE SIDE OF CUTOUTS. IF ARRESTER MOUNTING PROVISION DOES NOT EXIST, MOUNT THE ARRESTERS ON THE CUTOUT BRACKET.

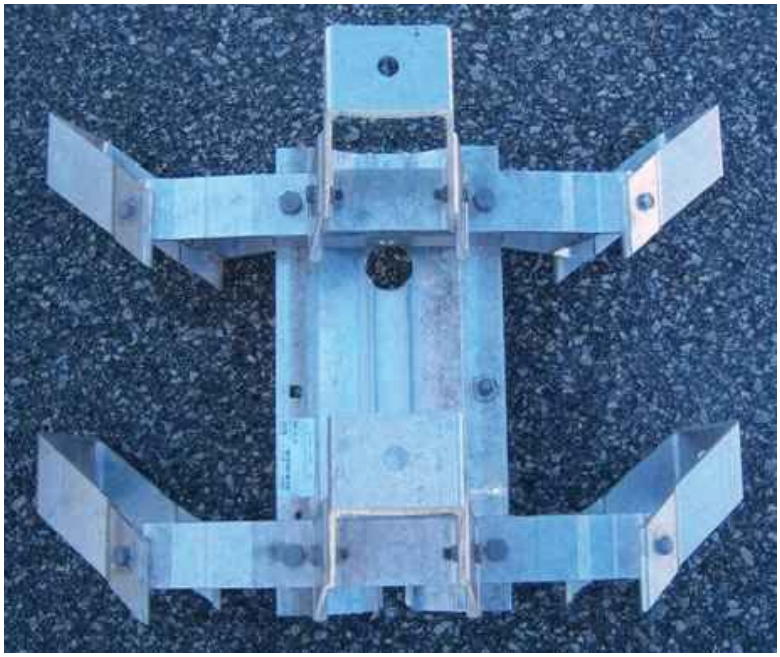
REVISED		BY	CK'D	APPR.
3				
2	11/8/12	KATIGBAK	DANNA	ADCOCK
1	12/12/11	BURLISON	BURLISON	ELKINS
0	11/23/10	SIMMONS	GUINN	ELKINS

TRANSFORMER CUTOUT BRACKETS

Duke Energy®

FLA

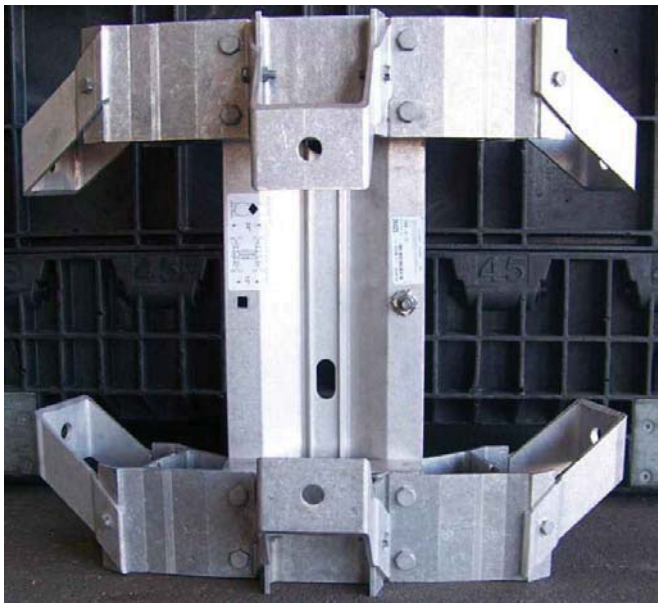
DWG. 06.04-03



RACK TYPE BRACKET
CU BKTTFMRSMALF
CN 12912507
5 THRU 50 KVA UNITS

NOTES:

1. USE TWO 3/4" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 5/8" BOLTS TO ATTACH EACH TRANSFORMER TO BRACKET.



THREE UNIT WING TYPE CLUSTER BRACKET
CU BKTTFMRMEDALF
CN 070255
75 THRU 167 KVA UNITS

NOTES:

1. USE TWO 3/4" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 3/4" BOLTS TO ATTACH EACH TRANSFORMER TO BRACKET.

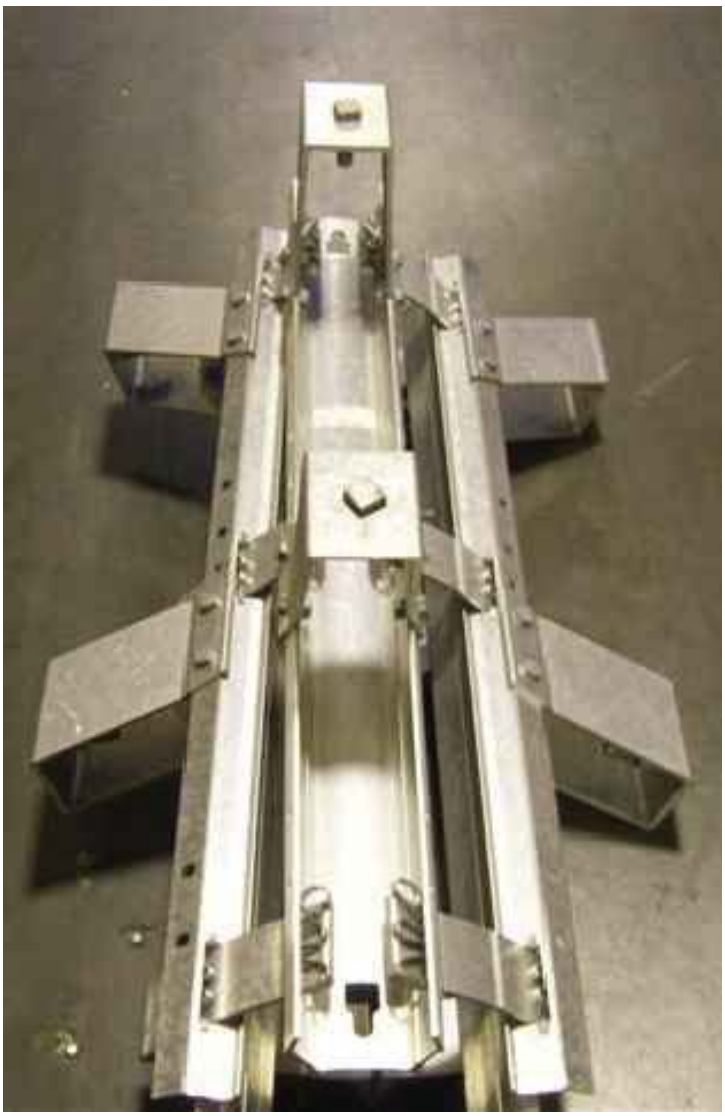
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRANSFORMER BANK MOUNTING BRACKETS

Duke Energy®

FLA

DWG. 06.04-06



THREE UNIT BANDED CLUSTER

CU BKTTFMRLGEALF
CN 12912705
250 - 500 KVA UNITS

NOTES:

1. USE TWO 5/8" BOLTS TO MOUNT BRACKET TO POLE. USE TWO 3/4" BOLTS TO MOUNT EACH TRANSFORMER TO BRACKET.

2. A PLATFORM IS THE PREFERRED MOUNTING FOR TRANSFORMERS OF THIS SIZE. CONSULT WITH DISTRIBUTION STANDARDS ON POLE SIZE AND GUYING **PRIOR** TO USING THIS TRANSFORMER MOUNTING BRACKET.

3. CHECK ON AVAILABILITY AS THIS IS A SPECIAL ORDER ITEM.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRANSFORMER BANK MOUNTING BRACKETS

Duke Energy®

FLA

DWG. 06.04-07

NOTES:

1. USE NON-LOADBREAK CUTOUTS.

   CU TFUSE15CO100F (FOR CUTOUT ON L BRACKET) (CN 221112)

2. USE 18KV LIGHTNING ARRESTERS ON A 25KV LINE.

   CU AREQOH18F (CN 220207)

3. USE 10KV LIGHTNING ARRESTERS ON A 12KV LINE.

   CU AREQOHTR10F (CN 114012033)

4. USE L BRACKET.

   CU BKTCOLASNGSTLF (CN 311263)

5. USE #6 SD COPPER WP PRIMARY RISERS.

6. FOR UNITS WITH EXTERNAL LIGHTNING ARRESTERS, ROTATE ARRESTER FROM SHIPPING POSITION TO STRAIGHT OUT FROM TANK.

7. INSTALL A WILDLIFE GUARD ON ALL NEW INSTALLATIONS. SEE DWG. 06.00-23.

   CU WGEQBUSHSNAPF (CN 470114)

8. FOR 50 KVA AND SMALLER, USE QUANTITY TWO - 5/8" X 12" GALVANIZED BOLTS (CU TOAMAF) TO MOUNT TRANSFORMER. FOR 75 KVA - 167 KVA, USE QUANTITY TWO - 3/4" X 12" GALVANIZED BOLTS TO MOUNT TRANSFORMER.

3				
2				
1	11/8/12	KATIGBAK	DANNA	ADCOCK
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE TRANSFORMER INSTALLATIONS

GENERAL POLICIES

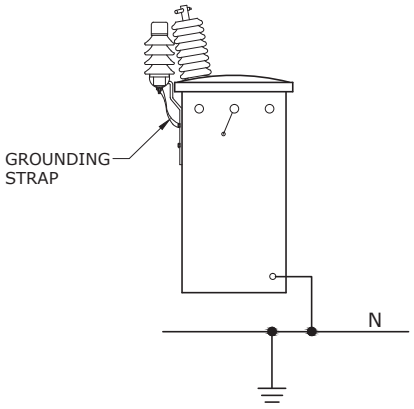
Duke Energy®

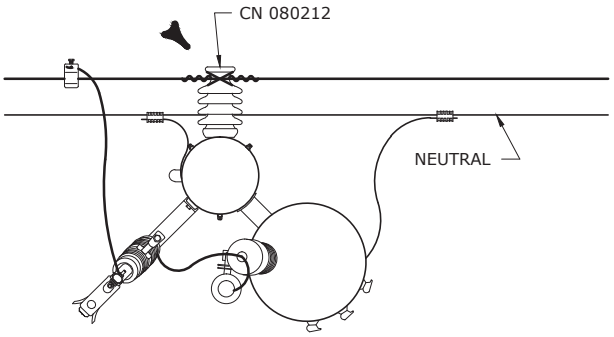
FLA

DWG. 06.06-01

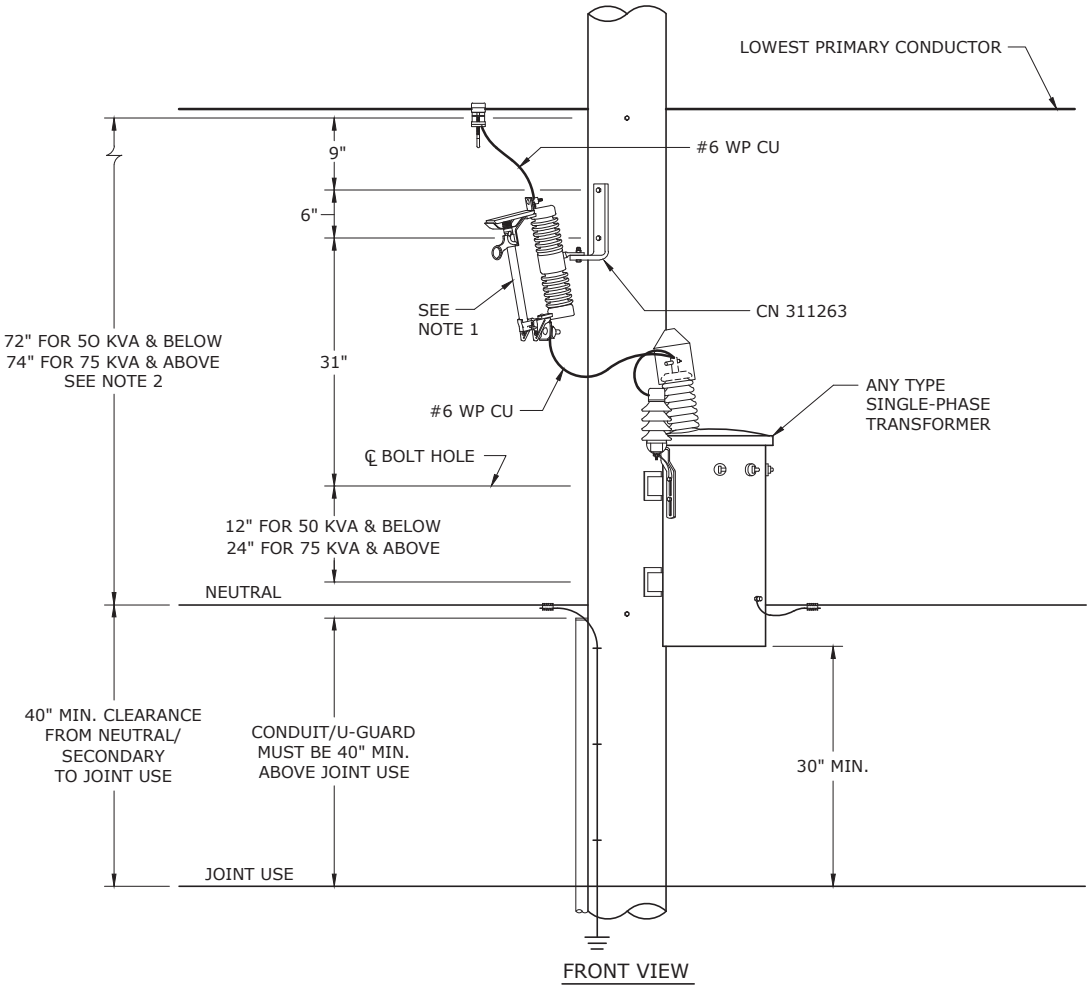
GROUNDING DETAILS

120/240





PLAN VIEW



FRONT VIEW

NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE THE TRANSFORMER.
2. 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. MINIMUM BOLT HOLE SPACING IS 4"; NO HOLES SHOULD BE DRILLED CLOSER THAN 4".
4. THE BOTTOM OF THE TRANSFORMER TANK MUST MAINTAIN 30 INCHES OF CLEARANCE ABOVE JOINT USE CABLES.

REVISED		BY	CK'D	APPR.
3				
2	4/18/13	McCONNELL	GUINN	ADCOCK
1	5/22/12	ROBESON	BURLISON	ELKINS
0	11/23/10	SIMMONS	GUINN	ELKINS

SINGLE-PHASE TRANSFORMER MOUNTING DIMENSIONS

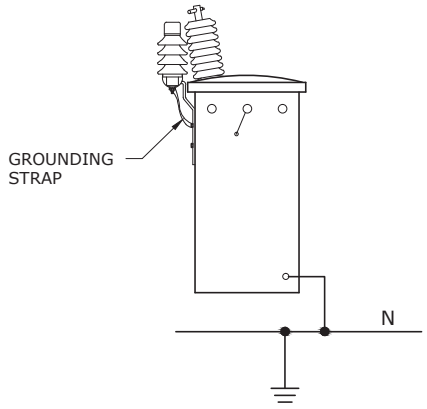
DUKE ENERGY.

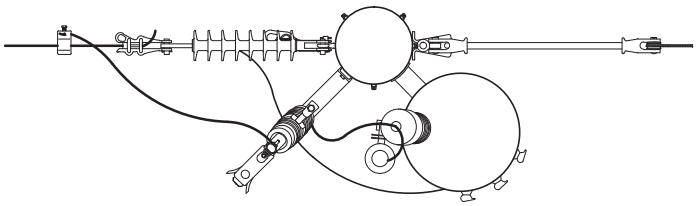
FLA

DWG. 06.06-04

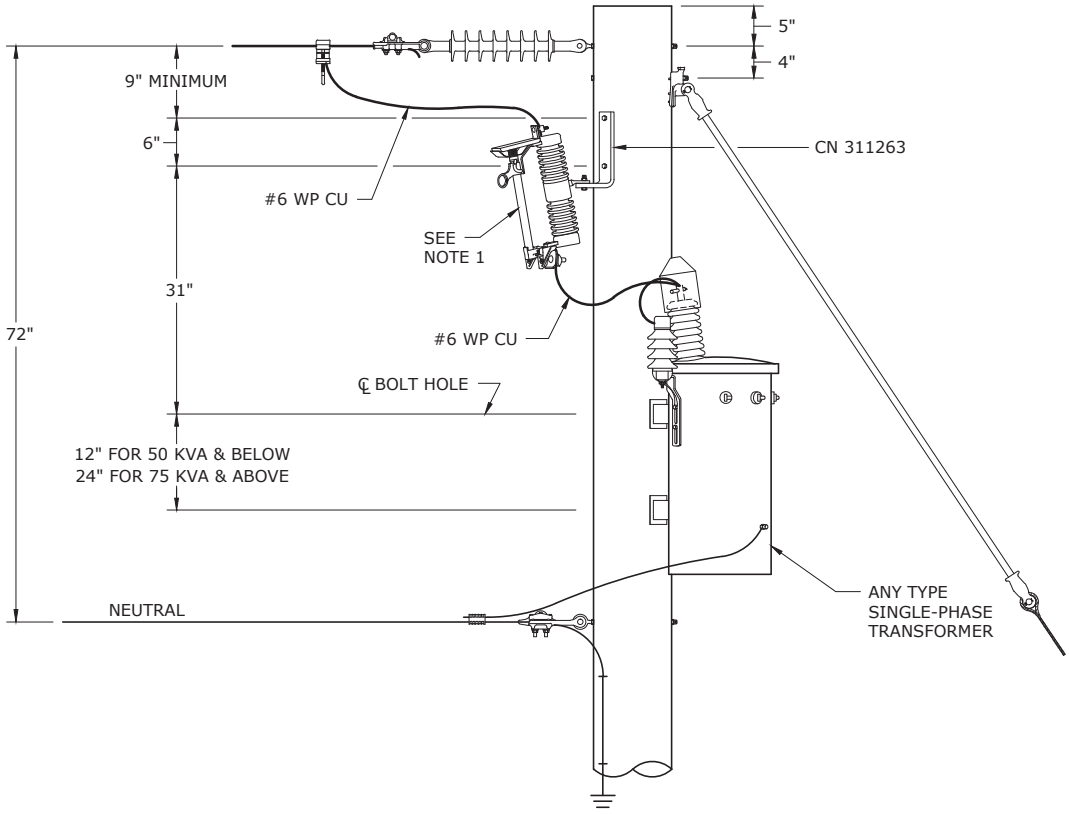
GROUNDING DETAILS

120/240





PLAN VIEW



FRONT VIEW

NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE THE TRANSFORMER.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE TRANSFORMER

MOUNTING DIMENSIONS

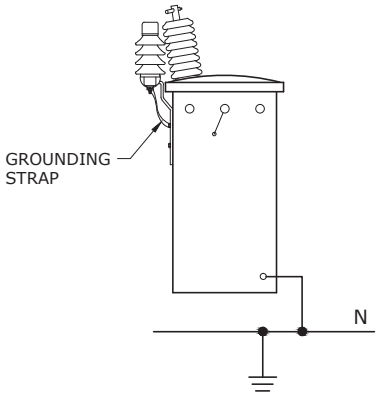
Duke Energy®

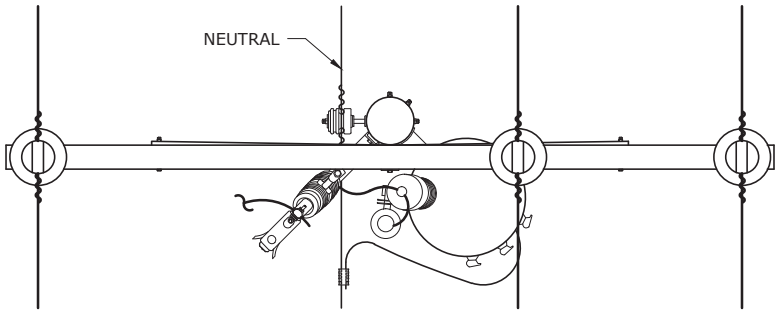
FLA

DWG. 06.06-05

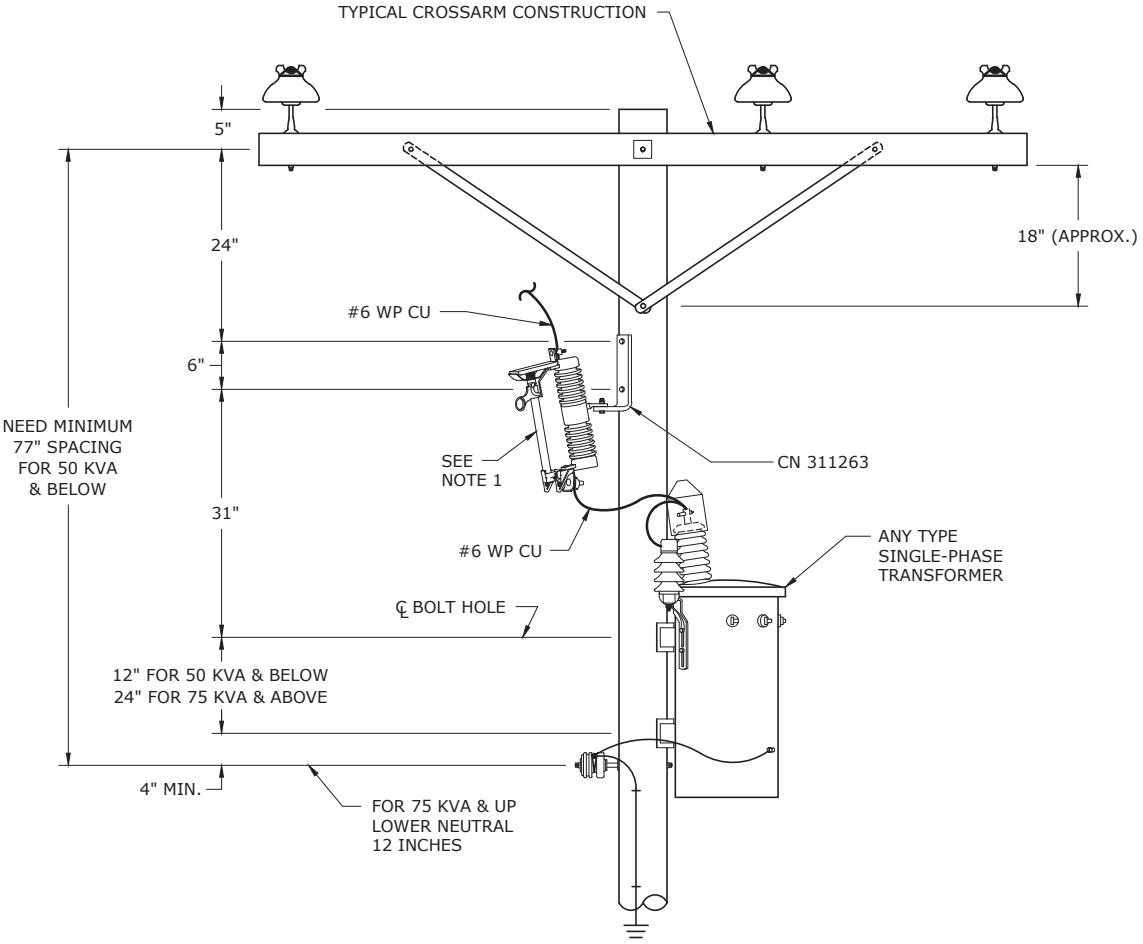
GROUNDING DETAILS

120/240





PLAN VIEW



FRONT VIEW

NOTES:

1. THE QUADRANT FOR INSTALLING THE TRANSFORMER AND CUTOUT MAY CHANGE FROM WHAT IS SHOWN IN THE DRAWING BASED ON FIELD CONDITIONS. THE CUTOUT SHOULD NOT BE INSTALLED DIRECTLY ABOVE THE TRANSFORMER.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

HORIZONTAL CONSTRUCTION
SINGLE-PHASE TRANSFORMER

Duke Energy®

FLA

DWG. 06.06-06

THE DISTRIBUTION TRANSFORMER CONNECTION DRAWINGS SHOW THE MOST COMMON TRANSFORMER CONNECTIONS PRESENTLY BEING USED. PARTICULAR NOTE SHOULD BE MADE OF THE FOLLOWING:

1. TRANSFORMER CONNECTIONS (DWGS. 06.10-01 THROUGH 06.10-13) ARE SHOWN FOR BOTH SUBTRACTIVE AND ADDITIVE POLARITY TRANSFORMERS AND ASSUME THAT ALL TRANSFORMERS IN A BANK ARE THE SAME POLARITY. THIS IS TRUE IN MOST CASES AND AS A RESULT THE SECONDARY BUSHING MARKINGS (X_1, X_2, X_3, ETC.) WILL BE THE SAME FOR EACH TRANSFORMER IN THE BANK. **THE DRAWINGS DO NOT APPLY WHERE UNITS OF DIFFERENT POLARITY ARE IN THE SAME BANK.** IN THIS CASE THE SECONDARY BUSHING MARKINGS WILL BE DIFFERENT AND CARE MUST BE TAKEN IN ORDER TO ENSURE THAT CONNECTIONS ARE MADE ACCORDING TO THE BUSHING DESIGNATIONS (X_1, X_2, X_3, ETC.). **IF TRANSFORMERS OF DIFFERENT POLARITIES ARE NOT CONNECTED PROPERLY, HIGH SECONDARY VOLTAGES CAN RESULT, OR SECONDARY VOLTAGES CAN CANCEL RESULTING IN HIGH CIRCULATING CURRENTS, BLOWN FUSES, ETC.** SEE DWG. 06.07-05.

2. WHEN TRANSFORMERS IN A BANK ARE REPLACED, IT IS NECESSARY TO KEEP CUSTOMERS' MOTORS RUNNING IN THE SAME DIRECTION. PHASE ROTATION SHOULD BE CHECKED BEFORE AND AFTER ANY CONNECTIONS ARE CHANGED. ROTATION MAY BE REVERSED BY SWAPPING CONNECTIONS OF TWO OF THE PHASE WIRES. IF THE BANK HAS A LIGHTING TRANSFORMER, SWAP THE TWO LARGE LIGHTING WIRES.

3. FOR CLARITY, SOME GROUND CONNECTIONS ARE SHOWN AS TAPS. WHEREVER POSSIBLE, A CONTINUOUS LOOP SHOULD BE USED BETWEEN BUSHINGS OR FROM A BUSHING TO GROUND.

4. IN CLOSED WYE CONNECTED SECONDARIES, THE NEUTRAL BUS MUST BE THE SAME SIZE AS THE PHASE CONDUCTORS. THE GROUND LEADS AND SECONDARY NEUTRAL BEYOND THE BUS SHOULD BE A REDUCED SIZE FROM THAT OF THE NEUTRAL BUS. **NOTE THAT ALL TRANSFORMERS BUT ONE SHOULD HAVE THE GROUND STRAP REMOVED SO THAT CURRENT FLOW WILL BE THROUGH THE PROPER CONDUCTORS.**

5. BE SURE TO REMOVE GROUND STRAP CONNECTIONS ON THE SECONDARY OF POWER TRANSFORMERS IN BANKS WITH DELTA SECONDARIES.

6. IN CLOSED BANKS WITH A DELTA SECONDARY CONNECTION, THE VOLTAGES OF THE TAP SETTINGS OF ALL OF ALL TRANSFORMERS MUST BE IDENTICAL TO PREVENT CIRCULATING CURRENTS AND OVERHEATING. THE PERCENT IMPEDANCE SHOULD BE APPROXIMATELY THE SAME TO ESTABLISH PROPER LOAD DIVISION. FOR UNITS OF EQUAL CAPACITY WITH ONE ODD IMPEDANCE, SUCH AS WHEN A FAILED UNIT MUST BE REPLACED, THE TOTAL BANK DERATING IS APPROXIMATED IN THE FOLLOWING TABLE:

RATIO OF ODD UNIT IMPEDANCE TO IMPEDANCE OF OTHER TWO UNITS	DERATING FACTOR
1.6	0.91
1.5	0.93
1.4	0.94
1.3	0.95
1.2	0.97
1.1	0.98
1.0	1.00
0.9	0.97
0.8	0.93
0.7	0.90

COPIED FROM THE WESTINGHOUSE DISTRIBUTION TRANS. GUIDE REVISED APRIL 1986.

7. FOR 240/120 VOLT, THREE-PHASE BANKS, THE TWO POWER (WING) TRANSFORMERS SHOULD HAVE THE SAME KVA RATING AND SIMILAR IMPEDANCE (ATTEMPT TO KEEP IMPEDANCE VALUES WITH +/-5% OF EACH OTHER). UNEQUAL KVA OR IMPEDANCE VALUES CAN LEAD TO TRANSFORMER OVERLOADS.

8. DO NOT USE SINGLE BUSHING TRANSFORMERS IN THREE TRANSFORMER BANKS EXCEPT FOR WYE-WYE 208Y/120 VOLT BANKS.

9. DO NOT MIX SINGLE BUSHING TRANSFORMERS AND DOUBLE BUSHING TRANSFORMERS TOGETHER IN THE BANK.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/9/11	SIMMONS	BURLISON	ELKINS
0	10/19/10	SIMMONS	GUINN	ELKINS

TRANSFORMER CONNECTIONS

GENERAL

Progress Energy

PGN

DWG. 06.07-01

POLARITY IS ESPECIALLY IMPORTANT WHEN BANKING TRANSFORMERS AND WHEN TWO OR MORE TRANSFORMERS ARE TO BE PARALLELED. CONNECTIONS TO ADDITIVE AND SUBTRACTIVE POLARITY WILL BE IN DIFFERENT PHYSICAL LOCATIONS ON THE TANK. BUSHING MARKINGS ON THE NAMEPLATE WILL BE AS SHOWN BELOW. NOTE THAT THE H_1 BUSHING IS ALWAYS ON THE LEFT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER, AND THAT THE PHYSICAL LOCATION OF THE SECONDARY BUSHINGS (X_1 X_2 X_3 ETC.) ON AN ADDITIVE POLARITY TRANSFORMER IS DIFFERENT FROM THAT OF A SUBTRACTIVE POLARITY TRANSFORMER.

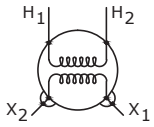
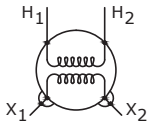
ADDITIVE POLARITY - ALL SINGLE-PHASE TRANSFORMERS RATED 167 KVA AND SMALLER, HAVING HIGH VOLTAGE WINDING 7200 VOLTS AND BELOW.

CHARACTERISTICS OF ADDITIVE POLARITY
1. THE LOW VOLTAGE X_1 BUSHING IS ON THE RIGHT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER.
2. THE DIRECTION OF INDUCED VOLTAGE FROM H_1 TO H_2 IS OPPOSITE THE DIRECTION OF INDUCED VOLTAGE FROM X_1 TO X_2

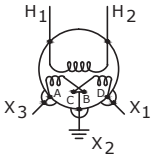
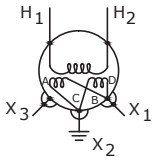
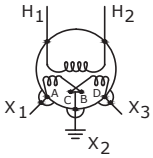
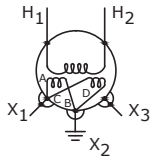
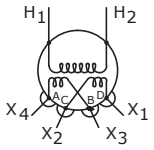
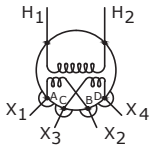
SUBTRACTIVE POLARITY - ALL SINGLE-PHASE TRANSFORMERS HAVING HIGH VOLTAGE WINDINGS OF 13200 AND ABOVE, ALL DUAL VOLTAGE (13200 X 7200) TRANSFORMERS AND ALL TRANSFORMERS LARGER THAN 167 KVA.

CHARACTERISTICS OF SUBTRACTIVE POLARITY
1. THE LOW VOLTAGE X_1 BUSHING IS ON THE LEFT WHEN FACING THE LOW VOLTAGE SIDE OF THE TRANSFORMER.
2. THE DIRECTION OF INDUCED VOLTAGE FROM H_1 TO H_2 IS THE SAME AS THE DIRECTION OF INDUCED VOLTAGE FROM X_1 TO X_2

<table>
<tr><th colspan="3">"NEMA STANDARDS FOR LOW VOLTAGE EXTERNAL TERMINALS"</th></tr>
<tr><th>DESCRIPTION OF CONNECTION</th><th>ADDITIVE POLARITY</th><th>SUBTRACTIVE POLARITY</th></tr>
<tr><td>TWO TERMINALS:

SINGLE LOW VOLTAGE</td><td>  </td><td>  </td></tr>
<tr><td>THREE TERMINALS:

THREE WIRE
120/240 VOLTS
(SERIES CONNECTION)

TWO WIRE
120 VOLTS
OR
FOUR WIRE
208Y/120 VOLT BANK
(PARALLEL CONNECTION)</td><td> 
 
ON ADDITIVE POLARITY TRANS., RECONNECT INTERNALLY A & C LEADS TO X_2 NEUTRAL TERMINAL & B & D LEADS TO X_1 PHASE TERMINAL.</td><td> 
 
ON SUBTRACTIVE POLARITY TRANS., RECONNECT INTERNALLY A & C LEADS TO X_1 PHASE TERMINAL & B & D LEADS TO X_2 NEUTRAL TERMINAL.</td></tr>
<tr><td>FOUR TERMINALS:</td><td colspan="2"> 
 
FOR 3-WIRE 120/240 VOLT (SERIES) OPERATION, CONNECT X_2 TO X_3 EXTERNALLY. FOR 4-WIRE 208Y/120 VOLT (PARALLEL) OPERATION CONNECT X_1 TO X_3 AND X_2 TO X_4 EXTERNALLY.</td></tr>
</table>

REVISED	BY	CK'D	APPR.
3			
2			
1 6/29/12	GUINN	BURLISON	ELKINS
0 7/9/10	SIMMONS	GUINN	ELKINS

DISTRIBUTION TRANSFORMER POLARITY

Progress Energy

PGN DWG. 06.07-05

NOTES:

1. ALL GENERAL POLICIES FOR SINGLE-PHASE TRANSFORMER INSTALLATIONS SHOULD BE FOLLOWED. GENERAL POLICIES CAN BE FOUND ON THE FOLLOWING DWGS: 06.00-20, 06.07-01, 06.15-01A AND 06.15-01B.

2. THE LIGHTING TRANSFORMER SHOULD BE CONNECTED TO THE LEADING PHASE. A PHASE LEADS B PHASE, B PHASE LEADS C PHASE AND C PHASE LEADS A PHASE.

3. THE GROUND STRAP MUST BE REMOVED FROM THE SECONDARY NEUTRAL BUSHING ON THE POWER TRANSFORMER.

4. DO NOT MIX ONE BUSHING UNITS AND TWO BUSHING UNITS IN THE SAME BANK DUE TO POLARITY PROBLEMS.

5. LIGHTNING ARRESTERS SHOULD BE MOUNTED ON THE TRANSFORMER TANK FOR ALL PRIMARY BUSHINGS CONNECTED TO AN ENERGIZED PRIMARY CONDUCTOR. MOUNT ARRESTER ON COLA BRACKET ONLY IF ARRESTER PROVISIONS ARE NOT ON TANK. THE H2 PRIMARY BUSHING SHOULD BE CONNECTED TO THE SYSTEM NEUTRAL WITH #6 SD BC.

6. USE BRACKET (CN 311263) TO MOUNT CUTOUT.

7. A THREE TRANSFORMER MOUNTING BRACKET SHOULD BE USED. SEE DWG. 06.07-10A FOR AVAILABLE BRACKETS.

8. SEE DWG. 06.07-06B FOR TRANSFORMER BANK MOUNTING DIMENSIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/12/11	BURLISON	BURLISON	ELKINS
0	11/23/10	SIMMONS	GUINN	ELKINS

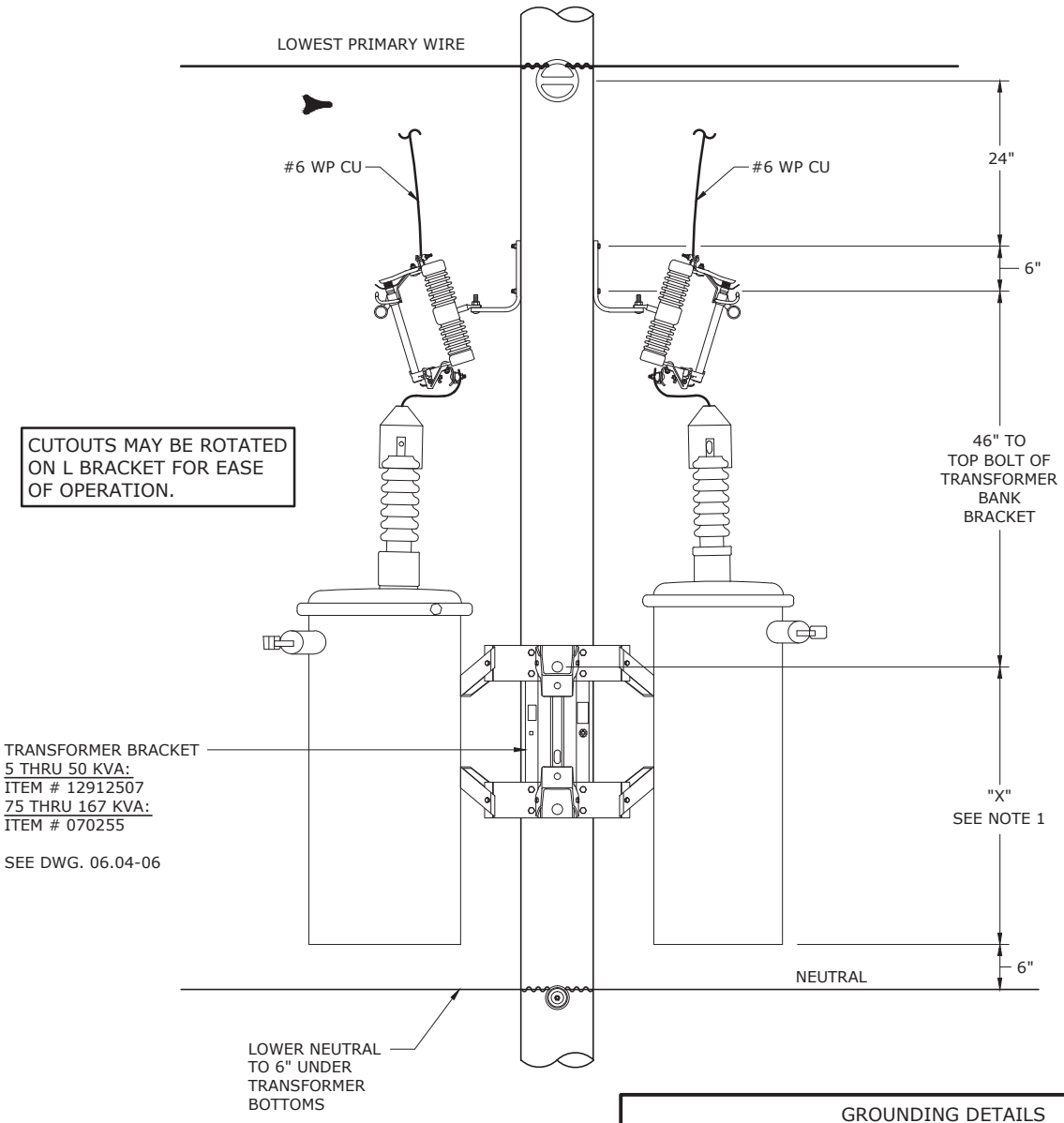
OPEN-WYE OPEN-DELTA TRANSFORMER BANKS

GENERAL POLICIES

Progress Energy

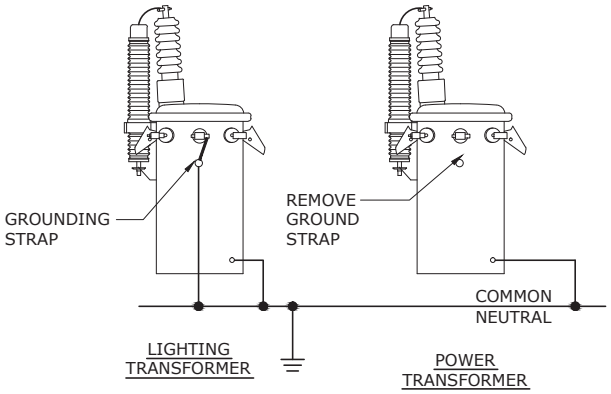
FLA

DWG. 06.07-06A



GROUNDING DETAILS

(240/120 VOLTS)



NOTES:

1. THE DISTANCE "X" BETWEEN THE TOP BOLT OF THE TRANSFORMER MOUNTING BRACKET AND THE BOTTOM OF THE TRANSFORMER VARIES. TYPICAL MAXIMUM DISTANCES ARE SHOWN IN THE TABLE BELOW.

SIZE OF TRANSFORMER	DISTANCE "X"
37.5 KVA AND BELOW	32"
50-100 KVA	39"
167 KVA	42"

2. SEE DWG. 06.07-06A FOR TRANSFORMER BANKS GENERAL POLICIES

3. APPROVED TO HANG LARGER POT IN CENTER OF TRANSFORMER BRACKET.

REVISED	BY	CK'D	APPR.
3 11/17/15	LOOSIER	BURLISON	ADCOCK
2 3/15/13	MCCONNELL	DANNA	ADCOCK
1 12/22/11	BURLISON	BURLISON	ELKINS
0 11/23/10	SIMMONS	GUINN	ELKINS

OPEN-WYE OPEN-DELTA TRANSFORMER BANK MOUNTING DIMENSIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

06.07-06B

NOTES:

1. ALL GENERAL POLICIES FOR TWO TRANSFORMER BANK INSTALLATIONS SHOULD CONTINUE TO BE FOLLOWED. GENERAL POLICIES CAN BE FOUND ON THE FOLLOWING DRAWINGS: 06.00-20, 06.07-01, 06.07-06A, 06.15-01A AND 06.15-01B. USE 3-TRANSFORMER BRACKET FOR 2-TRANSFORMER INSTALLATIONS.

2. THE THREE-PHASE COLA BRACKET (CU BKTCOLATRISTLF, CN 070104) SHOULD BE USED.

3. CLUSTER MOUNTING BRACKETS SHOULD BE USED.

4. ON 3-TRANSFORMER FLOATING WYE-DELTA BANKS, ARRESTERS SHOULD BE MOUNTED ON SOURCE SIDE OF CUTOUT. IF ARRESTRERS COME MOUNTED ON TRANSFORMER TANK, RELOCATE TO SOURCE SIDE OF CUTOUTS.

CLUSTER MOUNTING BRACKETS		
TRANSFORMER SIZES	COMPATIBLE UNIT	CATALOG NUMBER
5 TO 50 KVA	BKTTFMRSMALF	12912507
75 TO 167 KVA	BKTTFMRMEDALF	070255
250 TO 333 KVA (CLASS 1 POLE REQUIRED)	BKTTFMRLGEALF	12912705 (NON-STOCKED)

FOR 50 KVA AND BELOW, USE 5/8" X 2" MACHINE BOLTS.

FOR 75 KVA AND LARGER, USE 3/4" X 2" MACHINE BOLTS.

REVISED	BY	CK'D	APPR.
3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS

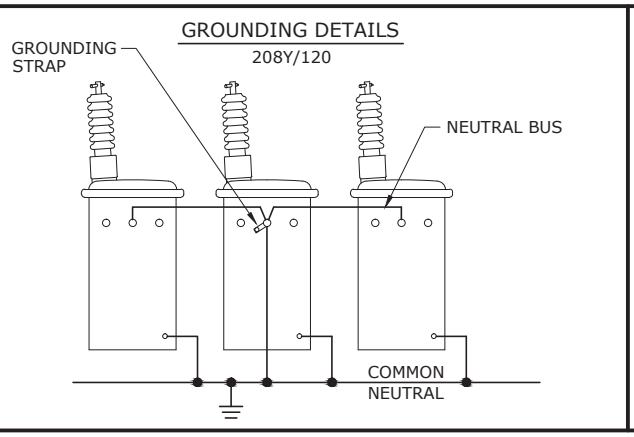
THREE-PHASE TRANSFORMER BANKS

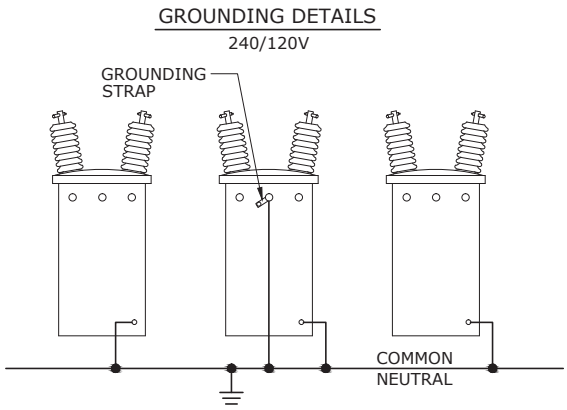
GENERAL POLICIES

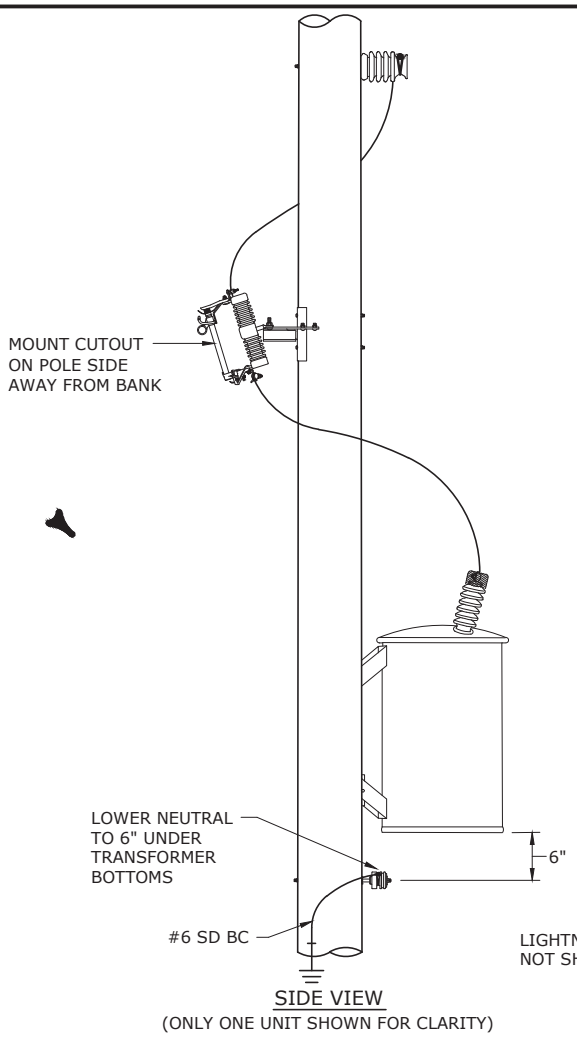
Duke Energy®

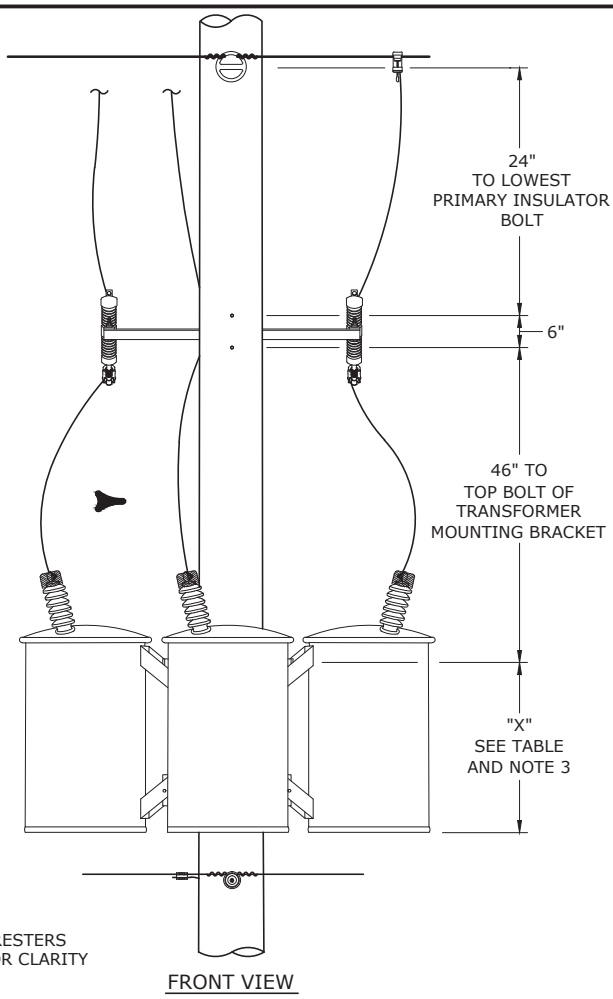
FLA

DWG. 06.07-10A









SIZE OF TRANSFORMER	DISTANCE "X"
50 KVA AND BELOW	32"
75-100 KVA	39"
167 KVA	42"

NOTES:

1. ALL GUYS ABOVE THE NEUTRAL POSITION MUST HAVE A GUY INSULATOR (LINK) OF SUFFICIENT LENGTH TO EXTEND BEYOND THE LOWEST ENERGIZED COMPONENT BY 24".
2. 12" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR.
3. THE DISTANCE "X" BETWEEN THE TOP BOLT OF THE TRANSFORMER MOUNTING BRACKET AND THE BOTTOM OF THE TRANSFORMER VARIES. TYPICAL MAXIMUM DISTANCES ARE SHOWN IN THE TABLE.
4. LOCATIONS OF CUTOUTS RELATIVE TO TRANSFORMERS CAN VARY.

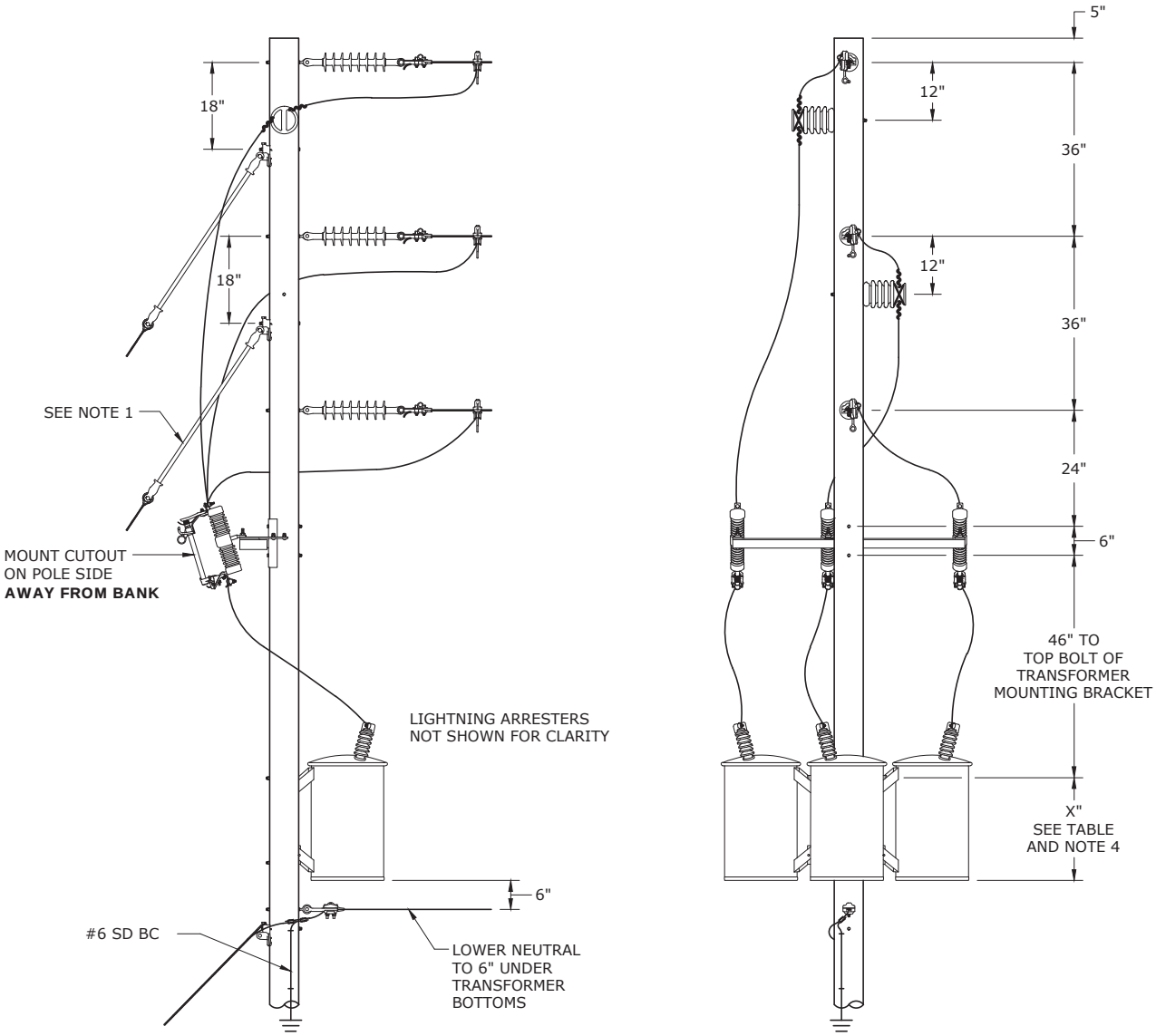
REVISED		BY	CK'D	APPR.
3				
2	3/15/13	MCCONNELL	DANNA	ADCOCK
1	9/14/12	BURLISON	BURLISON	ADCOCK
0	8/23/10	SIMMONS	GUINN	ELKINS

THREE-PHASE TRANSFORMER BANK MOUNTING DIMENSIONS

Duke Energy®

FLA

DWG. 06.07-10B



SIDE VIEW
(ONLY ONE UNIT SHOWN FOR CLARITY)

FRONT VIEW

SIZE OF TRANSFORMER	DISTANCE "X"
37.5 KVA AND BELOW	32"
50-100 KVA	39"
167 KVA	42"

NOTES:

1. GUY CONFIGURATION SHOWN IS TYPICAL FOR 1/0 OR SMALLER PRIMARY CONDUCTOR AND MAY VARY PER ENGINEERING DESIGN AND INSTRUCTIONS.

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

3. 8" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR FOR 12 KV CONDUCTOR. 12" MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PRIMARY RISER AND ANY GUY INSULATOR FOR 25 KV CONDUCTOR.

4. THE DISTANCE "X" BETWEEN THE TOP BOLT OF THE TRANSFORMER MOUNTING BRACKET AND THE BOTTOM OF THE TRANSFORMER VARIES. TYPICAL MAXIMUM DISTANCES ARE SHOWN IN THE TABLE.

5. LOCATIONS OF CUTOUTS RELATIVE TO TRANSFORMERS CAN VARY.

REVISED		BY	CK'D	APPR.
3				
2	5/29/12	DANNA	BURLISON	ELKINS
1	3/3/11	SIMMONS	BURLISON	ELKINS
0	11/23/10	SIMMONS	GUINN	ELKINS

THREE-PHASE TRANSFORMER BANK MOUNTING DIMENSIONS

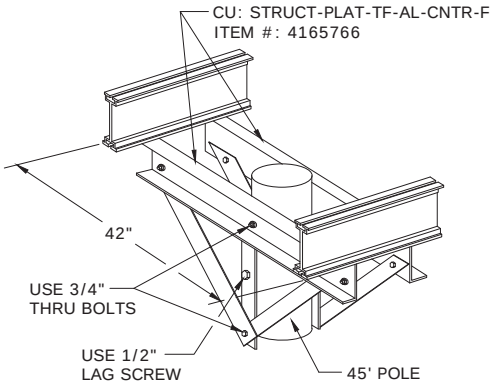
Progress Energy

FLA

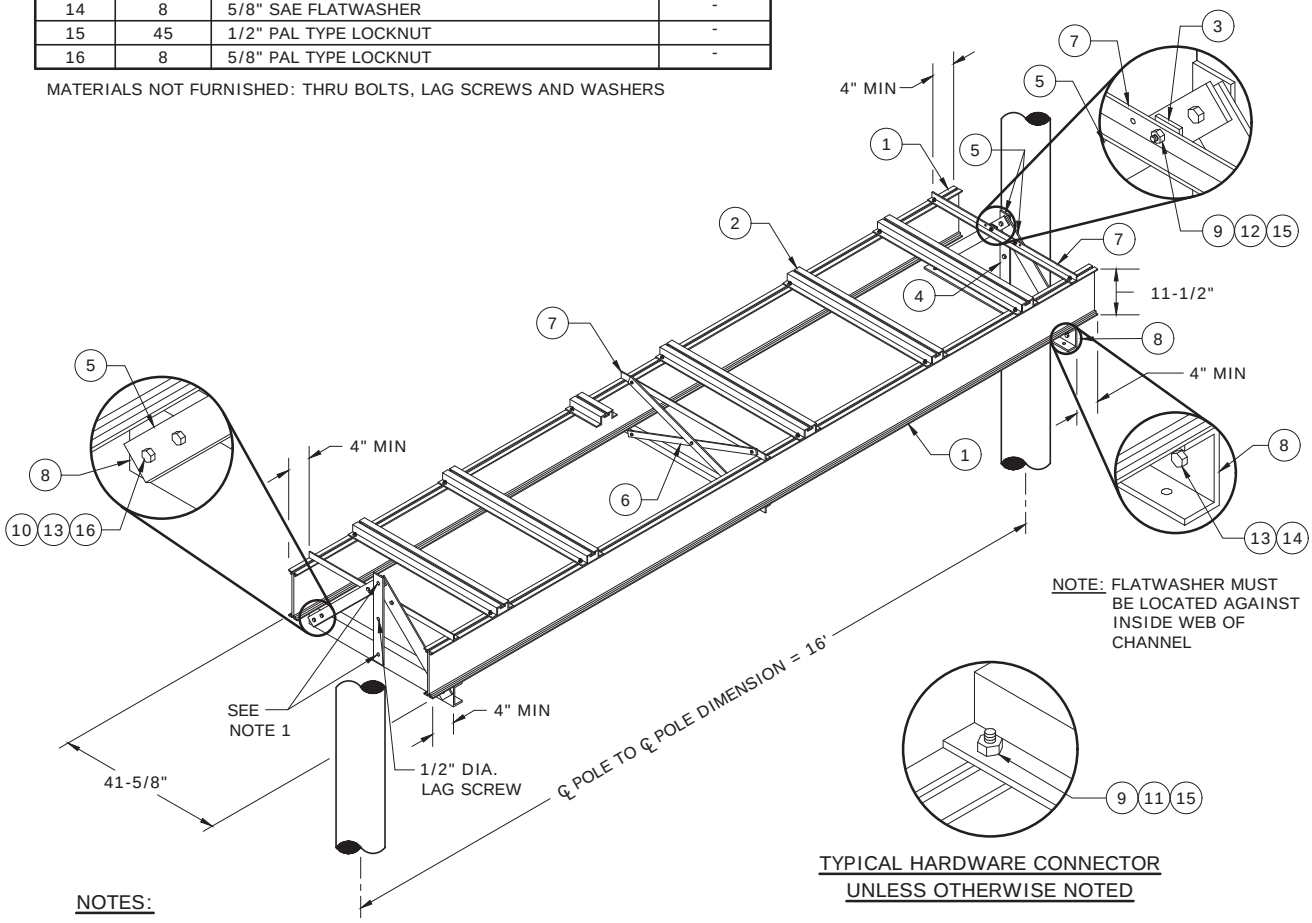
DWG. 06.07-12

TWO POLE ALUMINUM PLATFORM WAREHOUSE ITEM #: 4021540			
BILL OF MATERIALS			
ITEM	QUANTITY	DESCRIPTION	LENGTH
1	2	"C1" "I"BEAM, 11-1/2"	16'
2	6	"B2" HAT CHANNEL	41-1/8"
3	2	"C16" SPACER, BAR, 2-3/4" X 5/16"	1-3/4"
4	2	"C13" TEMPLATE BAR, 2-3/4" X 5/16"	22-7/16"
5	4	"C4" BRACE BAR, 2-3/4" X 5/16"	29-1/2"
6	2	"C15" X-BRACE BAR, 1-1/2" X 3/16"	40-3/16"
7	4	"C14" STABILIZER, ANGLE, 2" X 2" X 3/16"	41-1/8"
8	2	"C3" CHANNEL, 5" X 2"	41-5/8"
9	45	NUT, HEX, 1/2" (.018 OS)	-
10	8	NUT, HEX, 5/8" (.020 OS)	-
11	43	BOLT, HEX, 1/2" X 1-1/4"	1-1/4"
12	2	BOLT, HEX, 1/2" X 2" (FULL THREAD)	2
13	8	BOLT, HEX, 5/8" X 1-1/2"	1-1/2
14	8	5/8" SAE FLATWASHER	-
15	45	1/2" PAL TYPE LOCKNUT	-
16	8	5/8" PAL TYPE LOCKNUT	-

MATERIALS NOT FURNISHED: THRU BOLTS, LAG SCREWS AND WASHERS



NOTE: "C16" SPACER USED WITH 1/2" X 2" HEX BOLT IN (2) LOCATIONS ONLY



NOTE: FLATWASHER MUST BE LOCATED AGAINST INSIDE WEB OF CHANNEL

TYPICAL HARDWARE CONNECTOR UNLESS OTHERWISE NOTED

NOTES:

1. PLATFORM REQUIRES FOUR 3/4" MACHINE BOLTS, FOUR 3/4" LOCK WASHERS AND FOUR 2-1/4" X 2-1/4" SQUARE WASHERS FOR TWO POLE MOUNTING. BOLTS SHOULD BE INSTALLED WITH BOLT HEAD TOWARDS THE PLATFORM CENTER. USE WASHERS AT ALL CONTACT POINTS.
2. THE TWO POLE PLATFORM WILL SUPPORT A LOAD OF 13,500 LBS (NO CENTER STUB REQUIRED). FOR GREATER LOADS, USE CENTER STUB SUPPORT (CU: STRUCT-PLAT-TF-AL-CNTR-F).
3. THE CROSS MEMBERS CAN BE POSITIONED ANYWHERE ALONG THE BEAMS TO ALLOW EQUIPMENT TO BE PROPERLY SPACED.
4. FOR BANKS USING 250 AND 333 KVA TRANSFORMERS, AN EXTRA LARGE CLUSTER MOUNT BRACKET (CU: BKT-TF-CLUST-3POS-LG-AL-F, ITEM #: 4023979) IS AVAILABLE IF SITE CONDITIONS CREATE CONSTRAINTS OR CHALLENGES. THIS BRACKET IS SPECIAL ORDER, NON-STOCKED. USE THE EXTRA LARGE CLUSTER MOUNT BRACKET WITH CLASS 1 POLE.
5. SEE DWG. 06.08-03B FOR PLATFORM ASSEMBLY INSTRUCTIONS.
6. THE "I"-BEAM OF THE PLATFORM SHALL OVERHANG THE "A"-FRAME BY A MINIMUM OF 4 INCHES.

REVISED		BY	CHK'D	APPR.
3	6/30/18	MORGAN	BURLISON	ADCOCK
2	3/31/17	LOOSIER	BURLISON	ADCOCK
1	4/24/14	SIMMONS	DANNA	ADCOCK
0	11/23/10	SIMMONS	GUINN	ELKINS

DUKE ENERGY.

TWO POLE ALUMINUM PLATFORM

16' - HEAVY DUTY

DEC	DEM	DEP	DEF
			X

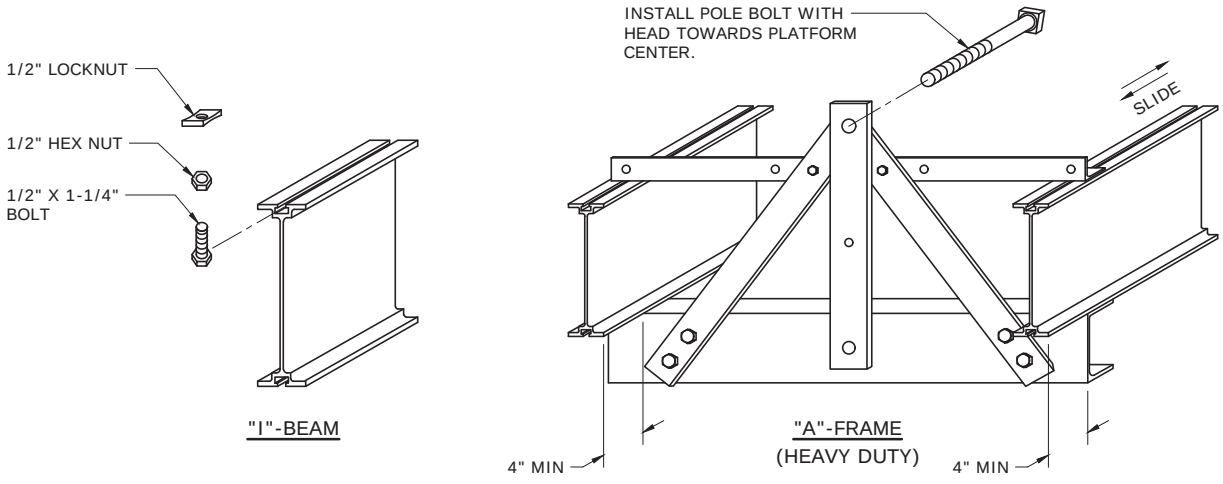
06.08-03A

PLATFORM ASSEMBLY INSTRUCTIONS

FOR EASE OF INSTALLATION, THIS ADJUSTABLE PLATFORM MAY BE PRE-ASSEMBLED IN THE SHOP AND CARRIED TO THE JOB SITE. IT MAY ALSO BE ASSEMBLED AT THE BASE OF THE POLES.

IT IS RECOMMENDED YOU PROCEED AS FOLLOWS:

1. OPEN THE BOXED PARTS. EXAMINE THE ERECTION DIAGRAM. LOCATE AND IDENTIFY ALL ITEMS LISTED ON THE DIAGRAM.
2. POSITION THE "I"-BEAMS AND SLIDE 1/2" X 1-1/4" BOLTS INTO PLACE.
3. CRITICAL - BEGIN ASSEMBLY OF THE CROSSMEMBERS (C14'S, B2'S ETC.) AT THE CENTER OF THE PLATFORM, WORKING OUTWARD TOWARD THE ENDS. HEX NUTS AND PAL-TYPE LOCKNUTS ARE PROVIDED FOR EACH 1/2" BOLT.
4. COMPLETE THE ASSEMBLY WITH THE "A"-FRAME POLE FACE ATTACHMENTS IN THE APPROXIMATE FINAL POSITIONS. FASTEN THE "I"-BEAMS TO THE "A"-FRAME ON ONE SIDE OF THE PLATFORM SUCH THAT BOTH "I"-BEAMS ARE OVERHANGING THE "A"-FRAME BY A MINIMUM OF 4". LEAVE THE OTHER "A"-FRAME LOOSE TO ALLOW IT TO SLIDE ALONG THE "I"-BEAMS AS THE PLATFORM IS RAISED TO THE PROPER POSITION.



5. HOIST PLATFORM TO DESIRED HEIGHT, LEVEL AND MAKE FINAL ADJUSTMENT OF "A"-FRAME ENDS TO ENSURE GOOD CONTACT WITH THE POLES. BOLT THE "A"-FRAMES TO THE POLES USING THE THRU-BOLTS AND LAG BOLTS SPECIFIED ON THE ERECTION DIAGRAM. INSTALL THE POLE THRU-BOLTS WITH THE HEADS TOWARD THE PLATFORM CENTER.
6. POSITION THE "I"-BEAMS SUCH THAT THERE IS A MINIMUM OF 4" OVERHANGING THE "A"-FRAME ON BOTH SIDES. IF THERE IS LESS THAN 4" OVERHANG, THEN THE POLES ARE TOO FAR APART AND MUST BE RE-POSITIONED.
7. TIGHTEN THE BOLT AND ASSOCIATED NUTS ON THE OTHER "A"-FRAME AND "I"-BEAMS. CHECK TO BE SURE ALL NUTS ARE TIGHT.
8. INSTALL EQUIPMENT DIRECTLY ON ALUMINUM CROSSMEMBERS. THE CROSSMEMBERS MAY BE ADJUSTED TO SUPPORT THE LOAD. NO ADDITIONAL EQUIPMENT MOUNTING BOLTS ARE NECESSARY FOR NORMAL APPLICATIONS.

NOTES:

1. SEE DWG. 06.08-03A FOR PLATFORM DETAIL, NOTES AND BILL OF MATERIALS.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	MORGAN	BURLISON	ADCOCK
0	11/23/10	SIMMONS	GUINN	ELKINS

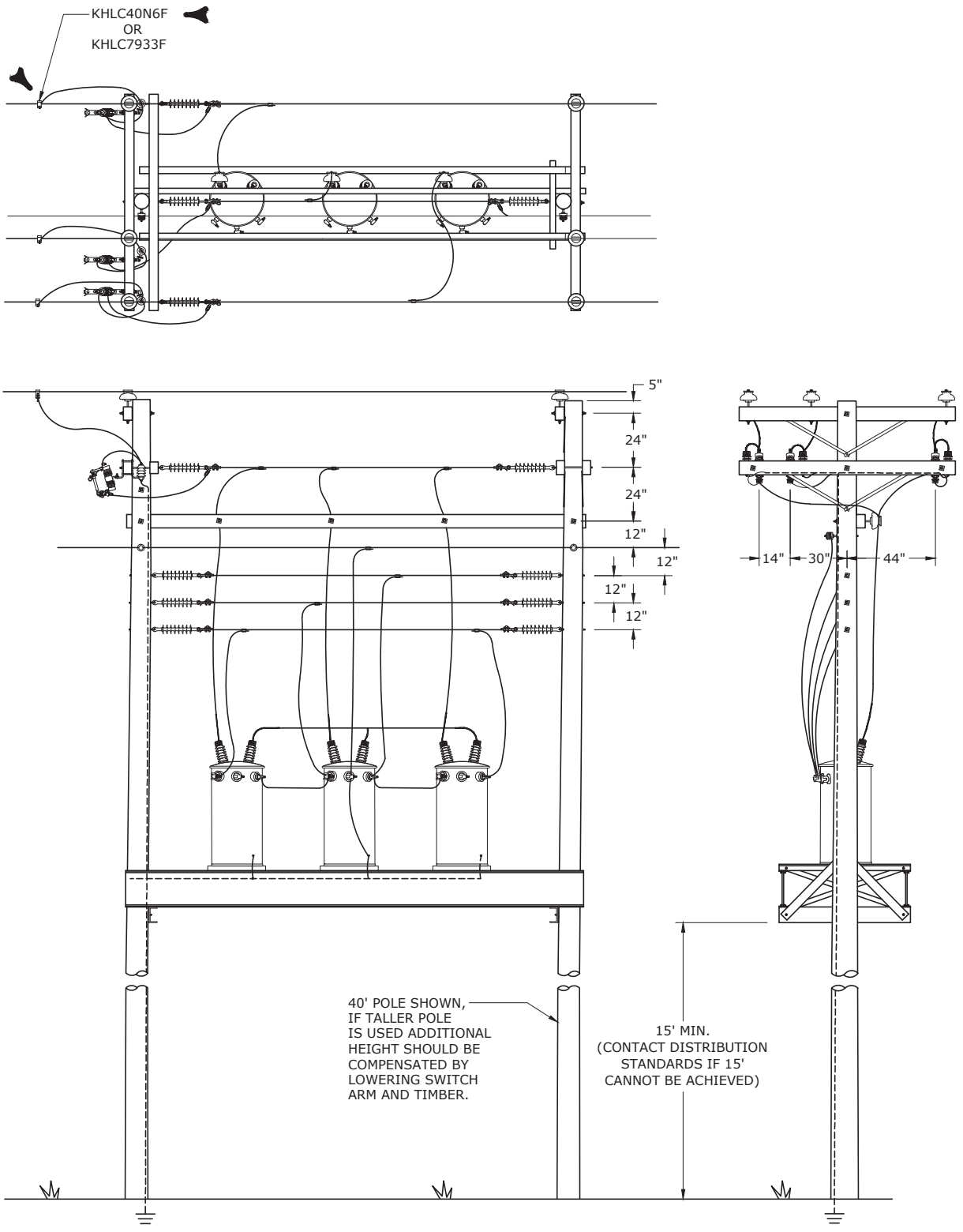
TWO POLE ALUMINUM PLATFORM

16' - HEAVY DUTY

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

06.08-03B



NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PLATFORM MOUNTING OF TRANSFORMERS ALL VOLTAGES

Duke Energy®

FLA

DWG. 06.08-08

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
120 VOLT TWO-WIRE SERVICE

Progress Energy

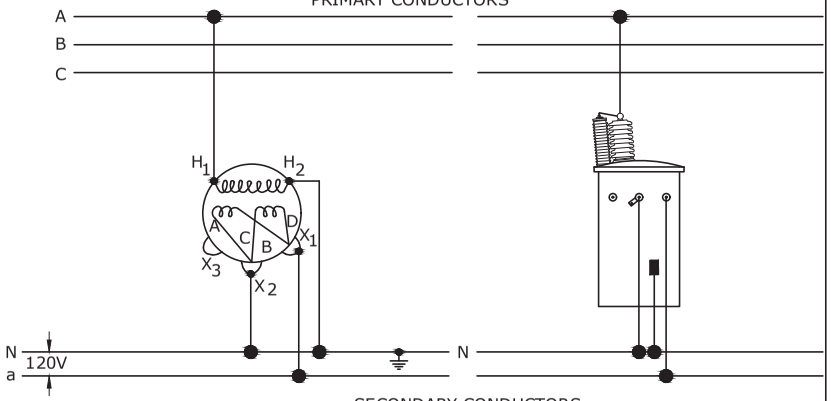
PGN

DWG. 06.10-01

I

12 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

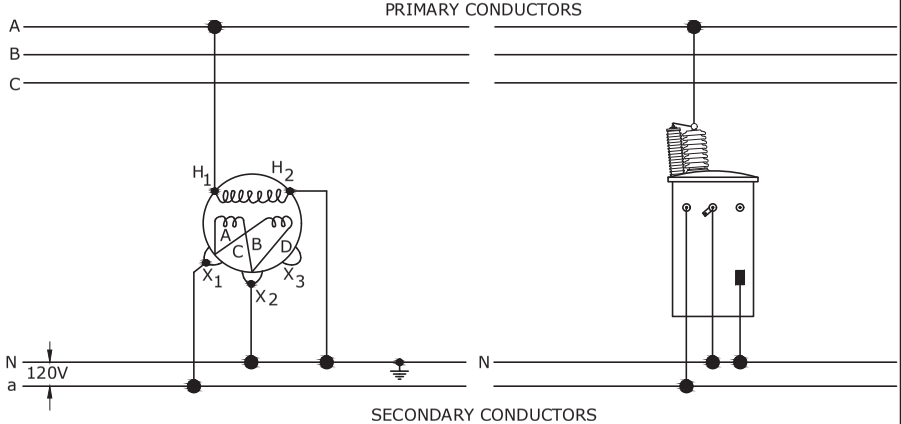
12470 GRD. Y/7200 TO 120/240 VOLT CSP TRANSFORMERS
120 VOLT SINGLE PHASE SERVICE

-ADDITIVE POLARITY-

II

23 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

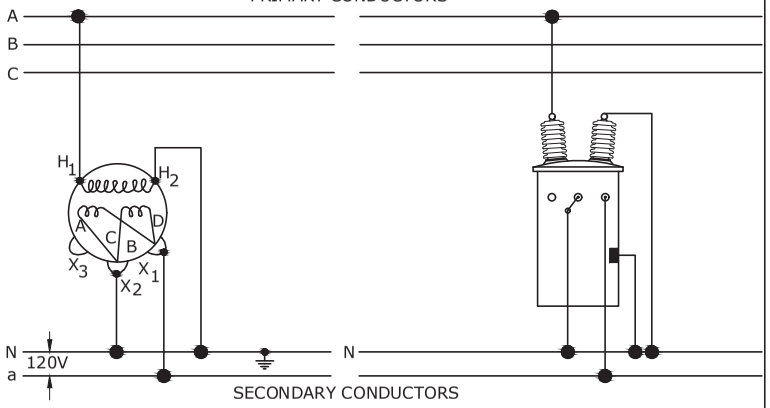
22860 GRD. Y/13200 TO 120/240 VOLT CSP TRANSFORMERS
120 VOLT SINGLE PHASE SERVICE

-SUBTRACTIVE POLARITY-

III

12 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

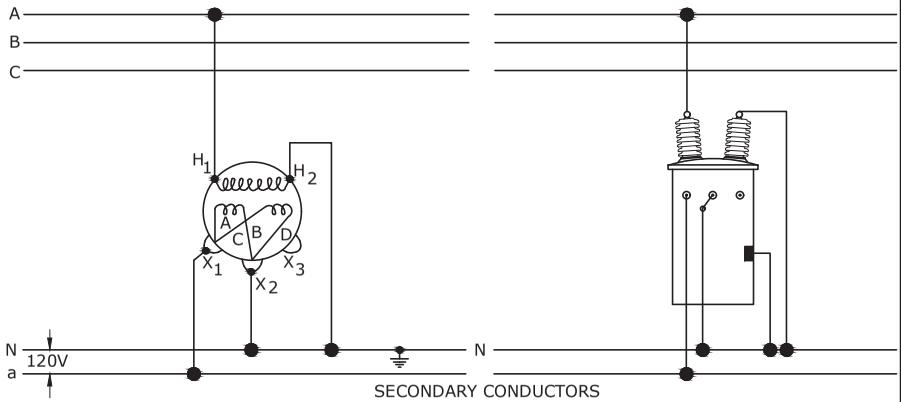
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
120 VOLT SINGLE PHASE SERVICE

-ADDITIVE POLARITY-

IV

23 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

13200/22860Y 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMER
120 VOLT SINGLE PHASE SERVICE

-SUBTRACTIVE POLARITY-

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
120/240 AND 240/480 VOLT SINGLE-PHASE SERVICE

Progress Energy

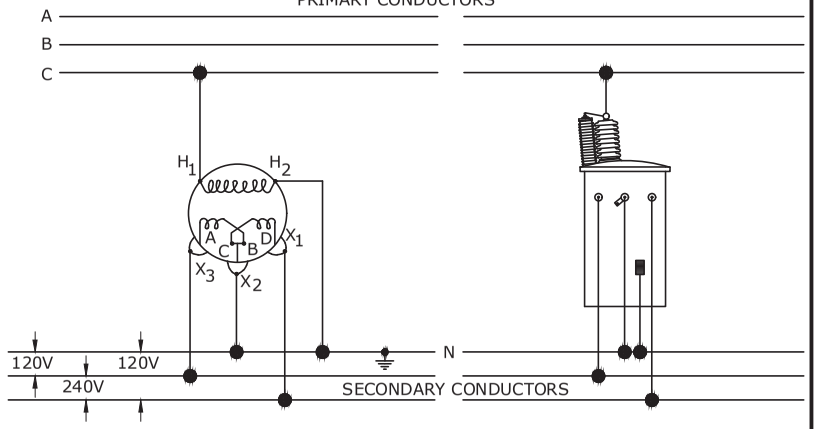
PGN

DWG. 06.10-02

I

12 KV SYSTEM

PRIMARY CONDUCTORS



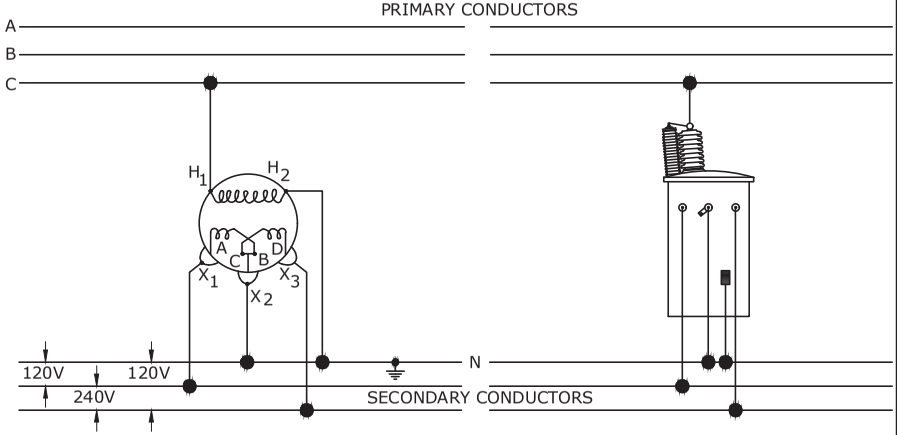
-SINGLE PHASE CONNECTION-

12470 GRD. Y/7200 TO 120/240 VOLT CSP TRANSFORMER
120/240 VOLT SINGLE PHASE SERVICE
-ADDITIVE POLARITY-

II

23 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

22860 GRD. Y/13200 TO 120/240 VOLT CSP TRANSFORMER
120/240 VOLT SINGLE PHASE SERVICE

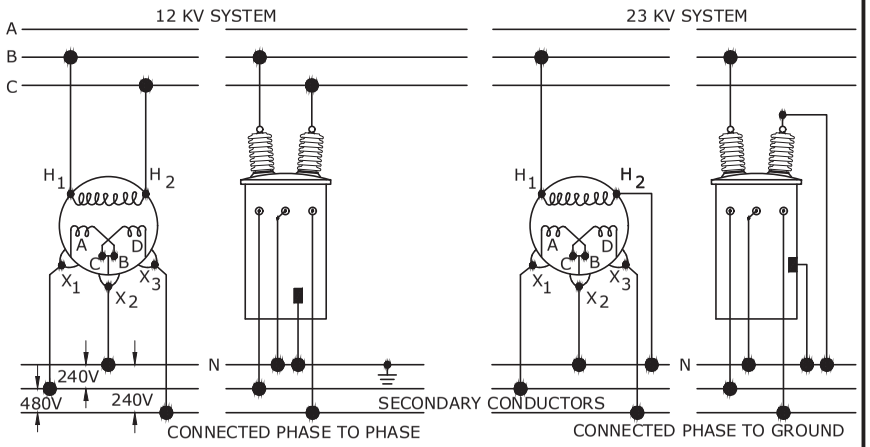
-SUBTRACTIVE POLARITY-

III

PRIMARY CONDUCTORS

12 KV SYSTEM

23 KV SYSTEM



-SINGLE PHASE CONNECTION-

14400/24940Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS
240/480 VOLT SINGLE PHASE SERVICE
-SUBTRACTIVE POLARITY-

IV

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
120/240V 1 PH AND 240/120V 3 PH (OPEN-DELTA) SERVICE

Progress Energy

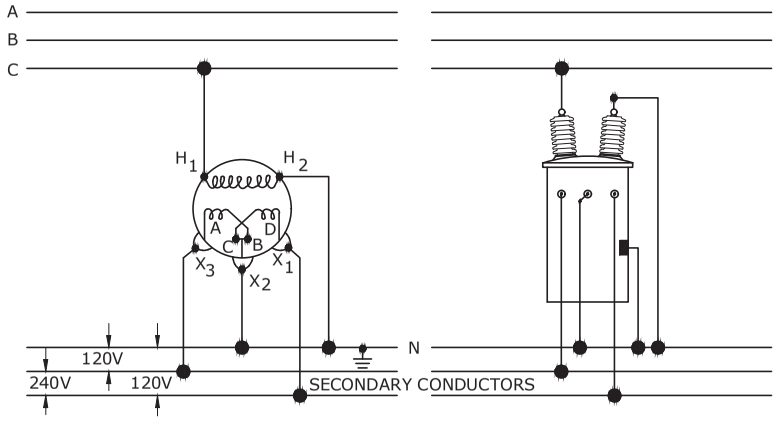
PGN

DWG. 06.10-03

I

12 KV SYSTEM

PRIMARY CONDUCTORS



-SINGLE PHASE CONNECTION-

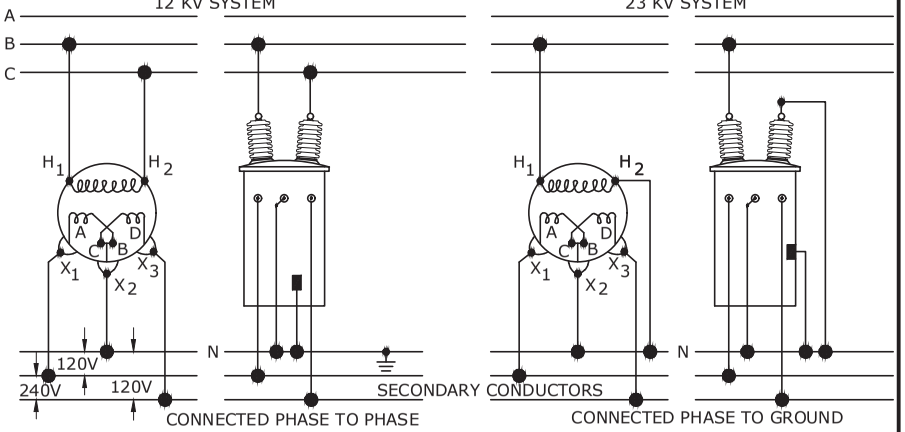
7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
120/240 VOLT SINGLE PHASE SERVICE
-ADDITIVE POLARITY-

II

PRIMARY CONDUCTORS

12 KV SYSTEM

23 KV SYSTEM



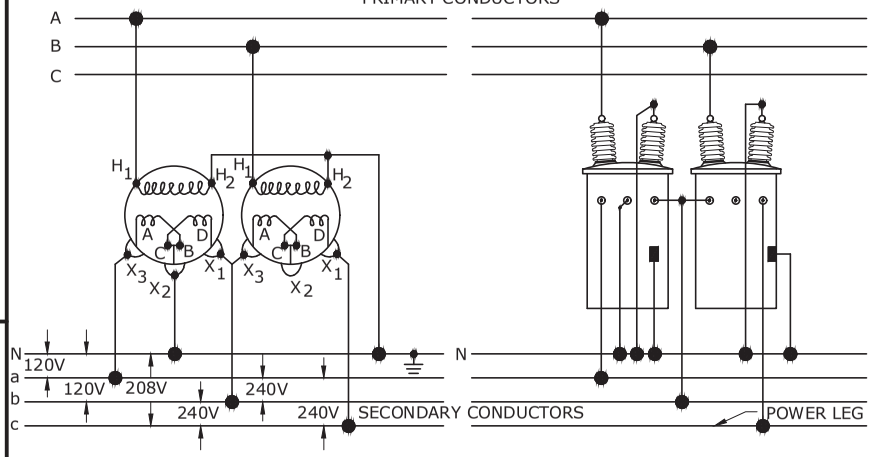
-SINGLE PHASE CONNECTION-

13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
120/240 VOLT SINGLE PHASE SERVICE
-SUBTRACTIVE POLARITY-

III

12 KV SYSTEM

PRIMARY CONDUCTORS



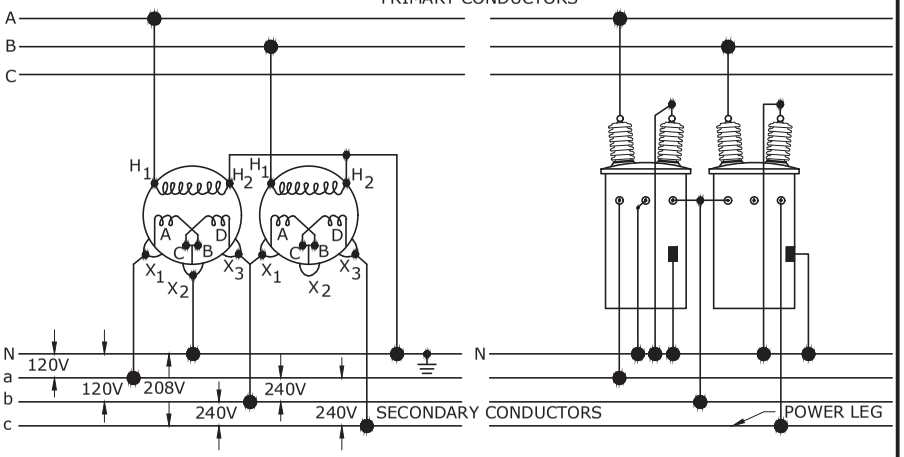
-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-

7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
240/120 VOLT THREE PHASE SERVICE
-ADDITIVE POLARITY-

IV

23 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-

13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
240/120 VOLT THREE PHASE SERVICE
-SUBTRACTIVE POLARITY-

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
240/120 VOLT 3 PHASE (OPEN-DELTA) SERVICE

Progress Energy

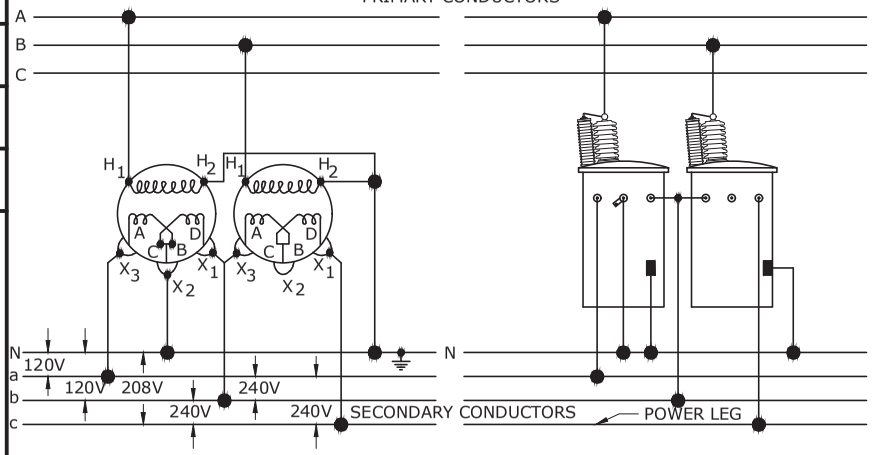
PGN

DWG. 06.10-04

I

12 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-

12470 GRD. Y/7200 TO 120/240 VOLT CSP TRANSFORMER

240/120 VOLT THREE PHASE SERVICE

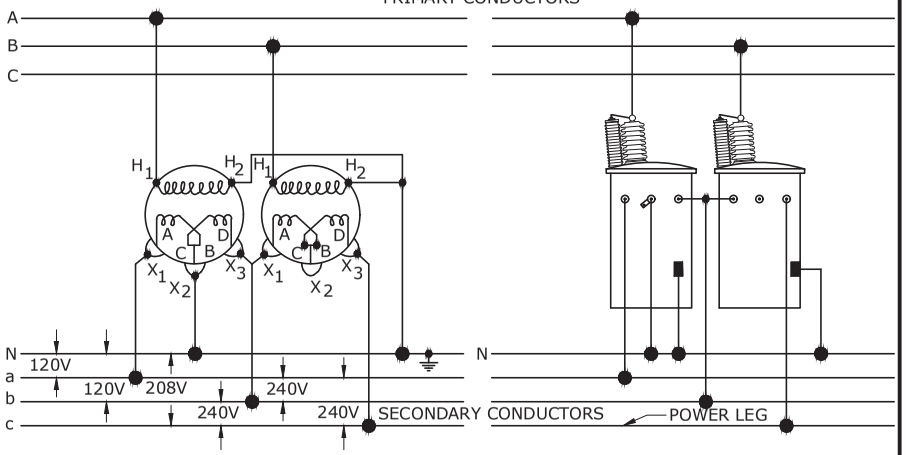
-ADDITIVE POLARITY-

CAUTION: A THIRD TRANSFORMER SHALL NOT BE ADDED TO THIS BANK

II

23 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE OPEN-WYE OPEN-DELTA CONNECTION-

22860 GRD. Y/13200 TO 120/240 VOLT CSP TRANSFORMER

240/120 VOLT THREE PHASE SERVICE

-SUBTRACTIVE POLARITY-

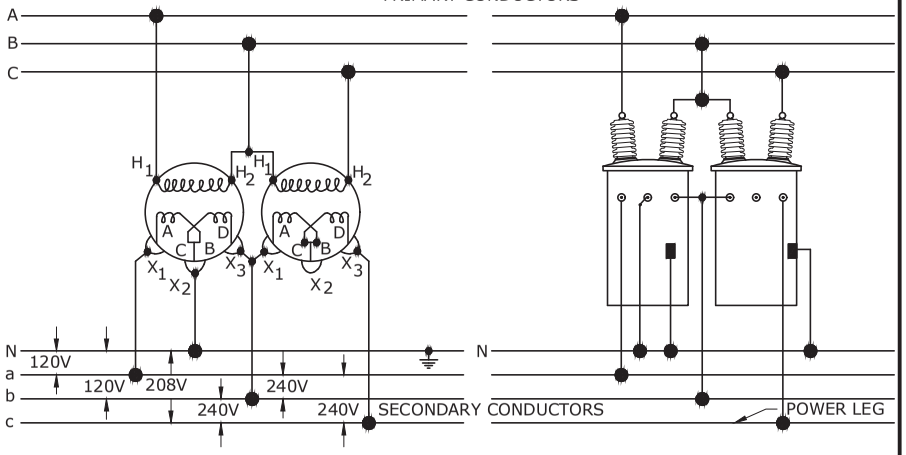
CAUTION: A THIRD TRANSFORMER SHALL NOT BE ADDED TO THIS BANK

III

IV

12 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE OPEN-DELTA OPEN-DELTA CONNECTION-

14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS

240/120 VOLT THREE PHASE SERVICE

-SUBTRACTIVE POLARITY-

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 7/9/10	SIMMONS	GUINN	ELKINS

DISTRIBUTION TRANSFORMER CONNECTIONS
-ADDITIVE AND SUBTRACTIVE POLARITY-
240/120 VOLT THREE-PHASE SERVICE

Progress Energy

PGN

DWG. 06.10-05

REVISED	BY	CK'D	APPR.
3				
2				
1				
0 7/9/10	SIMMONS	GUINN	ELKINS

DISTRIBUTION TRANSFORMER CONNECTIONS - ADDITIVE AND SUBTRACTIVE POLARITY - 240/120 VOLT THREE-PHASE SERVICE

Progress Energy

PGN

DWG. 06.10-06

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
208Y/120 VOLT THREE PHASE SERVICE

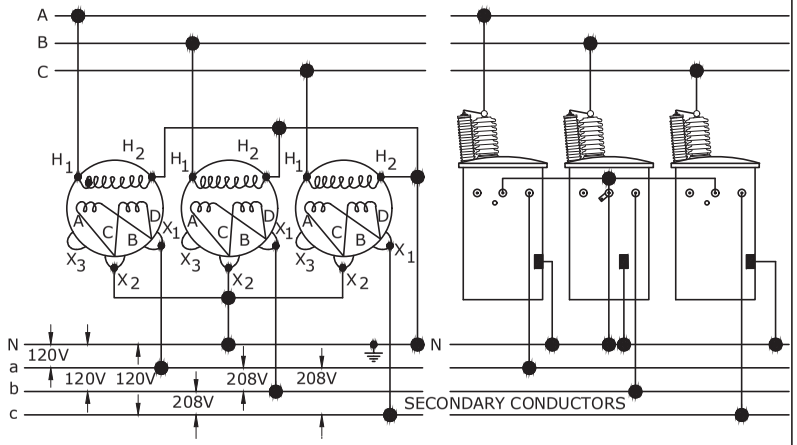
Progress Energy

PGN

DWG. 06.10-07

I

12 KV SYSTEM
PRIMARY CONDUCTORS



-THREE PHASE WYE-WYE CONNECTION-

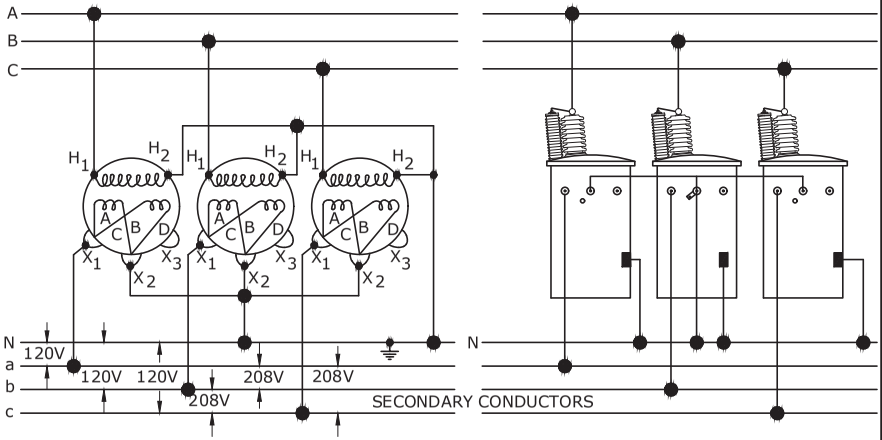
12470 GRD. Y/7200 TO 120/240 VOLT CSP TRANSFORMER
208Y/120 VOLT THREE PHASE SERVICE

-ADDITIVE POLARITY-

NOTE: DUAL VOLTAGE CSP TRANSFORMERS ARE SUBTRACTIVE POLARITY. CONNECT AS SHOWN IN PLATE II.

II

23 KV SYSTEM
PRIMARY CONDUCTORS



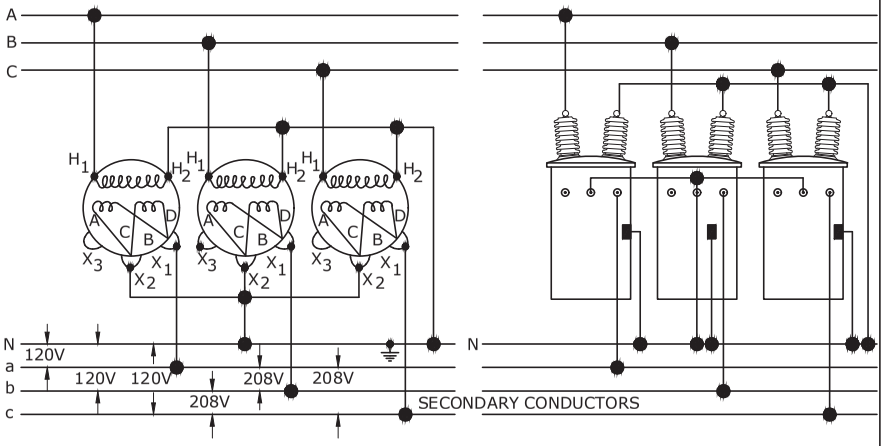
-THREE PHASE WYE-WYE CONNECTION-

22860 GRD. Y/13200 TO 120/240 VOLT CSP TRANSFORMERS
208Y/120 VOLT THREE PHASE SERVICE

-SUBTRACTIVE POLARITY-

III

12 KV SYSTEM
PRIMARY CONDUCTORS



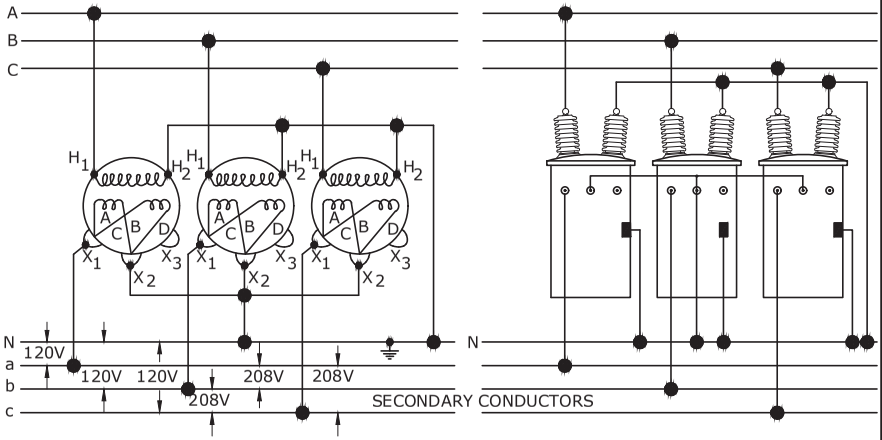
-THREE PHASE WYE-WYE CONNECTION-

7200/12470Y TO 120/240 CONVENTIONAL TRANSFORMERS
208Y/120 VOLT THREE PHASE SERVICE

-ADDITIVE POLARITY-

IV

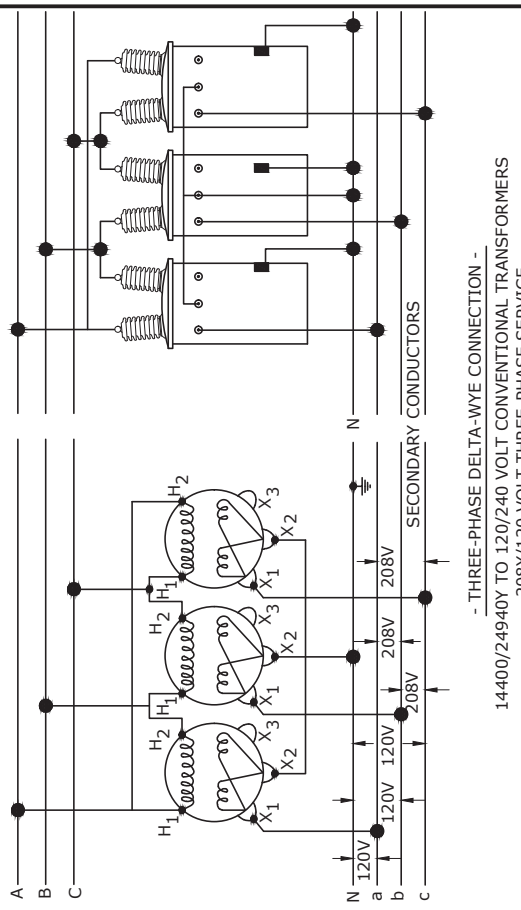
23 KV SYSTEM
PRIMARY CONDUCTORS



-THREE PHASE WYE-WYE CONNECTION-

13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
208Y/120 VOLT THREE PHASE SERVICE

-SUBTRACTIVE POLARITY-



- THREE-PHASE DELTA-WYE CONNECTION -
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS
208Y/120 VOLT THREE-PHASE SERVICE
- SUBTRACTIVE POLARITY -

I II III IV

3				
2				
1				
0	7/9/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
208Y/120 VOLT THREE-PHASE SERVICE

Progress Energy

PGN

DWG. 06.10-08

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS 167 KVA
- ADDITIVE AND SUBTRACTIVE POLARITY -
208Y/120 VOLT THREE-PHASE SERVICE

Progress Energy

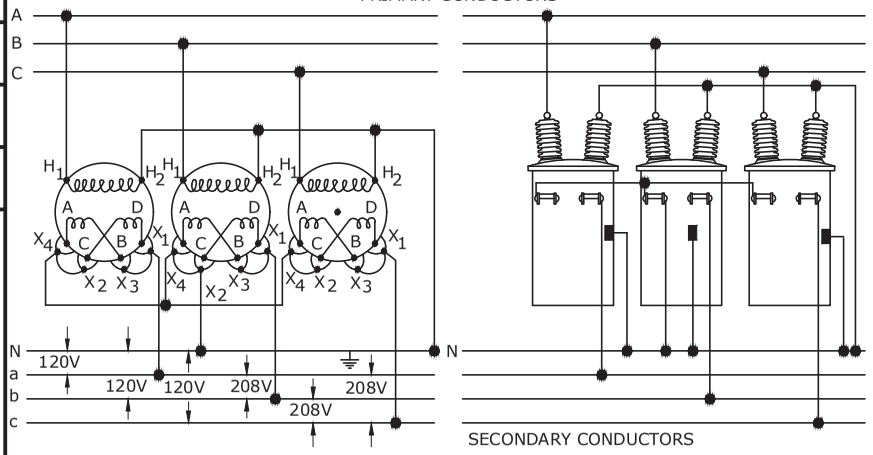
PGN

DWG. 06.10-09

I

12 KV SYSTEM

PRIMARY CONDUCTORS



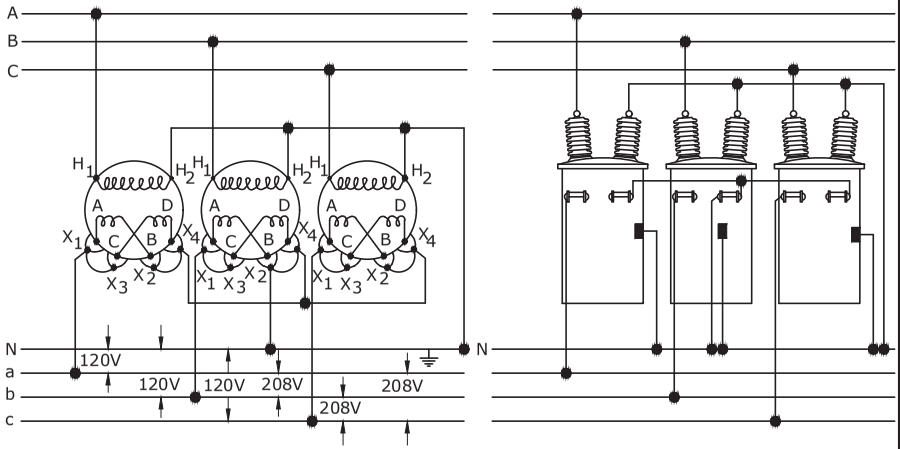
-THREE PHASE WYE-WYE CONNECTION-

7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
208Y/120 VOLT THREE PHASE SERVICE
-ADDITIVE POLARITY-

II

23 KV SYSTEM

PRIMARY CONDUCTORS



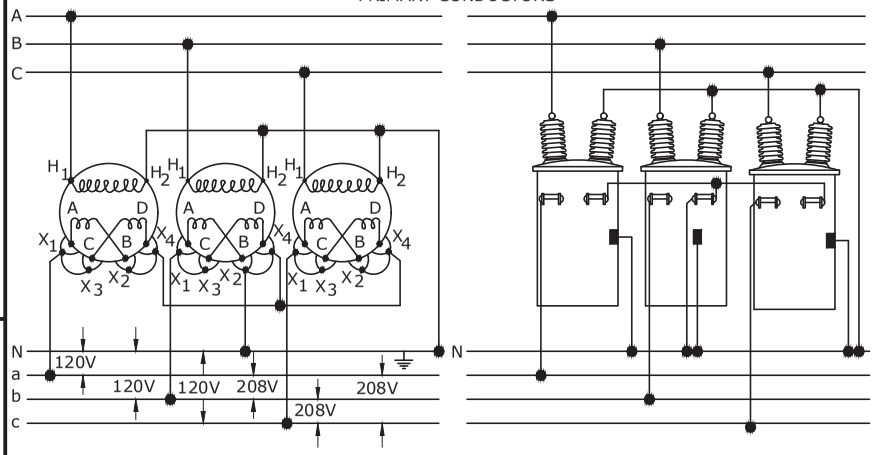
-THREE PHASE WYE-WYE CONNECTION-

13200/22860Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA AND
14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
208Y/120 VOLT THREE PHASE SERVICE
-SUBTRACTIVE POLARITY-

III

12 KV SYSTEM

PRIMARY CONDUCTORS



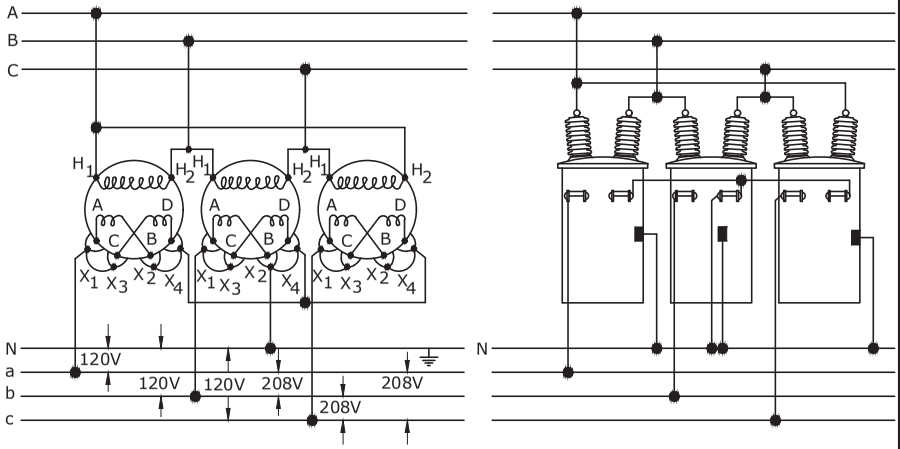
-THREE PHASE WYE-WYE CONNECTION-

7200/12470Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
208Y/120 VOLT THREE PHASE SERVICE
-SUBTRACTIVE POLARITY-

IV

12 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE DELTA-WYE CONNECTION-

14400/24940Y TO 120/240 VOLT CONVENTIONAL TRANSFORMERS 167 KVA
208Y/120 VOLT THREE PHASE SERVICE
-SUBTRACTIVE POLARITY-

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
480/277 THREE-PHASE FOUR-WIRE SERVICES

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1 8/31/11	SIMMONS	BURLISON	ELKINS
2			
3			

Progress Energy

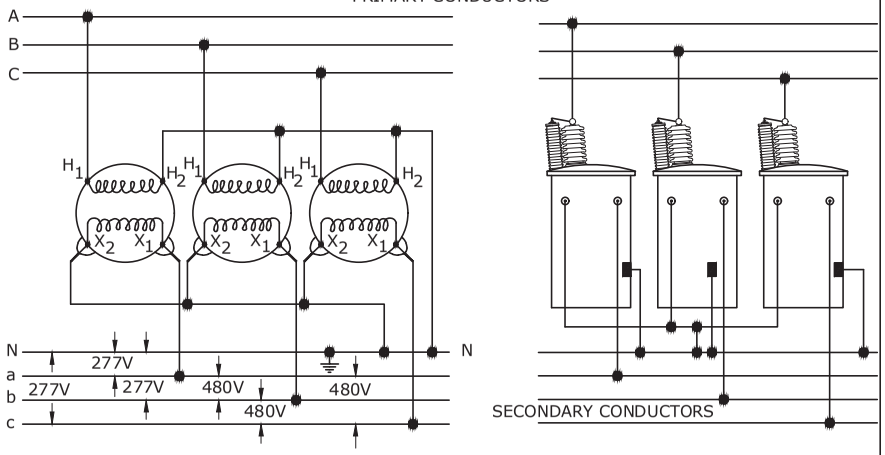
PGN

DWG. 06.10-10

I

12 KV SYSTEM

PRIMARY CONDUCTORS



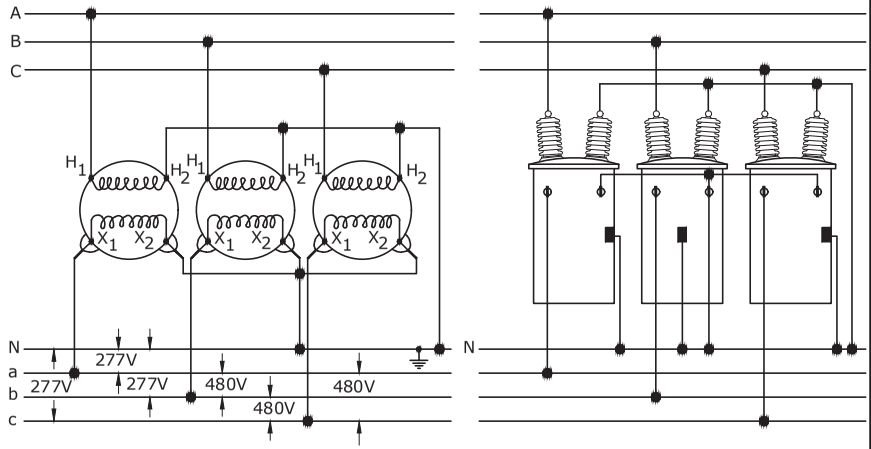
-THREE PHASE WYE-WYE CONNECTION-

12470GRDY/7200 TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-ADDITIVE POLARITY-

II

23 KV SYSTEM

PRIMARY CONDUCTORS



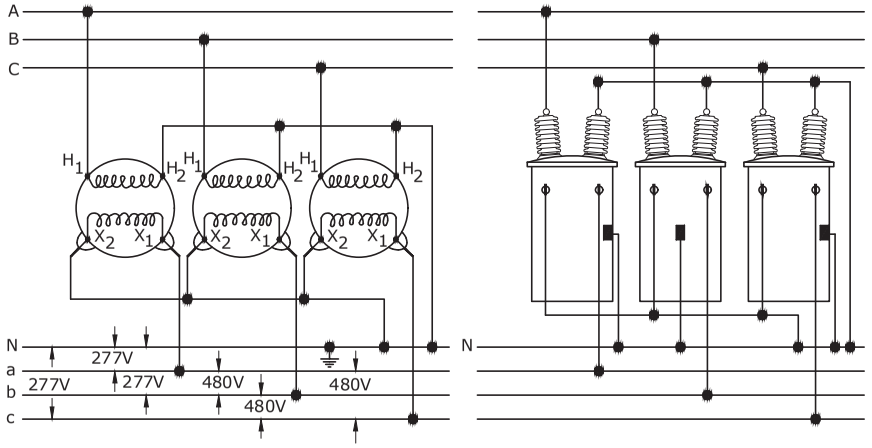
-THREE PHASE WYE-WYE CONNECTION-

13200/22860Y TO 277 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-

III

12 KV SYSTEM

PRIMARY CONDUCTORS



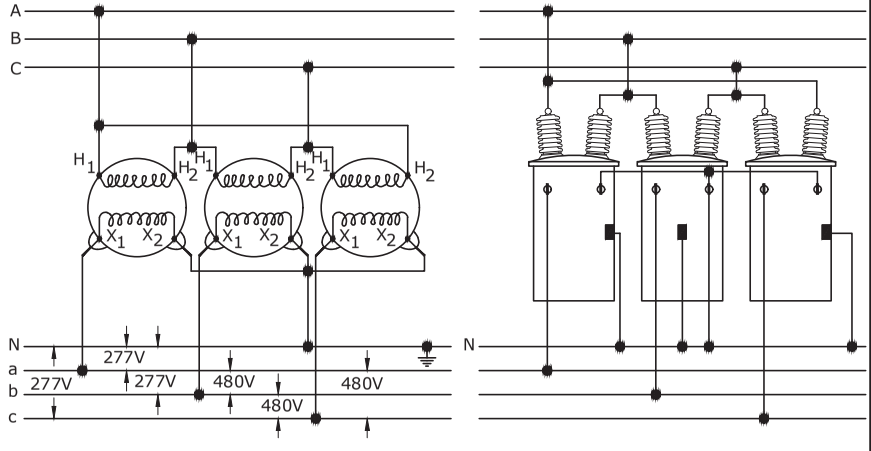
-THREE PHASE WYE-WYE CONNECTION-

7200/12470Y TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-ADDITIVE POLARITY-

IV

12 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE DELTA-WYE CONNECTION-

14400/24940Y TO 277 VOLT CONVENTIONAL TRANSFORMERS
480Y/277 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-

REVISED		BY	CK'D	APPR.
3				
2				
1	12/17/14	SIMMONS	GUINN	ADCOCK
0	7/9/10	SIMMONS	GUINN	ELKINS

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
480 VOLT 3 PHASE 3 WIRE (OPEN-DELTA) SERVICE

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

06.10-11

REVISED	BY	CK'D	APPR.
0 7/9/10	SIMMONS	GUINN	ELKINS
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
480 VOLT THREE-PHASE THREE-WIRE SERVICE

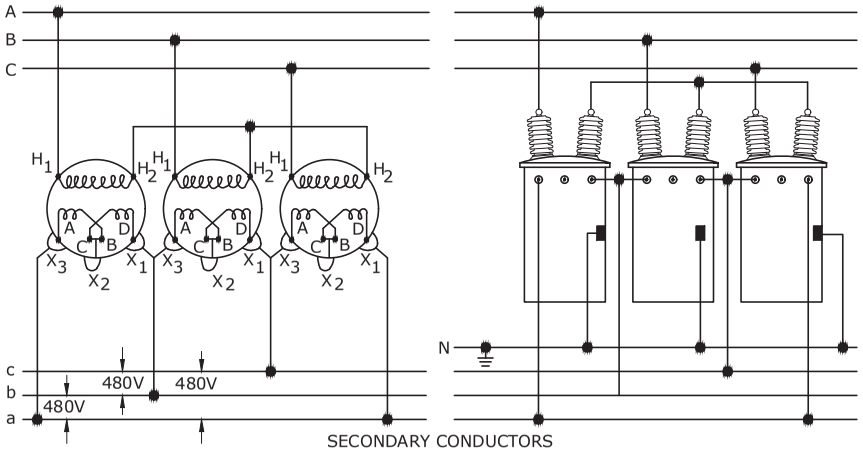
Progress Energy

PGN

DWG. 06.10-12

12 KV SYSTEM

PRIMARY CONDUCTORS



SECONDARY CONDUCTORS

-THREE PHASE WYE-DELTA CONNECTION-

7200/12470Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS
480 VOLT THREE-PHASE THREE-WIRE SERVICE

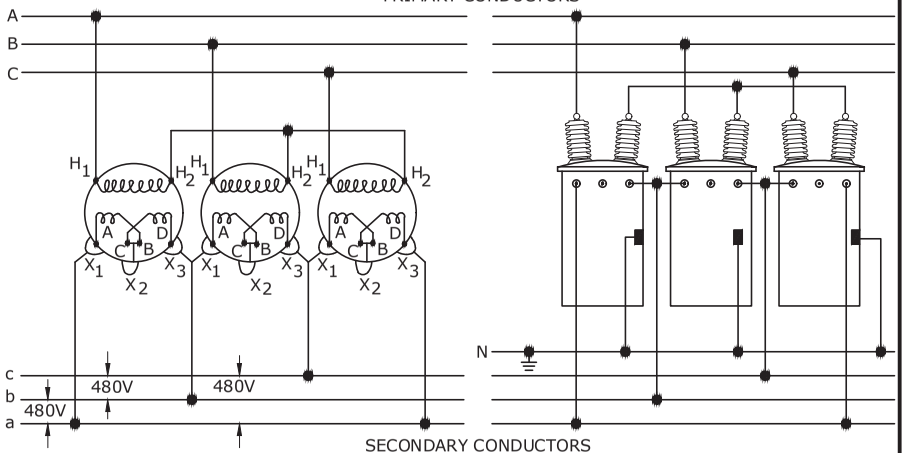
NOTE: DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK

-ADDITIVE POLARITY-

I

23 KV SYSTEM

PRIMARY CONDUCTORS



SECONDARY CONDUCTORS

-THREE PHASE WYE-DELTA CONNECTION-

13200/22860Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 240/480 VOLT CONVENTIONAL TRANSFORMERS
480 VOLT THREE-PHASE THREE-WIRE SERVICE

NOTE: DO NOT GROUND PRIMARY NEUTRAL OF TRANSFORMER BANK

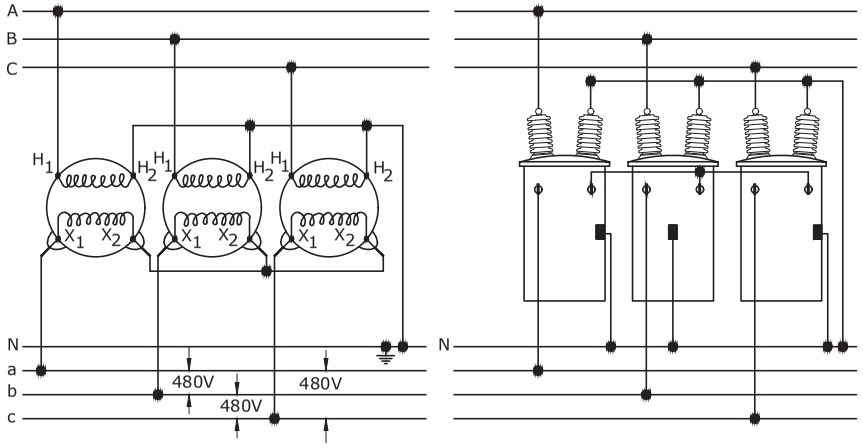
-SUBTRACTIVE POLARITY-

II

23 KV SYSTEM

III

PRIMARY CONDUCTORS



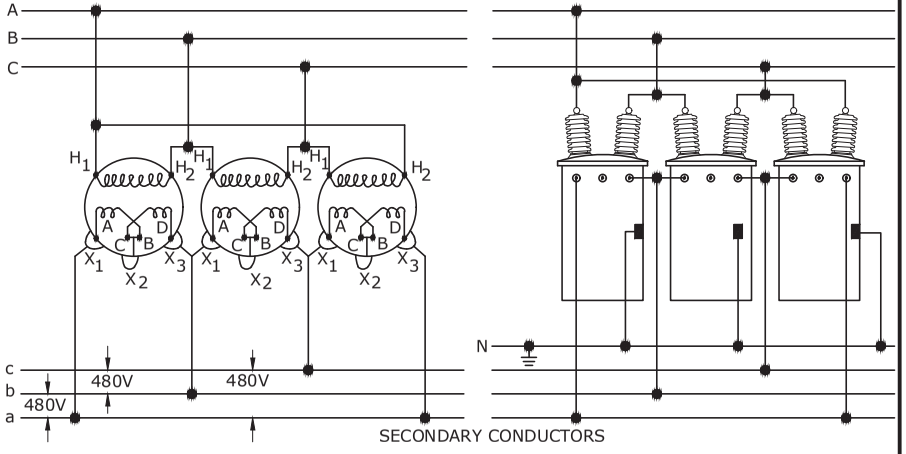
-THREE PHASE WYE FLOATING WYE CONNECTION-

13200/22860Y TO 277 VOLT CONVENTIONAL TRANSFORMERS AND
14400/24940Y TO 277 VOLT CONVENTIONAL TRANSFORMERS
480 VOLT THREE-PHASE THREE-WIRE SERVICE
-SUBTRACTIVE POLARITY-

IV

12 KV SYSTEM

PRIMARY CONDUCTORS

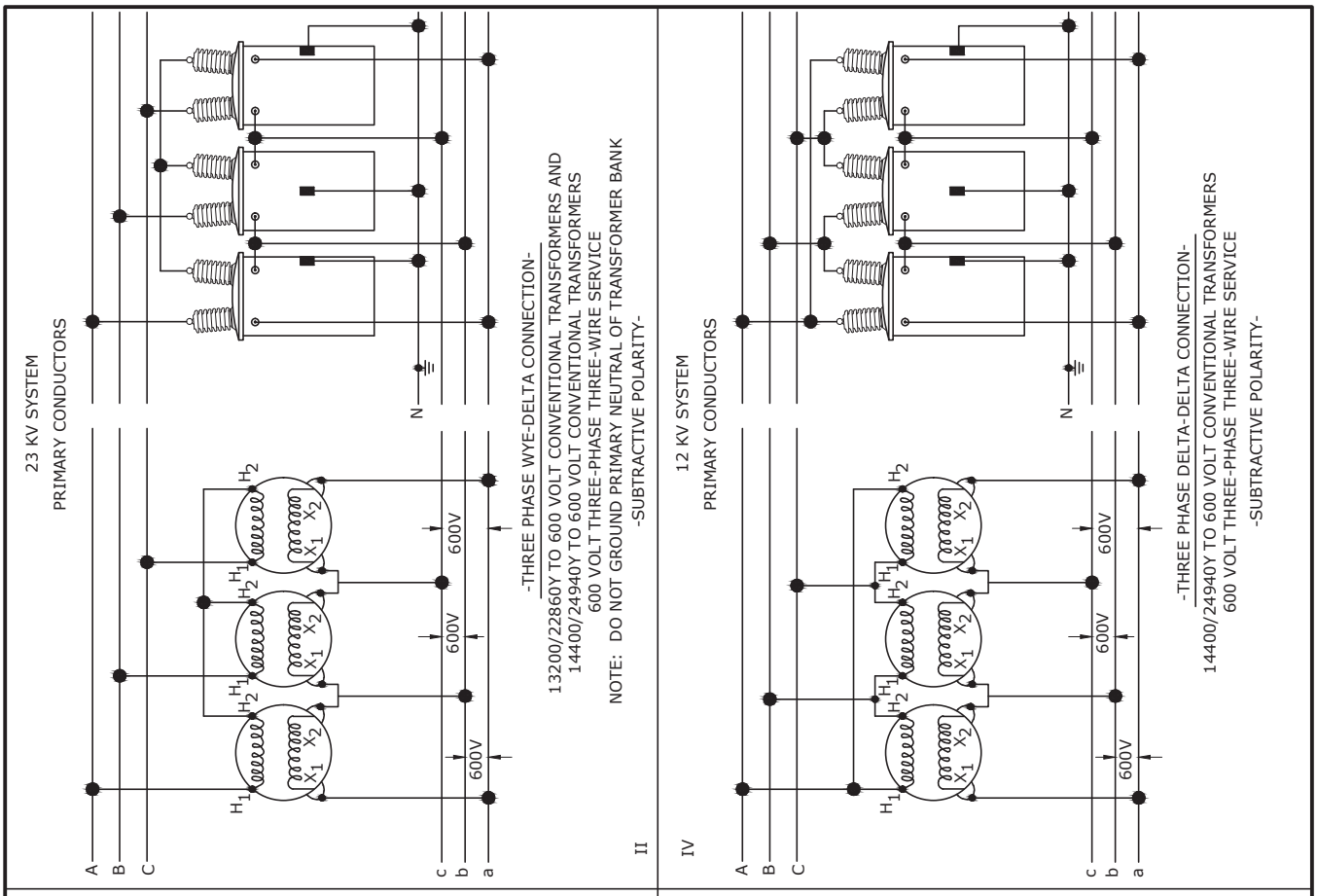


SECONDARY CONDUCTORS

-THREE PHASE DELTA-DELTA CONNECTION-

14400/24940Y 240/480 VOLT CONVENTIONAL TRANSFORMERS
480 VOLT THREE-PHASE THREE WIRE SERVICE

-SUBTRACTIVE POLARITY-



3				
2				
1				
0	7/9/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DISTRIBUTION TRANSFORMER CONNECTIONS
- SUBTRACTIVE POLARITY -
600 VOLT THREE-PHASE THREE WIRE SERVICE

Progress Energy

PGN

DWG.
06.10-13

3				
2				
1				
0	12/17/14	SIMMONS	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
480 VOLT 3 PHASE 4 WIRE (OPEN-DELTA) SERVICE

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

06.10-14

REVISED	BY	CK'D	APPR.
0 10/9/13	SIMMONS	GUINN	ADCOCK
1			
2			
3			

DISTRIBUTION TRANSFORMER CONNECTIONS
- ADDITIVE AND SUBTRACTIVE POLARITY -
4160Y/2400 THREE-PHASE FOUR-WIRE SERVICES

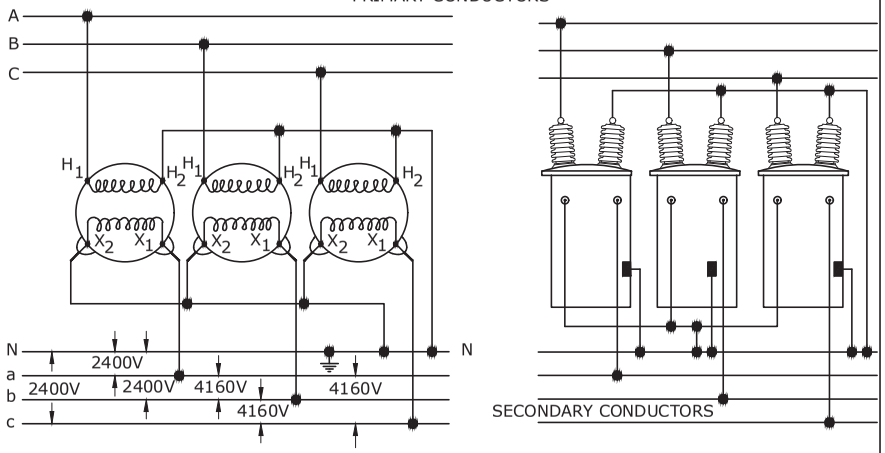
PGN

DUKE ENERGY.

DWG. 06.10-15

12 KV SYSTEM

PRIMARY CONDUCTORS



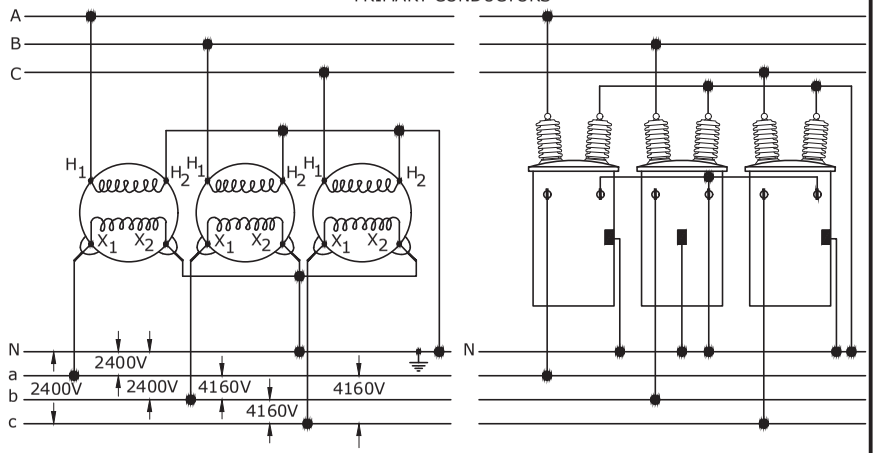
-THREE PHASE WYE-WYE CONNECTION-

7200/12470Y TO 2400/4160Y VOLT CONVENTIONAL TRANSFORMERS
4160Y/2400 VOLT THREE-PHASE FOUR-WIRE SERVICE
-ADDITIVE POLARITY-

I

23 KV SYSTEM

PRIMARY CONDUCTORS



-THREE PHASE WYE-WYE CONNECTION-

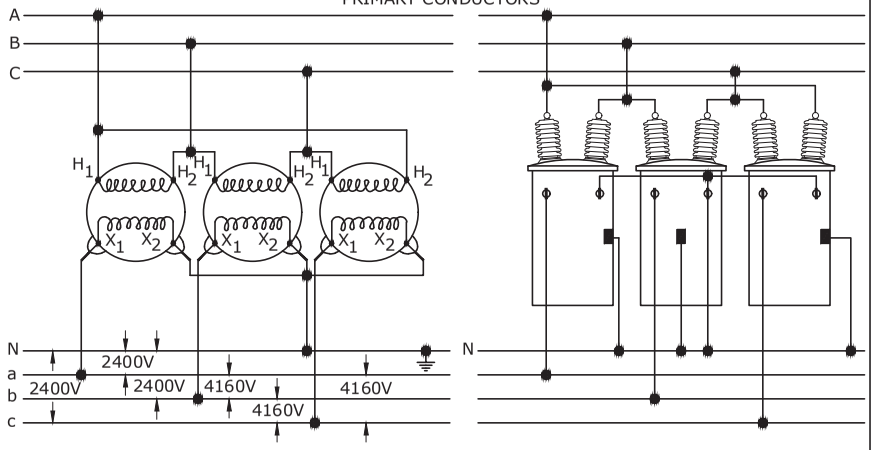
14400/24940Y TO 2400/4160Y VOLT CONVENTIONAL TRANSFORMERS
4160Y/2400 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-

II

12 KV SYSTEM

III

PRIMARY CONDUCTORS



-THREE PHASE DELTA-WYE CONNECTION-

14400/24940Y TO 2400/4160Y VOLT CONVENTIONAL TRANSFORMERS
4160Y/2400 VOLT THREE-PHASE FOUR-WIRE SERVICE
-SUBTRACTIVE POLARITY-

PROGRESS ENERGY

STANDARD PROCEDURES BULLETIN

OPERATING PROCEDURES FOR WYE-DELTA CONNECTED TRANSFORMER BANKS

WHEN ENERGIZING OR DE-ENERGIZING WYE-DELTA TRANSFORMER BANKS, THE BANK ARRESTERS MAY BE TEMPORARILY SUBJECTED TO 2.65 TIMES PHASE TO GROUND VOLTAGE, RESULTING IN ARRESTER FAILURE AND OTHER DAMAGES IF THE BANK IS NOT TEMPORARILY GROUNDED. NEWER, MOV ARRESTERS ARE MORE SUSCEPTIBLE TO THIS TYPE OF FAILURE THAN OLDER, SILICON CARBIDE ARRESTERS.

1. ENERGIZING WYE-DELTA BANK

   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - ENERGIZE THE TRANSFORMER BANK BY CLOSING ALL THREE PRIMARY CUTOUTS.
   - REMOVE TEMPORARY MECHANICAL GROUND OR OPEN THE GROUNDING CUTOUT IF ONE EXISTS.

2. DE-ENERGIZING WYE-DELTA BANK

   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - OPEN ALL PRIMARY CUTOUTS SERVING THE TRANSFORMER BANK.

3. PARTIAL POWER ON WYE-DELTA BANK (1 OR 2 CUTOUTS FOUND OPEN)

   - OPEN REMAINING PRIMARY CUTOUT(S).
   - INSTALL A TEMPORARY MECHANICAL GROUND OR CLOSE THE GROUNDING CUTOUT IF ONE EXISTS, ON THE TRANSFORMER BANK HIGH SIDE (FLOATING) NEUTRAL.
   - VISUALLY INSPECT TRANSFORMER BANK AND DETERMINE CAUSE OF TROUBLE.
   - AFTER TROUBLE HAS BEEN CORRECTED, RE-FUSE ALL PRIMARY CUTOUTS AND RE-ENERGIZE THE TRANSFORMER BANK BY CLOSING ALL THREE PRIMARY CUTOUTS.
   - REMOVE TEMPORARY MECHANICAL GROUND OR OPEN THE GROUNDING CUTOUT IF ONE EXISTS.

NOTES:

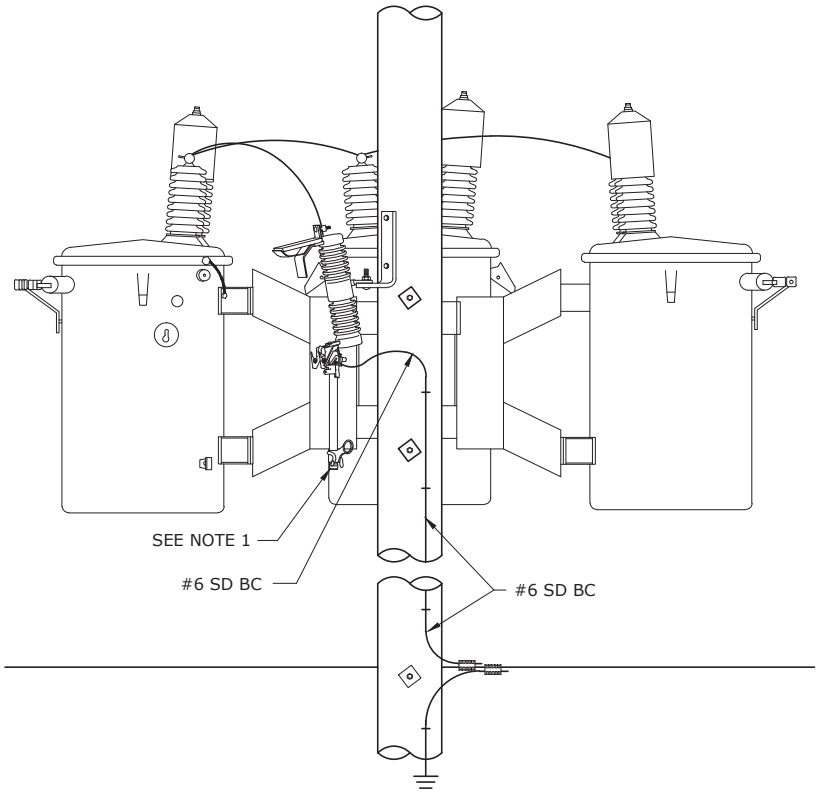
1. TEMPORARY MECHANICAL GROUND WILL NOT SERVE AS A PROTECTIVE GROUND. FOLLOW ALL APPLICABLE COMPANY SAFETY RULES FOR PROTECTIVE GROUNDING.
2. IF GROUNDING CUTOUT EXISTS, IT SHALL BE A 300-AMP SOLID-BLADE CUTOUT.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/27/12	ROBESON	BURLISON	ELKINS
0	7/9/10	SIMMONS	GUINN	ELKINS

WYE-DELTA TRANSFORMER BANKS
OPERATING PROCEDURES
TO PREVENT OVER VOLTAGES

Progress Energy

PGN DWG. 06.15-01A



FRONT VIEW

NOTES:

1. GROUNDING CUTOUT IS 300 AMP SOLID-BLADE.
2. SEE DWG. 06.15-01A FOR THE OPERATING PROCEDURES FOR WYE-DELTA CONNECTED TRANSFORMER BANKS.
3. THE GROUNDING CUTOUT SHALL BE OPEN DURING NORMAL OPERATION.
4. THE GROUNDING CUTOUT SHALL BE CLOSED DURING ENERGIZING OR DE-ENERGIZING A WYE-DELTA BANK.
5. THE GROUNDING CUTOUT WILL NOT SERVE AS A PROTECTIVE GROUND. FOLLOW ALL APPLICABLE COMPANY SAFETY RULES FOR PROTECTIVE GROUNDING.
6. GROUNDING CUTOUT MOUNTING BRACKET IS L-BRACKET (CN 311263).
7. MOUNT GROUNDING CUTOUT BRACKET WITH BOTTOM BOLT 4" ABOVE TOP BOLT OF TRANSFORMER HANGER.
8. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GROUNDING CUTOUT FOR FLOATING WYE-DELTA TRANSFORMER BANKS (POLE-MOUNT)

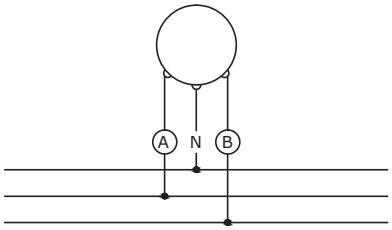
Duke Energy®

FLA

DWG. 06.15-01B

CURRENT CHECK POINTS - (A), (B)
VOLTAGE CHECK POINTS - (A) TO N, (B) TO N

120/240V. OR 240/480V.

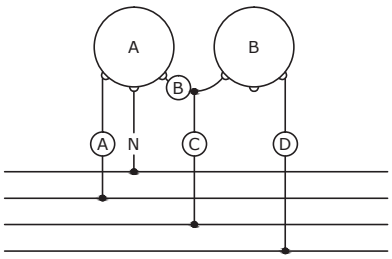


$$KVA = \frac{[\text{CURRENT (A) X VOLTAGE (AN)}] + [\text{CURRENT (B) X VOLTAGE (BN)}]}{1000}$$

SINGLE-PHASE CONNECTION

CURRENT CHECK POINTS - (A), (B), (D)
VOLTAGE CHECK POINTS - (A) TO N, (B) TO N, (C) TO (D)

120/240V. OR 240/480V.



TRANSFORMER A (LIGHTING TRANSFORMER)

$$KVA = \frac{[\text{CURRENT (A) X VOLTAGE (AN)}] + [\text{CURRENT B X VOLTAGE (BN)}]}{1000}$$

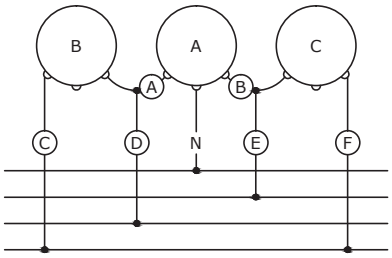
TRANSFORMER B

$$KVA = \frac{[\text{CURRENT (D) X VOLTAGE (CD)}]}{1000}$$

THREE-PHASE OPEN DELTA SECONDARY CONNECTION

CURRENT CHECK POINTS - (A), (B), (C), (F)
VOLTAGE CHECK POINTS - (C) TO (D), (D) TO N, (E) TO N, (E) TO (F)

120/240V.



TRANSFORMER A (LIGHTING TRANSFORMER)

$$KVA = \frac{[\text{CURRENT (A) X VOLTAGE (DN)}] + [\text{CURRENT (B) X VOLTAGE (EN)}]}{1000}$$

TRANSFORMER B

$$KVA = \frac{[\text{CURRENT (C) X VOLTAGE (CD)}]}{1000}$$

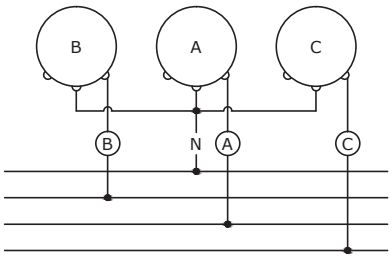
TRANSFORMER C

$$KVA = \frac{[\text{CURRENT (F) X VOLTAGE (EF)}]}{1000}$$

THREE-PHASE DELTA SECONDARY CONNECTION

CURRENT CHECK POINTS - (A), (B), (C)
VOLTAGE CHECK POINTS - (A) TO N, (B) TO N, (C) TO N

208Y/120 OR 480Y/277



ADDITIVE POLARITY

THREE-PHASE WYE SECONDARY CONNECTION

TRANSFORMER A

$$KVA = \frac{[\text{CURRENT (A) X VOLTAGE (AN)}]}{1000}$$

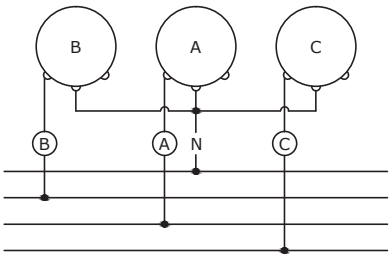
TRANSFORMER B

$$KVA = \frac{[\text{CURRENT (B) X VOLTAGE (BN)}]}{1000}$$

TRANSFORMER C

$$KVA = \frac{[\text{CURRENT (C) X VOLTAGE (CN)}]}{1000}$$

208Y/120 OR 480Y/277



SUBTRACTIVE POLARITY

THREE-PHASE WYE SECONDARY CONNECTION

NOTE: TRANSFORMERS USED IN A 480Y/277 BANK WILL HAVE 2 BUSHINGS INSTEAD OF 3 AS SHOWN ABOVE

3				
2				
1				
0	7/9/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

TRANSFORMER LOAD & VOLTAGE CHECKS

Progress Energy

PGN

DWG. 06.15-04

PROGRESS ENERGY STANDARD PROCEDURES BULLETIN

IDLE TRANSFORMERS

DEFINITION:

AN IDLE TRANSFORMER IS A TRANSFORMER THAT IS INSTALLED ON THE DISTRIBUTION SYSTEM BUT IS SERVING NO USEFUL PURPOSE. THERE IS NO CUSTOMER BEING SERVED, NO LIGHTS, NO TRAFFIC SIGNALS. THERE IS ALSO NO REASONABLE POTENTIAL FOR SERVING A CUSTOMER IN THE FUTURE. A TRANSFORMER INSTALLED IN A NEW UNDERGROUND DEVELOPMENT THAT IS SERVING NO CUSTOMERS BUT WILL IN THE FUTURE IS NOT CONSIDERED IDLE BECAUSE IT WILL BE SERVING CUSTOMERS IN THE NEAR FUTURE.

EXAMPLES ARE AS FOLLOWS:

1. A TRANSFORMER THAT WAS USED FOR TEMPORARY CONSTRUCTION SERVICE IS IDLE AFTER THE CONSTRUCTION IS COMPLETED AND THE TRANSFORMER IS NO LONGER NEEDED FOR CONSTRUCTION SERVICE.

2. A TRANSFORMER THAT SERVED A RESIDENTIAL CUSTOMER IS IDLE IF THE HOME IS NO LONGER OCCUPIED AND THERE IS NO PROSPECT OF SERVING A CUSTOMER AT THE SAME LOCATION.

3. A TRANSFORMER BANK THAT SERVED A COMMERCIAL/INDUSTRIAL CUSTOMER IS IDLE IF THE CUSTOMER IS NO LONGER IN BUSINESS AND THE TRANSFORMER BANK IS NOT NEEDED FOR A POTENTIAL NEW CUSTOMER AT THE SAME LOCATION.

ISSUES WITH IDLE TRANSFORMERS:

THERE ARE SEVERAL REASONS WHY IDLE TRANSFORMERS SHOULD BE REMOVED FROM THE SYSTEM. ONE THAT IS LEFT ENERGIZED EXPERIENCES "NO-LOAD" CORE LOSSES EVEN WHEN IDLE. THESE ARE ANNUAL LOSSES. A 25 KVA TRANSFORMER IS ESTIMATED TO HAVE $35 OF ANNUAL CORE LOSSES. A 167 KVA TRANSFORMER IS ESTIMATED TO HAVE $200 OF ANNUAL CORE LOSSES. A TRANSFORMER THAT THAT IS IDLE IS A POTENTIAL FOR VANDALISM, RESULTING IN AN ENVIRONMENTAL ISSUE, AN OIL SPILL. THERE HAVE BEEN A NUMBER OF SPILLS DUE TO VANDALISM OF IDLE TRANSFORMERS AND SOME OF THESE REQUIRED SIGNIFICANT COSTS FOR CLEANUP.

A TRANSFORMER THAT IS IDLE IS A POTENTIAL HAZARD FOR CRIMINALS WHO WOULD ATTEMPT TO VANDALIZE THE UNITS TO STEAL COPPER. THEY WILL TAKE EXTRAORDINARY RISKS WITH NO REGARD FOR THEIR OWN SAFETY OR PROPERTY OF OTHERS.

TRANSFORMER COSTS HAVE INCREASED SUBSTANTIALLY SINCE 2004 DUE TO THE RISING COSTS OF RAW MATERIALS: COPPER, CORE STEEL, MINERAL OIL. COSTS WILL INCREASE AGAIN SIGNIFICANTLY IN JANUARY, 2010 AS NEW DEPARTMENT OF ENERGY (DOE) EFFICIENCY REQUIREMENTS ARE IMPLEMENTED. IT IS A SIGNIFICANT FINANCIAL BENEFIT TO THE COMPANY TO REMOVE AND RE-USE IDLE TRANSFORMERS VERSUS BUYING NEW ONES AT SIGNIFICANTLY HIGHER PRICES. ONES THAT HAVE BEEN REMOVED AND RE-USED DO NOT HAVE TO MEET THE MORE STRINGENT EFFICIENCY REQUIREMENTS OF DOE.

PROCEDURE:

ANY TRANSFORMER THAT IS IDLE BUT LEFT ON THE POLE SHALL BE DE-ENERGIZED TO SAVE ANNUAL CORE LOSSES. TRANSFORMERS WITH NO CUTOUTS (CSP) SHALL HAVE THE HOT LINE CLAMP REMOVED FROM THE PRIMARY AND GROUNDED TO THE SYSTEM NEUTRAL. TRANSFORMERS WITH CUTOUTS MAY BE DE-ENERGIZED BY OPENING THE CUTOUT AND REMOVING THE CUTOUT BARREL.

WHEN A TRANSFORMER HAS BEEN DE-ENERGIZED, ASSET ENGINEERING SHALL BE NOTIFIED. ASSET ENGINEERING WILL EVALUATE AND DETERMINE IF THE TRANSFORMER SHOULD BE REMOVED AND IF SO, PREPARE A WORK ORDER TO REMOVE. ASSOCIATED EQUIPMENT (CUTOUTS, ARRESTERS, SERVICE CONDUCTORS, ETC.) SHOULD BE REMOVED AT THE SAME TIME THE TRANSFORMER IS REMOVED.

FOR TRANSFORMER BANKS SERVING COMMERCIAL OR INDUSTRIAL CUSTOMERS, CONTACT WITH ACCOUNT MANAGERS WILL BE REQUIRED TO DETERMINE IF THERE IS POTENTIAL FOR FUTURE CUSTOMERS OCCUPYING A VACANT FACILITY.

TRANSFORMERS THAT HAVE BEEN REMOVED SHALL BE PLACED IN STOCK AT THE LOCAL STOREROOM, IF THE IF THE TRANSFORMER IS IN GOOD CONDITION AND IS NON-PCB. IF NOT IN GOOD CONDITION, OR THE PCB CONTENT IS UNKNOWN, THE TRANSFORMER SHALL BE RETURNED TO THE WILDWOOD TRANSFORMER SHOP WHERE IT WILL BE EVALUATED, REPAIRED, REPAINTED AND RETURNED TO STOCK, IF POSSIBLE.

3				
2				
1				
0	11/23/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

IDLE TRANSFORMERS

Duke Energy®

FLA

DWG. 06.15-05

DUKE ENERGY.

3				
2	8/18/14	KATIGBAK	DANNA	ADCOCK
1	6/21/13	KATIGBAK	DANNA	ADCOCK
0	11/24/10	CECCONI	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SECTION 7 - CAPACITORS AND REGULATORS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE

GENERAL

CAPACITORS ARE A VITAL PART OF THE DUKE ENERGY SYSTEM. CAPACITORS PERFORM THE DUAL JOB OF MAINTAINING THE SYSTEM VOLTAGE LEVEL AND INCREASING SYSTEM EFFICIENCY. TO ENSURE THAT CAPACITORS PERFORM PROPERLY, THE GUIDELINES OUTLINED IN THESE STANDARDS SHOULD BE CAREFULLY READ AND FOLLOWED.

CAPACITORS ARE GENERALLY INSTALLED IN THREE-PHASE BANK CONFIGURATIONS WITH THE SIZE EXPRESSED IN kVAR. THERE ARE TWO TYPES OF CAPACITOR BANKS; FIXED AND SWITCHED. FIXED BANKS ARE USED WHEN kVAR IS NEEDED 24 HOURS PER DAY. THEY CAN BE MANUALLY ENERGIZED AND DE-ENERGIZED SEASONALLY AS SYSTEM REQUIREMENTS DICTATE. SWITCHED BANKS ARE ELECTRONICALLY CONTROLLED AND AUTOMATICALLY COME ON AND GO OFF.

INSPECTION

1. CHECK THE NAMEPLATE FOR SIZE, RATED VOLTAGE AND TYPE OF CAPACITOR TO COMPLY WITH JOB REQUIREMENTS.

2. ALL CAPACITORS SHALL BE SHORTED OUT WHILE NOT INSTALLED. ATTACH WIRE JUMPERS FROM BUSHING TO BUSHING AND THEN TO TANK GROUND. THIS SHALL BE DONE TO ALL UNITS WHEN BROUGHT IN FROM THE FIELD.

3. MAKE A VISUAL INSPECTION OF THE CAPACITOR. DO NOT INSTALL A CAPACITOR WITH ANY OF THE FOLLOWING:

   A. BROKEN INSULATORS.
   B. BULGED TANK (A SIGN OF A DEFECTIVE CAPACITOR).
   C. DEFECTIVE WELDS, BENT HANGERS, LOOSE BUSHINGS.
   D. OIL LEAKS (FOLLOW APPROPRIATE OILS DISPOSAL GUIDELINES).

TESTING - CAPACITOR METER

1. USE A DUKE ISSUED FLUKE METER CAPABLE OF MEASURING CAPACITANCE OR A B&K PRECISION METER MODEL 830C.

2. WHEN TESTING CAPACITORS IN THE FIELD, CARE SHALL BE TAKEN TO INSURE THAT THE CAPACITOR IS PROPERLY DE-ENERGIZED AND GROUNDED BEFORE ATTEMPTING TO TAKE MEASUREMENTS.

3. REMOVE THE SHORTING JUMPER FROM THE CAPACITOR.

4. FOLLOW METER MANUFACTURER'S INSTRUCTIONS FOR PROPERLY TAKING CAPACITANCE MEASUREMENTS.

5. OBTAIN MEASUREMENT.

SINGLE-PHASE UNITS (TWO BUSHINGS)

   A. CONNECT THE C-METER LEADS FROM BUSHING CONNECTOR TO BUSHING CONNECTOR.
   B. IF THE C-METER DISPLAYS A NEGATIVE VALUE, REVERSE THE LEADS AND REPEAT TEST.

PHASE TEST

FOR CAPACITOR BANKS WITH MORE THAN ONE UNIT PER PHASE, THE MEASUREMENT MAY BE TAKEN ACROSS THE PARALLELED UNITS. THE VALUE MEASURED MUST FALL WITHIN THE LIMITS FOR THE PARALLELED UNITS (SUM OF THE KVAR FOR EACH UNIT IN THE PHASE). IF THE READING FALLS OUTSIDE THE ACCEPTED VALUE, DISCONNECT THE PARALLELED CAPACITOR UNITS AND TEST EACH INDIVIDUALLY TO DETERMINE WHICH UNITS PASS OR FAIL.

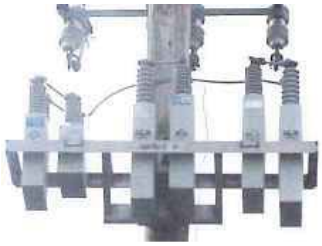
6. COMPARE THE MEASURED VALUE TO THOSE IN THE TABLE OF ACCEPTABLE CAPACITANCE VALUES ON DWG. 07.00-35.

7. RETURN THE SHORTING JUMPER TO ANY UNIT THAT IS GOING TO BE BROUGHT IN FROM THE FIELD.

MOUNTING

CAPACITORS ARE HEAVY AND NOT EASY TO HANDLE. MANY INDIVIDUAL UNITS DO NOT HAVE LIFTING EYES. CAPACITORS SHOULD NOT BE LIFTED OR MOVED BY THE BUSHINGS.

1. CAPACITORS ARE MANUFACTURED WITH A STANDARD DISTANCE BETWEEN MOUNTINGS. THIS WAY, THEY ARE INTERCHANGEABLE AND FIT IN STANDARD RACKS. HOWEVER, THE HEIGHT AND WIDTH MAY VARY FROM MANUFACTURER TO MANUFACTURER. THIS MAY BE EVIDENT WHEN REPLACING DAMAGED OR DEFECTIVE CANS AS SHOWN IN THE FOLLOWING PICTURE.



INSTALLATION

1. CAPACITOR MOUNTING FRAMES (RACKS) ARE TO BE GROUNDED.

2. USE #6 WP SOLID COPPER WIRE FROM THE CAPACITOR BANK TO THE CUTOUT AND FROM THE CUTOUT TO THE HOTLINE CLAMP. #6 WP COPPER SHALL ALSO BE USED BETWEEN CAPACITOR UNITS TO REDUCE POTENTIAL FOR OUTAGES DUE TO ANIMALS.

3. A 10KV ARRESTER SHALL BE MOUNTED ON THE CAPACITOR RACK ON THE SOURCE SIDE OF THE OIL SWITCH. THESE COME PRE-INSTALLED ON NEW BANKS.

4. ON SWITCHED BANKS, LOCATE THE POLE GROUND DOWN LEAD AS FAR AWAY FROM THE CAPACITOR CONTROL CABLE AS POSSIBLE TO REDUCE POTENTIAL DAMAGE TO THE CONTROL IF A LIGHTNING STRIKE IS DISCHARGED THROUGH THE GROUND.

5. ON SWITCHED BANKS INSTALLED ON VERTICAL CONSTRUCTION, THE 1KVA CONTROL TRANSFORMER SHOULD BE CONNECTED TO CØ (THE LOWEST PHASE CONDUCTOR) TO MINIMIZE THE POTENTIAL FOR LIGHTNING DAMAGE.

6. ON SWITCHED BANKS, NEITHER CONDUCTOR OF THE 120-VOLT SOURCE IS TO BE GROUNDED AT THE CONTROL BOX OR JUNCTION BOX.

7. ON SWITCHED BANKS THE CONTROL BOX SHALL BE CONNECTED TO THE POLE GROUND.

8. ON SWITCHED BANK CONTROLS, INSTALL A 175-VOLT ARRESTER TO REDUCE THE POTENTIAL FOR DAMAGE FROM LIGHTNING.

9. CAPACITOR BANKS SHALL BE INSTALLED ON THE LINE SIDE OF ANY ASSOCIATED PRIMARY METER INSTALLATION.

FUSING

CAPACITOR FUSING SCHEDULE FOR 12.47 KV GROUNDED Y BANKS IS AS FOLLOWS:

KVAR CONNECTED PER PHASE	FUSE SIZE
200	40K
400	65K

APPLICATION BASED ON AVAILABLE CURRENT:

1. CAPACITOR UNITS SHALL NOT BE INSTALLED IN AREAS WHERE THE AVAILABLE PHASE TO GROUND CURRENT EXCEEDS 6000 AMPS PHASE TO GROUND.

2. CONSULT DISTRIBUTION STANDARDS IF AN INSTALLATION NEEDS TO BE MADE WHERE FAULT CURRENT EXCEEDS 6000 AMPS PHASE TO GROUND.

3. SYSTEM ENGINEERING SHOULD BE CONSULTED REGARDING CAPACITOR BANK FUSING IF CAPACITOR BANK IS INSTALLED BEYOND SINGLE-PHASE RECLOSERS RATED LESS THAN 100 AMPS CONTINUOUS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
4	1/8/16	BRAVO	BURLISON	ADCOCK
3	8/9/13	DANNA	DANNA	ADCOCK
2	3/15/13	MCCONNELL	DANNA	ADCOCK
0	9/7/10	SIMMONS	GUINN	ELKINS

CAPACITORS

DEC	DEM	DEP	DEF
			X

07.00-20

ENERGIZING

NOTE: DO NOT ENERGIZE CAPACITOR WITH RIGHT-OF-WAY ON THE FEEDER.

FIXED CAPACITORS

1. CHECK TO SEE THAT THE BANK IS INSTALLED TO THESE OVERHEAD DISTRIBUTION SPECIFICATIONS.
2. CLOSE IN THE CUTOUTS WITH AN EXTENDO STICK OR AN 8-FOOT SWITCH STICK.

SWITCHED CAPACITORS

1. CHECK TO SEE THAT THE CAPACITOR BANK IS INSTALLED TO THESE OVERHEAD DISTRIBUTION SPECIFICATIONS.
2. EACH CAPACITOR CONTROL IS SLIGHTLY DIFFERENT. REFER TO THE SECTION OF THIS SPECIFICATION FOR THE CONTROL INVOLVED FOR SPECIFIC MANUAL, AUTOMATIC, TRIP AND CLOSE OPERATING INSTRUCTIONS. UNLOCK THE CONTROL BOX AND PLACE THE CONTROL IN MANUAL AND TRIP POSITIONS.
3. CLOSE THE CUTOUTS ENERGIZING THE CONTROL TRANSFORMER AND LEADS TO THE OIL SWITCHES.

NOTE: IT IS VERY IMPORTANT TO GIVE CAPACITORS FIVE MINUTES TO DRAIN BEFORE ATTEMPTING TO RE-ENERGIZE THEM.

4. IF IT HAS BEEN AT LEAST FIVE MINUTES BEFORE THE CAPACITORS WERE LAST ENERGIZED, INITIATE A CLOSE COMMAND TO THE CONTROL. THE OIL SWITCHES SHOULD RESPOND WITH A CLEAR AUDIBLE SOUND. VERIFY CLOSE POSITION OF ALL THREE OIL SWITCH OPERATING HANDLES.
5. INITIATE A TRIP COMMAND TO THE CONTROL. VERIFY THAT ALL THREE OIL SWITCH HANDLES ARE IN THE OPEN POSITION.

NOTE: AGAIN, IT IS VERY IMPORTANT TO GIVE CAPACITORS FIVE MINUTES TO DRAIN BEFORE ATTEMPTING TO RE-ENERGIZE THEM.

6. IF THE CONTROL SETTINGS HAVE NOT BEEN INSTALLED, LEAVE THE CONTROL IN THE MANUAL AND EITHER CLOSE OR TRIP POSITIONS AS INSTRUCTED BY THE ENGINEER IN THE WORK ORDER DRAWING. NOTIFY THE APPROPRIATE PERSONNEL THAT THE CAPACITOR INSTALLATION IS READY FOR CONTROL SETTINGS.
7. IF THE CONTROL SETTINGS HAVE BEEN INSTALLED, WAIT FIVE MINUTES FOR THE CAPACITORS TO DRAIN. THEN PLACE THE CONTROL IN THE AUTOMATIC MODE. NOTE: THE CAPACITORS MAY CLOSE AT THIS TIME.
8. CLOSE AND LOCK CONTROL BOX.

DE-ENERGIZING

NOTE: BEFORE WORKING ON OR TESTING CAPACITORS, THEY MUST BE COMPLETELY DRAINED. FOLLOW THE PROCEDURES AS DIRECTED UNDER "GROUNDING".

FIXED CAPACITOR BANKS

1. A LOAD BREAK TOOL SHALL BE USED TO DE-ENERGIZE A FIXED CAPACITOR BANK.
2. IF THE BANK IS TO BE LEFT DE-ENERGIZED, REMOVE THE CUTOUT DOORS AND SECURE THEM TO THE POLE IN THE UPRIGHT POSITION TO PREVENT WATER FROM COLLECTING IN THE DOOR TUBE.

SWITCHED CAPACITOR BANKS

1. EACH CAPACITOR CONTROL IS SLIGHTLY DIFFERENT. REFER TO THE SECTION OF THIS SPECIFICATION FOR THE CONTROL INVOLVED FOR SPECIFIC MANUAL, AUTOMATIC, TRIP AND CLOSE OPERATING INSTRUCTIONS. UNLOCK THE CONTROL BOX AND PLACE THE CONTROL IN MANUAL AND INITIATE A TRIP COMMAND.
2. IF THE BANK IS IN THE CLOSE POSITION, THE OIL SWITCHES SHOULD RESPOND AND OPEN WITH AN AUDIBLE SOUND. IF THE BANK IS ALREADY OPEN, NO RESPONSE WILL OCCUR.
3. VERIFY THAT ALL THREE OIL SWITCH HANDLES ARE IN THE OPEN POSITION.
4. OPEN THE CUTOUTS WITH A LOAD BREAK TOOL.

3				
2				
1				
0	9/7/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ENERGIZING AND DE-ENERGIZING CAPACITOR BANKS

Duke Energy®

FLA

DWG. 07.00-25

A. IF THE BANK IS BEING DE-ENERGIZED FOR SEASONAL PURPOSES, THE OIL SWITCHES SHOULD BE CHECKED IN THE MANUAL MODE. THE CUTOUT DOORS SHOULD BE LEFT CLOSED TO SUSTAIN THE CONTROL TO PREVENT UNNECESSARY DRAIN ON THE BATTERY.

B. IF THE BANK IS BEING DE-ENERGIZED TO CORRECT A DEFECT OR IN PREPARATION FOR REMOVAL, THE CUTOUT DOOR SHOULD BE REMOVED AND SECURED TO THE POLE IN THE UPRIGHT POSITION TO PREVENT WATER FROM COLLECTING IN THE DOOR TUBE. THE CONTROL BATTERY MAY DRAIN IN A FEW DAYS AND IF POSSIBLE THE BATTERY SHOULD BE REMOVED AND LEFT IN THE CONTROL BOX.

GROUNDING

WHEN GROUNDING A DE-ENERGIZED CAPACITOR, PRIMARY GROUNDING STICKS OR EQUIVALENT SHALL BE USED. DISTRIBUTION CAPACITORS WILL DISCHARGE WITHIN FIVE MINUTES. TO ENSURE COMPLETE DISCHARGING, A PRIMARY GROUNDING STICK CAN BE USED. AFTER DISCHARGING A CAPACITOR AND BEFORE ANY C-METER TESTING IS DONE, A SHUNT WIRE SHOULD BE PUT ACROSS EACH BUSHING TO BE TESTED. IT MAY BE REMOVED BEFORE TESTING AND THEN REPLACED FOR STORING OR SHIPPING THE DE-ENERGIZED CAPACITORS TO THE FIELD. RUBBER GLOVES SHALL BE USED ON POLE-MOUNTED TEST.

CURRENT LIMITING FUSE

THE 80 AMP CURRENT LIMITING FUSES ARE USED ON 1200KVAR BANKS WHERE THE AVAILABLE PHASE TO GROUND FAULT CURRENT IS GREATER THAN 6000 AMPS SYMMETRICAL.

ENGINEERING SHOULD SPECIFY THE LOCATIONS WHERE THIS CURRENT LIMITING FUSE IS NEEDED.

THE CURRENT LIMITING FUSE FITS IN A STANDARD 15KV CUTOUT AS SHOWN IN THE PICTURE. WHEN THE FUSE BLOWS, THE DOOR SHOULD DROP OPEN LIKE A CONVENTIONAL FUSE DOOR.

CURRENT LIMITING FUSES ARE NON-REUSABLE AND MUST BE REPLACED WITH A NEW ONE WHEN BLOWN.

CN 232204

PRIMARY VOLTAGE/SHUNT CAPACITOR VALUES - SINGLE-PHASE

UNIT RATED VOLTAGE	UNIT RATED KVAR	ACCEPTABLE RANGE OF PHASE CURRENT AND UNIT CAPACITANCE					
		ALL UNITS		UNITS MANUFACTURED BEFORE 2002		UNITS MANUFACTURED IN 2002 OR LATER	
		LOW CURRENT (AMPS)	LOW CAPACITANCE (μF)	HIGH AMPS	HIGH (μF)	HIGH AMPS	HIGH (μF)
7200	25	3.5	1.28	4.0	1.47	-	-
7200	50	6.9	2.56	8.0	2.94	-	-
7200	100	13.9	5.12	16.0	5.88	15.3	5.63
7200	150	20.8	7.68	24.0	8.83	-	-
7200	200	27.8	10.23	31.9	11.77	30.6	11.26
7620	200 (SEBRING)	26.2	9.14	30.2	10.51	28.9	10.05
7200	300	41.7	15.35	47.9	17.65	45.8	16.89
7200	400	55.6	20.47	63.9	23.54	61.1	22.51
14,400	400 (HOLYPAW)	27.8	5.12	31.9	5.88	30.6	5.63

* CURRENT VALUES ARE CALCULATED BASED ON NAMEPLATE RATED VOLTAGE. IF TWO UNITS ARE PARALLELED ON A PHASE, THE PHASE CURRENT WILL BE 2X UNIT CURRENT.

NOTE: FOR UNITS ON THIS LIST, USE THE FOLLOWING EQUATION TO DETERMINE THE NOMINAL CAPACITANCE VALUE. THEACCEPTABLE CAPACITANCE RANGE OF A TESTED UNIT IS 100% - 115% OF NOMINAL, FOR UNITS MADE BEFORE 2002. UNITS MADE AFTER 2002 SHOULD TEST BETWEEN 100% AND 110%.

$$\text{SINGLE-PHASE UNIT CAPACITANCE} = \frac{2.65252 \times (\text{RATED UNIT KVAR})}{(\text{RATED UNIT KV})^2}$$

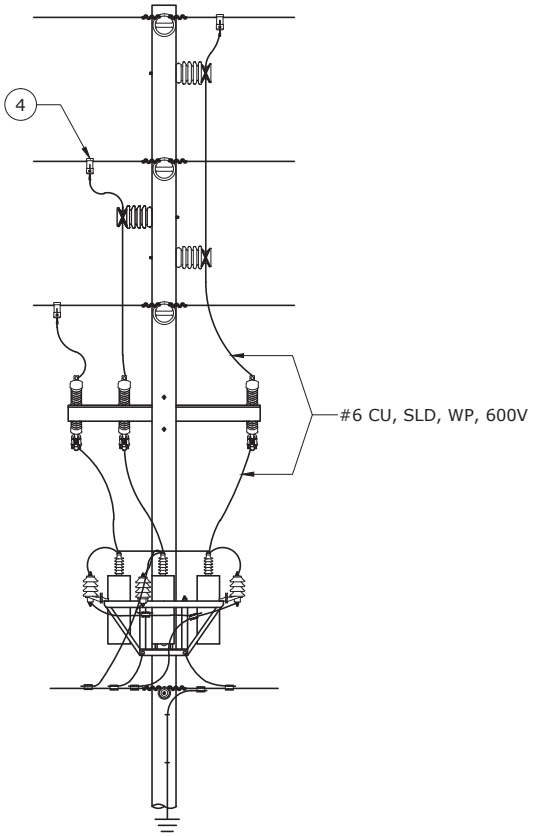
3				
2				
1				
0	9/3/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GROUNDING, CURRENT LIMITING FUSE AND CAPACITANCE TABLE

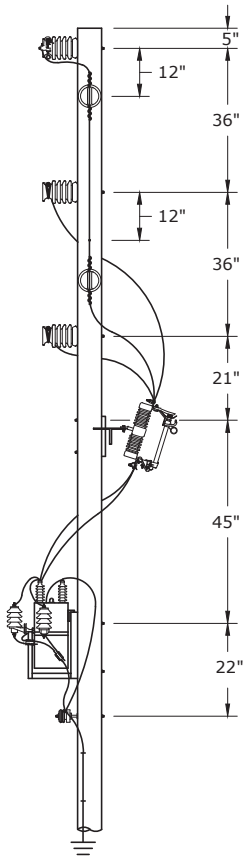
Duke Energy®

FLA

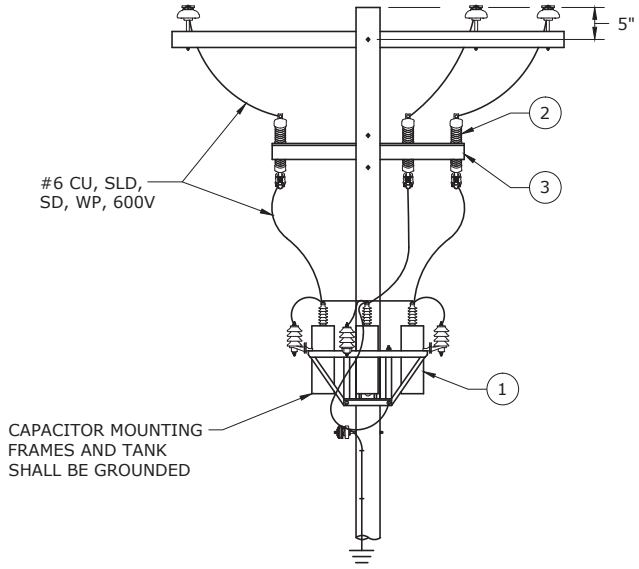
DWG. 07.00-35



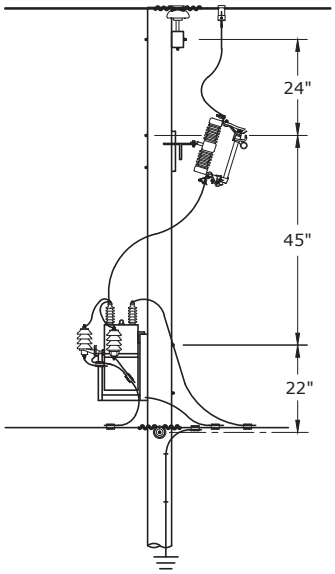
FRONT VIEW



SIDE VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. STRIP WIRE WHERE IT IS TIED TO JUMPER POST.
2. PRIMARIES SHOULD BE COVERED TO REDUCE DAMAGE CAUSED BY ANIMAL CONTACT.
3. SEE DWG. 07.02-25 AND SECTION 01 FOR GROUNDING DETAILS.
4. SEE DWG. 07.02-15B FOR BILL OF MATERIALS.
5. CAPACITOR BANK SHALL BE INSTALLED ON THE LINE SIDE OF ANY ASSOCIATED PRIMARY METER INSTALLATION.

REVISED	BY	CK'D	APPR.
4 8/9/13	DANNA	DANNA	ADCOCK
3 2/14/12	BURLISON	BURLISON	ELKINS
2 1/27/12	BURLISON	BURLISON	ELKINS
0 9/3/10	GUINN	GUINN	ELKINS

CAPACITOR - FIXED

DUKE ENERGY.

FLA

DWG. 07.02-15A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
C1200FX12FM	1	CAP1200FX12F	1	9220130636	1	CAPACITOR, BANK, 1200KVAR, 12KV, FIXED, GND-Y
	1	CAP600FX12F	1	22070205	1	CAPACITOR, BANK, 600KVAR, 12KV, FIXED, GND-Y
	2	TFUSE15CO100F	1	221112	1	CUTOUT, 15KV, 100A, 16KA, 110KV BIL
	2	TFUSE27CO100PF	1	9220090063	1	CUTOUT, SILICON, 27KV, 100A, 12KA, 150KV BIL
	3	BKTCOLATRISTLF	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				070104	1	BRACKET, LA & CO TRI MNTG
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	3	BKTCOLATRIFGF	1	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	1	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				070105	1	BRACKET, FIBER, 3PH, SW ARM, SP=10
				152107	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
	4	KHLC40N6F	1	9220184790	3	CLAMP, HOT LINE, ALUM, SMALL, 4/0
		KHLC7933F	1	9220184794	3	CLAMP, HOT LINE, ALUM, LARGE, 336-795
C600FX12FM	CAP BANK MU 600KVAR FIXED 12.47KV					
C1200FX12CFM	CAP BANK MU 1200KVAR FIXED 12.47KV COASTAL					
C600FX12CFM	CAP BANK MU 600KVAR FIXED 12.47KV COASTAL					

NOTES:

1. SEE DWG. 07.02-15A FOR DESIGN SPECIFICATIONS.

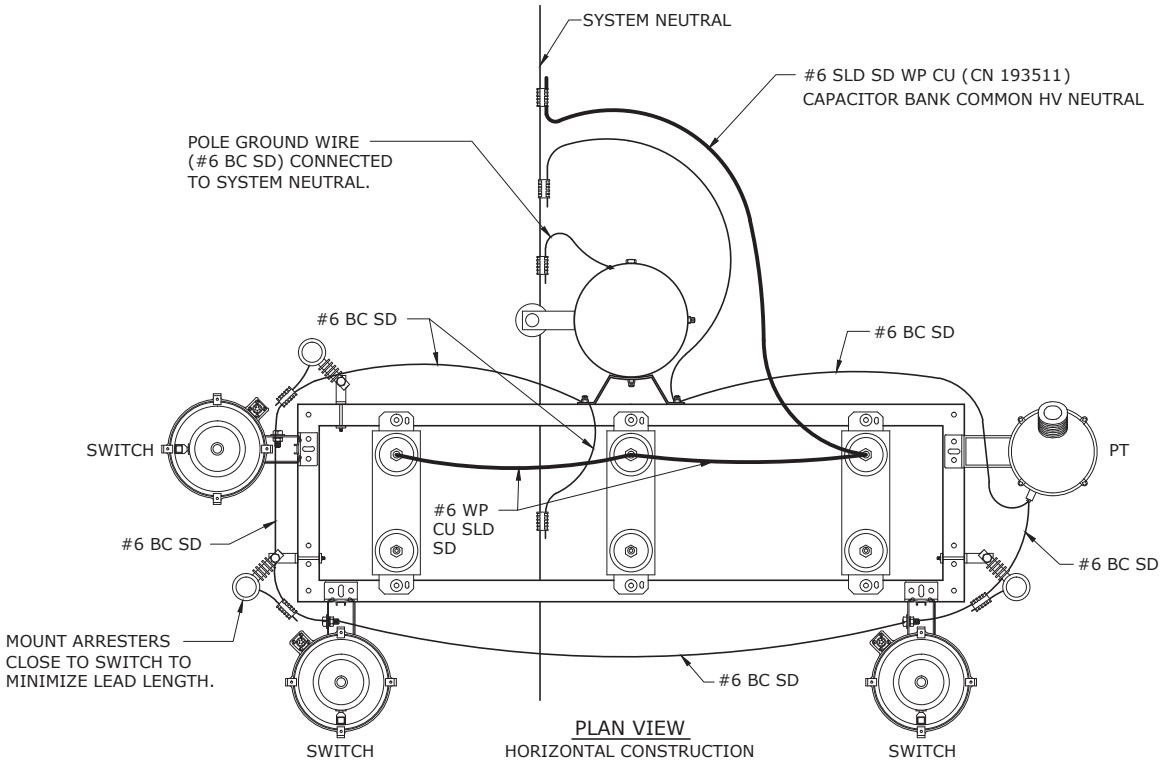
REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	9/3/10	GUINN	GUINN	ELKINS

CAPACITOR - FIXED

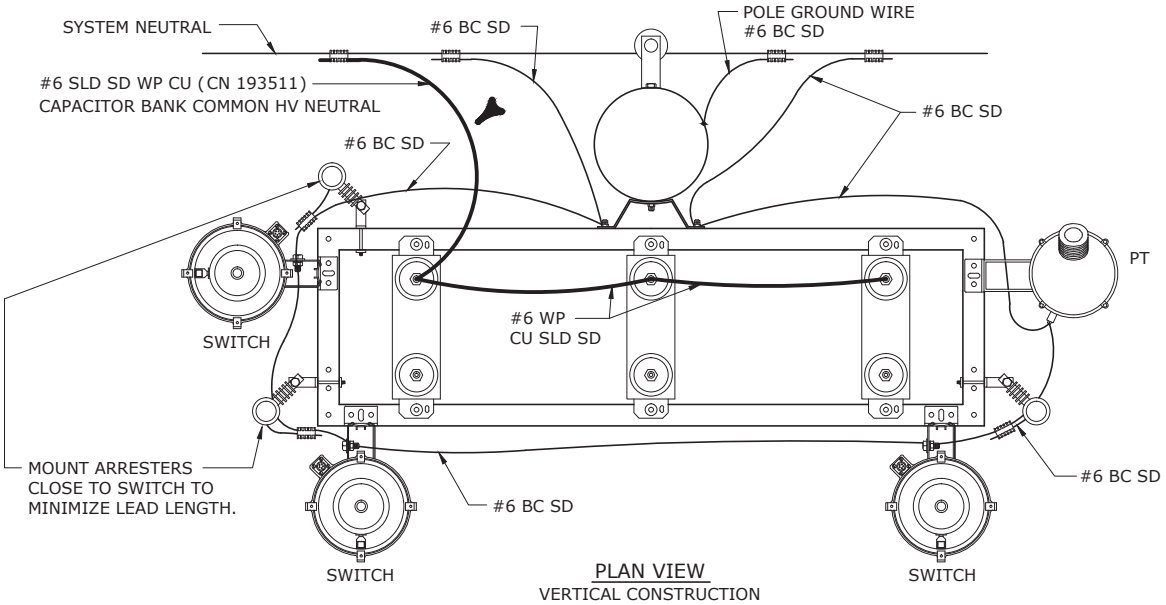
Duke Energy®

FLA

DWG. 07.02-15B



PLAN VIEW
HORIZONTAL CONSTRUCTION



PLAN VIEW
VERTICAL CONSTRUCTION

NOTES:

1. SEE SECTION 01.01 FOR REQUIRED EQUIPMENT-TO-EARTH GROUNDING.
2. WILDLIFE GUARDS ARE NOT SHOWN. INSTALL WILDLIFE GUARDS ON ALL BUSHINGS.
3. BANK ORIENTATION IS TO BE PARALLEL TO THE LINE ON VERTICAL CONSTRUCTION AND PERPENDICULAR TO THE LINE ON HORIZONTAL OR TRIANGULAR CONSTRUCTION.
4. WHEN MAINTAINING EXISTING BANKS WITH BARE COPPER, REPLACE WITH #6 WP CU SLD SD.

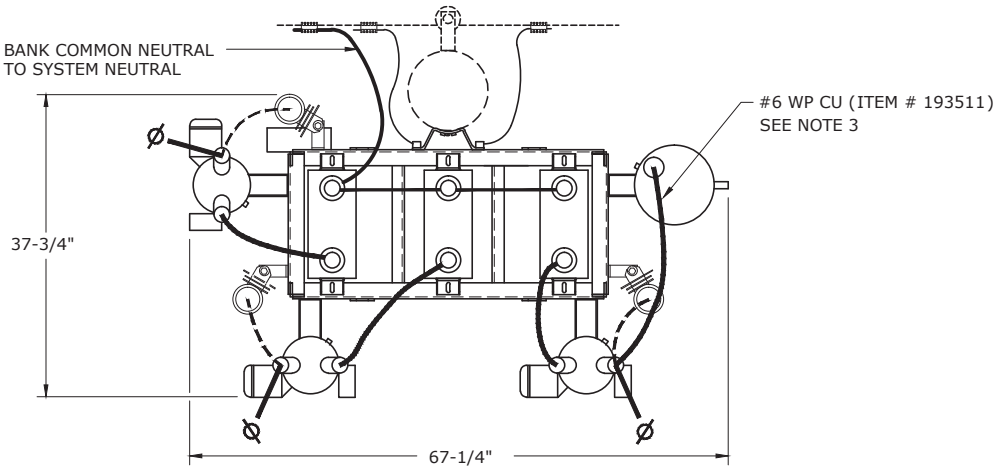
REVISED		BY	CK'D	APPR.
3				
2	3/6/12	HOFFMAN	BURLISON	ELKINS
1	2/14/12	HOFFMAN	BURLISON	ELKINS
0	4/12/10	GUINN	GUINN	ELKINS

CAPACITOR BANK GROUNDING WIRING

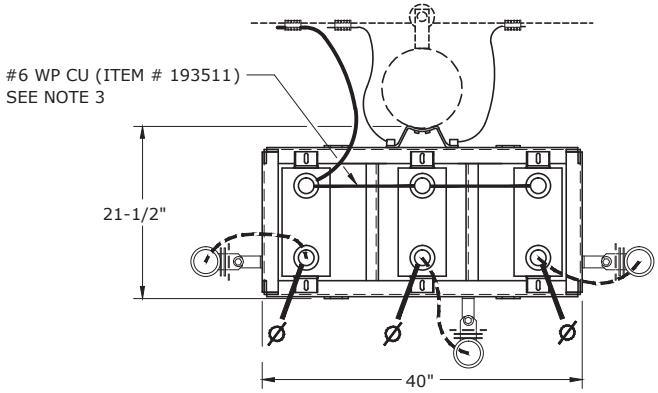
Progress Energy

FLA

DWG. 07.02-20



OIL SWITCHED BANKS



FIXED BANKS

NOTES:

1. ALL BANK HIGH VOLTAGE WIRING TO BE #6 SOLID SD WP CU.
2. BANK ORIENTATION IS TO BE PARALLEL TO THE LINE ON VERTICAL CONSTRUCTION AND PERPENDICULAR TO THE LINE FOR HORIZONTAL OR TRIANGULAR CONSTRUCTION.
3. INSULATED TUBING FOR ANIMAL PROTECTION IS SUPPLIED ON NEW BANKS.
4. ANGLE ARRESTERS AWAY FROM FRAME.

3				
2				
1	1/5/16	LOOSIER	BURLISON	ADCOCK
0	2/14/12	HOFFMAN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

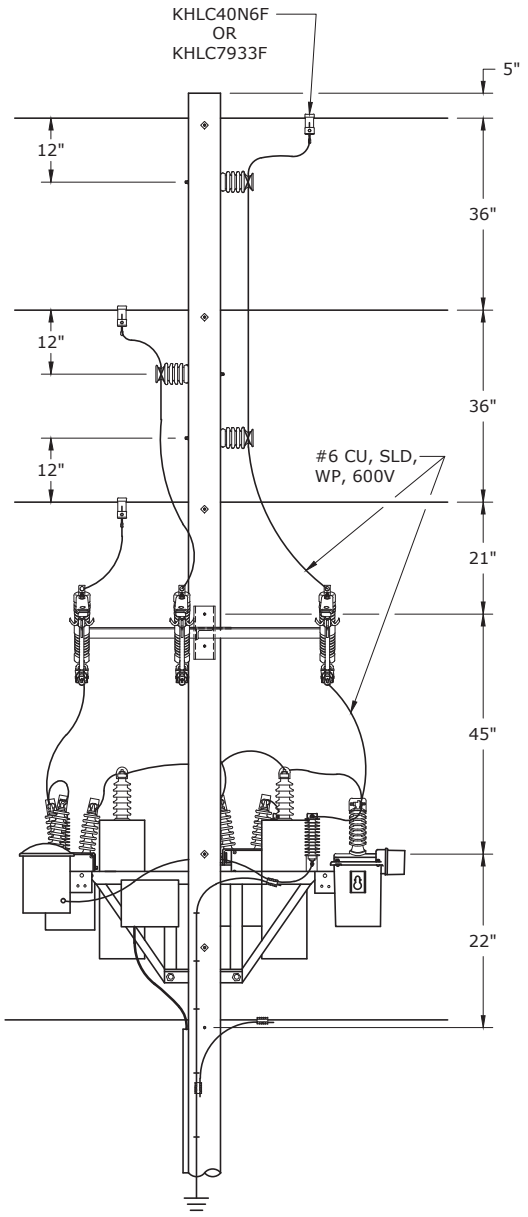
CAPACITOR RACK

HIGH VOLTAGE WIRING

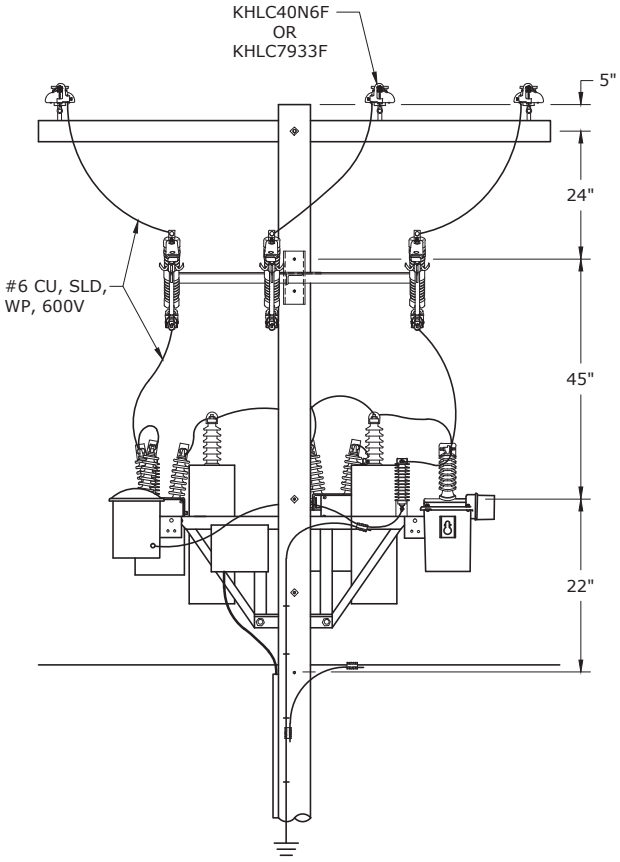
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.02-25



FRONT VIEW - VERTICAL



FRONT VIEW - HORIZONTAL

NOTES:

1. LOCATE THE POLE GROUND DOWN LEAD AS FAR FROM THE CONTROL CABLE AS POSSIBLE.
2. THE MOUNTING FRAME, TANKS, TRANSFORMERS AND JUNCTION BOX SHALL BE GROUNDED. SEE DWG. 07.02-02. SEE SECTION 01.01 FOR EQUIPMENT-TO-EARTH GROUNDING.
3. STRIP WIRE WHERE TIED TO INSULATORS.
4. FOR FIXED BANK SPACING DIMENSIONS, SEE DWG. 07.02-15.
5. CAPACITOR BANK SHALL BE INSTALLED ON THE LINE SIDE OF ANY ASSOCIATED PRIMARY METER INSTALLATION.

REVISED	BY	CK'D	APPR.
3 8/9/13	DANNA	DANNA	ADCOCK
2 2/14/12	HOFFMAN	BURLISON	ELKINS
1 8/31/11	BURLISON	BURLISON	ELKINS
0 9/7/10	GUINN	GUINN	ELKINS

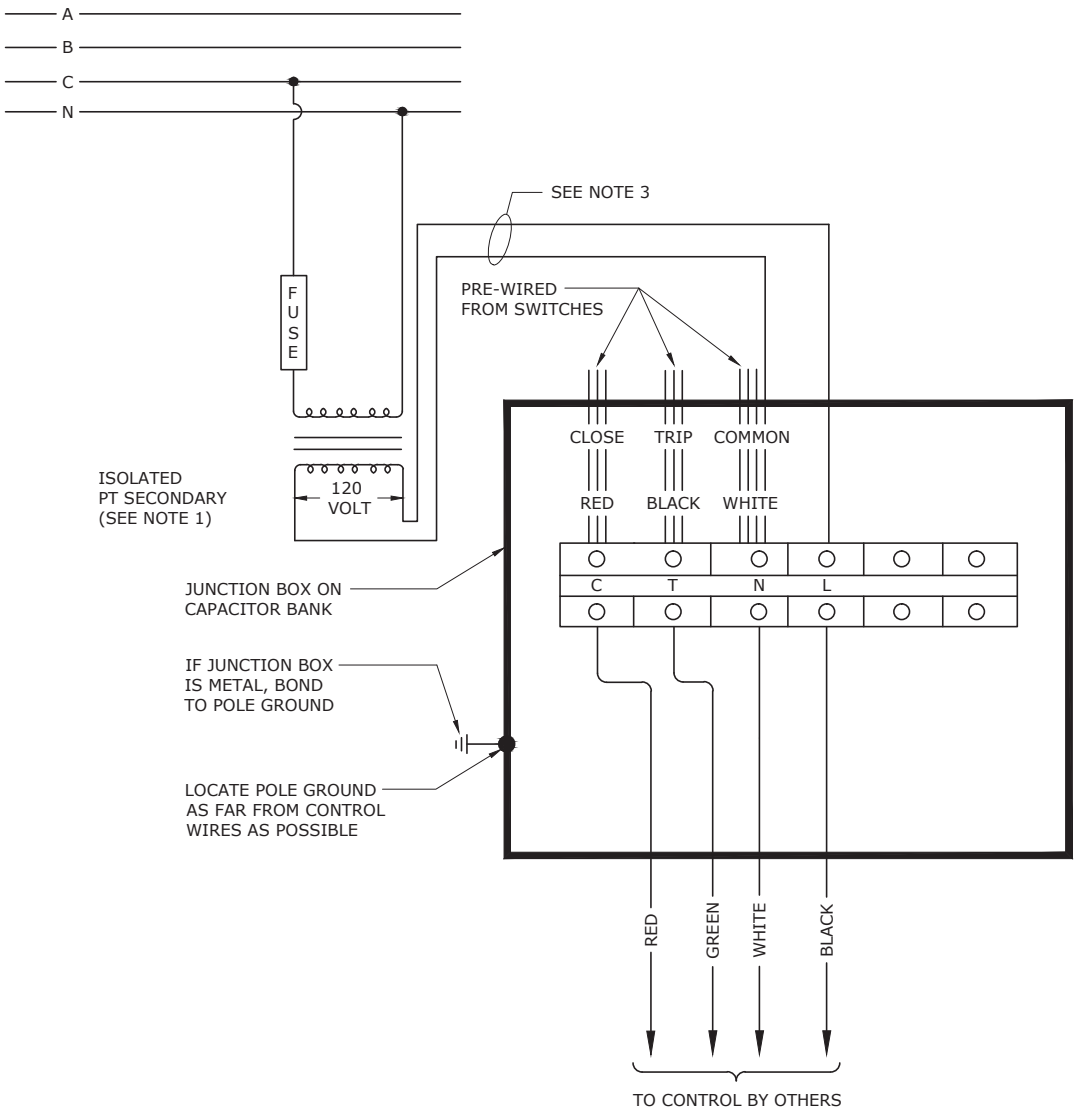
CAPACITORS - SWITCHED

DUKE ENERGY.

FLA

DWG. 07.03-05

POSITION LEGEND			
POSITION	LABEL	FUNCTION	WIRE COLOR TO CONTROL BOX
1	C	CLOSE	RED
2	T	TRIP/OPEN	GREEN
3	N	NEUTRAL/COMMON	WHITE
4	L	LINE/120V	BLACK



NOTES:

1. NEITHER TERMINAL OF THE 120 VOLT SOURCE IS TO BE GROUNDED.
2. REPLACEMENT JUNCTION BOX KIT IS CN 9220127270. THIS INCLUDES THE BOX WITH PRE-WIRED LEADS TO THE THREE OIL SWITCHES AND A PT LEAD WITH APPROPRIATE CONNECTORS.
3. REPLACEMENT PT-JUNCTION BOX CABLE (WITH 5-PIN PT CONNECTOR) IS AVAILABLE, CN 9220159493. ON THE 5-PIN CONNECTOR, POSITION 'A' IS THE 120-VOLT LINE (BLACK) WIRE, POSTION 'E' IS THE TRANSFORMER ISOLATED NEUTRAL/COMMON (WHITE) WIRE, AND THE PIGTAIL (GREEN) WIRE IS TO BE CUT OFF (NOT USED).
4. REPLACEMENT SWITCH CABLE IS AVAILABLE, CN 9220159493.

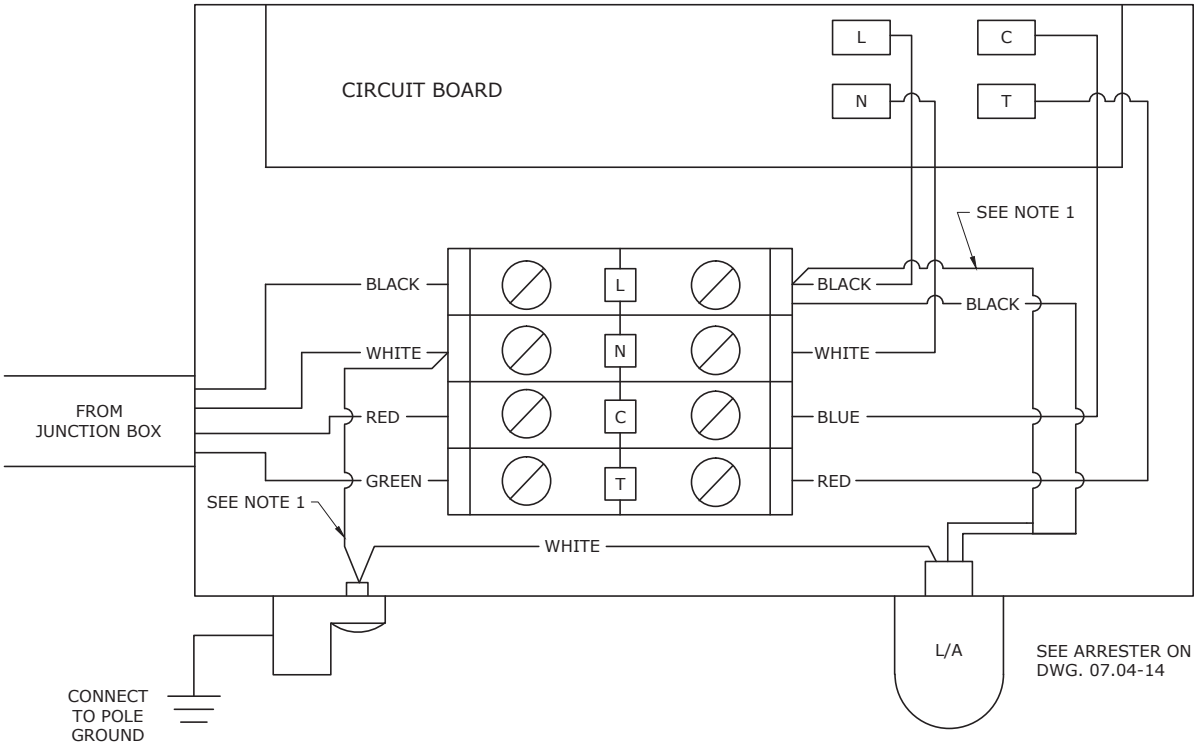
3				
2				
1				
0	10/26/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

WIRE SCHEMATIC FOR SWITCHED CAPACITOR BANK JUNCTION BOX

Duke Energy

FLA

DWG. 07.03-40



APPROPRIATE SETTINGS FOR THIS CAPACITOR CONTROL ARE DETERMINED BY ENGINEERING. FOLLOW ALL GUIDELINES IN THIS SECTION FOR PROPER INSTALLATION. INFORM ENGINEERING WHEN A NEW CONTROL IS READY FOR SETTINGS TO BE INSTALLED. LEAVE A NEW CONTROL IN MANUAL UNLESS INSTRUCTED BY ENGINEERING. REFER TO ENGINEERING FOR ANY QUESTIONS RELATIVE TO THE SETTINGS OF THIS TYPE OF CAPACITOR CONTROL.

NOTES:

1. OLDER INSTALLATIONS WERE WIRED DIFFERENTLY. THE WIRING SHOWN IS FOR NEW CONTROLS. THE WIRING SHOULD BE CONVERTED AS SHOWN HERE WHEN REPLACING CONTROLS.

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

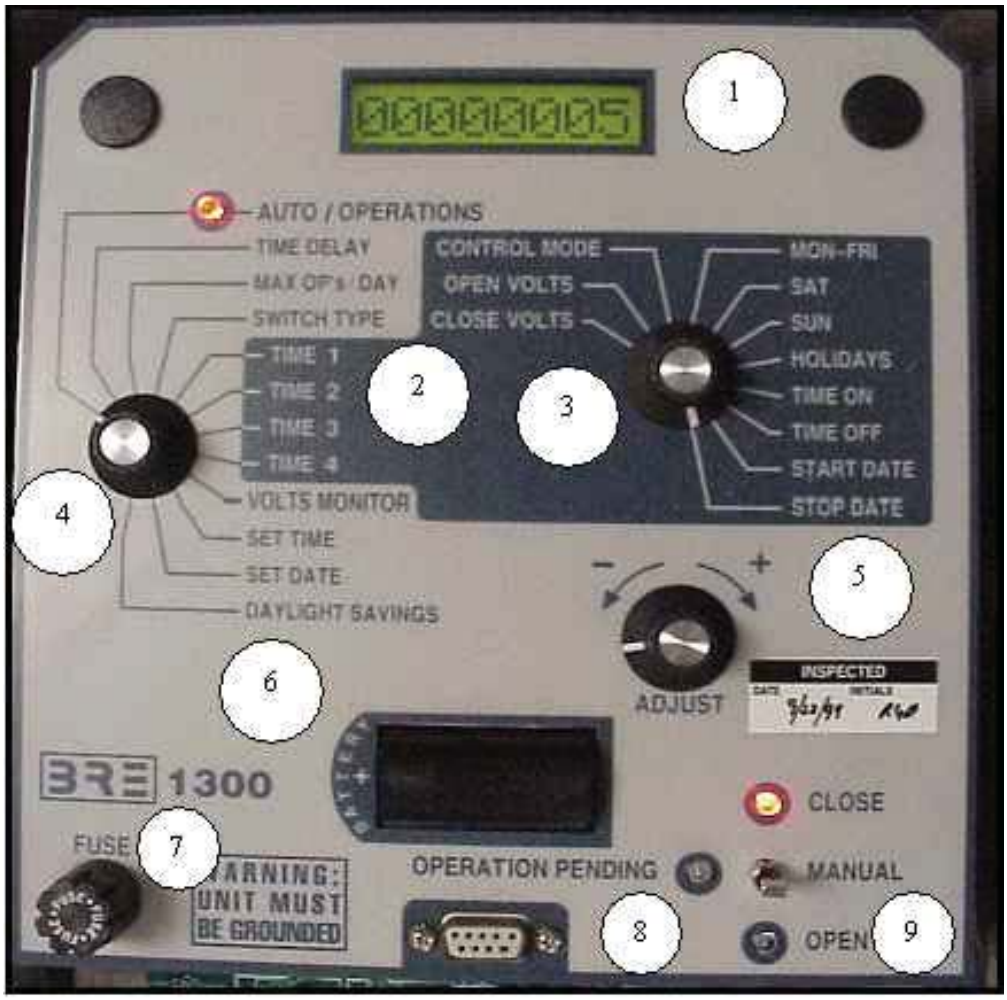
WIRING SCHEMATIC -

BRE TYPE CONTROL

Duke Energy

FLA

DWG. 07.04-10A



1. LCD DISPLAY - WILL DISPLAY CONTROL SETTINGS

2. SWITCH TYPE A. MOTOR OP - USE THIS SETTING FOR ALL OIL SWITCHES IF THERE ARE OIL AND VACUUM SWITCHES ON THE SAME CAPACITOR BANK OR IF THERE ARE MOTOR OPERATED AND SOLENOID OPERATED SWITCHES ON THE SAME CAPACITOR BANK.
B. SOLENOID - USE THIS SETTING FOR ALL VACUUM SWITCHES (SOLENOID OPERATED).

3. SCHEDULE SETTINGS KNOB - OPERATIONS ENGINEER TO DETERMINE SCHEDULE SETTINGS

4. CONTROL SETTINGS KNOB

5. ADJUSTMENT KNOB (USE TO CHANGE ALL SETTINGS)

6. 10 YEAR LITHIUM BATTERY

7. 15A SLO-BLO FUSE

8. RS-232 PORT DB-9 FEMALE FRONT 2400 BAUD

9. MANUAL CLOSE/OPEN TOGGLE SWITCH

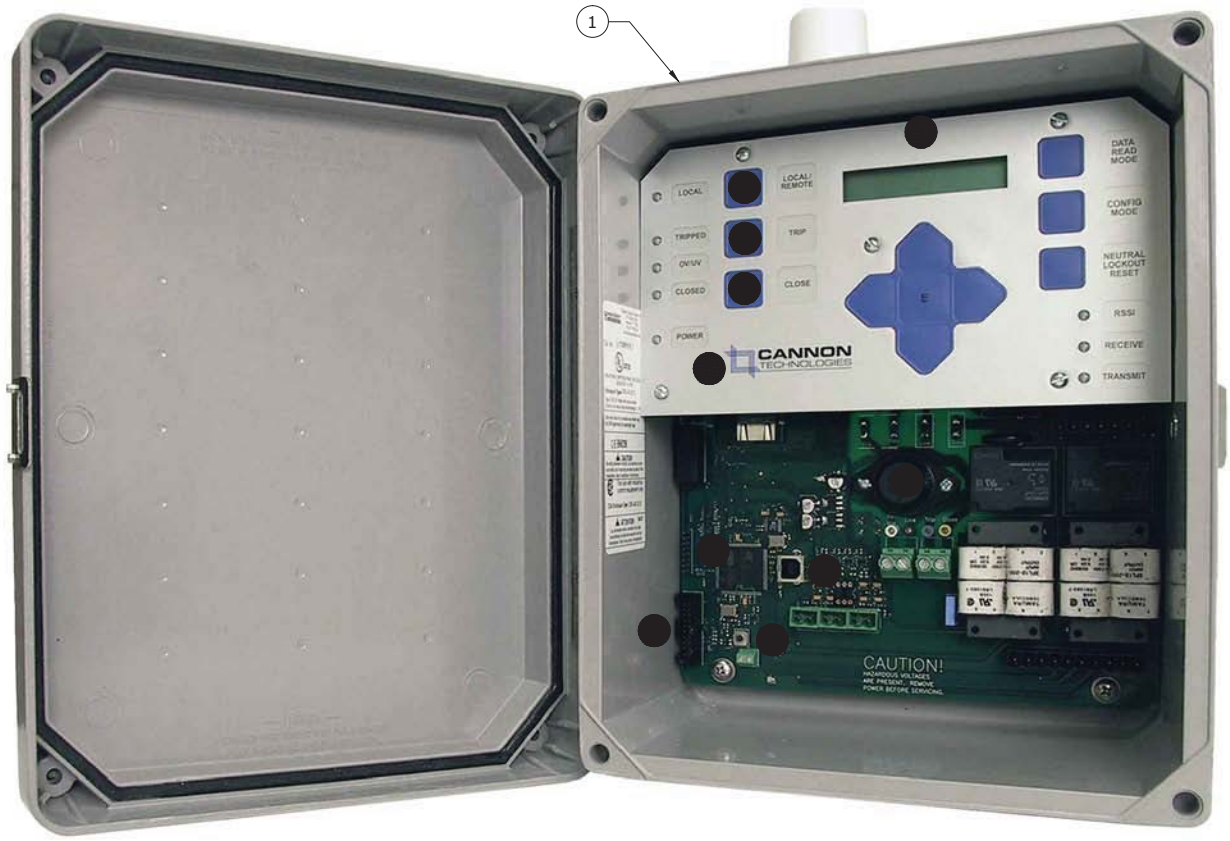
3				
2				
1				
0	4/12/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS -
BRE TYPE CONTROL

Duke Energy

FLA

DWG. 07.04-10B



LEGEND

1. LCD READOUT
2. REMOTE/LOCAL BUTTON
3. MANUAL TRIP BUTTON
4. MANUAL CLOSE BUTTON
5. POWER INDICATOR
6. 10 AMP FUSE
7. USB PORT FOR LAPTOP
8. BLUETOOTH PORT
9. J-TAG PORT
10. CONTROLLER RESET BUTTON

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	CCNTCELF	1	9220140008	1	CONTROL, CAPACITOR, AUTOMATED, 2-WAY, CELLULAR COMM.

NOTES:

1. SEE DWG. 07.04-12B FOR MANUAL OPERATION INSTRUCTIONS.

2. THE CBC-7000 IS NO LONGER PURCHASED BUT MANY REMAIN IN SERVICE. NEW INSTALLS WILL INCORPORATE THE CBC-8000. SEE DWGS. 07.04-13A AND 07.04-13B.

3. USE THIS CU FOR REMOVAL OR TRANSFER OF THE CBC-7000.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/15/14	BURLISON	BURLISON	ADCOCK
0	9/3/10	GUINN	GUINN	ELKINS

CANNON CBC-7000 2-WAY CAPACITOR CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.04-12A

MANUAL OPERATION:

- TO PUT THE CBC IN THE LOCAL MODE, PRESS THE LOCAL/REMOTE BUTTON ON THE BLUE KEYPAD LOCATED ON THE TOP LEFT OF THE CONTROL PANEL. AT THIS TIME, THE LED LOCATED TO THE LEFT OF " **LOCAL**" SHOULD BE LIT.

- TO RETURN THE CBC TO THE REMOTE/AUTOMATIC MODE, PRESS THE " **LOCAL/REMOTE**" BUTTON. AT THIS TIME, THE LED SHOULD GO OFF.

- TO CLOSE THE CAPACITOR BANK, PLACE THE CBC IN THE LOCAL MODE AND PRESS THE BLUE " **CLOSE**" BUTTON. AT THIS TIME THE "**CLOSED**" LED WILL BEGIN FLASHING. THE CAPACITOR BANK WILL MOVE TO THE CLOSED WILL MOVE TO THE CLOSED POSITION IN 60 SECONDS, OR 5 MINUTES ON A RECLOSE. AFTER THE CAPACITOR BANK CLOSES, THE "**CLOSED**" LED WILL REMAIN ON.

- TO OPEN OR "**TRIP**" THE CAPACITOR BANK, PLACE THE CBC IN THE LOCAL MODE AND PRESS THE BLUE " **TRIP**" BUTTON. AT THIS TIME, THE CAPACITOR BANK WILL TRIP AND THE TRIP LED WILL BE LIT.

IF THE CBC IS LEFT IN LOCAL MODE FOR ANY REASON, PLEASE CONTACT THE DCC TO REPORT CAPACITOR BANK ON REASON TO BE PLACED IN THE STATE OF THE GRID.

PLACE ON RUDI FEEDERS. THIS CONTROLLER IS OPERATED AUTOMATICALLY BY THE VMS COMPUTER AND USES 2-WAY COMMUNICATIONS. CONTROL REQUIRES FEEDER LEVEL DATA ONLY AVAILABLE ON RUDI FEEDERS.

ALL CANNON 7000 CONTROLLERS MUST BE PROGRAMMED BY METER DEPARTMENT PERSONNEL BEFORE INSTALLATION, AND HAVE COMMUNICATIONS COMPONENT ACTIVATED. RETURN ALL REMOVED CANNON 7000 CONTROLLERS TO METER SHOP. REFER TO METER SHOP FOR ANY QUESTIONS RELATIVE TO THIS TYPE OF CAPACITOR CONTROL

NOTES:

1. SEE DWG. 07.04-12A FOR CONTROL DETAILS AND BILL OF MATERIALS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/18/14	BURLISON	DANNA	ADCOCK
0	4/12/10	GUINN	GUINN	ELKINS

CANNON CBC-7000 2-WAY CAPACITOR CONTROL

DEC	DEM	DEP	DEF
			X

07.04-12B

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	CCNTCELF	1	9220271525	1	CONTROL, CAPACITOR, AUTO, CANNON CBC8000, 2 WAY, CELLULAR

NOTES:

1. REMOVE CONTROL FUSE BEFORE INSTALLING OR REMOVING CAPACITOR CONTROL.

2. SEE DWG. 07.04-13B FOR MANUAL OPERATION INSTRUCTIONS.

3				
2				
1				
0	8/18/14	BURLISON	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

CANNON CBC-8000 2-WAY CAPACITOR CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.04-13A

MANUAL OPERATION:

1. TO PUT THE CBC-8000 IN THE MANUAL MODE, PRESS THE GRAY "MANUAL" BUTTON ON THE BOTTOM SECTIONS OF THE CONTROL PANEL. THE LED IN THE UPPER LEFT CORNER OF THE GRAY "MANUAL" BUTTON SHOULD ILLUMINATE RED. THE LED IN THE UPPER LEFT CORNERS OF THE "REMOTE" AND "AUTO" GRAY BUTTONS SHOULD NOT BE LIT RED.

2. TO RETURN THE CBC-8000 TO THE REMOTE MODE, PRESS THE GRAY "REMOTE" BUTTON ON THE BOTTOM SECTIONS OF THE CONTROL PANEL. THE LED IN THE UPPER LEFT CORNER OF THE GRAY "REMOTE" BUTTON SHOULD ILLUMINATE RED. THE LED IN THE UPPER LEFT CORNERS OF THE "MANUAL" AND "AUTO" GRAY BUTTONS SHOULD NOT BE LIT RED.

3. TO MANUALLY CLOSE THE CAPACITOR BANK, PLACE THE CBC-8000 IN THE MANUAL MODE AND PRESS THE RED "CLOSE" BUTTON. AT THIS TIME, THE LED IN THE UPPER LEFT CORNER OF THE RED CLOSE BUTTON WILL BEGIN FLASHING. THE CAPACITOR BANK WILL MOVE TO THE CLOSE POSITION IN 60 SECONDS, OR 5 MINUTES ON A RECLOSE. AFTER THE CAPACITOR BANK CLOSES, THE LED LIGHT IN THE UPPER LEFT CORNER OF THE RED CLOSE BUTTON WILL REMAIN ILLUMINATED.

4. TO MANUALLY OPEN THE CAPACITOR BANK, PLACE THE CBC-8000 IN THE MANUAL MODE AND PRESS THE GREEN "TRIP" BUTTON. THE LED LIGHT IN THE UPPER LEFT CORNER OF THE "TRIP" BUTTON WILL ILLUMINATE.

IF THE CBC-8000 IS LEFT IN THE "MANUAL" OR "AUTO" MODE FOR ANY REASON, PLEASE CONTACT THE DCC TO REPORT CAPACITOR BANK ON REASON TO BE PLACED IN THE STATE OF THE GRID.

PLACE ON RUDI FEEDERS. THIS CONTROLLER IS OPERATED REMOTELY BY THE VMS COMPUTER AND USES 2-WAY COMMUNICATIONS. CONTROL REQUIRES FEEDER LEVEL DATA ONLY AVAILABLE ON RUDI FEEDERS.

ALL CANNON CBC-8000 CONTROLLERS MUST BE PROGRAMMED BY METER DEPARTMENT PERSONNEL BEFORE INSTALLATION, AND HAVE COMMUNICATIONS COMPONENT ACTIVATED. RETURN ALL REMOVED CANNON CBC-8000 CONTROLLERS TO THE METER SHOP. REFER TO METER SHOP FOR ANY QUESTIONS RELATIVE TO THIS TYPE OF CAPACITOR CONTROL.

NOTES:

1. SEE DWG. 07.04-13A FOR CONTROL DETAILS AND BILL OF MATERIALS.

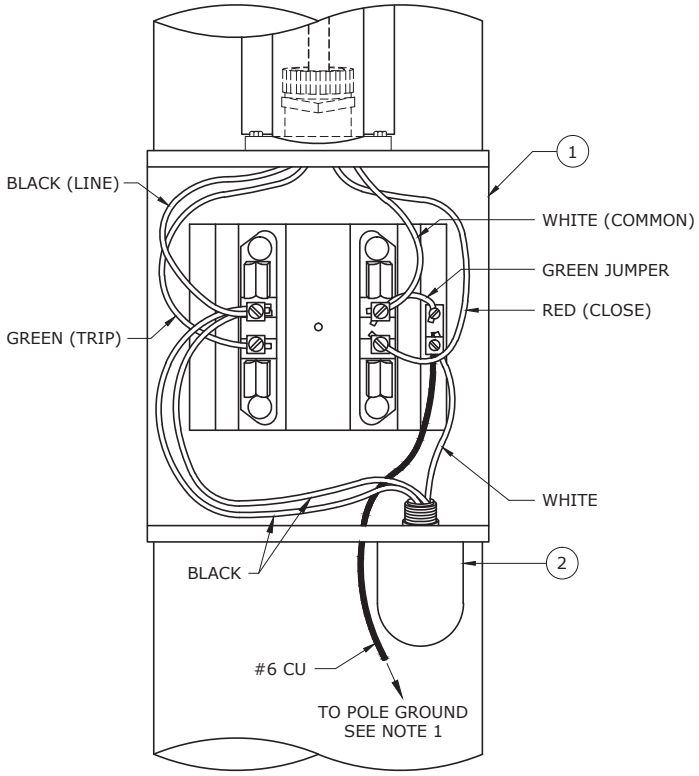
DUKE ENERGY.

3				
2				
1				
0	8/18/14	BURLISON	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

CANNON CBC-8000 2-WAY CAPACITOR CONTROL

DEC	DEM	DEP	DEF
			X

07.04-13B



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
-	1	CCNTRLMAT4JF	1	014111	45	SCREW, LAG, HX, 1/4" X 2", GALV
				160182	1	CONNECTOR, TF, GND, EYEBOLT
				192283	30	CABLE, CTRL, #10, 4-CONDUCTOR
				323422	3	GUARD, PVC, CABLE, 2-1/4" X 10'
				434337	1	PADLOCK, ROTARY, HASP, KEYED
				11061009	3	WIRE, TIE, #6, SOLID SOFT DRAWN BARE COPPER
				14411003	1	SOCKET, METER, 1/2" TO 5/8", TOP, CAPACITOR CONTROL, 4 JAW
				9220150812	1	CONNECTOR, BOX 3/4", CORD GRIP 0.500-0.625, WATER TIGHT
	2	AREQSC120F	1	220139	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE

NOTES:

1. CONNECT TO POLE GROUND USING CRIMP TYPE CONNECTOR.
2. CONTROL CABLE SHALL BE UNDER MOLDING.

REVISED		BY	CK'D	APPR.
3				
2	1/5/16	LOOSIER	BURLISON	ADCOCK
1	3/2/11	KATIGBAK	BURLISON	ELKINS
0	9/3/10	GUINN	GUINN	ELKINS

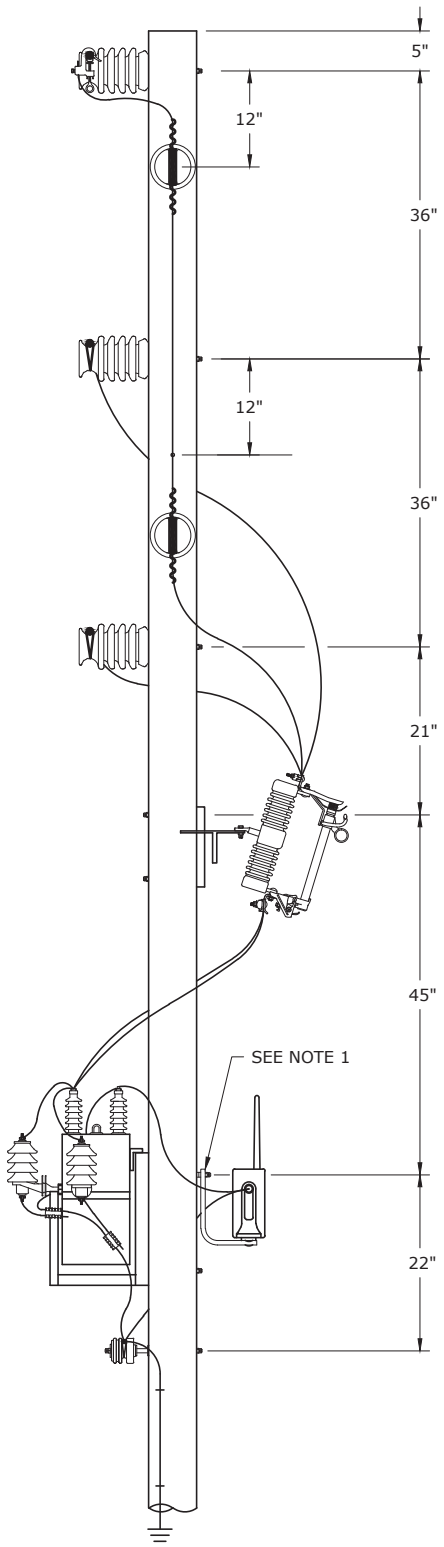
SOCKET MOUNTING AND WIRING SCHEME

SOCKET MOUNT TYPE CONTROLS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.04-14



SIDE VIEW

NOTES:

1. MOUNT BRACKET WITH SENSOR ON THE BACK OF THE CAPACITOR BANK TOP THROUGH BOLT.
2. RUN NEUTRAL FROM CAPACITOR BANK THROUGH SENSOR TO SYSTEM NEUTRAL USING #4 COVERED COPPER.
3. THE NEUTRAL FROM THE CAPACITOR THROUGH THE SENSOR MUST NOT HAVE ANY GROUNDS. IT SHOULD NOT TOUCH THE POLE OR BRACKET. THERE SHOULD BE NO OTHER GROUNDS ATTACHED TO THE CAPACITOR NEUTRAL. ALL NEUTRAL CURRENT FROM THE CAPACITOR MUST TRAVEL THROUGH THE SENSOR. ONCE THE CAPACITOR NEUTRAL PASSES THROUGH THE SENSOR FROM THE CAPACITOR, IT MAY BE GROUNDED AND BONDED TO THE SYSTEM NEUTRAL.
4. THE SENSOR SHALL BE UTILIZED ONLY FOR FIXED CAPACITORS.
5. IF THE FIXED CAPACITOR BANK IS REMOVED OR RELOCATED, REMOVE OR RELOCATE THE SENSOR WITH THE CAPACITOR BANK.

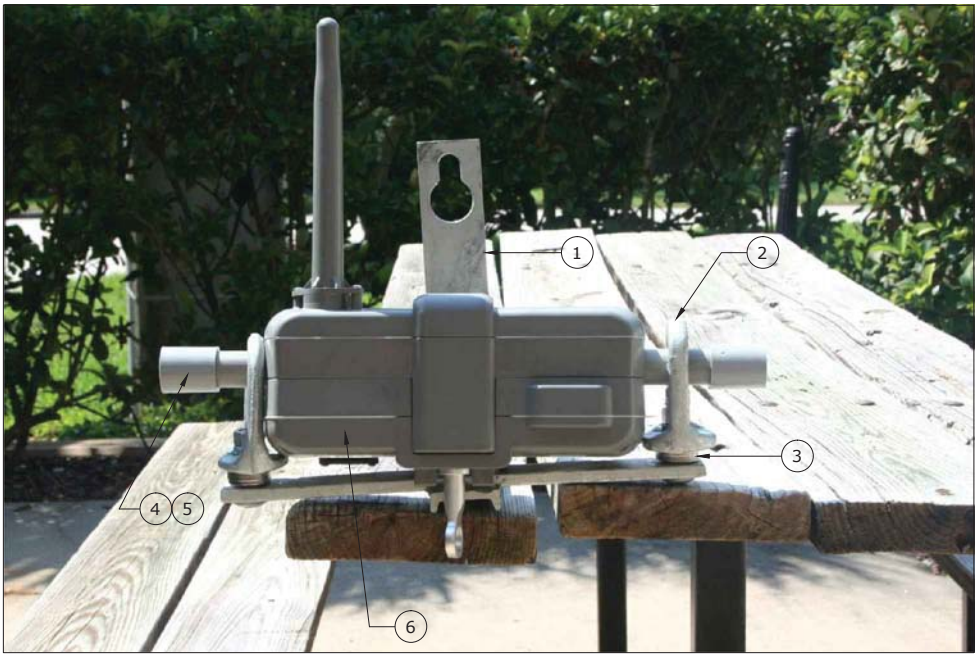
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	5/14/15	BURLISON	BURLISON	ADCOCK
1	3/9/15	LOOSIER	WHITE	ADCOCK
0	5/13/14	BURLISON	DANNA	ADCOCK

CAPACTIOR NEUTRAL SENSOR INSTALLATION

DEC	DEM	DEP	DEF
			X

07.05-01



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	-	1	070106	1	BRACKET, ARSTR & CO, DBL MNTG
	2	-	1	119236	2	EYELET, BOLT, EYE, 3/4" BOLT
	3	-	1	10542504	12	WASHER, ROUND, 1/2, SS, 1.375" OD
	4	-	1	-	24"	CONDUIT, 3/4" SCH. 40, PVC, GREY
	5	-	1	-	1	COUPLING, 3/4" SCH. 40, PVC
	6	MVSTGCAPVZ3GF	1	9220267166	1	SENSOR, CURRENT, MV, TOLLGRADE LIGHTHOUSE CELLULAR

NOTES:

1. SENSOR FITS OVER 3/4" CONDUIT.

3				
2				
1				
0	5/13/14	BURLISON	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

CAPACTIOR NEUTRAL SENSOR

BILL OF MATERIALS AND ASSEMBLY

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.05-02

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
9110041076 REG100A72F	7.62	7.62 OR 7.2	76	100	160	179	POLE/PLATFORM	22" X 22"	1620	-
9121941167 REG219A72F	7.62	7.62 OR 7.2	167	219	350	392	POLE/PLATFORM	24.5" X 24.5"	2770	85"
9132841250 REG328A72F	7.62	7.62 OR 7.2	250	328	525	588	PLATFORM	32" X 25"	3634	88"
9143804333 REG438A72F	7.62	7.62 OR 7.2	333	438	668	668	PLATFORM	29" X 17"	3950	97"
9220044288 REG200A72F	14.4 OR 7.2	14.4	288	200	320	358	PLATFORM	32" X 25"	3479	84"

* 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. 14.4 REGULATORS MAY BE USED ON 14.4 OR 7.2KV TAP. THEY COME SET FROM THE FACTORY FOR USE ON 14.4KV TAP. FOR USE IN HOLOPAW.
4. SEE DWG. 12.07-01 FOR STAINLESS STEEL REGULATORS. THESE UNITS ARE ONLY TO BE USED IN DESIGNATED COASTAL AREAS.

REVISED		BY	CK'D	APPR.
3				
2				
1	2/13/12	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

REGULATOR DESCRIPTION

Duke Energy®

FLA

DWG. 07.10-05

PROCEDURE TO DETERMINE WHEN REGULATOR TAP-CHANGER IS ON-NEUTRAL POSITION

PURPOSE:

TO PROVIDE OPERATING PROCEDURES FOR PROGRESS ENERGY DISTRIBUTION OPERATIONS PERSONNEL WHEN BYPASSING REGULATORS.

GENERAL:

IF REGULATORS ARE NOT IN THE NEUTRAL POSITION WHEN BYPASSED, THEY WILL FREQUENTLY FAIL AS A RESULT OF HIGH CIRCULATING CURRENTS INSIDE THE REGULATOR. THESE CIRCULATING CURRENTS ARE CAUSED BY A SHORT-CIRCUITING OF THE SERIES WINDING, AND ARE NOT DETECTED BY DISTRIBUTION LINE PROTECTIVE EQUIPMENT UNTIL THE FAULT CURRENT HAS DAMAGED THE REGULATOR.

TO BYPASS A REGULATOR, THE REGULATOR TAP-CHANGER MUST FIRST BE PLACED IN THE NEUTRAL POSITION. IF A LINEMAN PROCEEDS TO CLOSE THE BYPASS SWITCH WITH THE TAP-CHANGER AT SOME POSITION OTHER THAN NEUTRAL, PART OR ALL OF THE SERIES WINDING WILL BE SHORT-CIRCUITED. CIRCULATING CURRENTS CAN RANGE FROM 10,000 TO 30,000 AMPS.

SET REGULATOR TO NEUTRAL POSITION:

THERE ARE SEVERAL METHODS OF DETERMINING THE NEUTRAL POSITION. LISTED ARE FIVE METHODS; USE AS MANY METHODS AS NEEDED TO ASSURE REGULATOR IS ON NEUTRAL (2 OR MORE).

1. POSITION INDICATOR - THE POSITION INDICATOR IS MECHANICALLY DRIVEN BY THE TAP CHANGER. IT REGISTERS ALL 32 STEPS AND NEUTRAL. THIS IS THE MOST RELIABLE METHOD BUT IS NOT FOOLPROOF.
   A. CHECK THE POSITION INDICATOR'S SETTING.
   B. TURN REGULATOR "AUTO- OFF- RAISE/LOWER" CONTROL SWITCH TO THE DESIRED POSITION FOR RAISING OR LOWERING THE REGULATOR SETTING.
   C. RAISE OR LOWER THE REGULATOR SETTING TO REACH "NEUTRAL" INDICATION.

2. NEUTRAL INDICATOR LIGHT - THE LIGHT IS ACTIVATED BY A SWITCH ON THE TAP CHANGER WHICH CLOSES THE LIGHT CIRCUIT WHEN THE NEUTRAL POSITION IS REACHED. CHECK THE NEUTRAL INDICATOR LIGHT TO ENSURE IT IS "ON" WHEN THE REGULATOR POSITION INDICATOR POINTS TO NEUTRAL POSITION.

3. "HASTINGS REGULATOR NEUTRAL DETECTOR (RND) ON APPROVED HOT STICK". - THE HASTINGS RND, CATALOG NUMBER 6709-1, MUST BE USED IN CONJUNCTION WITH AN INSULATED HOT STICK. THE RND PROBES MUST BE PLACED BETWEEN ONLY THE SOURCE AND LOAD CONDUCTORS OF THE REGULATOR, IN A POSITION AWAY FROM ANY GROUND POTENTIAL. THE NEUTRAL POSITION WILL BE THE POSITION IN WHICH THE LOWEST RND READING IS OBTAINED. RND TESTING PROCEDURES ARE INSIDE THE RND CASE.

4. PD 50 PHASING VOLTMETER
   A. SELECT 2KV ON SELECTOR SWITCH ON METER PROBE.
   B. TAKE READING BETWEEN "S" AND "L" BUSHING USING PD 50 ATTACHED TO APPROPRIATE LENGTH STICK. READING LESS THAN 5 VOLTS CAN BE CONSIDERED IN THE NEUTRAL POSITION. IF READING GREATER THAN 5 VOLTS, STEP IN EITHER DIRECTION AND RECHECK WITH PD 50. IF LESS THAN 5 VOLT READING IS NOT OBTAINABLE, CONTACT DCC AND DE-ENERGIZE LINE AT AN UPSTREAM DEVICE.

   ADDITIONAL INFORMATION REGARDING PD 50 OPERATIONS CAN BE FOUND IN THE OPERATIONS QUICK REFERENCE MANUAL.

5. MANUAL STEPPING OF REGULATOR FROM MAXIMUM RAISE OR LOWER POSITION TO NEUTRAL (LEAST PREFERRED METHOD):
   A. SHOULD THE NEUTRAL INDICATOR LIGHT FAIL TO GIVE AN INDICATION AND ONLY ONE NEUTRAL INDICATION IS DETERMINED, THEN CHECK THE REGULATED VOLTAGE ON THE PANEL TO ASSIST IN DETERMINING IF THE REGULATOR CAN BE RAISED TO FULL RAISE POSITION WITHOUT RISKING A VOLTAGE LEVEL ABOVE THE REGULATED LIMIT, OR IF THE REGULATOR CAN BE LOWERED TO THE LOWEST POSITION WITHOUT RISKING A VOLTAGE LEVEL BELOW THE REGULATED LIMIT.
   B. THE NEUTRAL POSITION CAN BE FOUND BY MANUALLY STEPPING THE REGULATOR FROM **MAXIMUM** LOWER OR **MAXIMUM** RAISE POSITION AND COUNTING ALL THE STEPS. THE NUMBER OF STEPS REQUIRED TO REACH NEUTRAL WILL VARY DEPENDING ON WHAT THE REGULATION IS SET TO ON THE TAP-CHANGER HEAD:
      1. ±10% REGULATION WILL REQUIRE 16 STEPS TO REACH NEUTRAL.
      2. ±8.75% REGULATION WILL REQUIRE 14 STEPS TO REACH NEUTRAL.
      3. ±7.5% REGULATION WILL REQUIRE 12 STEPS TO REACH NEUTRAL.
      4. ±6.25% REGULATION WILL REQUIRE 10 STEPS TO REACH NEUTRAL.
      5. ±5% REGULATION WILL REQUIRE 8 STEPS TO REACH NEUTRAL.

REVISED		BY	CK'D	APPR.
3				
2				
1	7/15/11	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

VOLTAGE REGULATOR BYPASSING

DETERMINATION OF TAP-CHANGER ON-NEUTRAL

Duke Energy®

PGN DWG. 07.10-15A

PROCEDURE TO ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR(S)

1. CALL DCC AND NOTIFY OF PLANNED WORK TO ENERGIZE REGULATOR. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.
2. PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT SOURCE AND LOAD DISCONNECTS FOR REGULATOR SHALL NEVER BE BOTH CLOSED UNLESS REGULATOR IS IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS.
3. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I.E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.
4. REGULATOR SHOULD BE INSTALLED WITH BYPASS DISCONNECT CLOSED AND SOURCE AND LOAD DISCONNECTS OPEN AND ALL PERMANENT JUMPERS INSTALLED (PREFERRED CONSTRUCTION). IF A TEMPORARY JUMPER HAS BEEN INSTALLED AROUND THE INLINE DEAD-END, THE SOURCE AND LOAD DISCONNECTS SHALL BE VERIFIED TO BE OPEN. CLOSE BYPASS DISCONNECT AND REMOVE THE TEMPORARY JUMPER.
5. VERIFY THAT REGULATOR IS IN NEUTRAL POSITION. IF NOT, CLOSE SOURCE DISCONNECT AND SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND **REMOVE ALL CONTROL FUSES**.
6. PERSON IN CHARGE SHALL VERIFY THAT BYPASS DISCONNECT IS CLOSED, SOURCE DISCONNECT IS CLOSED, LOAD DISCONNECT IS OPEN, REGULATOR IS ON NEUTRAL POSITION, CONTROL IS OFF, AND **ALL CONTROL FUSES** ARE REMOVED. PERSON IN CHARGE SHALL EXAMINE THE WORK ZONE AND STOP ANY ACTIVITY THAT MAY BE DISTRACTING TO THE PERSON IN CHARGE OR THE PERSON WHO WILL CLOSE THE LOAD DISCONNECT. PERSON IN CHARGE WILL THEN AUTHORIZE THAT LOAD SIDE DISCONNECT BE CLOSED.
7. CLOSE LOAD SIDE DISCONNECT. VERIFY THAT BYPASS, SOURCE AND LOAD DISCONNECTS ARE ALL CLOSED, AND OPEN BYPASS DISCONNECT.
8. INSTALL **ALL CONTROL FUSES**. SWITCH CONTROL TO AUTO POSITION.
9. REPEAT PROCESS IF MULTIPLE REGULATORS ARE INSTALLED, SUCH AS A THREE PHASE BANK.
10. REMOVE HOT LINE TAG.
11. NOTIFY DCC THAT WORK IS COMPLETE, AND REGULATOR IS IN SERVICE.
12. NOTIFY LOCAL ENGINEER THAT REGULATOR IS IN SERVICE.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/5/14	GUINN	GUINN	ADCOCK
0	4/1/10	GUINN	GUINN	ELKINS

VOLTAGE REGULATOR BYPASSING
ENERGIZING PROCEDURE

DEC	DEM	DEP	DEF
		X	X

07.10-15B

PROCEDURE TO DE-ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR(S)

1. CALL DCC AND NOTIFY OF PLANNED WORK TO DE-ENERGIZE REGULATOR. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.

2 PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT BYPASS DISCONNECT SHALL NEVER BE CLOSED UNLESS REGULATOR IS IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS. CONTROL MUST ALSO BE IN THE OFF POSITION WITH **ALL CONTROL FUSES** REMOVED.

3. A HOT LINE TAG NORMALLY IS NOT REQUIRED TO DE-ENERGIZE A LINE REGULATOR. HOWEVER, PERSON IN CHARGE MAY DECIDE TO PLACE ONE IF DEEMED NECESSARY. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I.E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.

4. VERIFY THAT SOURCE AND LOAD DISCONNECTS ARE CLOSED AND BYPASS DISCONNECT IS OPEN.

5. SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND REMOVE **ALL CONTROL FUSES**.

6. PERSON IN CHARGE SHALL VERIFY THAT SOURCE AND LOAD DISCONNECTS ARE CLOSED, BYPASS SWITCH IS OPEN, REGULATOR IS ON NEUTRAL POSITION, CONTROL IS OFF, AND **ALL CONTROL FUSES** ARE REMOVED. PERSON IN CHARGE SHALL EXAMINE THE WORK ZONE AND STOP ANY ACTIVITY THAT MAY BE DISTRACTING TO THE PERSON IN CHARGE OR THE PERSON WHO WILL CLOSE THE BY-PASS DISCONNECT. PERSON IN CHARGE WILL THEN AUTHORIZE THAT BY-PASS DISCONNECT BE CLOSED.

7. CLOSE BYPASS DISCONNECT. VERIFY THAT BYPASS, SOURCE AND LOAD DISCONNECTS ARE ALL CLOSED. OPEN LOAD DISCONNECT. OPEN SOURCE DISCONNECT.

8. INSTALL **ALL CONTROL FUSES**.

9. REPEAT PROCESS IF MULTIPLE REGULATORS ARE INSTALLED, SUCH AS A THREE-PHASE BANK.

10. REMOVE HOT LINE TAG IF ONE WAS PLACED.

11. NOTIFY DCC THAT WORK IS COMPLETE AND REGULATOR IS OUT OF SERVICE.

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

VOLTAGE REGULATOR BYPASSING

DE-ENERGIZING PROCEDURE

Duke Energy®

PGN DWG. 07.10-15C

PROCEDURE TO DE-ENERGIZE SINGLE-PHASE DISTRIBUTION LINE VOLTAGE REGULATOR

THAT IS NOT OPERATING AND IS OFF-NEUTRAL POSITION

1. (PEC ONLY) NOTIFY DISTRIBUTION I & C GRID TECH THAT A REGULATOR IS STUCK OFF-NEUTRAL AND SHOULD BE REPAIRED. IF POSSIBLE, DISTRIBUTION GRID TECH SHOULD PERFORM THIS PROCEDURE. IF FAILS, GO TO STEP 2.

2. DISTRIBUTION PERSONNEL TO CALL DCC AND NOTIFY OF PLANNED WORK TO DE-ENERGIZE A REGULATOR STUCK OFF NEUTRAL. PROVIDE FEEDER NAME AND LOCID NUMBER AT THE SITE.

3. PRE-JOB BRIEFING SHALL INCLUDE THE WARNING THAT BYPASS DISCONNECT FOR REGULATOR SHALL NEVER BE CLOSED UNLESS REGULATOR IS DE-ENERGIZED OR IN NEUTRAL POSITION AND VERIFIED TO BE IN NEUTRAL BY TWO METHODS AS DESCRIBED IN DISTRIBUTION SPECIFICATIONS.

4. PLACE HOT LINE TAG ON NEAREST SOURCE SIDE DEVICE IN ACCORDANCE WITH STANDARD PROCEDURE. IF WORKING OFF-SYSTEM (I. E. T/D JOB) COORDINATE HOT LINE TAG WITH APPROPRIATE OFF-SYSTEM OPERATIONS PERSONNEL.

5. IF POSSIBLE, MAKE REPAIR TO REGULATOR SO THAT IT CAN BE STEPPED TO NEUTRAL POSITION AND IF ADDITIONAL MAINTENANCE IS REQUIRED WHICH REQUIRES THE REGULATOR TO BE REMOVED FROM SERVICE FOLLOW STANDARD PROCEDURE FOR REMOVING A REGULATOR FROM SERVICE.

6. IF REGULATOR CAN NOT BE STEPPED TO NEUTRAL THE REGULATOR WILL HAVE TO BE DE-ENERGIZED TO REMOVE FROM SERVICE.

7. REGULATOR MUST BE DROPPED BY NEAREST SOURCE-SIDE LOAD BREAK DEVICE. IF THERE IS NO NEARBY LOADBREAK SINGLE-PHASE (PREFERRED) OR THREE-PHASE SWITCH THAT CAN BE OPENED TO CLEAR THE REGULATOR THEN A LINE CREW SHOULD BE ARRANGED TO INSTALL A SINGLE-PHASE LOAD BREAK SWITCH ON THE NEAREST SOURCE-SIDE POLE TO THE REGULATOR. NORMALLY, THE CIRCUIT BREAKER SHOULD NOT BE OPENED TO CLEAR A SINGLE-PHASE REGULATOR STUCK OFF NEUTRAL.

8. OPEN THE NEAREST SOURCE SIDE LOAD BREAK SWITCH. OPEN THE SOURCE AND LOAD-SIDE DISCONNECTS FOR THE REGULATOR AND CLOSE THE BYPASS DISCONNECT. CLOSE THE NEAREST SOURCE SIDE LOAD BREAK SWITCH.

9. REMOVE HOT LINE TAG IF ONE WAS PLACED.

10. NOTIFY DCC THAT WORK IS COMPLETE AND REGULATOR IS OUT OF SERVICE.

3				
2				
1				
0	10/26/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REGULATOR BYPASSING

OFF-NEUTRAL POSITION PROCEDURE

Duke Energy®

PGN

DWG. 07.10-15D

PROCEDURE TO BYPASS LINE REGULATORS FROM A DEAD LINE

IF IT IS NECESSARY TO BYPASS LINE REGULATORS FROM A DEAD LINE IN ORDER TO BACK FEED A CIRCUIT, THE REGULATORS SHALL BE BYPASSED AS FOLLOWS:

STEPS REQUIRED TO BYPASS REGULATORS FROM SERVICE:

1. OPEN LOAD SIDE DISCONNECT.

2. CLOSE BYPASS DISCONNECT.

3. LEAVE SOURCE SIDE DISCONNECT IN CLOSE POSITION.

STEPS REQUIRED TO RETURN REGULATORS TO SERVICE AFTER LINE IS ENERGIZED:

1. VERIFY THAT REGULATOR IS IN NEUTRAL POSITION. IF NOT, SWITCH THE REGULATOR CONTROL TO MANUAL POSITION AND OPERATE REGULATOR TO NEUTRAL POSITION. VERIFY NEUTRAL POSITION BY TWO METHODS IN ACCORDANCE WITH DISTRIBUTION SPECIFICATIONS. WHEN NEUTRAL POSITION IS VERIFIED TURN CONTROL TO OFF POSITION AND **REMOVE ALL CONTROL FUSES**.

2. CLOSE LOAD SIDE DISCONNECTS.

3. OPEN BYPASS DISCONNECTS.

4. INSTALL **ALL CONTROL FUSES**. SWITCH CONTROL TO AUTO POSITION.

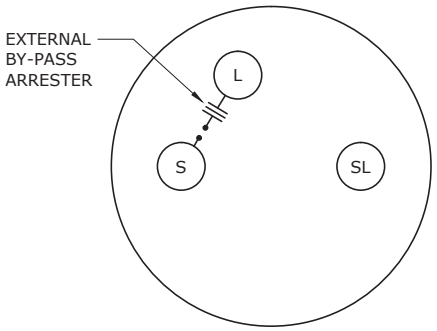
3				
2				
1				
0	9/7/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VOLTAGE REGULATOR BYPASSING
LINE REGULATORS FROM A DEAD LINE

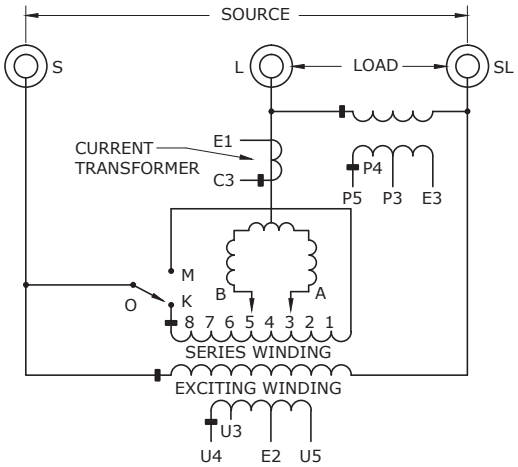
Duke Energy®

PGN DWG. 07.10-15E

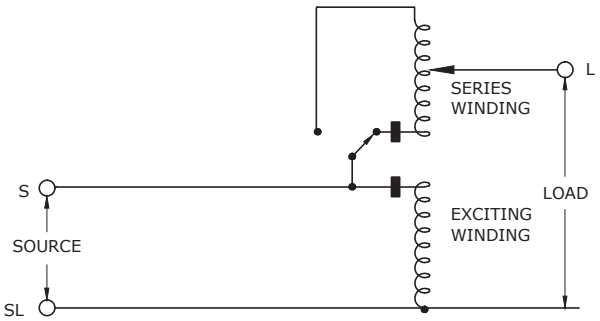
STRAIGHT DESIGN UNIT



TOP VIEW

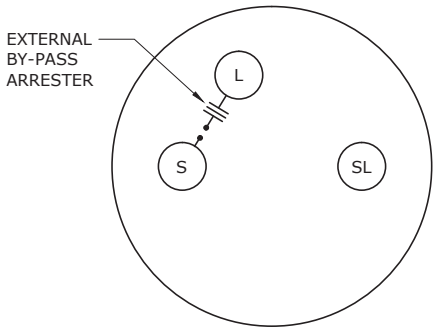


EXAMPLE NAMEPLATE
SCHEMATIC DIAGRAM

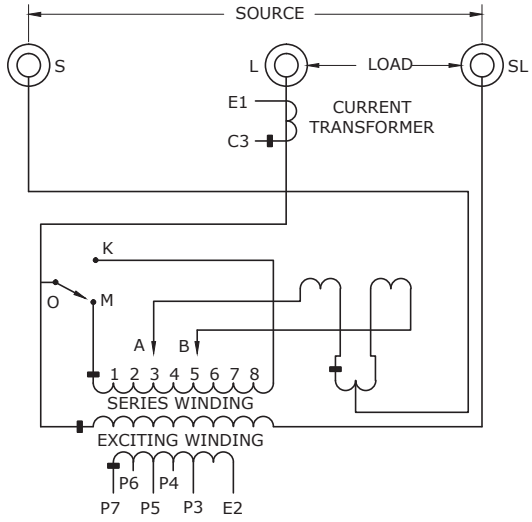


SCHEMATIC DIAGRAM REDRAWN FOR CLARITY
(SEE NOTE 1)

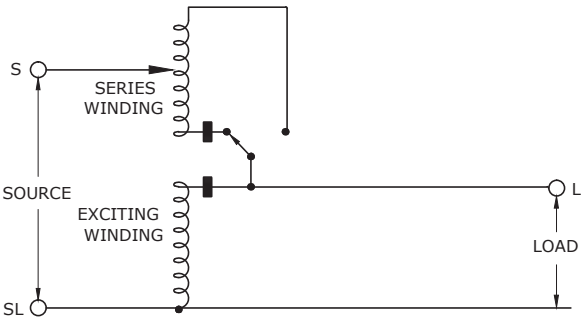
INVERTED DESIGN UNIT



TOP VIEW



EXAMPLE NAMEPLATE
SCHEMATIC DIAGRAM



SCHEMATIC DIAGRAM REDRAWN FOR CLARITY
(SEE NOTE 2)

NOTES:

1. A STRAIGHT DESIGN REGULATOR IS ONE IN WHICH THE SOURCE (S) BUSHING IS CONNECTED TO THE EXCITING WINDING AND THE LOAD (L) BUSHING IS CONNECTED TO THE TAP CHANGER MECHANISM ON THE SERIES WINDING TO RAISE AND LOWER THE LOAD VOLTAGE.

2. AN INVERTED DESIGN REGULATOR IS ONE IN WHICH THE LOAD (L) BUSHING IS CONNECTED TO THE EXCITING WINDING AND THE SOURCE (S) BUSHING IS CONNECTED TO THE TAP CHANGER MECHANISM ON THE SERIES WINDING TO RAISE AND LOWER THE LOAD VOLTAGE.

3. THE SL BUSHING IS THE GROUNDED NEUTRAL CONNECTION POINT.

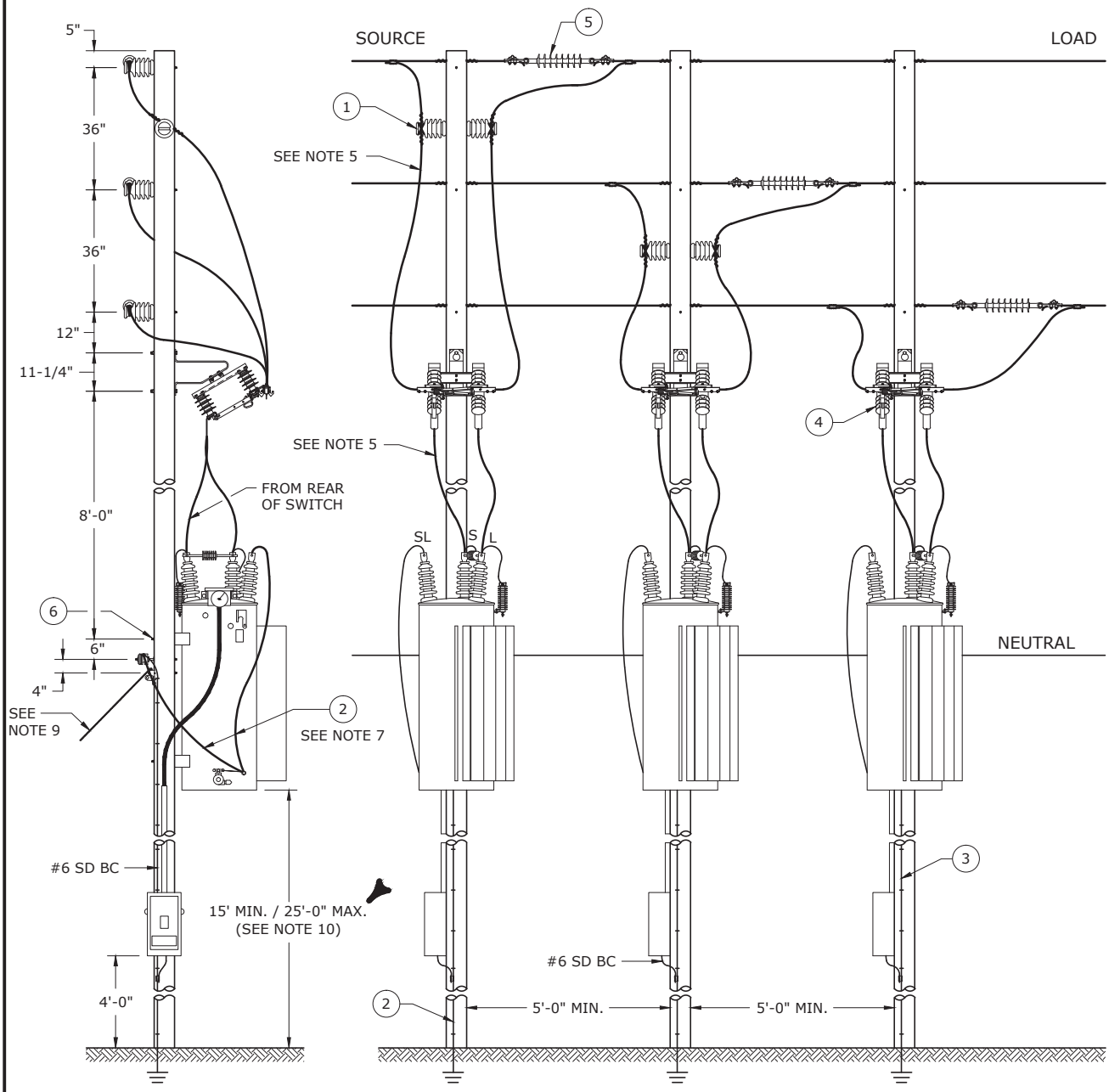
3				
2				
1				
0	4/1/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STRAIGHT AND INVERTED REGULATOR DESIGNS

Duke Energy®

PGN

DWG. 07.10-20



NOTES:

1. SEE DWG. 07.20-10B FOR BILL OF MATERIALS AND NOTES.
2. FOR THREE-PHASE REGULATOR INSTALLATIONS, A THREE REGULATOR PLATFORM IS PREFERRED OVER SINGLE-PLATFORM INSTALLATION.

REVISED		BY	CK'D	APPR.
3				
2	8/21/14	SIMMONS	DANNA	ADCOCK
1	6/21/13	SIMMONS	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, POLE MOUNTED FOR 167KVA AND SMALLER

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.20-10A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
RG1P100A72POFM	1	IHPTT15F	2	080212	1	INSULATOR, POST, TIE, TOP, 15/25KV, WITHOUT STUD
		ISSTUDBOLT5810F	2	013264	1	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				072366	1	STUD, LP 5/8" X 10"
	2	GOWE2F	1	160182	2	CONNECTOR, TF, GND, EYEBOLT
				015280	40	STAPLE, GALV STL 2" X 5/8" X 3/16"
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				162205	2	CONNECTOR, VISE TYPE 2 CU
				9220162221	40	CONDUCTOR, #2 SOLID, SOFT DRAWN, BARE, ON 125 FOOT SPOOL
	3	GAR4F	1	015280	8	STAPLE, GALV STL 2" X 5/8" X 3/16"
				060136	3	COUPLING, 5/8" THREADLESS, COPPER
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				190404	32	WIRE, CU, BR, SDW, SLD, #6
				9220192319	4	ROD, GROUND, COPPER CLAD, THREADLESS 5/8" X 5'
	4	SW256BYPC	1	9220087628	1	SWITCH, BY-PASS, 3-SLD BLADE DSCONN, 600A, 25KV, 1PH
				0010034908	2	BOLT, MCH, SQ, GLV 5/8" X 12" GALVANIZED MAC
				0010543007	2	WASHER, SQ, 2-1/4" X 2-1/4" X 3/16", GLV
				0010544005	2	WASHER, LK, 5/8, COIL, DBL, GLV
	5	IDES25PF	1	0000080577	1	INSULATOR, POLYMER, 25KV, DEADEND, SILICONE, RATED 15K
	6	REGHDWF	1	-	1	REGULATOR MOUNTING HARDWARE
	7	REG100A72F	1	9110041076	1	VR, 76KVA 100A W/OPTS

NOTES:

1. SEE DWG. 07.20-10A FOR DESIGN SPECIFICATIONS.
2. BILL OF MATERIALS IS BASED ON SUPPLY OF 1 REGULATOR.
3. REGULATORS SHOULD HAVE ARRESTERS PRE-INSTALLED ON THE TANK FOR THE SOURCE AND LOAD BUSHINGS.
4. ONE 10 FOOT SECTION OF 2-1/4" U-GUARD (CU CRIS1UGPVC225WF) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.
5. SIZE RISER (JUMPER) FROM REGULATOR TO BYPASS SWITCH FOR REGULATOR RATED CURRENT. SIZE RISER (JUMPER) FROM BYPASS SWITCH TO THE PRIMARY LINE TO BE EQUIVALENT TO THE PRIMARY LINE SIZE. WHEN CONNECTING ALUMINUM CONDUCTOR TO REGULATOR BUSHINGS, TERMINATE WITH A STEM CONNECTOR (DWG. 06.03-04). CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION.
6. SEE SECTION 01 FOR ADDITIONAL GROUNDING INFORMATION.
7. GROUND CONTROL BOX WITH #6 SD BC. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL.
8. **CAUTION:** WHEN IT IS NECESSARY TO BYPASS THE REGULATOR, SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND 07.10-15E.
9. A SIDE GUY IS REQUIRED TO KEEP POLE FROM LEANING. IF POLE CANNOT BE GUYED, USE CLASS 3 POLE THAT IS 5' TALLER THAN NECESSARY, BURY 5' DEEPER AND USE POLESET (CN 9220108823).
10. CLEARANCE OF REGULATOR ABOVE GROUND REQUIREMENT IS 15', UNLESS JOINT USERS EXIST. IF JOINT USE EXISTS ON THE POLE, THE HEIGHT OF THE REGULATOR MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLE SUCH THAT THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE REGULATOR AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO THE BOTTOM OF THE REGULATOR IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF THE REGULATOR FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF REGULATOR, SELECT ANOTHER LOCATION FOR THE REGULATOR.
11. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. SOURCE AND LOAD LEADS GOING TO THE BYPASS SWITCH CAN BE CROSSED AS LONG AS 12" CLEARANCE IS MAINTAINED.
12. SEE DWG. 07.10-05 FOR REGULATOR WEIGHTS, MOUNTING DIMENSIONS AND SAFETY REQUIREMENTS. ANCHOR EACH REGULATOR TO PLATFORM WITH A BOLT ON EACH CORNER.
13. SEE DWG. 08.10-10 FOR 600 AMP BY-PASS TYPE SWITCH.

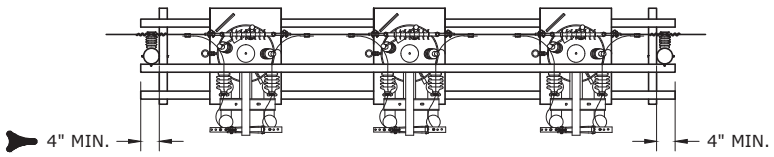
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	8/21/14	SIMMONS	DANNA	ADCOCK
1	4/18/13	McCONNELL	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

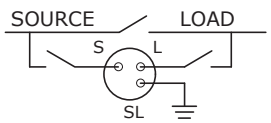
REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, POLE MOUNTED FOR 167KVA AND SMALLER

DEC	DEM	DEP	DEF
			X

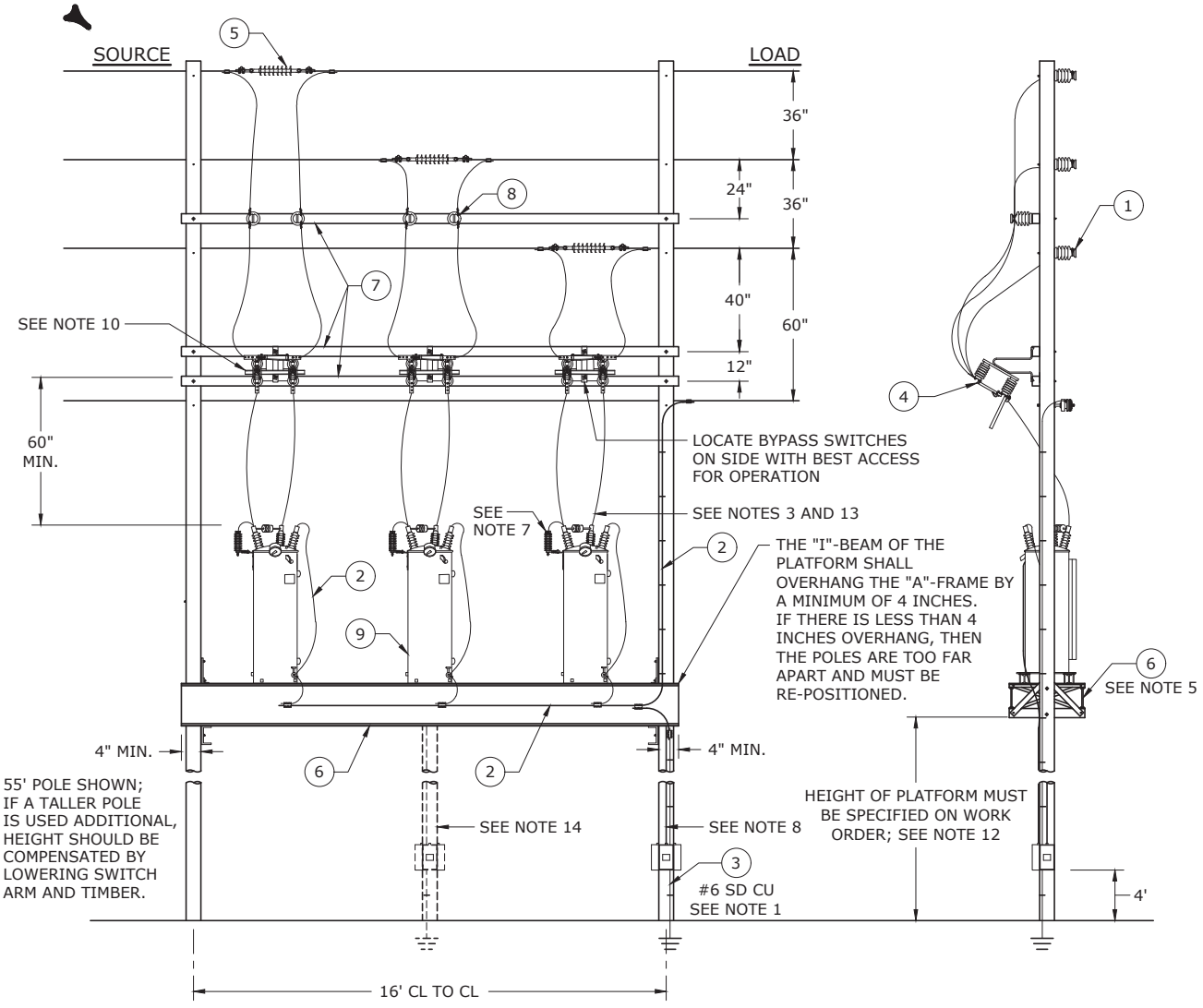
07.20-10B



PLAN VIEW



SCHEMATIC



FRONT VIEW

SIDE VIEW

NOTES:

1. SEE DWG. 07.20-25B FOR BILL OF MATERIALS AND NOTES.

REVISED		BY	CHK'D	APPR.
4	6/30/18	MORGAN	BURLISON	ADCOCK
3	8/21/14	SIMMONS	DANNA	ADCOCK
2	5/24/13	McCONNELL	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, PLATFORM MOUNTED

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.20-25A

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
RG3P100A723PFM	1	IHPTT15F	6	080212	1	INSULATOR, POST, TIE, TOP, 15/25KV, WITHOUT STUD
		ISSTUDBOLT5810F	6	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				072366	1	STUD, LP 5/8" X 10"
	2	GOWE2F	1	160182	2	CONNECTOR, TF, GND, EYEBOLT
				015280	40	STAPLE, GALV STL 2" X 5/8" X 3/16"
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8", ROD, 2, CU
				162205	2	CONNECTOR, VISE TYPE 2 CU
				9220162221	40	CONDUCTOR, #2 SOLID, SOFT DRAWN, BARE, ON 125 FOOT SPOOL
	3	GAR4F	1	015280	8	STAPLE, GALV STL 2" X 5/8" X 3/16"
				060136	3	COUPLING, 5/8" THREADLESS, COPPER
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8", ROD, 2, CU
				190404	32	WIRE, CU, BR, SDW, SLD, #6
				9220192319	4	ROD, GROUND, 5/8" X 60", COPPER CLAD, THREADLESS 5/8" X 5'
	4	SW256BYPF	3	260552	1	SWITCH, SOLID BLADE, BYPASS, 600AMP DISCONNECT, 25KV
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	5	IDES25PF	3	080577	1	INSULATOR, POLYMER, 25KV, DEADEND, SILICONE, RATED 15K
	6	PLF16HDALF	1	10351203	1	PLATFORM, BEAM, 3'-5 5/8" X 16', AL HEAVY DUTY 11-1/2"
				152122	4	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307, GLV, 10, UNC
				013308	8	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				014114	4	SCREW, LAG, 1/2" X 4", STEEL, GLV, LAG, 1/2" X 4"
				152105	12	BOLT, MACH, SQ, NUT, 5/8" X 6"
				013264	16	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	7	ARMS18WF	3	032147	1	TIMBER, 4" X 6" X 18', PENTA
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	8	IHPTT15F	4	080212	1	INSULATOR, POST, TIE, TOP, 15/25KV, WITHOUT STUD
		ISSTUDBOLT5812F	4	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				072367	1	STUD, LINE POST 5/8" X 12"
	9	REG100A72F	3	9110041076	1	VR, 76KVA 100A W/OPTS
RG3P219A723PFM	REGULATOR MU THREE-PHASE 219A 7.2KV MILD THREE-PHASE PLATFORM					
RG3P328A723PFM	REGULATOR MU THREE-PHASE 328A 7.2KV MILD THREE-PHASE PLATFORM					
RG3P438A723PFM	REGULATOR MU THREE-PHASE 438A 7.2KV MILD THREE-PHASE PLATFORM					
RG3P200A143PFM	REGULATOR MU THREE-PHASE 200A 14.4KV MILD THREE-PHASE PLATFORM					

NOTES:

1. GROUND CONTROL BOXES AND PLATFORM WITH #6 SD BC. GROUND PLATFORM WITH COPPER GROUNDING LUG. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM SL BUSHING TO REGULATOR TANK GROUND, THEN TO SYSTEM NEUTRAL.
2. SEE DWG. 07.20-25A FOR DESIGN SPECIFICATIONS.
3. SIZE RISER (JUMPER) FROM REGULATOR TO BYPASS SWITCHES FOR REGULATOR RATED CURRENT. SIZE RISER (JUMPER) FROM BYPASS SWITCH TO THE PRIMARY LINE TO BE EQUIVALENT TO THE PRIMARY LINE SIZE. WHEN CONNECTING ALUMINUM CONDUCTOR TO REGULATOR BUSHINGS, TERMINATE WITH STEM CONNECTOR (DWG. 06.03-04). CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION.
4. SEE DWG. 07.10-05 FOR REGULATOR WEIGHTS, MOUNTING DIMENSIONS AND SAFETY REQUIREMENTS. ANCHOR EACH REGULATOR TO PLATFORM WITH BOLT ON EACH CORNER.
5. MOUNT PLATFORM WITH 3/4" BOLTS (2 PER SIDE - TOTAL OF 4). ADD CENTER STUB FOR WEIGHTS GREATER THAN 13,800 POUNDS; SEE DWG. 06.08-03.
6. **CAUTION:** WHEN IT IS NECESSARY TO BYPASS THE REGULATOR, SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND 07.10-15E.
7. NEW REGULATORS SHOULD HAVE LIGHTNING ARRESTERS PRE-INSTALLED AT THE SOURCE AND LOAD BUSHINGS. IF NOT, CN 14012033 INCLUDES 10KV ARRESTERS, TANK MOUNTING BRACKET AND PRIMARY TAP LEAD.
8. ONE 10 FOOT SECTION OF 2-1/4" U-GUARD (CU CRIS1UGPVC225WF) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET. WHEN USING U-GUARD, ALLOW 1.5 FEET OF VERTICAL CLEARANCE BETWEEN BOTTOM OF U-GUARD AND TOP OF CONTROL BOX TO ELIMINATE OVERSTRESSING THE CONDUIT CONNECTION TO THE CONTROL BOX.
9. SEE DWG. 06.08-03 FOR PLATFORM SPECIFICATIONS.
10. SEE DWG. 08.10-10 FOR 600 AMP BY-PASS TYPE SWITCH.
11. BILL OF MATERIALS IS BASED ON SUPPLY OF 3 REGULATORS. SINGLE REGULATOR REQUIREMENTS WILL HAVE TO BE ADJUSTED ACCORDINGLY.
12. CLEARANCE TO BOTTOM OF PLATFORM CAN BE 11' ONLY IF THE AREA UNDER THE PLATFORM IS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC. IF AREA UNDER PLATFORM IS SUBJECT TO RIDERS ON HORSEBACK OR OTHER LARGE ANIMALS, VEHICLES OR OTHER MOBILE UNITS EXCEEDING 8' IN HEIGHT, THE DIMENSION TO THE BOTTOM OF THE PLATFORM SHALL BE 15' MINIMUM. HEIGHT OF PLATFORM MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLES SO THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE PLATFORM AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO BOTTOM OF PLATFORM IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF PLATFORM FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF PLATFORM, SELECT ANOTHER LOCATION FOR THE PLATFORM.
13. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED - MAINTAIN MINIMUM 12" CLEARANCE BETWEEN LEADS.
14. WHEN CENTER STUB IS USED, MOUNT CONTROLS ON CENTER STUB AND INSTALL GROUND RODS AT CENTER STUB INSTEAD OF END POLE.

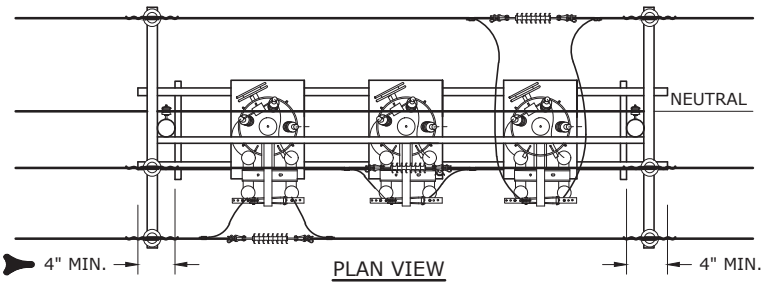
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3	8/21/14	SIMMONS	DANNA	ADCOCK
2	5/24/13	McCONNELL	DANNA	ADCOCK
1	3/8/13	SIMMONS	GUINN	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

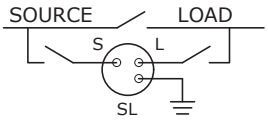
REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, PLATFORM MOUNTED

DEC	DEM	DEP	DEF
			X

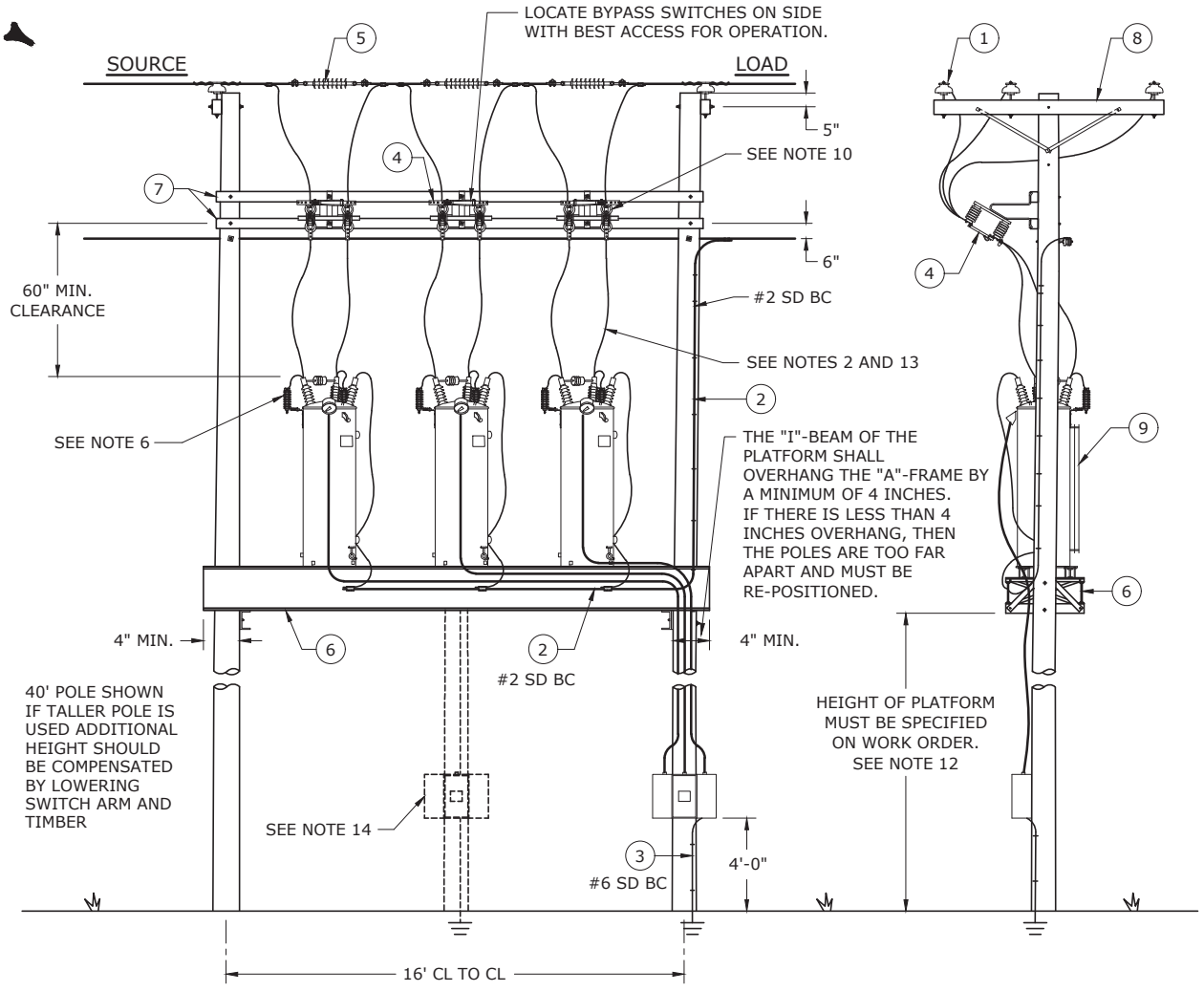
07.20-25B



PLAN VIEW



SCHEMATIC



FRONT VIEW

SIDE VIEW

NOTES:

1. SEE DWG. 07.20-30B FOR BILL OF MATERIALS AND NOTES.

3				
2	6/30/18	MORGAN	BURLISON	ADCOCK
1	8/21/14	SIMMONS	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CHK'D	APPR.

REGULATOR ASSEMBLY, HORIZONTAL CONSTRUCTION, PLATFORM MOUNTED

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

07.20-30A

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	IPIN23F	3	080304	1	INSULATOR, PIN, 23KV, CLASS-55-5
		PINCARMS586F	3	072306	1	PIN, SHDR, 6" X 5/8 X6-1/2, S 6 INCH FORGED STEEL SHOULDER
	2	GOWE2F	1	160182	2	CONNECTOR, TF, GND, EYEBOLT
				015280	40	STAPLE, GALV STL 2" X 5/8" X 3/16"
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				162205	2	CONNECTOR, VISE TYPE 2 CU
				9220162221	40	CONDUCTOR, #2 SOLID, SOFT DRAWN, BARE, ON 125 FOOT SPOOL
	3	GAR4F	1	015280	8	STAPLE, GALV STL 2" X 5/8" X 3/16"
				060136	3	COUPLING, 5/8" THREADLESS, COPPER
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				190404	32	WIRE, CU, BR, SDW, SLD, #6
				9220192319	4	ROD, GROUND, 5/8" X 60" IN, COPPER CLAD, THREADLESS
	4	SW156BYPF	3	260123	1	SWITCH, SOILD BLADE, BYPASS, 600AMP DISCONNECT, 15KV
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	5	IDES25PF	3	080577	1	INSULATOR, POLYMER, 25KV, DEADEND, SILICONE, RATED 15K
	6	PLF16HDALF	1	10351203	1	PLATFORM, BEAM, 3'-5 5/8" X 16', AL HEAVY DUTY 11-1/2"
				152122	4	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307, GLV, 10, UNC
				013308	8	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				014114	4	SCREW, LAG, 1/2" X 4", STEEL, GLV, LAG, 1/2" X 4"
				152105	12	BOLT, MACH, SQ, NUT, 5/8" X 6"
				013264	16	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	7	ARMS18WF	2	032147	1	TIMBER, 4" X 6" X 18', PENTA
				013264	2	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	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, 299WOOD, 4-3/4" X 5-3/4" X 10', MS-121-F HEAVY
				071206	1	BRACE, BOW ANG STL 60"
				152098	2	BOLT, MACH, SQ, NUT, 1/2" X 7"
				152107	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
				152108	1	BOLT, MACH, SQ, NUT, 5/8" X 16"
	9	-		-	3	REGULATOR (VARIES)

NOTES:

1. GROUND CONTROL BOXES AND PLATFORM WITH #6 SD BC. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL LOOP.
2. SIZE RISER (JUMPER) FROM REGULATOR TO BYPASS SWITCHES FOR REGULATOR RATED CURRENT. SIZE RISER (JUMPER) FROM BYPASS SWITCHES TO THE PRIMARY LINE TO BE EQUIVALENT TO THE PRIMARY LINE SIZE. WHEN CONNECTING ALUMINUM CONDUCTOR TO REGULATOR BUSHINGS, CONNECT WITH STEM CONNECTOR (SEE DWG. 06.03-04). CONNECTORS USED ON INSULATED WIRE TO BE SEALED BY APPLYING AQUA SEAL AND WRAPPING WITH ELECTRICAL TAPE TO PREVENT WATER INTRUSION.
3. MOUNT PLATFORM WITH 3/4" BOLTS (2 PER SIDE - TOTAL OF 4). SEE DWG. 07.10-05 FOR REGULATOR WEIGHTS, MOUNTING DIMENSIONS AND SAFETY REQUIREMENTS. ANCHOR EACH REGULATOR TO PLATFORM WITH BOLT ON EACH CORNER.
4. ADD CENTER STUB FOR WEIGHTS GREATER THAN 13,800 POUNDS; SEE DWG. 06.08-03.
5. **CAUTION:** WHEN IT IS NECESSARY TO BYPASS THE REGULATOR, SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D AND AND 07.10-15E.
6. NEW REGULATORS SHOULD HAVE LIGHTNING ARRESTERS PRE-INSTALLED AT THE SOURCE AND LOAD BUSHINGS. IF NOT, CN 14012033 INCLUDES 10KV ARRESTERS, TANK MOUNTING BRACKET AND PRIMARY TAP LEAD.
7. ONE 10 FOOT SECTION OF 2-1/4" U-GUARD (CU CRIS1UGPVC225WF) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.
8. SEE DWG. 07.20-30A FOR DESIGN SPECIFICATIONS.
9. SEE DWG. 06.08-03 FOR PLATFORM SPECIFICATIONS.
10. SEE DWG. 08.10-10 FOR 600 AMP BYPASS TYPE SWITCH.
11. BILL OF MATERIALS IS BASED ON SUPPLY OF 3 REGULATORS. SINGLE REGULATOR REQUIREMENTS WILL HAVE TO BE ADJUSTED ACCORDINGLY.
12. CLEARANCE OF PLATFORM ABOVE GROUND REQUIREMENT IS 15', UNLESS JOINT USERS EXIST. IF JOINT USE EXISTS ON THE POLE, THE HEIGHT OF THE PLATFORM MUST BE INCREASED TO ALLOW FOR JOINT USERS TO ATTACH TO THE POLE SUCH THAT THEY HAVE ADEQUATE GROUND CLEARANCE UNDER THE PLATFORM AND IN ADJACENT SPANS (JOINT USERS NEED 15.5'). CLEARANCE FROM THE HIGHEST JOINT USE ATTACHMENT TO THE BOTTOM OF THE PLATFORM IS 2.5' (IF COMMUNICATIONS MESSENGER IS BONDED TO THE NEUTRAL) SO MINIMUM HEIGHT OF THE PLATFORM FOR A LINE WITH A SINGLE JOINT USER IS 18.0'. INCREASE SPACING AS NEEDED TO ALLOW FOR MULTIPLE JOINT USERS AND SAG IN ADJACENT SPANS, UP TO 25' MAX. IF JOINT USERS CAN NOT GET ADEQUATE CLEARANCE WITH 25' HEIGHT OF PLATFORM, SELECT ANOTHER LOCATION FOR THE PLATFORM.
13. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED - MAINTAIN MINIMUM 12" CLEARANCE BETWEEN LEADS.
14. WHEN CENTER STUB IS USED, MOUNT CONTROLS ON CENTER STUB AND INSTALL GROUND RODS AT CENTER STUB INSTEAD OF END POLE.

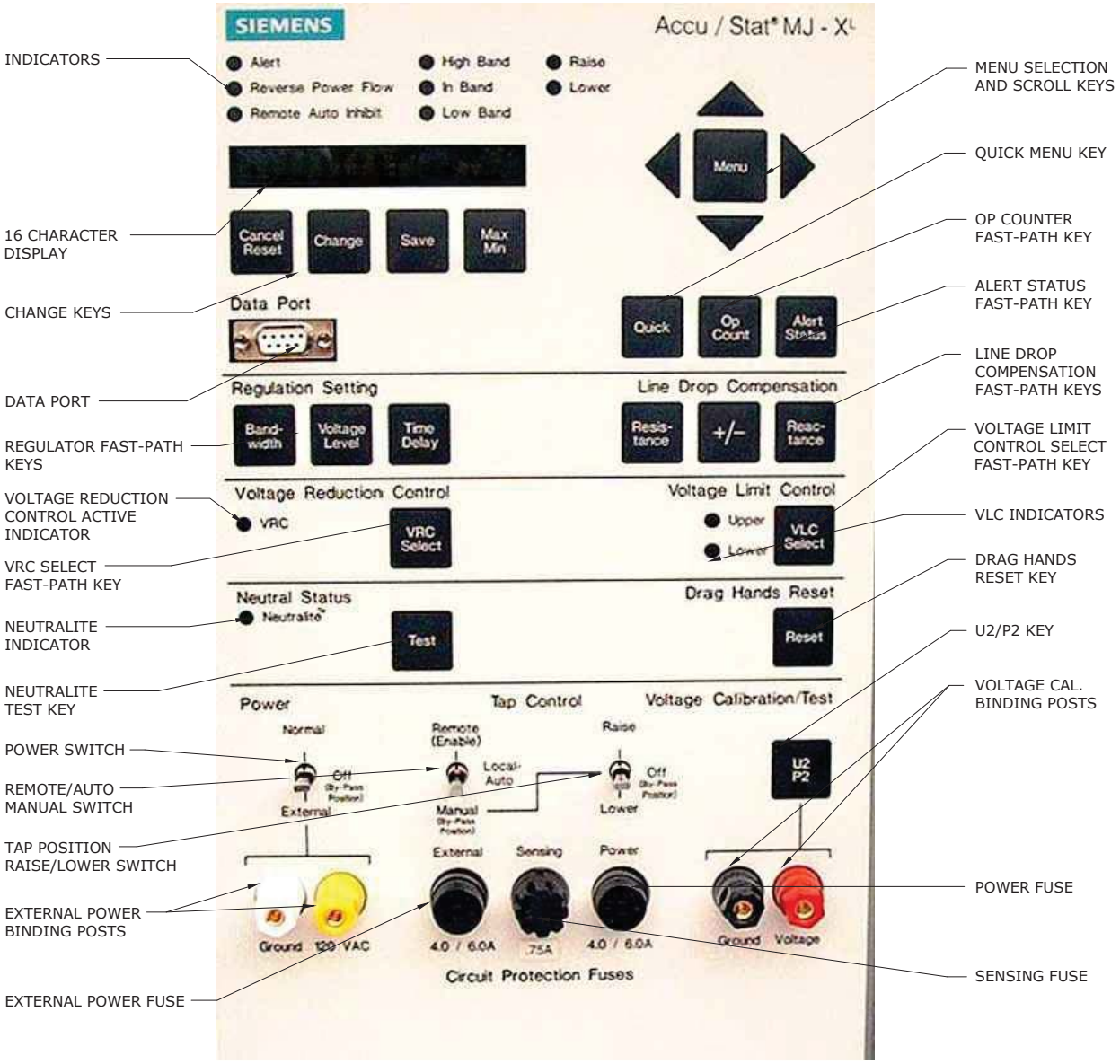
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	8/21/14	SIMMONS	DANNA	ADCOCK
1	10/17/13	SIMMONS	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

REGULATOR ASSEMBLY, HORIZONTAL CONSTRUCTION, PLATFORM MOUNTED

DEC	DEM	DEP	DEF
			X

07.20-30B



3				
2				
1				
0	8/30/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SIEMENS MJ-XL SINGLE-PHASE REGULATOR CONTROL

Duke Energy®

FLA

DWG. 07.30-10

FEATURES:

- MICROCONTROLLER-BASED LTC TRANSFORMER AND REGULATOR CONTROL PROVIDES RELIABLE OPERATION AND EXPANDED CAPABILITIES.
- TWO ACTIVE SERIAL COMMUNICATIONS PORTS, THROUGH RS-232, RS-485, OR FIBER OPTICS
- FIELD-UPDATABLE PROGRAMMING
- REVERSE POWER DETECTION/ OPERATION
- DEMAND METERING
- TIME/ DATE STAMPING OF MAXIMUM/ MINIMUM SYSTEM CONDITIONS
- DATA LOGGING OF METERED PARAMETERS
- SELF-TEST ALARM AND USER-PROGRAMMABLE ALARM
- LINE OVERCURRENT TAPCHANGE INHIBIT
- LDC WITH R & X OR Z-COMPENSATION
- DEFINITE OR INVERSE TIME DELAY
- VOLTAGE LIMITS WITH AUTOMATIC RUNBACK, TAP POSITION LIMITS
- SEE BECKWITH INSTALLATION/OPERATION MANUAL FOR FUNCTIONS TO STEP THROUGH MENU

3				
2				
1				
0	8/30/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

BECKWITH M-2001B MOD 467
REGULATOR CONTROL

Duke Energy

FLA

DWG. 07.30-20

BAND EDGE INDICATORS ALERT YOU TO OUT-OF-BAND HIGH OR LOW CONDITIONS

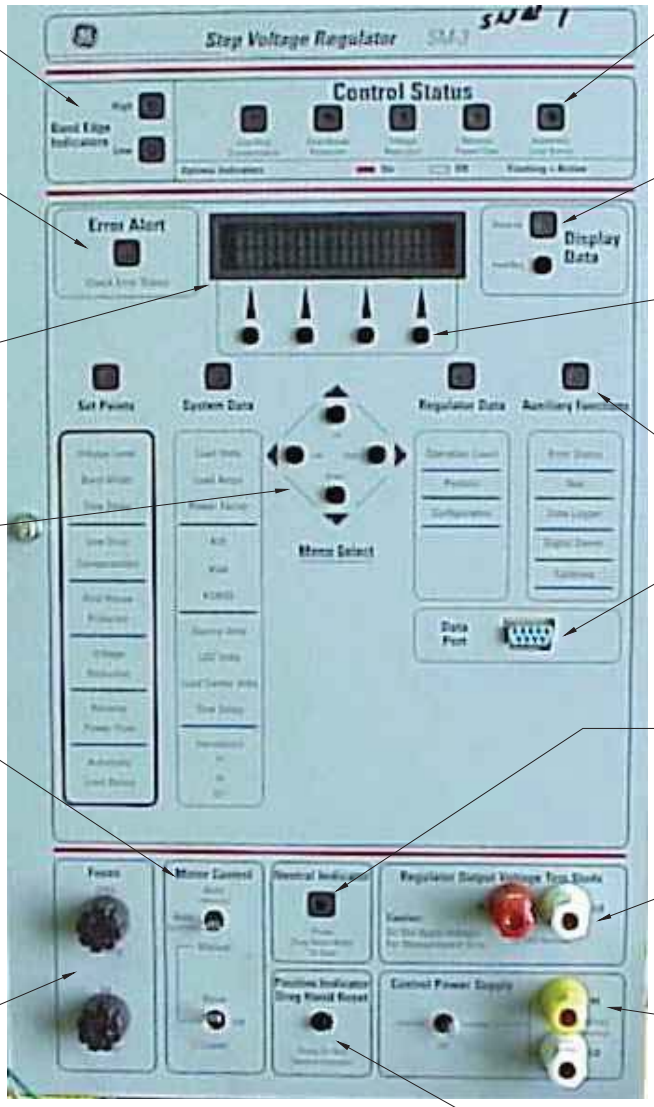
ERROR ALERT LED DISPLAY IMMEDIATE ERROR STATUS

MULTILINE, HIGHLY-VISIBLE VACUUM-FLUORESCENT DISPLAY SHOWS METERING DATA AND ALLOWS EASY PROGRAMMING

MENU SELECT KEYPAD ENABLES EASY MENU NAVIGATION

MOTOR CONTROL LETS YOU SELECT AUTOMATIC OR MANUAL CONTROL; IN MANUAL MODE, MOTOR CONTROL SWITCH LETS YOU OPERATE THE MOTOR DIRECTLY TO RAISE OR LOWER THE POSITION OF THE TAP CHANGER.

FUSES PROVIDE SEPARATE PROTECTION FOR THE CONTROL AND THE TAP CHANGE MOTOR



CONTROL STATUS LED'S SHOW STATUS OF VARIOUS OPTIONS

DISPLAY DATA LED SHOWS POWER FLOW DIRECTION

SOFTKEYS PROVIDE INTERACTION WITH DISPLAYED MENUS

LEDS INDICATE WHICH MENU IS CURRENTLY ACTIVE

RS-232 PORT FOR COMMUNICATIONS WITH WINDOWS-BASED CONFIGURATION SOFTWARE

NEUTRAL INDICATOR INDICATES WHEN REGULATOR IS IN NEUTRAL POSITION

OUTPUT VOLTAGE TEST STUDS ALLOW YOU MEASURE SYSTEM VOLTAGE WITH AN EXTERNAL METER

CONTROL POWER SUPPLY STUDS ALLOW YOU TO SUPPLY EXTERNAL POWER TO UNIT

DRAG HAND RESET BUTTON RETURNS THE DRAG HANDS TO PRESENT POSITION AND ALLOWS THE USER TO TEST THE NEUTRAL INDICATOR.

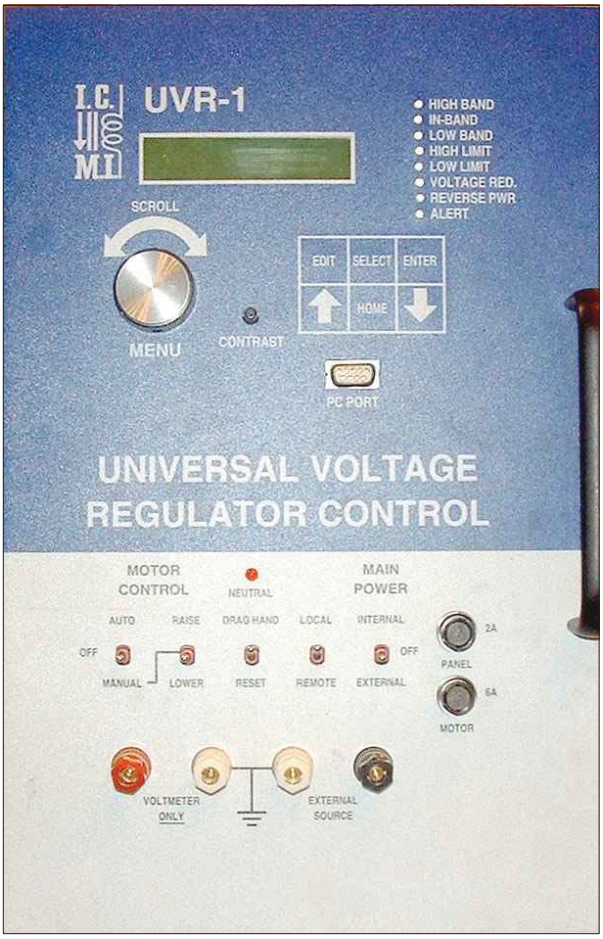
3				
2				
1				
0	4/5/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

GE SM3 SINGLE-PHASE REGULATOR CONTROL

Duke Energy

FLA

DWG. 07.30-30



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	REGCNUVR1F	1	9220103751	1	PANEL, CONTROL, REGULATOR, ICMI UVR-1 ELECTRONIC, WITH FIBER PORT
	2	RGCNBX3F	1	9220103755	1	304L STAINLESS STEEL REPLACEMENT CABINET FOR ICMI CONTROL
	3	RGCNBXMF	1	9220191749	1	PLAIN / MILD STEEL REPLACEMENT CABINET FOR ICMI CONTROL
	4	REGCNUVR1RCPSF	1	9220103751	1	PANEL, CONTROL, REGULATOR, ICMI UVR-1 ELECTRONIC, WITH FIBER PORT
				9220098521	1	KIT, HARNESS & RAIL, FOR COOPER CL-4 AND CL-5 CONTROL
	5	REGCNUVR1RSIEF	1	9220103751	1	PANEL, CONTROL, REGULATOR, ICMI UVR-1 ELECTRONIC, WITH FIBER PORT
				9220098520	1	KIT, HARNESS & RAIL, FOR SIEMENS
	6	REGCNUVR1RSM3F	1	9220103751	1	PANEL, CONTROL, REGULATOR, ICMI UVR-1 ELECTRONIC, WITH FIBER PORT
				9220104591	1	KIT, HARNESS & RAIL, FOR GE SM-3

NOTES:

1. REPLACEMENT 2 AMP (TYPE ABC) FUSE FOR THE UVR-1 PANEL IS CN 9220229396.
2. REPLACEMENT 6 AMP (TYPE MDA) FUSE FOR THE UVR-1 PANEL IS CN 9220229395.

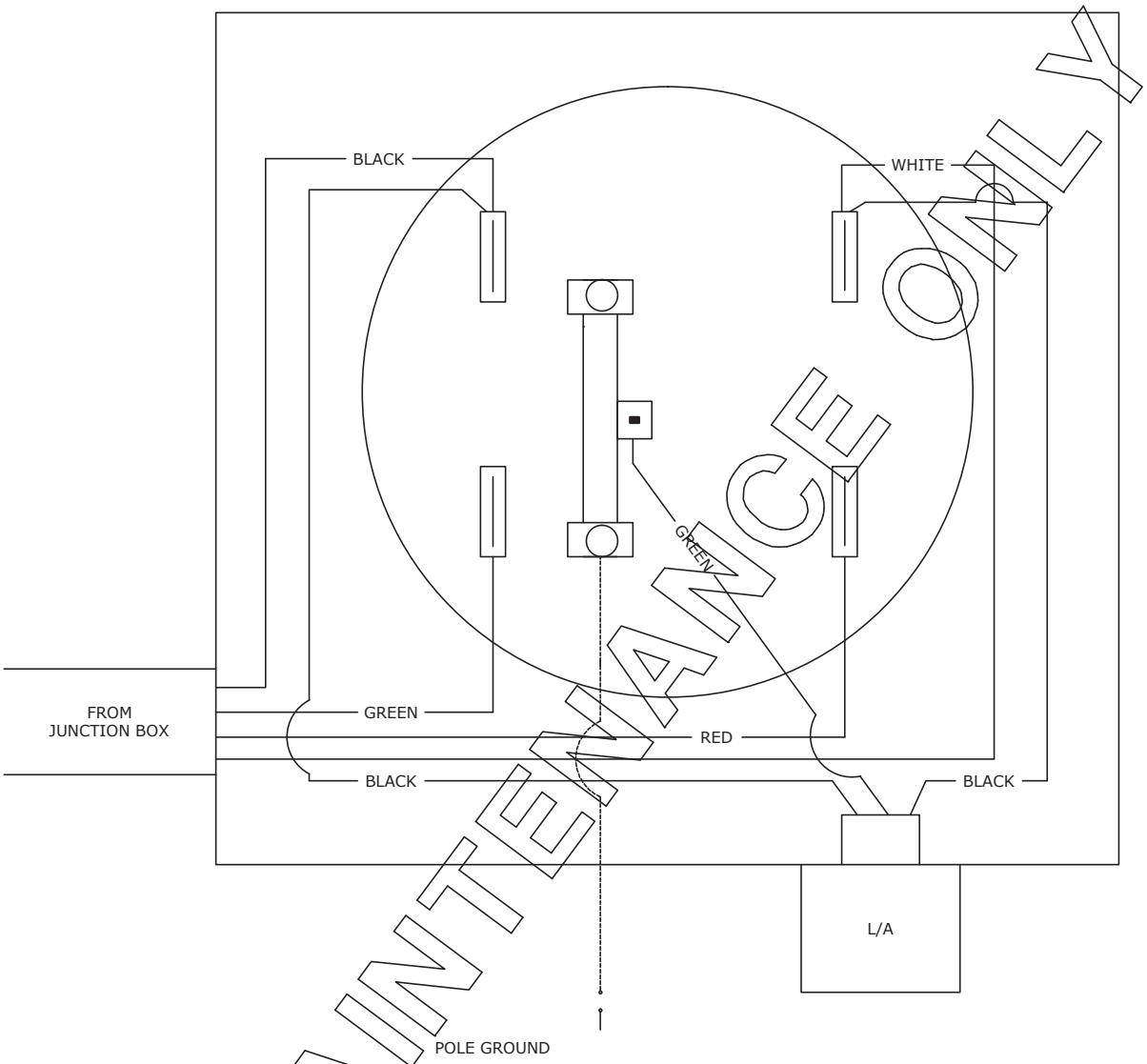
REVISED		BY	CK'D	APPR.
3				
2				
1	9/29/11	SIMMONS	BURLISON	ELKINS
0	10/14/10	SIMMONS	GUINN	ELKINS

ICMI UVR-1 UNIVERSAL SINGLE-PHASE REGULATOR CONTROL

Progress Energy

FLA

DWG. 07.30-35



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

WIRING SCHEMATIC -
BECKWITH TYPE CONTROL (FMO)

Duke Energy®

FLA

DWG.
07.04-15A

1. AUTO/MANUAL SWITCH CAN BE ACCESSED BY REMOVING LEXAN COVER. ALLOWS MANUAL INITIATION OPEN OR CLOSE AFTER 30 SECOND DELAY. THE CONTROL IS SUBJECT TO A FIVE MINUTE RECLOSING DELAY.

2. OPEN/CLOSE SWITCH WORK IN THE MANUAL MODE.

3. MANUAL MODE LED (BLUE) - LIT STEADILY WHEN THE CONTROL IS IN THE MANUAL MODE. IT WILL BLINK FOR FIVE MINUTES AFTER A MANUAL OPEN OPERATION IS INITIATED IN THE MANUAL MODE.

4. AUTOMATIC MODE LED (YELLOW) - LIT STEADILY WHEN IN THE AUTOMATIC MODE.

5. CLOSE LED (RED) - LIT CONTINUOUSLY WHEN THE CONTROL BELIEVES THE BANK IS CLOSED AND DURING THE 15 SECONDS WHEN A MANUAL CLOSE OPERATION IS IN PROGRESS. IT WILL BLINK FOR 30 SECONDS BEFORE THE 15 SECONDS AFTER A MANUAL CLOSE OPERATION IS INITIATED.

6. OPEN LED (GREEN) - LIT CONTINUOUSLY WHEN THE CONTROL BELIEVES THE BANK IS OPEN AND DURING THE 15 SECONDS WHEN A MANUAL CLOSE OPERATION IS IN PROGRESS. IT WILL BLINK FOR 30 SECONDS BEFORE AND 15 SECONDS AFTER A MANUAL OPEN OPERATION IS INITIATED.

7. INFRARED COMMUNICATION PORT USED BY ENGINEERING TO SETUP AND OPERATE CONTROL USING BECKWITH'S BLINC1R SOFTWARE AND A COMPUTER WITH THE APPROPRIATE INFRARED PORT.

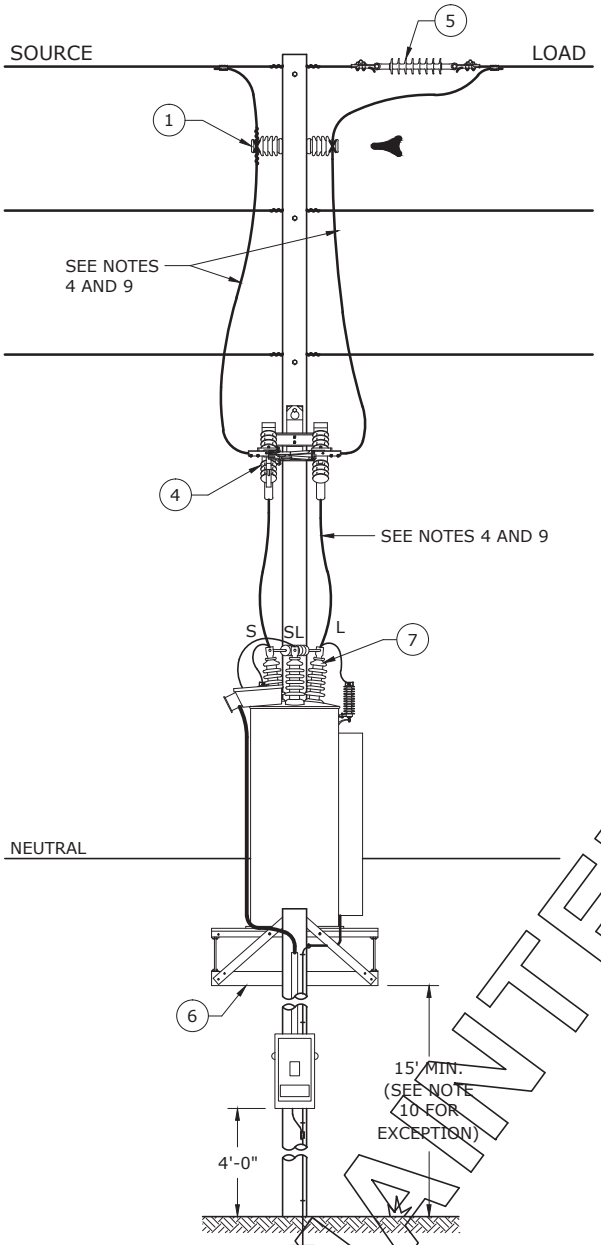
APPROPRIATE SETTINGS FOR THIS CAPACITOR CONTROL ARE DETERMINED BY ENGINEERING. FOLLOW ALL GUIDELINES IN THIS SECTION FOR PROPER INSTALLATION. INFORM ENGINEERING WHEN A NEW CONTROL IS READY FOR SETTINGS TO BE INSTALLED. LEAVE A NEW CONTROL IN MANUAL UNLESS INSTRUCTED BY ENGINEERING. REFER TO ENGINEERING FOR ANY QUESTIONS RELATIVE TO THE SETTINGS OF THIS TYPE OF CAPACITOR CONTROL.

3				
2				
1				
0	8/18/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

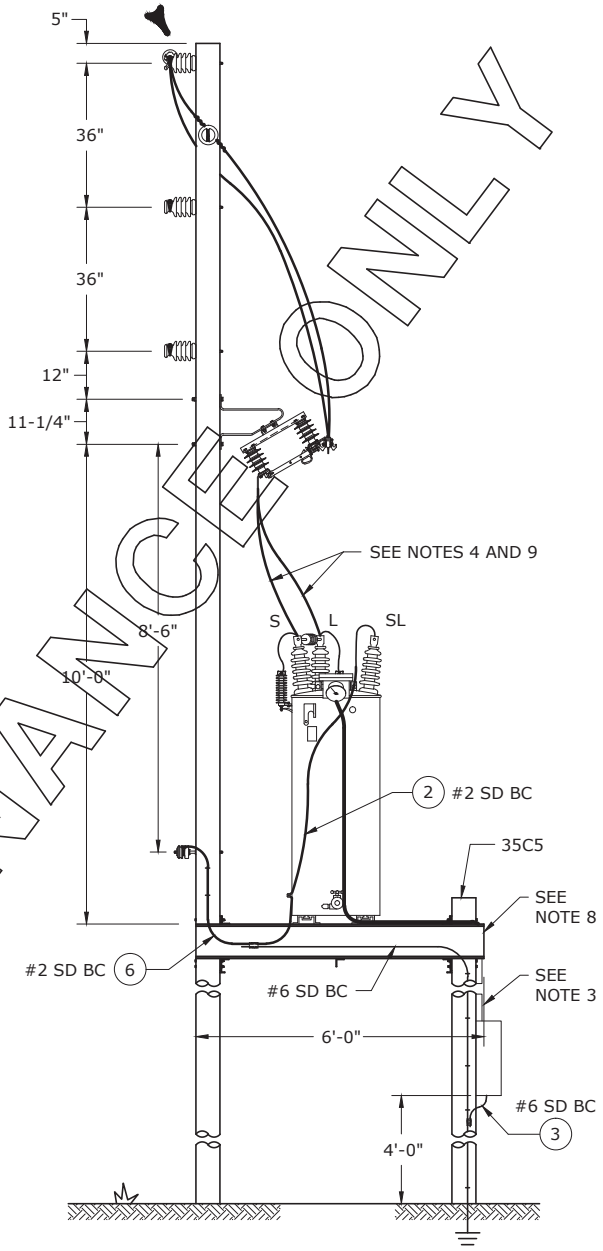
INSTALLATION INSTRUCTIONS -
BECKWITH TYPE CONTROL (FMO)

Duke Energy®

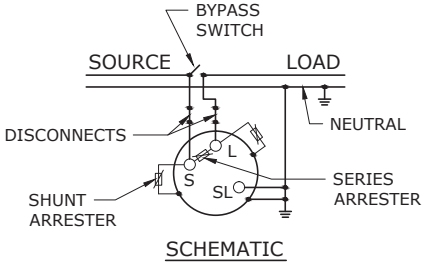
FLA | DWG. 07.04-15B



FRONT VIEW



SIDE VIEW



SCHEMATIC

NOTES:

1. SEE DWG. 07.20-12B FOR NOTES AND BILL OF MATERIALS.
2. FOR THREE-PHASE REGULATOR INSTALLATIONS, A THREE REGULATOR PLATFORM IS PREFERRED OVER SINGLE-PLATFORM INSTALLATION.

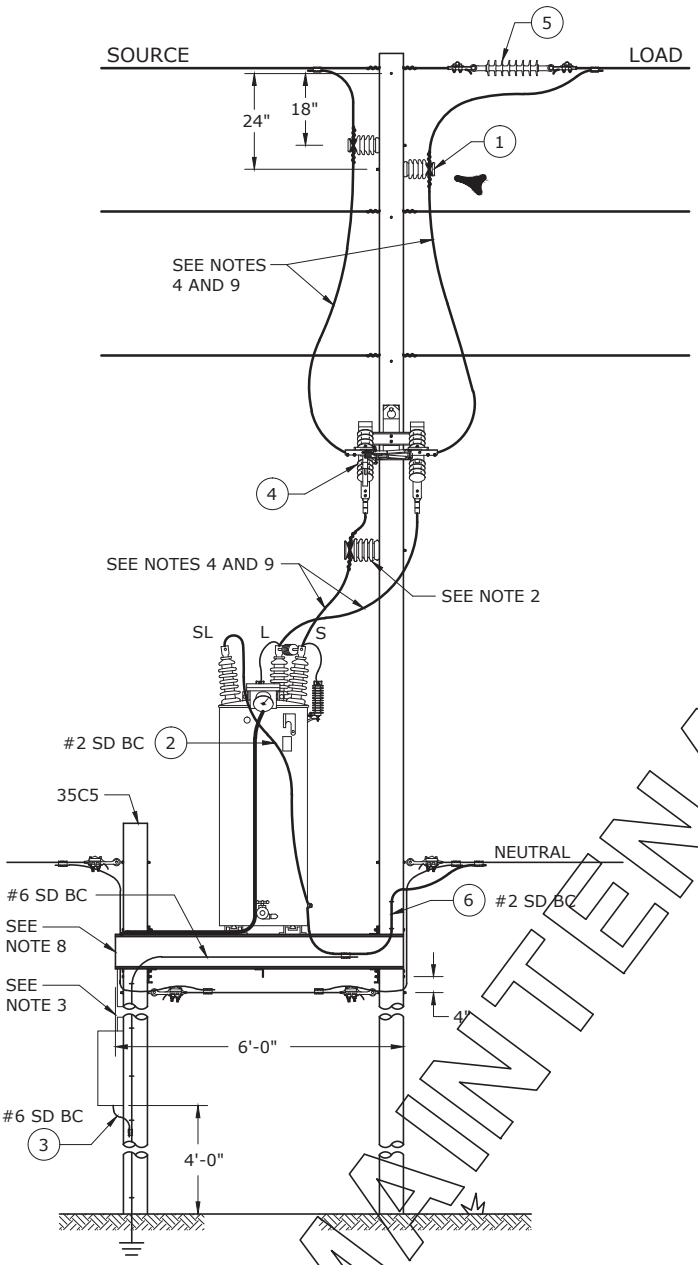
3				
2				
1	6/21/13	SIMMONS	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, POLE MOUNTED FOR 250KVA AND LARGER (FMO)

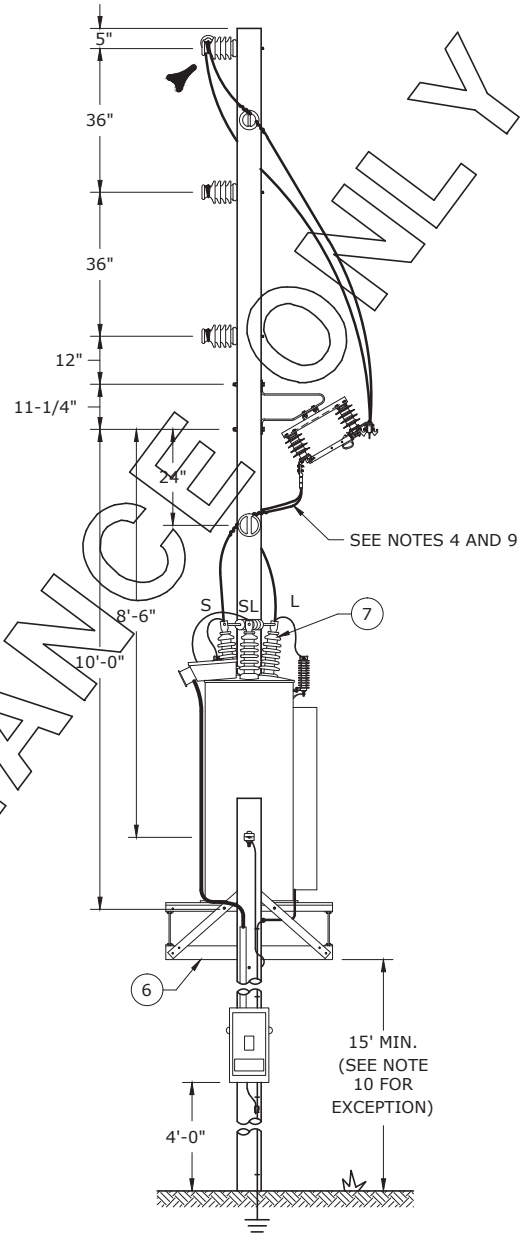
DUKE ENERGY.

FLA

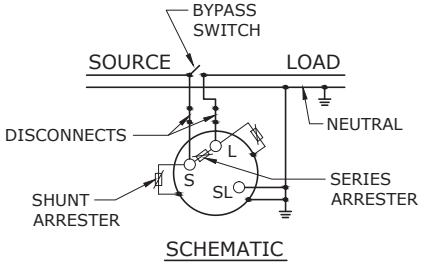
DWG. 07.20-12A



SIDE VIEW



FRONT VIEW



SCHEMATIC

NOTES:

1. SEE DWG. 07.20-12C FOR NOTES AND BILL OF MATERIALS.
2. INCREASE QUANTITY OF BOM ITEM 1 TO BE (3) IF ADDITIONAL SUPPORT FOR LEADS IS REQUIRED.
3. FOR THREE-PHASE REGULATOR INSTALLATIONS, A THREE REGULATOR PLATFORM IS PREFERRED OVER SINGLE-PLATFORM INSTALLATION.

REVISED		BY	CK'D	APPR.
3				
2				
1	6/21/13	SIMMONS	DANNA	ADCOCK
0	11/24/10	SIMMONS	GUINN	ELKINS

REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION, POLE MOUNTED FOR 250KVA AND LARGER (FMO)

DUKE ENERGY.

FLA

DWG. 07.20-12B

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
RG1P100A721PFM	1	IHPTT15F	2	080212	1	INSULATOR, POST, TIE, TOP, 15KV, WITHOUT STUD
		ISSTUDBOLT5810F	2	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT GALV.
				072366	1	STUD, LP 5/8"X 10"
	2	GOWE2F	1	160182	2	CONNECTOR, TF, GND, EYEBOLT
				015280	40	STAPLE, GALV STL 2 X 5/8 X 3/16
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				162205	2	CONNECTOR, VISE TYPE 2 CU
				9220162221	40	CONDUCTOR, #2 SOLID, SOFT DRAWN, BARE, ON 125 FOOT SPOOL
	3	GAR4F	1	015280	8	STAPLE, GALV STL 2 X 5/8 X 3/16
				060136	3	COUPLING, 5/8" THREADLESS, COPPER
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				190404	32	WIRE, CU, BR, SDW, SLD, #6
				9220192319	4	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD, THREADLESS 5/8" X 5'
	4	SW256BYPC	1	9220087628	1	SWITCH, BYPASS, 3-SLD BLADE DSCONN, 600A, 25KV, 1PH
				10034908	2	BOLT, MCH, SQ, 5/8-11 X 12", GLV 5/8 X 12" GALVANIZED MAC
				10543007	2	WASHER, SQ, 2-1/4 X 2-1/4 X 3/16, GLV
				10544005	2	WASHER, LK, 5/8, COIL, DBL, GLV
	5	IDES25PF	1	080577	1	INSULATOR, POLYMER, 25KV, DEADEND, SILICONE, RATED 15K
	6	PLFSNGLALF	1	079254	1	PLATFORM, 1PH REGULATOR-AL
				152105	4	BOLT, MACH, SQ, NUT, 5/8" X 6"
				152122	4	BOLT, SQUAREHEAD, 3/4", 12", S, A307, GLV, 10, UNC
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				013264	2	WASHER, SPRING, COIL, STEEL, FOR, 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16", HOLE, GALV.
	7	REG100A72F	1	9110041076	1	VR, 76KVA 100A W/OPTS
RG1P219A721PFM	REGULATOR MU SINGLE-PHASE 219A 7.2KV MILD SINGLE-PHASE PLATFORM					
RG1P328A721PFM	REGULATOR MU SINGLE-PHASE 328A 7.2KV MILD SINGLE-PHASE PLATFORM					
RG1P438A721PFM	REGULATOR MU SINGLE-PHASE 438A 7.2KV MILD SINGLE-PHASE PLATFORM					
RG1P200A141PFM	REGULATOR MU SINGLE-PHASE 200A 14.4KV MILD SINGLE-PHASE PLATFORM					

NOTES:

1. SINGLE PLATFORM TO BE USED FOR REPLACEMENT OF EXISTING SINGLE REGULATOR ONLY. TO MAKE READY FOR FUTURE DSDR PROGRAM, NEW BANKS OR WHEN REPLACING MORE THAN ONE REGULATOR SHOULD BE DONE ON A THREE-PHASE PLATFORM AS SHOWN ON DWG. 07.20-30A.

2. THIS INSTALLATION IS FOR USE WHEN A POLE MOUNTED 250 KVA OR LARGER REGULATOR MUST BE REPLACED AND THE NEW REGULATOR DOES NOT HAVE POLE MOUNTING BRACKETS. A NEW INSTALLATION OF THREE REGULATORS SHOULD BE DONE ON A PLATFORM.

3. REGULATOR SHOULD HAVE ARRESTERS PRE-INSTALLED ON THE REGULATOR.

4. ONE 10 FOOT SECTION OF 2-1/4" U-GUARD (CU CRIS1UGPVC225WF) SHALL BE INSTALLED TO COMPLETELY COVER CONTROL CABLE AT CONTROL CABINET UNLESS CONTROL CABLE IS ALREADY IN FLEXIBLE CONDUIT. USE GALVANIZED CONDUIT STRAP (CN 30637805) TO ATTACH FLEX CONDUIT TO POLE EVERY 3 FEET.

5. JUMPERS SHALL BE SIZED TO BE EQUIVALENT TO PHASE CONDUCTORS.

6. GROUND CONTROL BOX AND PLATFORM WITH #6 SD BC. REGULATOR GROUND TO CONSIST OF #2 SD BC RUN FROM SL BUSHING TO REGULATOR TANK GROUND, THEN TO NEUTRAL LOOP.

7. **CAUTION:** WHEN IT IS NECESSARY TO BYPASS THE REGULATOR, SEE DWGS. 07.10-15A, 07.10-15B, 07.10-15C, 07.10-15D, AND 07.10-15E.

8. SEE DWG. 07.20-12A FOR DESIGN SPECIFICATIONS.

9. MOUNT PLATFORM WITH 5/8" BOLTS (2 PER SIDE - TOTAL OF 4).

10. SOURCE BUSHING ON REGULATOR SHOULD ALWAYS BE CONNECTED TO PRIMARY SOURCE. BYPASS SOURCE AND LOAD LEADS MAY BE CROSSED, MAINTAIN MINIMUM 12" CLEARANCE BETWEEN LEADS.

11. CLEARANCE TO BOTTOM OF PLATFORM CAN BE 11' ONLY IF THE AREA UNDER THE PLATFORM IS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC. IF AREA UNDER PLATFORM IS SUBJECT TO RIDERS ON HORSEBACK OR OTHER LARGE ANIMALS, VEHICLES OR OTHER MOBILE UNITS EXCEEDING 8' IN HEIGHT, THE DIMENSION TO THE BOTTOM OF PLATFORM SHALL BE 15' MINIMUM.

12. WHEN RIGHT-OF-WAY IS AN ISSUE, PLATFORM MAY BE SET IN LINE WITH THE PRIMARY WIRES.

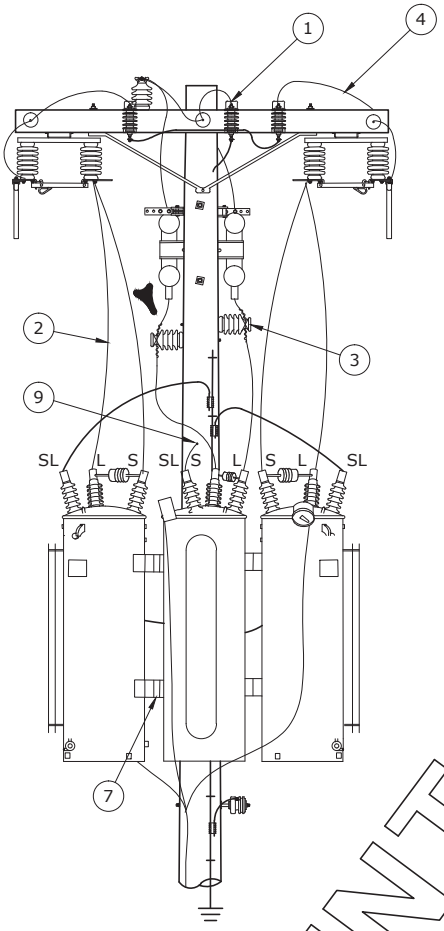
3					
2					
1					
0	6/21/13	SIMMONS	DANNA	ADCOCK	
REVISED		BY	CK'D	APPR.	

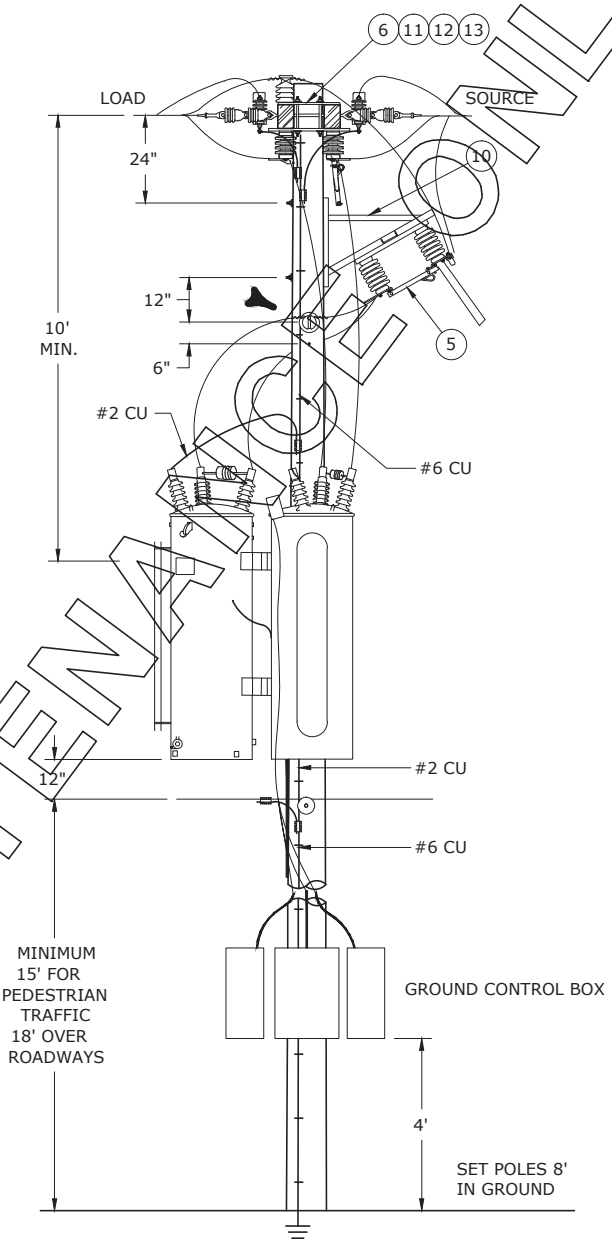
REGULATOR ASSEMBLY, VERTICAL CONSTRUCTION,
POLE MOUNTED FOR 250KVA AND LARGER (FMO)

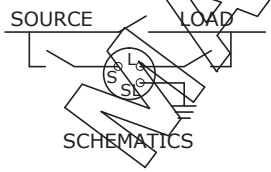
DUKE ENERGY.

FLA

DWG. 07.20-12C







SCHEMATICS

NOTES:

1. CONNECT SL BUSHINGS TO NEUTRAL AND POLE GROUNDS WITH #2 COPPER.
2. ARRESTER LEADS AND POLE GROUNDS ARE #6 COPPER.
3. SEE DWG. 07.20-15B FOR BILL OF MATERIALS.

3				
2				
1	4/18/13	McCONNELL	DANNA	ADCOCK
0	10/14/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

REGULATOR ASSEMBLY, HORIZONTAL CONSTRUCTION, POLE MOUNTED (FMO)

DUKE ENERGY.

FLA

DWG. 07.20-15A

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D 2Ø	QTY REQ'D 3Ø	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	BKTCOLASTLXARMF	2	3	011213	2	BOLT, CARRIAGE, 3/8" X 6"
					070101	1	BRACKET, LA AND CO
		AREQOH10F	2	3	220202	1	ARRESTER, LIGHTNING, 10KV, HD, MOV
	2	REGRISER40CUF	75	102	190164	1	WIRE, CU, BR, HARD DRAWN, 7 STR, 4/0
	3	IHPTT15F	2	2	080212	1	INSULATOR, POST, TIE TOP, 15/25KV, WITHOUT STUD
		ISSTUDBOLT5810F	2	2	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	4	WOCN6CU1CF	8	15	190204	1	WIRE, CU, BR, HARD DRAWN, #6
	5	SW156BYPF	2	3	260123	1	SWITCH, BYPASS, 3 SLD BLADE DISC, 600A, 15KV, 1PH
					152107	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
					013308	1	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
					013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	6	BKTBKPLTF	1	2	013202	2	WASHER, SPLITLOCK, GALVANIZED, FOR 1/2" BOLT
					013229	2	WASHER, ROUND, FLAT, 1/2" BOLT
					070793	1	PLATE, SW BACKING
					152098	2	BOLT, MACHINE, SQ, NUT, 1/2" X 7"
	7	BKTTFMRMEDALF	1	1	013346	2	WASHER, 3", SQUARE, CURVED, 13/16" HOLE
					070255	1	BRACKET, CLSTR XFMR 75-167KVA, ALUMINUM, 3 UNIT,
					152119	6	BOLT, MACHINE, 3/4" X 2"
					152122	2	BOLT, SQUARE HEAD, 3/4" X 12", S, A307, GALV
		BKTTFMRPLATEF	6	9	152122	2	BOLT, SQUARE HEAD, 3/4" X 12", S, A307, GALV
					152119	2	BOLT, MACHINE, 3/4" X 2"
					013346	2	WASHER, 3", SQUARE, CURVED, 13/16" HOLE
					070776	1	PLATE, ADAPTER, XFMR, MNTG, HORIZONTAL
		TUAMUA3PDFLLF	1	1	190318	6	WIRE, CU, BR, SDW, 4/0
					160112	2	CONNECTOR, CW, 5/8" ROD, 2/0 - 250
					160186	2	CONNECTOR, GROUND, TRANSFORMER, 6-250 CU
					161234	6	CONNECTOR, BOLT, #4/0 CU
					434337	1	PADLOCK, ROTARY, HASP, KEYED
					443333	6	TAG, WHITE, 1.75" X 3.30", BLANK WHITE
					9220111316	1	LABEL, WARNING, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7"
	8	WOCN2CU1CF	20	20	190208	1	WIRE, CU, BR, HARD DRAWN, #2 SLD
	9	-	1	1	161234	1	CONNECTOR, BOLTED
	10	BKTBPSSTLF	1	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
					013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
					070615	1	BRACKET, POLE, BYPSS, SW L - R
					152107	2	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
	11	-	2	4	013299	1	WASHER, ROUND FLAT, 1/2"
	12	-	2	4	010326	1	BOLT, MACHINE, 1/2" X 7" WITH NUT
	13	-	2	4	013202	1	WASHER, SPLIT LOCK, 1/2"

NOTES:

1. ISSUE REGULATORS AND GROUND SEPARATELY.
2. SEE DWG. 07.20-15A FOR DESIGN SPECIFICATIONS.
3. SEE DWG. 08.01-01 FOR CUTOUTS AND ARRESTERS.
4. SEE DWG. 03.06-04 FOR INSULATORS.
5. SEE DWG. 08.10-10 FOR BYPASS SWITCH DETAILS.

REVISED	BY	CK'D	APPR.
3			
2			
1 4/18/13	McCONNELL	DANNA	ADCOCK
0 11/24/10	SIMMONS	GUINN	ELKINS

REGULATOR ASSEMBLY,
HORIZONTAL CONSTRUCTION,
POLE MOUNTED (FMO)

DUKE ENERGY.

FLA DWG. 07.20-15B

08.00 GENERAL

08.01 CUTOUTS AND ARRESTERS

08.04 SECTIONALIZERS

08.05 RECLOSERS - SINGLE-PHASE CONFIGURATIONS

08.06 RECLOSERS - THREE-PHASE CONFIGURATIONS

08.06 RECLOSERS - THREE-PHASE CONFIGURATIONS (CONT.)

08.10 SWITCHES - MANUAL

08.12 SWITCHES - LOAD CONTROL

08.13 SWITCHES - AUTOMATED

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE

STANDARD PROCEDURES BULLETIN

STANDARD DISTRIBUTION ARRESTERS:

THE STANDARD DISTRIBUTION ARRESTER IS A DIRECT-CONNECTED METAL OXIDE ARRESTER WITH A GROUND LEAD DISCONNECTOR (DWG. 08.01-04 FOR DISCONNECTOR PROCEDURES).

METAL OXIDE ARRESTERS (MOV) HAVE BEEN PURCHASED SINCE 1984 AND OFFER THE BEST AVAILABLE PROTECTION AGAINST LIGHTNING AND SWITCHING SURGES. BY DESIGN, THE MOV ARRESTER CONDUCTS A SMALL LEAKAGE CURRENT (MILLIAMPS) TO GROUND UNDER NORMAL VOLTAGE CONDITIONS. SINCE 1990, ALL OF OUR MOV ARRESTERS HAVE BEEN PURCHASED WITH POLYMER HOUSINGS. THE ADVANTAGE OF THE POLYMER HOUSING IS THAT IT IS DESIGNED TO RETAIN THE BLOCKS DURING A CATASTROPHIC FAILURE MODE. THESE MOV ARRESTERS ARE AVAILABLE IN THREE DIFFERENT CLASSIFICATIONS AS FOLLOWS:

- RISER POLE ARRESTERS ARE USED ON PRIMARY UNDERGROUND CABLE RISERS. THESE ARRESTERS NORMALLY CONTAIN LARGER BLOCKS THAN STANDARD DISTRIBUTION ARRESTERS TO PROVIDE ADDITIONAL PROTECTION FOR THIS APPLICATION. THESE ARRESTERS ARE LABELED WITH THE WORDS "RP" AND THE VOLTAGE CLASS.

- STANDARD DISTRIBUTION ARRESTERS ARE USED FOR OVERHEAD LINE AND EQUIPMENT PROTECTION. WHILE THEY DO NOT HAVE A SPARK OVER VOLTAGE AS LOW AS THE RISER POLE ARRESTER, THEY PROVIDE AN ECONOMICAL BIL MARGIN OF PROTECTION EXCEEDING THE OLD SILICONE CARBIDE ARRESTER.

- TRANSFORMER ARRESTERS ARE IDENTICAL TO THE STANDARD DISTRIBUTION ARRESTER. THEY ARE CATALOGED DIFFERENTLY TO INCLUDE A CONNECTION LEAD AND A GROUND STRAP TO CONNECT IT TO A TRANSFORMER.

SILICONE CARBIDE ARRESTERS HAVE NOT BEEN PURCHASED SINCE 1984. THESE ARRESTERS CAN BE FOUND ON THE SYSTEM WITH INTERNAL OR EXTERNAL GAP STRUCTURES. ALL SILICONE CARBIDE ARRESTERS HAVE PORCELAIN HOUSINGS.

- INTERNAL GAP ARRESTERS CONTINUE TO PROVIDE GOOD SURGE PROTECTION FOR THE SYSTEM AND SHALL CONTINUE TO BE USED UNTIL THEY ARE REMOVED FOR ANY REASON. **ONCE REMOVED, THEY SHALL BE SCRAPPED**.

- EXTERNAL GAP ARRESTERS THAT ARE REMOVED SHALL BE SCRAPPED.

INSTALLATION PRACTICES:

1. ARRESTER LEAD LENGTHS (BOTH LINE AND GROUND LEADS) SHALL BE AS SHORT AND AS STRAIGHT AS POSSIBLE. THIS PROVIDES THE BEST PROTECTION BY MINIMIZING THE SURGE VOLTAGE DURING ARRESTER OPERATION. DO NOT COIL TRANSFORMER RISERS.

2. GROUND RODS SHALL BE INSTALLED AT ALL POLES CONTAINING ARRESTERS ACCORDING TO THE STANDARD PROCEDURES OUTLINED ON DWGS. 01.01-01A, 01.01-01B, 01.01-01C AND 01.01-05.

ARRESTER APPLICATIONS

1. EQUIPMENT PROTECTION (GROUND PER DWGS. 01.01-01A, 01.01-01B, 01.01-01C AND 01.01-05) ALL TRANSFORMERS, RECLOSERS, CAPACITOR BANKS, VOLTAGE REGULATORS, AND OTHER EQUIPMENT SHALL HAVE ARRESTERS INSTALLED AS SHOWN ON THE APPROPRIATE SPECIFICATION DRAWINGS CONTAINED HEREIN.

2. LINE PROTECTION

A. ALL NORMAL OPEN POINTS SHALL HAVE ARRESTERS INSTALLED ON EACH PHASE ON BOTH SIDES (NORMAL SOURCE AND LOAD). ARRESTERS MAY BE MOUNTED ON POLE ADJACENT TO SWITCHES.

B. INSTALL ARRESTERS AT DEADENDS UNLESS PROTECTED BY EQUIPMENT ARRESTER.

C. INSTALL ARRESTERS EVERY 1400' TO 1600' UNLESS THERE ARE ARRESTERS PRESENT. ALSO, AREAS WITH TALL TREES AND/OR BUILDINGS ALONG SIDE THE LINE ARE SHIELDED AND MIGHT REQUIRE LESS REQUIRE LESS ARRESTERS AS PER ENGINEER'S JUDGMENT.

DUKE ENERGY.

3				
2				
1	3/31/15	LOOSIER	WHITE	ADCOCK
0	8/16/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DISTRIBUTION SURGE ARRESTERS

DEC	DEM	DEP	DEF
			X

08.00-01

GENERAL

ON WOOD POLE CONSTRUCTION USE SINGLE COIL LOCKWASHER AND SQUARE WASHERS WITH CUTOUT, ARRESTER AND SWITCH BRACKETS.

CUTOUTS

1. BYPASS FUSE HOLDERS OR NORMALLY OPEN CUTOUT DOORS SHOULD BE HUNG BY THEIR OPERATING RINGS SO THE BARRELS WILL NOT FILL UP WITH WATER.

2. A TRANSFORMER STEM CONNECTOR MAY BE USED WHEN 1/0 OR SMALLER ALUMINUM WIRE IS RUN DIRECTLY INTO THE CUTOUT.

3. WHEN ADDING CUTOUTS TO EXISTING VERTICAL CONSTRUCTION, THE PHASE TO PHASE SPACING SHOULD BE 42 INCHES FOR 23KV.

3				
2				
1				
0	3/31/18	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

CUTOUTS GENERAL

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

08.00-103

NOTES:

1. ARRESTERS SHALL BE INSTALLED ON BOTH SIDES OF ANY NORMALLY OPEN PRIMARY SWITCH DEVICE WHICH CAN BE SOURCE FED FROM EITHER DIRECTION.

2. ARRESTERS SHALL BE INSTALLED ON THE SOURCE AND LOAD SIDE OF RECLOSERS AND REGULATORS.

3. ARRESTERS SHALL BE INSTALLED ON ALL TRANSFORMERS AND CAPACITOR BANKS.

4. ARRESTERS SHALL BE INSTALLED ON ALL PRIMARY UNDERGROUND RISER POLES.

5. ARRESTERS SHALL BE INSTALLED ON THE MIDDLE PHASE OF HORIZONTAL UNDERBUILD DISTRIBUTION ON STEEL AND CONCRETE TRANSMISSION POLES. ARRESTERS SHALL BE INSTALLED ON ALL SINGLE-PHASE UNDERBUILD DISTRIBUTION ON STEEL AND CONCRETE TRANSMISSION POLES.

6. ARRESTERS SHALL BE INSTALLED ON ALL PHASES OF VERTICAL UNDERBUILD DISTRIBUTION ON STEEL AND CONCRETE TRANSMISSION POLES.

7. ARRESTERS SHALL BE INSTALLED ON ALL MULTI-PHASE PRIMARY DEADEND POLES WITH NO EQUIPMENT.

8. ARRESTERS INSTALLED FOR ITEMS 1-7 LISTED ABOVE USUALLY RESULTS IN ADEQUATE LINE ARRESTER APPLICATION. HOWEVER, WHEN SITUATIONS OCCUR WHERE WE HAVE NO OTHER ARRESTERS PRESENT IN A 1320 FT LINE SEGMENT (1/4 MILE), AN ARRESTER ONLY STATION SHOULD BE INSTALLED. KEY EXAMPLES WOULD INCLUDE RURAL AREAS, EXPRESS FEEDERS OR DISTRIBUTED ENERGY RESOURCES FEEDERS. AS THE SYSTEM GROWS AND NEW EQUIPMENT IS ADDED WITHIN 1320 FT (1/4 MILE) OF AN "ARRESTER ONLY STATION", THE "ARRESTER ONLY STATION" SHALL BE REMOVED WHILE INSTALLING THE NEW EQUIPMENT.

9. ALL ARRESTER ONLY STATIONS (NOT INSTALLED AS PART OF A PIECE OF EQUIPMENT OR A UNDERGROUND RISERS) SHALL BE PROTECTED BY A FAULT TAMER FUSE REGARDLESS OF AVAILABLE FAULT CURRENT LEVEL.

REFER TO THE APPROPRIATE CONSTRUCTION STANDARDS FOR APPLICATION SPECIFIC MOUNTING DETAILS INCLUDING INSTALLATION OF FAULT TAMER FUSES WHERE APPLICABLE.

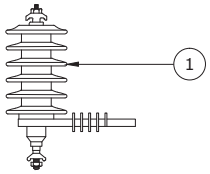
DUKE ENERGY.

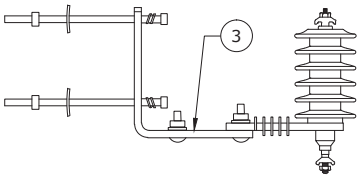
3				
2				
1				
0	3/31/18	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

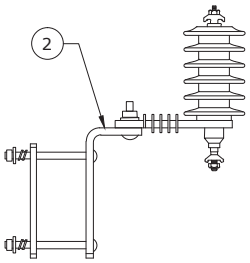
ARRESTERS GENERAL

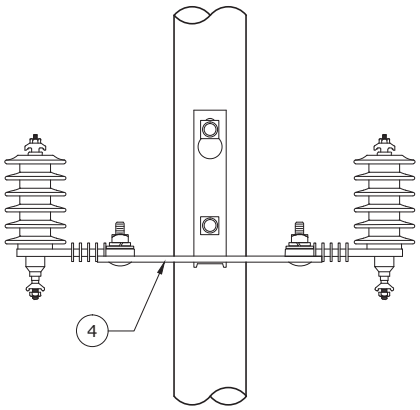
DEC	DEM	DEP	DEF
X	X	X	X

08.00-105









BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	AREQOH10F	1	193511	2	CABLE, 600V #6 SOLID SD CU
				220202	1	ARRESTER, LIGHTNING, 10KV, HD MOV
	2	BKTCOLASTLXARMF	1	070101	1	BRACKET, ARRESTER AND CUTOUT
	3	BKTCOLASNGSTLF	1	311263	1	BRACKET, SINGLE MOUNT
				152106	2	BOLT, MACHINE, 5/8" X 10"
				013264	2	WASHER, SPRING COIL, 5/8"
				013308	2	WASHER, 2-1/4" SQUARE
	4	BKTCOLADBLSTLF	1	070106	1	BRACKET, DOUBLE LIGHTNING ARR & CO
				152106	2	BOLT, MACHINE, 5/8" X 10"
				013264	2	WASHER, SPRING COIL, 5/8"
				013308	2	WASHER, 2-1/4" SQUARE

NOTES:

1. **CAUTION:** DO NOT TIGHTEN TOP NUT ON ARRESTERS WITH AN AIR OR HYDRAULIC SPEED WRENCH. OVER-TORQUING CAN EASILY OCCUR USING THESE WRENCHES RESULTING IN A BROKEN CONTACT INSIDE THE ARRESTER HOUSING.

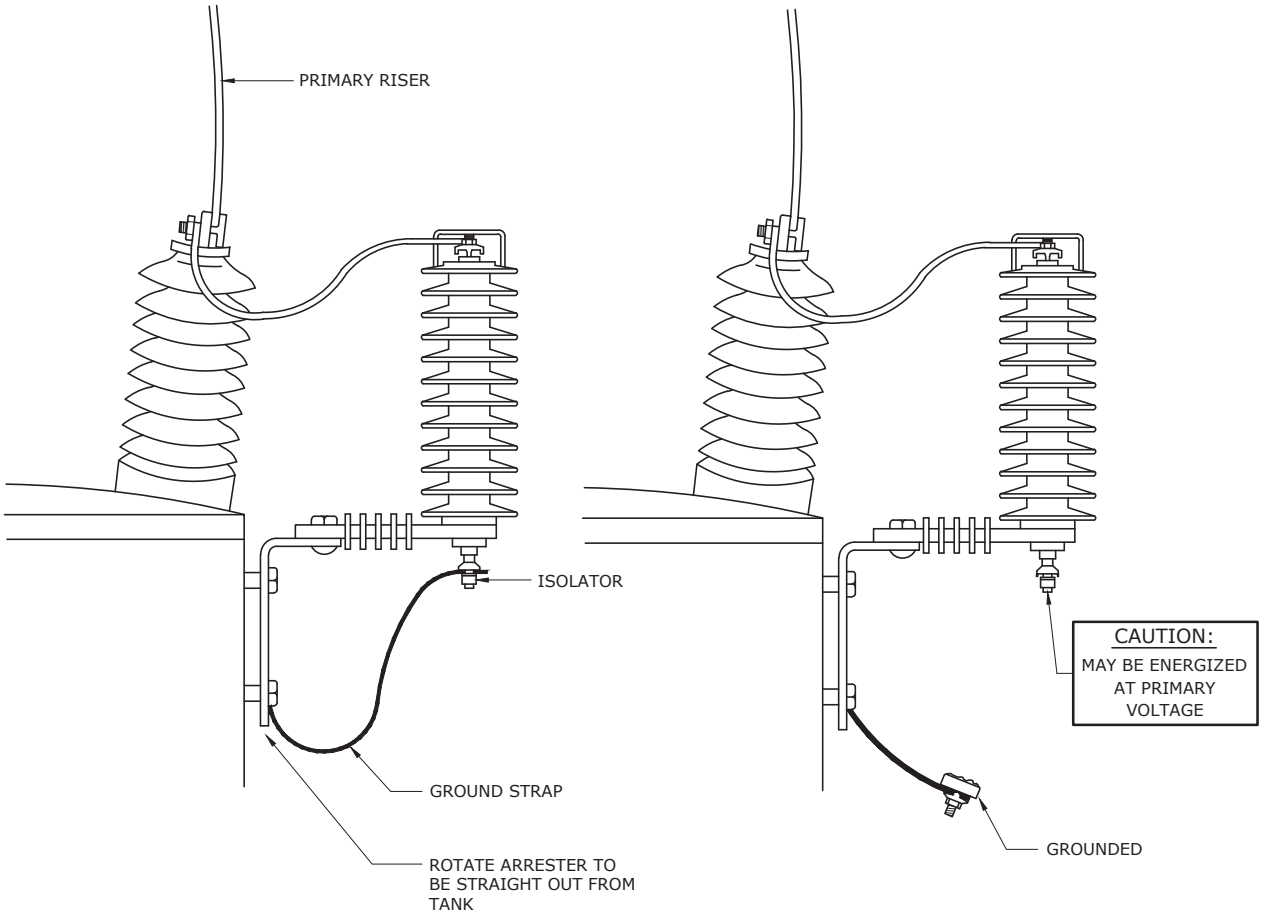
3				
2				
1				
0	8/31/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ARRESTERS, 10 KV

Duke Energy®

FLA

DWG. 08.01-01



PROPERLY INSTALLED ARRESTER

FAILED ARRESTER

NOTES:

1. DIRECT CONNECTED ARRESTER LEADS ARE FURNISHED WITH AN EYE TERMINAL. THE LEAD IS TO BE CONNECTED BETWEEN THE ARRESTER AND THE PRIMARY BUSHING TERMINAL WITH THE EYE TERMINAL BETWEEN THE NUT AND THE TERMINAL, AND ARRANGED SO AS NOT TO INTERFERE WITH THE PRIMARY RISER

2. IN THE EVENT OF AN ARRESTER FAILURE, THE ISOLATOR WILL OPERATE AND DISCONNECT THE GROUND LEAD, THUS PREVENTING AN INTERRUPTION TO THE CIRCUIT. ALL FAILED ARRESTERS ARE TO BE REPORTED TO THE LOCAL OPERATIONS CENTER. THE ARRESTER IS TO BE CHANGED OUT AS SOON AS POSSIBLE AFTER BEING REPORTED.

3. ON NEW POLE MOUNTED SINGLE-PHASE TRANSFORMERS, THE TRANSFORMER IS SHIPPED WITH THE LIGHTNING ARRESTER ROTATED UP AGAINST THE TANK. THIS IS DONE TO PREVENT BREAKAGE OF THE ARRESTER DURING SHIPPING. BEFORE THE TRANSFORMER IS INSTALLED, THE ARRESTER MOUNTING BOLT SHOULD BE LOOSENED AND THE ARRESTER ROTATED UNTIL IT IS STRAIGHT OUT FROM THE TANK. IF THIS IS NOT DONE AND THE ARRESTER IS LEFT UP AGAINST THE TANK, IT WILL EVENTUALLY CAUSE MOMENTARY FEEDER OPERATIONS OR OUTAGES.

4. **CAUTION:** DO NOT TIGHTEN TOP NUT ON ARRESTERS WITH AN AIR OR HYDRAULIC SPEED WRENCH. OVER-TORQUING CAN EASILY OCCUR USING THESE WRENCHES RESULTING IN A BROKEN CONTACT INSIDE THE ARRESTER HOUSING.

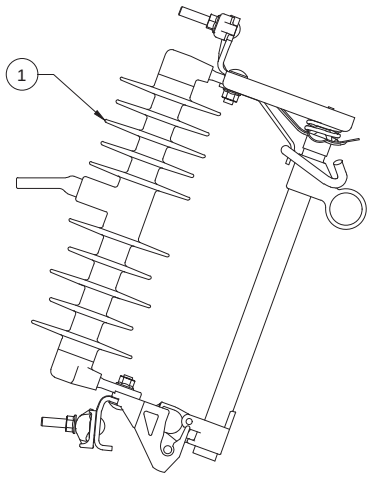
3				
2				
1				
0	7/11/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

APPLICATION OF DIRECT CONNECTED ARRESTERS ON DISTRIBUTION TRANSFORMERS

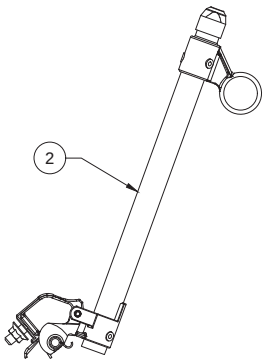
Progress Energy

PGN

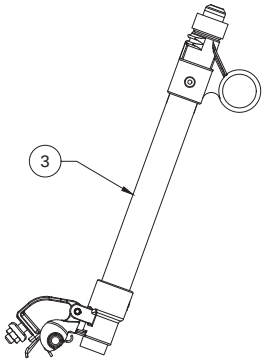
DWG. 08.01-04



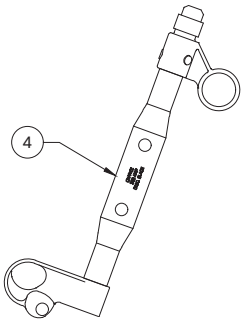
CUTOUT WITH 100A BARREL
15KV OR 27KV



100A BARREL
15KV, 16KA
OR
27KV, 12KA



200A BARREL
15KV, 12KA
OR
27KV, 12KA



300A SOLID BLADE
15KV OR 27KV

NOTES:

1. CUTOUT BODIES ARE RATED AT A VOLTAGE CLASS AND BIL LEVEL. THE CUTOUTS WE USE ARE RATED AT 15KV 110 KV BIL AND 27KV 150KV BIL. SEE DWG. 08.01-110B FOR REGION SPECIFIC APPLICATIONS. WE PURCHASE OUR CUTOUTS WITH A 100A BARREL, BUT A 200A BARREL OR A 300A SOLID BLADE (OF THE SAME VOLTAGE CLASS/BIL) CAN BE EXCHANGED WITHIN THE SAME CUTOUT BODY.
2. BARRELS ARE RATED AT VOLTAGE CLASS, CONTINUOUS CURRENT AND INTERRUPT CAPACITY (ASYMMETRICAL AMPS). IF YOU ARE UNSURE OF THE FAULT CURRENT AVAILABLE IN YOUR AREA, CHECK WITH YOUR LOCAL CAPACITY PLANNER.
3. THESE CUTOUTS AND PARTS ARE DESIGNED TO BE INTERCHANGEABLE BETWEEN MANUFACTURERS.
4. 100A (INCLUDING S&C 103A) OR SMALLER FUSE LINKS SHALL NOT BE USED IN 200A BARRELS. IT CAN AFFECT THE CURRENT INTERRUPTING CAPABILITY AND TIME-CURRENT CHARACTERISTICS OF THAT LINK.
5. FUSE LINKS125A AND GREATER SHALL USE A 200A BARREL.
6. INSPECT BARREL AFTER EACH OPERATION. REPLACE BARREL IF SWOLLEN INSIDE, FUZZY ON THE OUTSIDE OR OTHERWISE DAMAGED.
7. CUTOUTS COME WITH PARALLEL GROOVE CONNECTORS THAT ACCOMMODATE #6 SOL - 4/0. THE BOTTOM CONNECTOR CAN BE FIELD ROTATED BY 90 DEGREES. THEY ALSO INCLUDE A KICKOUT SPRING OR MECHANICAL ASSIST TO ELIMINATE "STUCK" BARRELS THAT HAVE NOT FALLEN OPEN UNDER CERTAIN CIRCUMSTANCES.
8. THESE CUTOUTS ARE NON-LOADBREAK WITH LOADBREAK HOOKS. A LOADBREAK TOOL MUST BE USED TO BREAK LOAD.
9. ALWAYS CONNECT SOURCE TO THE TOP SIDE OF CUTOUT.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/12/18	BURLISON	BENDER	ADCOCK
0	4/30/18	BENDER	BURLISON	ADCOCK

POLYMER NON LOAD-BREAK CUTOUTS
WITH LOADBUSTER HOOKS

DEC	DEM	DEP	DEF
X	X	X	X

08.01-110A

BILL OF MATERIALS - COMPLETE UNITS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
	FUSE-CUTOUT-100-15KV-POLY-TF-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
	FUSE-CUTOUT-100-15KV-POLY-RETRO-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
	FUSE-CUTOUT-100-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
	FUSE-CUTOUT-100-27KV-POLY-TF-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
	FUSE-CUTOUT-100-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
	FUSE-CUTOUT-100-27KV-POLY-RETRO-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
BILL OF MATERIALS - BARRELS AND SOLID BLADES					
2	FUSE-BARREL-100-15KV-F	1	1551107	1	HOLDER, FUSE, 100A, 15KV,CUTOUT, 16KA ASYM, 110KV BIL
	FUSE-BARREL-100-27KV-F	1	50128475	1	HOLDER, FUSE, 100A, 27KV, CUTOUT, 12KA ASYM, 150KV BIL
3	FUSE-BARREL-200-27KV-F	1	1549385	1	HOLDER, FUSE, 200A, 27KV, CUTOUT, 12KA ASYM, 150KV BIL
4	SW-BLADE-300-15KV-1P-CUTOUT-F	1	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL, 110 KV BIL
	SW-BLADE-300-15KV-1P-EQUIP-F	1	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL, 110 KV BIL
	SW-BLADE-300-27KV-1P-CUTOUT-F	1	30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL
	SW-BLADE-300-27KV-1P-EQUIP-F	1	30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL
BILL OF MATERIALS - ADDITIONAL CU'S (CUTOUT WITH 200A BARREL OR 300A BLADE)					
5	FUSE-CUTOUT-200-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
			1549385	1	HOLDER, FUSE, 200A, 27KV, CUTOUT, 12KA ASYM, 150KV BIL
	FUSE-CUTOUT-200-27KV-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
			1549385	1	HOLDER, FUSE, 200A, 27KV, CUTOUT, 12KA ASYM, 150KV BIL
6	SW-CUTOUT-300-15KV-1P-POLY-EQUIP-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
			194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL, 110 KV BIL
	SW-CUTOUT-300-15KV-1P-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 110KV BIL
			194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL, 110 KV BIL
	SW-CUTOUT-300-27KV-1P-POLY-EQUIP-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
			30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL
	SW-CUTOUT-300-27KV-1P-POLY-LINE-F	1	1549384	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER INSULATOR, W/ INTERCHANGEABLE DOOR, W/O NEMA BKT, 150KV BIL
			30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL

NOTES:

1. 15KV UNITS SHALL BE USED ON 12.47KV AND 13.2KV CIRCUITS ON WOOD POLES ONLY, WHERE THE FUSE SIZE IS 103 OR SMALLER OR THE DOOR IS 300A BLADE. FOR ALL OTHER APPLICATIONS, USE A 27KV CLASS CUTOUT.

2. SEE DWG. 12.04-100 FOR COASTAL CUTOUTS.

3. POLY-F CU'S ARE USED FOR PROTECTING A LINE; TF-F CU'S ARE USED FOR PROTECTING A TRANSFORMER/ CAPACITOR (NON TRANSFORMER RETROFIT WORK); EQUIP-F CU'S ARE USED FOR PROTECTING EQUIPMENT (EXCEPT TRANSFORMERS AND CAPACITORS); RETRO-F CU'S ARE USED FOR TRANSFORMER RETROFIT PROGRAM.

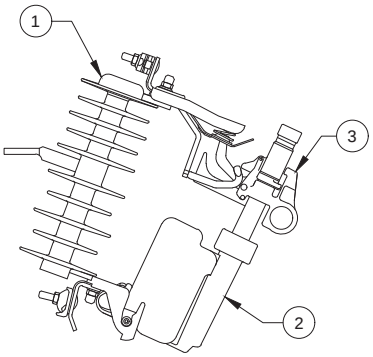
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3			
2 4/30/18	BENDER	BURLISON	ADCOCK
1 1/8/18	BENDER	BURLISON	ADCOCK
0 12/31/17	BENDER	BURLISON	ADCOCK

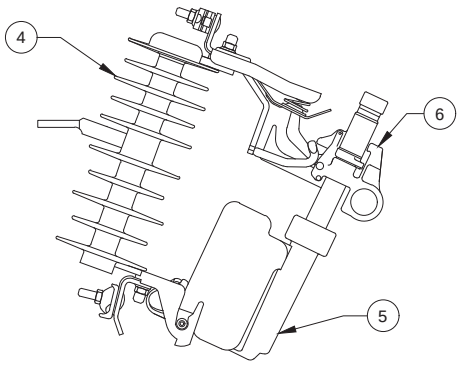
POLYMER NON LOAD-BREAK CUTOUTS WITH LOADBUSTER HOOKS

DEC	DEM	DEP	DEF
			X

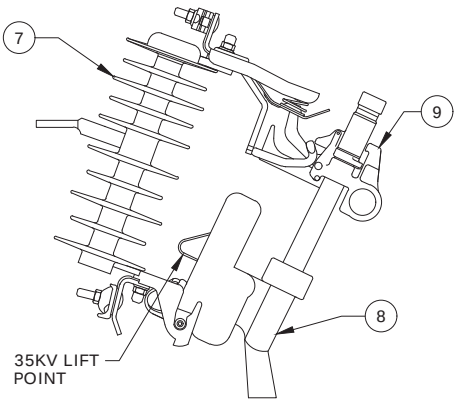
08.01-110B



15KV FAULT TAMER



15KV FAULT TAMER WITH EXTENDER TO ALLOW IT TO BE MOUNTED IN A 27KV CUTOUT



25KV FAULT TAMER

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
15KV FAULT TAMER IN A 15KV POLYMER CUTOUT					
1	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-EQUIP-F	1	1501218	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		1	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		1	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
1	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-TF-F	1	1501218	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		1	406679	1	FUSE,CURRENT LIMITING,15KV,FAULT TAMER
		1	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
1	FUSE-CUTOUT-15/FLIMITER-15KV-POLY-RETRO-F	1	1501218	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
		1	406679	1	FUSE,CURRENT LIMITING,15KV,FAULT TAMER
		1	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
15KV FAULT TAMER (PARTS) (FOR USE IN 15KV CUTOUT)					
2	FUSE-BACKUP-20-CL-15KV-FLIMITER-F	1	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
3	FUSE-BARREL-15KV-FLIMITER-F	1	406680	1	TUBE, EXPULSION FUSE, F/ 15KV FAULT TAMER
15KV FAULT TAMER IN 27KV POLYMER CUTOUT (FOR USE ON 12KV SYSTEM) (OVER INSULATED AREAS OR CONCRETE POLES)					
4	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
		1	1534820	1	TUBE, EXPULSION FUSE, W/EXTENSION ADAPTER, USE IN 25KV C/O
4	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-TF-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406679	1	FUSE,CURRENT LIMITING,15KV,FAULT TAMER
		1	1534820	1	TUBE, EXPULSION FUSE, W/EXTENSION ADAPTER, USE IN 25KV C/O
4	FUSE-CUTOUT-15/FLIMITER-27KV-POLY-RETRO-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406679	1	FUSE,CURRENT LIMITING,15KV,FAULT TAMER
		1	1534820	1	TUBE, EXPULSION FUSE, W/EXTENSION ADAPTER, USE IN 25KV C/O
15KV FAULT TAMER (PARTS) (FOR USE ON 12KV SYSTEM IN A 27KV CUTOUT) (OVER INSULATED AREAS OR CONCRETE POLES)					
5	FUSE-BACKUP-20-CL-15KV-FLIMITER-F	1	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
6	FUSE-BARREL-15KV-FLIMITER-EXT-F	1	1534820	1	TUBE, EXPULSION FUSE, W/EXTENSION ADAPTER, USE IN 25KV C/O
25KV FAULT TAMER IN A 27KV POLYMER CUTOUT (FOR USE ON 24.9/13.3KV SYSTEM)					
7	FUSE-CUTOUT-25/FLIMITER-27KV-POLY-EQUIP-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
		1	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
7	FUSE-CUTOUT-25/LIMITER-27KV-POLY-TF-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406669	1	FUSE,CURRENT LIMITING,25KV,FAULT TAMER
		1	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
7	FUSE-CUTOUT-25/LIMITER-27KV-POLY-RETRO-F	1	1549384	1	CUTOUT,FUSE, NON-LOADBREAK, 100A, 12KAIC, 27KV, POLYMER
		1	406669	1	FUSE,CURRENT LIMITING,25KV,FAULT TAMER
		1	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE
25KV FAULT TAMER (PARTS) (FOR USE ON 24.9/13.3KV SYSTEM)					
8	FUSE-BACKUP-20-CL-25KV-FLIMITER-F	1	406669	1	FUSE, CURRENT LIMITING, 25KV, FAULT TAMER
9	FUSE-BARREL-25KV-FLIMITER-F	1	406676	1	TUBE, EXPULSION FUSE, F/ 25KV FAULT TAMER FUSE

NOTES:

1. SEE DWG. 08.01-122B FOR NOTES.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	BENDER	BURLISON	ADCOCK
1	3/31/18	BRAVO	BURLISON	ADCOCK
0	12/31/17	BENDER	BURLISON	ADCOCK

FAULT TAMER FUSE LIMITER

DEC	DEM	DEP	DEF
			X

08.01-122A

NOTES:

1. FAULT TAMERS ARE INSTALLED ON TRANSFORMERS TO PROTECT THEM FROM CATASTROPHIC FAULTS IN HIGH CURRENT AREAS, AND ARRESTERS TO PREVENT MOMENTARIES WHEN ARRESTERS FAIL.

2. THE FAULT TAMER IS VOLTAGE SPECIFIC. THE FAULT LIMITER MUST MATCH THE CORRECT VOLTAGE CLASS OF THE SYSTEM IT IS BEING USED ON (15KV, OR 25KV).

3. FAULT TAMERS USED FOR ARRESTERS SHOULD BE FUSED AT 20A.

4. FAULT TAMERS ARE USED FOR FUSING OVERHEAD TRANSFORMERS UP TO 100KVA ON 15KV SYSTEMS IN FAULT ZONES ABOVE 3500A PHASE TO GROUND AND ON 25KV SYSTEMS ABOVE 2000 AMPS.

5. TF-F CU'S ARE USED FOR PROTECTING A TRANSFORMER/ CAPACITOR (NON TRANSFORMER RETROFIT WORK); EQUIP-F CU'S ARE USED FOR PROTECTING EQUIPMENT/ARRESTERS (EXCEPT TRANSFORMERS AND CAPACITORS); RETRO-F CU'S ARE USED FOR TRANSFORMER RETROFIT PROGRAM.

6. SEE DWG. 06.01-104A AND 06.01-104B FOR TRANSFORMER FAULT TAMER EXPULSION FUSE CARTRIDGE CHART AND BILL OF MATERIALS.

7. SEE DWG. 08.01-125A, 08.01-125B AND 08.01-125C FOR THE FUSE CARTRIDGE INSTALLATION PROCEDURE.

8. SEE DWG. 08.01-125D FOR THE METHOD OF CHECKING THE CONTINUITY OF THE BACKUP LIMITER AFTER A CUTOUT OPERATION.

9. WHERE A NON-LOADBREAK INTERCHANGEABLE CUTOUT (PORCELAIN OR POLYMER) EXISTS IN GOOD CONDITION, THE FUSE BARREL CAN BE REMOVED AND REPLACED WITH THE FAULT TAMER FUSE TUBE AND FAULT LIMITER. WHERE AN OLDER CUTOUT (LOADBREAK, LINK BREAK, ETC) EXISTS, REMOVE THE CUTOUT AND REPLACE WITH A COMPLETE FAULT TAMER UNIT.

DUKE ENERGY.

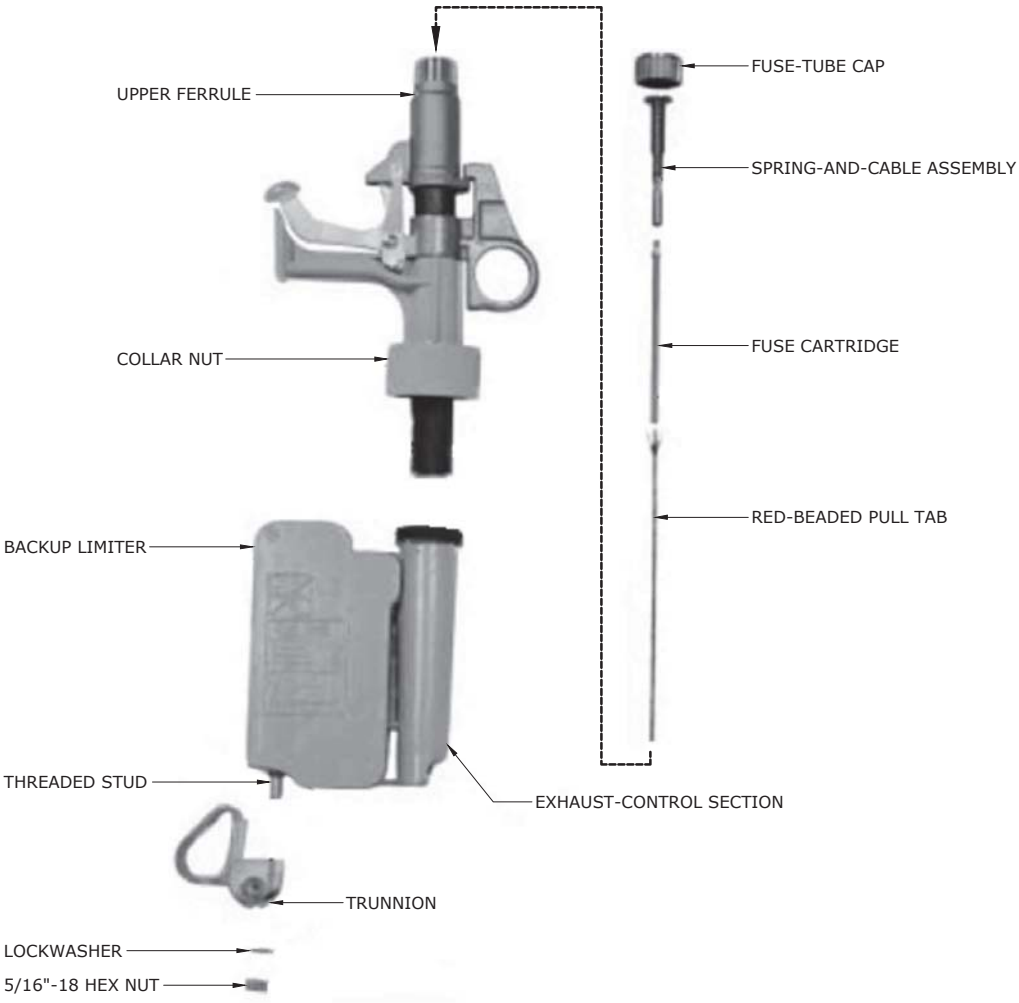
3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

FAULT TAMER FUSE LIMITER

DEC	DEM	DEP	DEF
			X

08.01-122B

INSTALLING THE EXPULSION FUSE CARTRIDGE



STEP 1:
UNSCREW THE FUSE-TUBE CAP FROM THE FUSE TUBE AND REMOVE THE SPRING-AND-CABLE ASSEMBLY.

STEP 2:
SCREW A NEW FUSE CARTRIDGE INTO THE LOWER END OF THE SPRING-AND-CABLE ASSEMBLY. HAND-TIGHTEN UNTIL THE THREAD BOTTOMS OUT.

STEP 3:
ROTATE THE RED-BEADED PULL TAB UNTIL IT IS EXTENDED IN LINE WITH THE FUSE CARTRIDGE AS SHOWN, AND INSERT THE ENTIRE ASSEMBLY (FUSE, CARTRIDGE AND SPRING-AND-CABLE ASSEMBLY) INTO THE FUSE TUBE. THEN, SCREW THE FUSE-TUBE CAP ON THE FUSE.

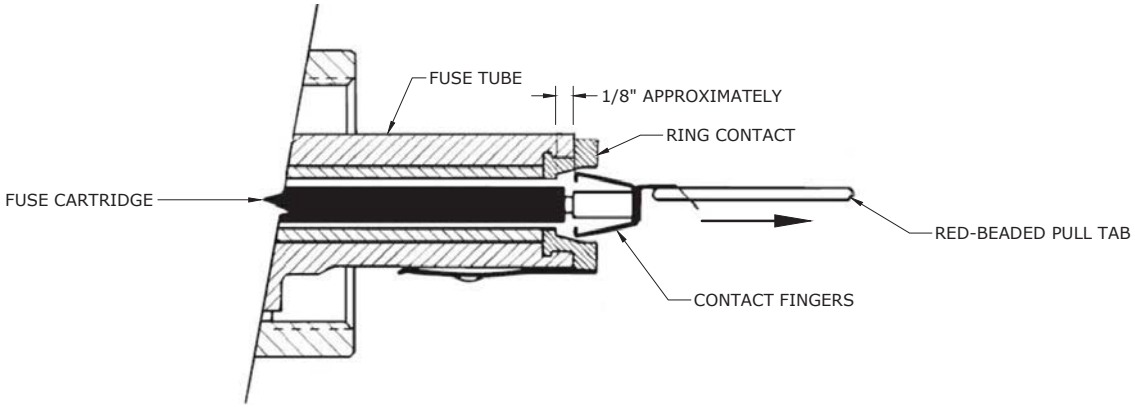
3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

FAULT TAMER FUSE LIMITER

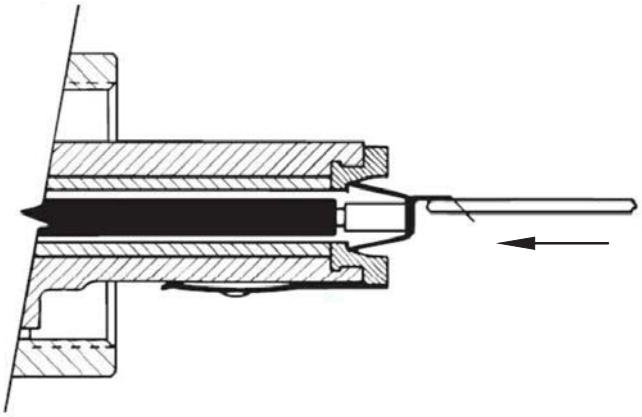
FUSE INSTALLATION PROCEDURE

DEC	DEM	DEP	DEF
X	X	X	X

08.01-125A



MAXIMUM PULL-THROUGH POSITION



DROP-BACK POSITION

STEP 4:

PULL ON THE RED-BEADED PULL TAB TO PULL THE FUSE CARTRIDGE THROUGH THE FUSE TUBE AGAINST THE SPRING TENSION.

STEP 5:

AS SHOWN ABOVE, PULL ON THE RED-BEADED TAB UNTIL THE CONTACT FINGERS EXPAND, THEN RELEASE THE TENSION AS THE CONTACT FINGERS SEAT ON THE BOTTOM OF THE TUBE. PULL THE RED-BEADED TAP BACK THROUGH THE HOLDING RING AND DISCARD. DO NOT TRY TO TEAR OR BREAK OFF THE RED-BEADED TAP BECAUSE IT MAY DAMAGE THE FUSE CONTACT FINGERS.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

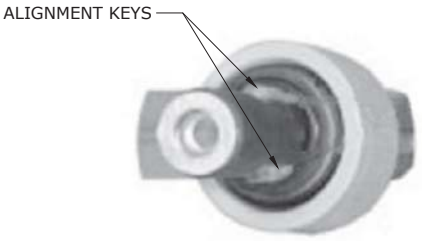
FAULT TAMER FUSE LIMITER

FUSE INSTALLATION PROCEDURE

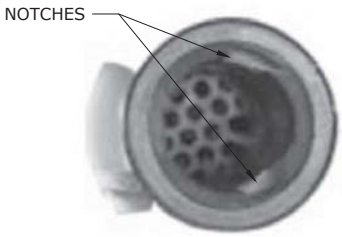
DEC	DEM	DEP	DEF
X	X	X	X

08.01-125B

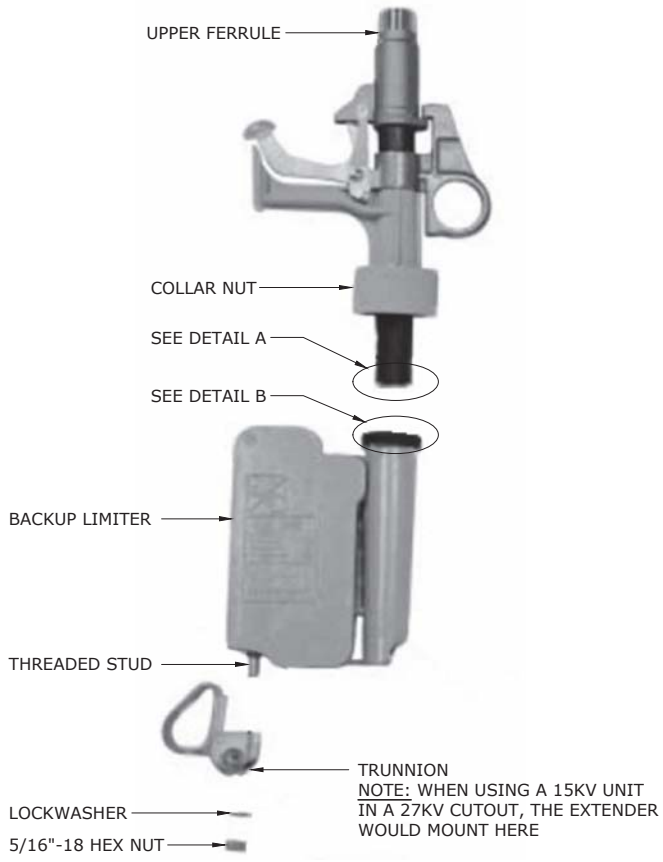
ASSEMBLING THE FUSE TUBE TO THE BACKUP LIMITER



DETAIL A
BOTTOM VIEW



DETAIL B
TOP VIEW



STEP 1:
ALIGN THE KEYS ON THE FUSE TUBE WITH THE NOTCHES IN THE EXHAUST-CONTROL SECTION OF THE BACKUP LIMITER. INSERT THE FUSE TUBE INTO THE EXHAUST-CONTROL SECTION AND HAND-TIGHTEN THE COLLAR NUT.

STEP 2:
ATTACH THE TRUNNION TO THE THREADED STUD ON THE BACKUP LIMITER WITH THE LOCK WASHER AND 5/16”-18 HEX NUT, PROVIDED. MAXIMUM TORQUE IS 10 FT.-LBS. OVER TORQUING MAY DAMAGE THE BACKUP LIMITER.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

FAULT TAMER FUSE LIMITER
ASSEMBLY PROCEDURE

DEC	DEM	DEP	DEF
X	X	X	X

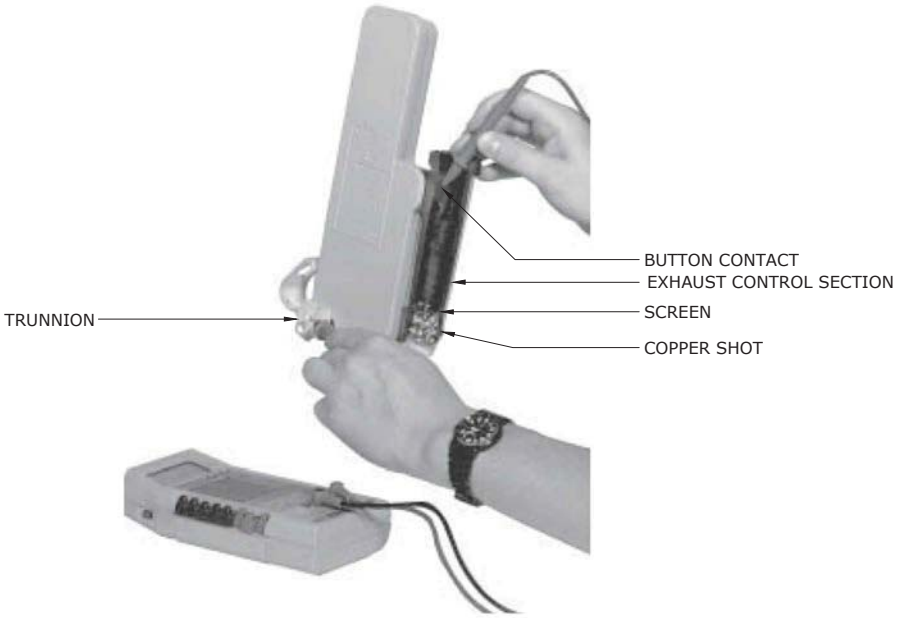
08.01-125C

CHECKING THE CONTINUITY OF THE BACKUP LIMITER

NOTES:

1. WHEN THE FAULT TAMER OPERATES, IT SWINGS TO THE OPEN POSITION JUST LIKE A STANDARD FUSE BARREL. ANY TIME THE FAULT TAMER OPERATES, THE EXPULSION FUSE HAS OPERATED AND MUST BE REPLACED. BEFORE REPLACING THE EXPULSION FUSE LINK, THE BACKUP LIMITER MUST BE CHECKED TO DETERMINE IF IT HAS OPERATED. SINCE IT DOES NOT HAVE A VISUAL INDICATION OF OPERATION, ITS CONTINUITY IS CHECKED USING A CONTINUITY CHECKER (OHM METER) AS FOLLOWS:

   UNSCREW THE COLLAR NUT ON THE FUSE TUBE TO REMOVE THE FUSE TUBE FROM THE BACKUP LIMITER. SEE DIAGRAM ON DWG. 08.01-125A.



STEP 1: WITH THE FUSE TUBE SEPARATED FROM THE BACKUP LIMITER, DETERMINE IF THE BACKUP LIMITER HAS CONTINUITY. DO THIS BY TOUCHING ONE LEAD OF A CONTINUITY TESTER TO THE TRUNION AND THE OTHER LEAD TO THE BUTTON CONTACT INSIDE THE EXHAUST CONTROL SECTION.

STEP 2: IF THE BACKUP LIMITER DOES NOT HAVE CONTINUITY, REMOVE THE TRUNNION TO BE REUSED AND DISCARD THE LIMITER. IF IT HAS CONTINUITY, IT CAN BE REUSED. REMOVE ANY DEBRIS THAT MAY BE INSIDE THE EXHAUST-CONTROL SECTION OF THE BACKUP LIMITER BEFORE REUSING.

STEP 3: UNSCREW THE FUSE-TUBE CAP FROM THE FUSE TUBE AND REMOVE THE SPRING-AND-CABLE ASSEMBLY. UNSCREW THE UPPER TERMINAL OF THE BLOWN FUSE CARTRIDGE FROM THE SPRING-AND-CABLE ASSEMBLY AND DISCARD. REPLACE EXPULSION FUSE. SEE DETAILED STEPS ON DWGS. 08.01-125A AND 08.01-125B.

STEP 4: VISUALLY INSPECT THE FUSE TUBE BORE AND REMOVE ANY DEBRIS.

STEP 5: PUSH THE UPPER FERRULE DOWN UNTIL IT REACHES A POSITIVE STOP TO VERIFY FULL TRAVEL OF THE UPPER FERRULE AND THE LATCHING MECHANISM.

STEP 6: ATTACH THE FUSE TUBE AND TRUNION TO THE BACKUP LIMITER. SEE DETAILED STEPS ON DWG. 08.01-125C.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

BACKUP LIMITER CONTINUITY CHECK PROCEDURE

DEC	DEM	DEP	DEF
X	X	X	X

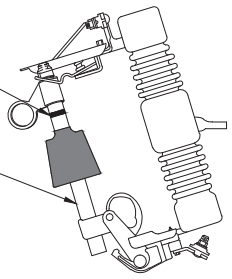
08.01-125D

TRADITIONAL NON-LOADBREAK SECTIONALIZER

COLOR CODED BANDS

TOP
NO BAND = 2 COUNT
GREEN BAND = 3 COUNT

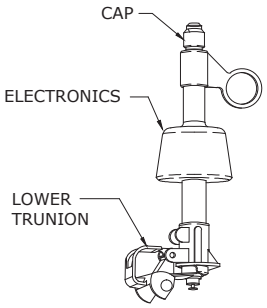
BOTTOM
BROWN BAND = 100 AMP
NO BAND = 200 AMP



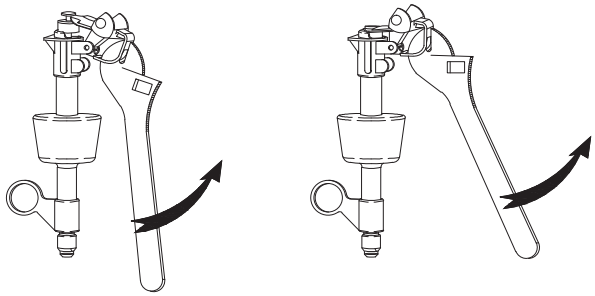
USER SETABLE NON-LOADBREAK SECTIONALIZER

*SEE QUICK REFERENCE MANUAL FOR USER OPERATING INSTRUCTIONS.

RESETTABLE SECTIONALIZER



RESETTING TRADITIONAL SECTIONALIZERS



INSERT THE OPENING OF AN ADJUSTABLE WRENCH INTO THE HOLE ON THE BACK OF THE TRUNION. ROTATE THE TRUNION WITH THE WRENCH UNTIL TRUNION DOOR IS COMPLETELY SHUT. SLOWLY, REMOVE THE WRENCH FROM THE TRUNION. THE TRUNION WILL SNAP OPEN IF IT IS NOT FULLY CLOSED.

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SECT15E100S2F	1	300601	1	SECTIONALIZER, 15KV, NLBK, 1-PH, 100A, 2-SHOT, NO CUTOUT
	2	SECT15E100S3F	1	9220108582	1	SECTIONALIZER, 15KV, NLBK, 1-PH, 100A, 3-SHOT, NO CUTOUT
	3	SECT15E200S2F	1	9220108583	1	SECTIONALIZER, 15KV, NLBK, 1-PH, 200A, 2-SHOT, NO CUTOUT
	4	SECT15E200S3F	1	9220109650	1	SECTIONALIZER, 15KV, NLBK, 1-PH, 200A, 3-SHOT, NO CUTOUT
	5	SECT27E100S2F	1	9220086479	1	SECTIONALIZER, 25KV, NLBK, 1-PH, 100A, 2-SHOT, NO CUTOUT
	6	SECT15EABBF	1	9220181861	1	SECTIONALIZER, 15KV, NLBK, 1-PH, USER SETABLE, NO CUTOUT

NOTES:

1. SECTIONALIZERS WILL FIT IN A STANDARD NLB INTERCHANGEABLE CUTOUT.
2. SECTIONALIZERS HAVE NO FAULT CURRENT INTERRUPTING CAPABILITY. THEY RELY ON THE SOURCE SIDE BREAKER OR RECLOSER TO OPEN DURING THE FAULT. THE SECTIONALIZER OPENS WHILE THE BREAKER/ RECLOSER IS OPEN. THEY DO NOT RELY ON FAULT CURRENT FOR COORDINATION; THEREFORE THEY ARE USEFUL WHERE COORDINATION PROBLEMS EXIST.
3. SECTIONALIZER COUNTS WHEN LINE CURRENT DROPS BELOW 300 mA.
4. CONTACT YOUR SYSTEM ENGINEER PRIOR TO INSTALLATION ON MULTI-PHASE LOCATIONS.
5. ITEM 6 - SEE QUICK REFERENCE MANUAL FOR OPERATING INSTRUCTIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	6/16/11	HOFFMAN	BURLISON	ELKINS
0	9/20/10	HOFFMAN	GUINN	ELKINS

ELECTRONIC RESETTABLE SECTIONALIZERS

Duke Energy®

FLA

DWG. 08.04-02

RECLOSERS, SECTIONALIZERS, TRANSFERS

GENERAL

1. USE THE SUPPLIED GROUNDING CONNECTOR ON THE OIL SECTIONALIZER TANK AND RECLOSER TANK TO GROUND THE UNIT TO THE ARRESTER DOWN LEAD.

2. A LOAD BREAK TOOL SHOULD BE USED TO OPEN DRY TYPE SECTIONALIZERS AND RECLOSER BYPASS SWITCHES.

3. FOR VERTICAL CONSTRUCTION THE MINIMUM TANK CLEARANCE BETWEEN SINGLE-PHASE RECLOSER TANKS AND ADJACENT RECLOSER BUSHINGS IS TO BE 13 INCHES.

4. FOR THREE-PHASE RECLOSERS, THE GROUND TRIP SHORTING SWITCH OPERATES AS FOLLOWS:

   A. SWITCH-UP - THE GROUND TRIP IS CUT OUT
   B. SWITCH DOWN - THE GROUND TRIP IS CUT IN

5. THE THREE-PHASE RECLOSER MAY BE REVERSED IN THE MOUNTING BRACKET TO ACCOMMODATE THE SOURCE TO LOAD DIRECTION OF FEED THROUGH THE RECLOSER.

3				
2				
1				
0	11/29/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

RECLOSERS, SECTIONALIZERS, TRANSFERS AND THREE-PHASE RECLOSER LIGHTNING ARRESTER MOUNTING DETAIL

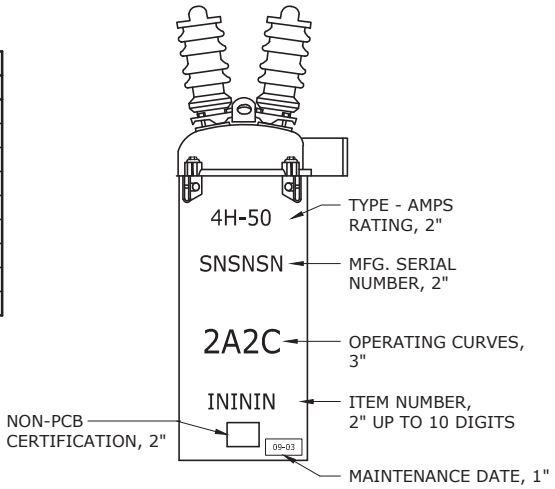
Duke Energy®

FLA

DWG. 08.05-00

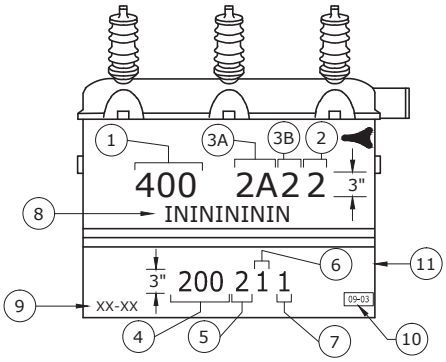
SINGLE-PHASE RECLOSERS		
SEQUENCE	OPERATING SEQUENCE	CURVE(S)
2A2B	TWO FAST FOLLOWED BY TWO RETARDED	A AND B
2A2C	TWO FAST FOLLOWED BY TWO EXTRA RETARDED	A AND C
2A2D	TWO FAST FOLLOWED BY TWO STEEP RETARDED	A AND D
1A3B	ONE FAST FOLLOWED BY THREE RETARDED	A AND B
1A3C	ONE FAST FOLLOWED BY THREE EXTRA RETARDED	A AND C
1A3D	ONE FAST FOLLOWED BY THREE STEEP RETARDED	A AND D
1A2B	ONE FAST FOLLOWED BY TWO RETARDED	A AND B
1A2C	ONE FAST FOLLOWED BY TWO EXTRA RETARDED	A AND C
1A2D	ONE FAST FOLLOWED BY TWO STEEP RETARDED	A AND D

INCLUDED RECLOSERS:
H, 4H, L, V4L AND E



SINGLE-PHASE RECLOSERS

1 - PHASE TRIP COIL SIZE: 100, 160, 185, 225, 280, 400, 400X, 560, 560X
2 - PHASE TRIP TIME DELAY CURVE CODE: B, C, D OR E-CURVE
3 - PHASE TRIP OPERATING SEQUENCE:
  A. NUMBER OF OPERATIONS ON A-CURVE
  B. NUMBER OF OPERATIONS ON DELAYED B, C, D OR E-CURVE
4 - BUSHING CT RATIO:
  100 (100:5) 200(200:5) 300(300:5)
  400 (400:5) 500(500:5) 600(600:5)
5 - GROUND TRIP TIME DELAY CURVE: 2 3
6 - GROUND TRIP FAST OPEN OPERATIONS: 1 2 3 4
7 - GROUND TRIP SOLENOID CONNECTION: 1 (SERIES) 2 (PARALLEL)
8 - ITEM NUMBER (UP TO 10 DIGITS)
9 - MANUFACTURER'S SERIAL NUMBER
10 - MAINTENANCE DATE
11 - NON-PCB CERTIFICATION (ON END WITH OPERATING HANDLE)



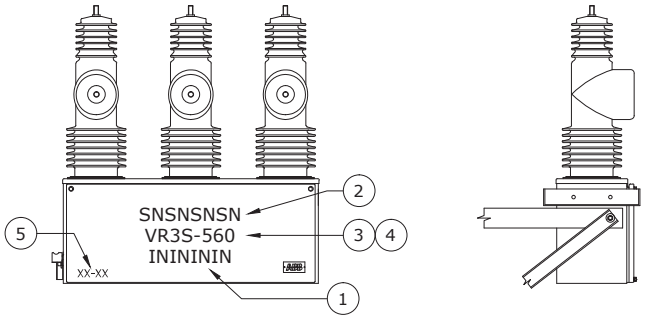
INCLUDED RECLOSERS:
VW AND WV

THREE-PHASE HYDRAULIC RECLOSERS
ALL HYDRAULICS - NOT VACUUM UNITS

1 - ITEM NUMBER (UP TO 10 DIGITS)
2 - MANUFACTURER'S SERIAL NUMBER
3 - MANUFACTURER'S TYPE RECLOSER: VWE, VR3S AND OVR
4 - FULL-LOAD CURRENT RATING (560, 630, 800)
5 - MAINTENANCE DATE

NOTES:

1. STENCIL THE CATALOG NUMBER ON THE OUTSIDE, PADLOCK SIDE OF THE RECLOSER ELECTRONIC CONTROL CABINET.

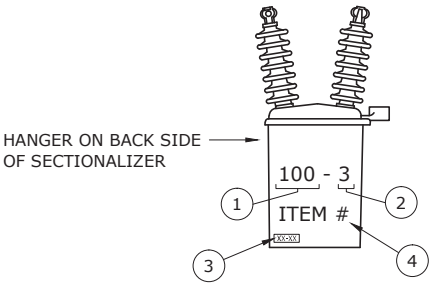


THREE-PHASE ELECTRONIC CONTROLLED RECLOSERS

1 - AMPERE RATING
2 - COUNTS TO OPEN OR SHOTS TO LOCKOUT
3 - MAINTENANCE DATE
4 - ITEM NUMBER, 2"

NOTES:

1. SEE DWG. 08.04-02 FOR ELECTRONIC SECTIONALIZERS.



HYDRAULIC SECTIONALIZERS

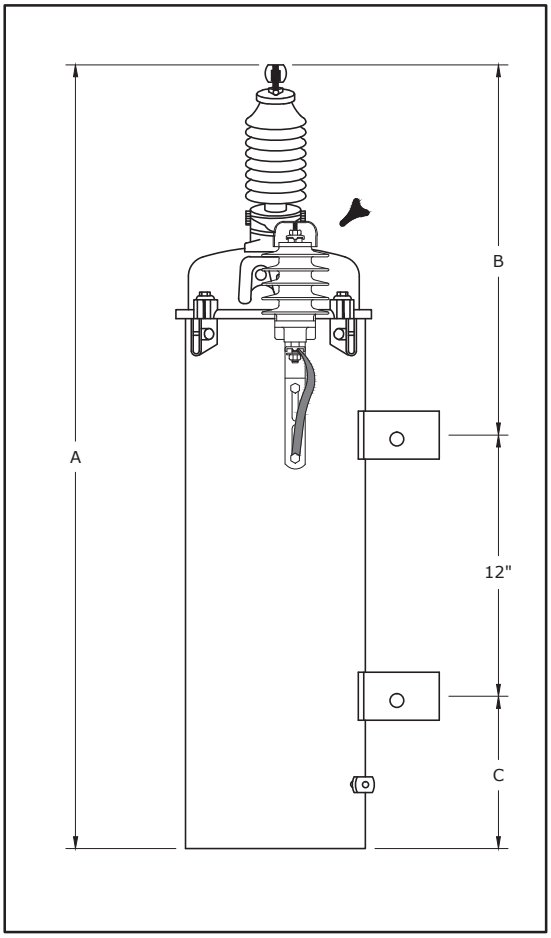
DUKE ENERGY.

3				
2				
1	11/29/16	BRAVO	BURLISON	ADCOCK
0	11/29/10	GUINN	GUINN	HOYT
REVISED		BY	CK'D	APPR.

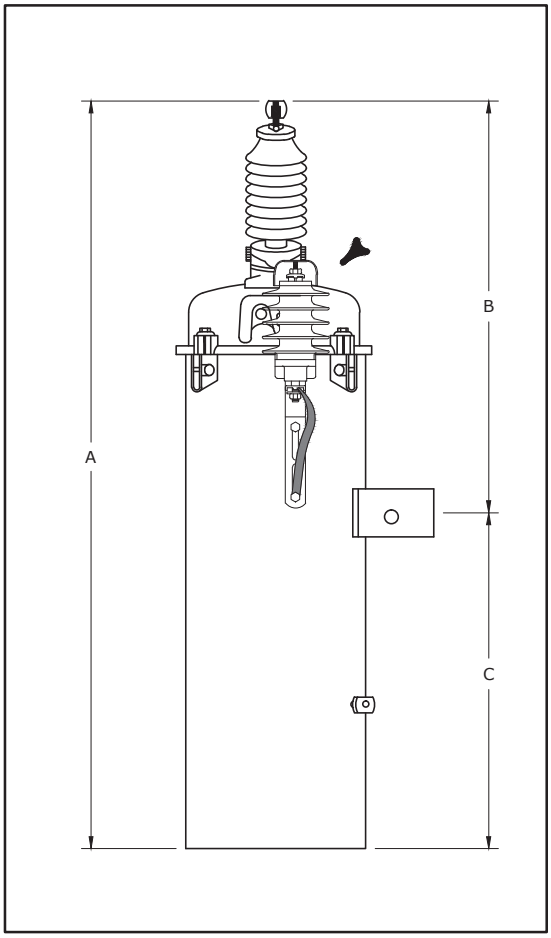
RECLOSER IDENTIFICATION

DEC	DEM	DEP	DEF
			X

08.05-01



DIMENSIONS
TYPE 4H, L, V4L, E AND 4E RECLOSERS



DIMENSIONS
TYPE H RECLOSER

DIMENSION (IN.)	RECLOSER TYPE					
	4H	L	V4L	E	4E	H
A	36	37	45	42	49	30
B	17	19	19	20	23	16
C	7	6	15	9	15	14

WEIGHT WITH OIL (LBS.)	114	159	205	169	205	85
OIL CAPACITY (GAL.)	5	7	9.5	8.2	9.5	4

NOTES:

1. THE DIMENSIONS, WEIGHTS AND CAPACITIES LISTED ABOVE ARE APPROXIMATE.

DUKE ENERGY.

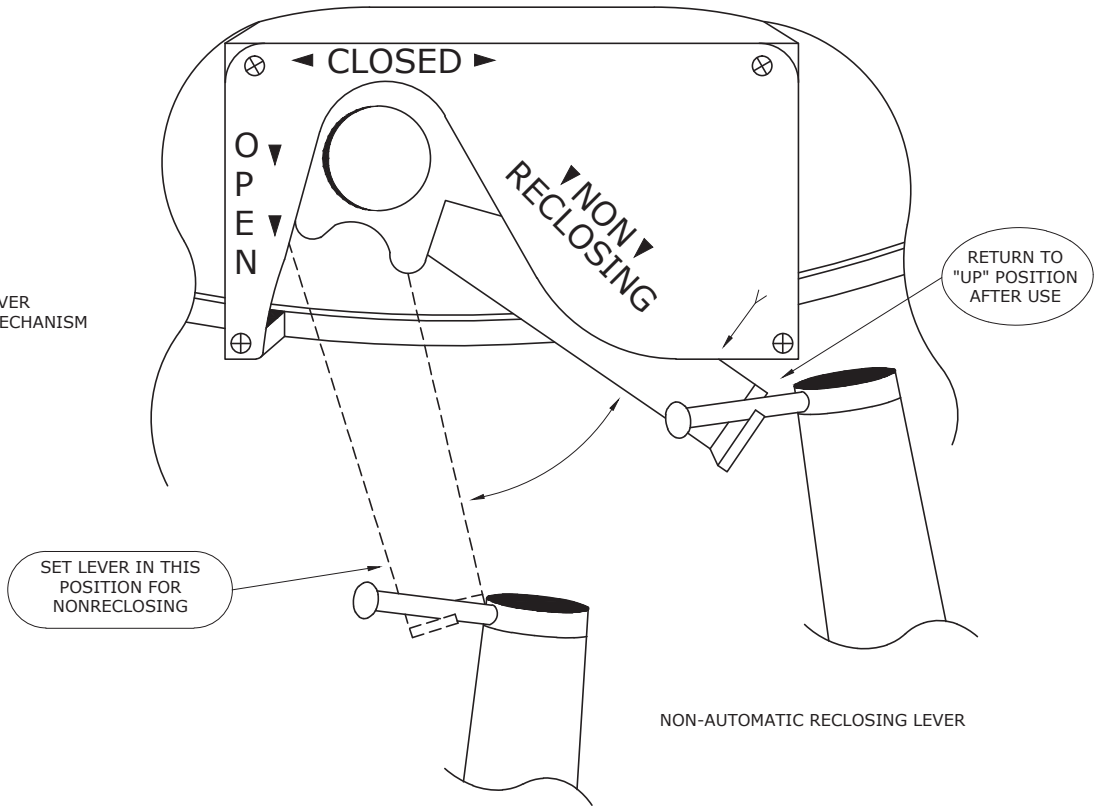
REVISED		BY	CK'D	APPR.
3				
2				
1	11/17/15	LOOSIER	BURLISON	ADCOCK
0	11/29/10	HOFFMAN	GUINN	ELKINS

TYPICAL SINGLE-PHASE RECLOSER DIMENSIONS, WEIGHTS AND OIL CAPACITIES

DEC	DEM	DEP	DEF
			X

08.05-02

VIEW OF LEVER CONTROL MECHANISM

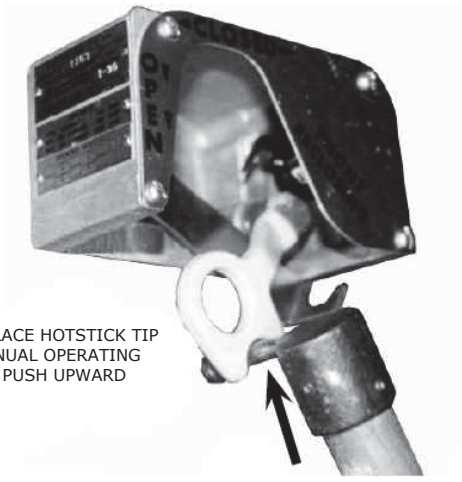


NON-AUTOMATIC RECLOSING LEVER

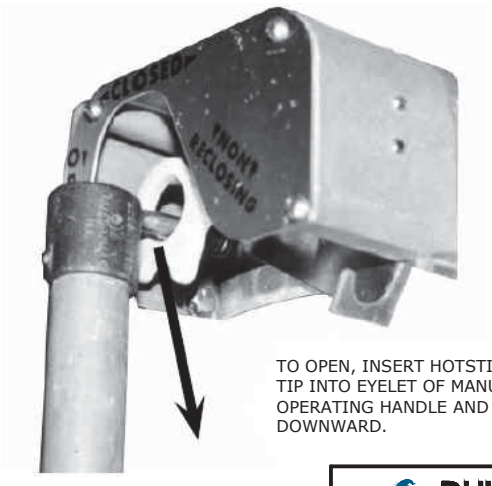
NOTES:

1. NON-AUTOMATIC RECLOSING LEVER FOR COOPER RECLOSERS PROVIDES ONE-SHOT LOCKOUT OF THE RECLOSER WHEN TRIPPED ELECTRICALLY. IT IS CONTROLLED BY AN ADDITIONAL LEVER UNDER THE OPERATING HANDLE HOOD WHICH, WHEN PULLED DOWN, ENGAGES THE LOCKOUT AND PLUNGER MECHANISMS, BYPASSING THE HYDRAULIC LOCKOUT IN SUCH A MANNER THAT WHEN THE SOLENOID PLUNGER IS PULLED DOWN, THE LOCKOUT MECHANISM IS TRIPPED. IN ORDER FOR THE RECLOSER TO RESUME NORMAL, FULL-AUTOMATIC OPERATION, THE LEVER IS MOVED BACK TO THE "UP" POSITION. THE LEVER OPERATES ON A TOGGLE SO THAT IT IS POSITIVELY IN THE NON-AUTOMATIC OR AUTOMATIC POSITION.

2. AFTER USE, THE NON-AUTOMATIC RECLOSING LEVER MUST BE RETURNED TO NORMAL "UP" POSITION TO PROVIDE AUTOMATIC RECLOSING



TO CLOSE, PLACE HOTSTICK TIP AGAINST MANUAL OPERATING HANDLE AND PUSH UPWARD



TO OPEN, INSERT HOTSTICK TIP INTO EYELET OF MANUAL OPERATING HANDLE AND PULL DOWNWARD.

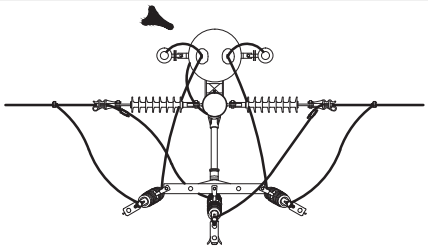
3				
2				
1				
0	7/31/14	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

COOPER RECLOSERS
OPERATING LEVERS

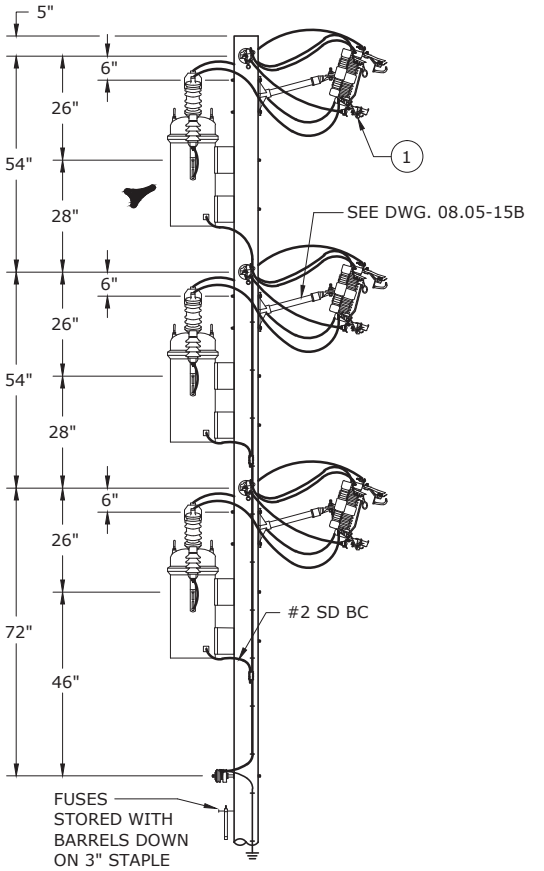
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

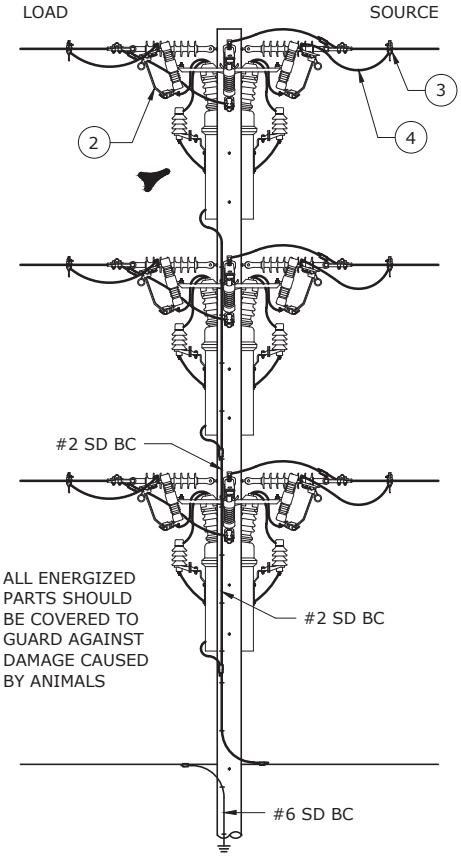
08.05-06



PLAN VIEW



FRONT VIEW



SIDE VIEW

BILL OF MATERIALS								
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY. REQ'D.			ITEM NUMBER	QTY PER CU	DESCRIPTION
			1Ø	2Ø	3Ø			
-	1	FUSE15CO100F	1	2	3	221112	1	CUTOUT, LB, 15KV, 100A, 16KA, 110KV BIL
	2	SW153COSBDF	2	4	6	9220210916	1	CUTOUT, BLADE, SLD
	3	KHLC40N6F	2	4	6	9220184790	1	CLAMP, HOT LINE, ALUMINUM, SMALL
	4	RCRISERN2CUF	1	2	3	9220218857	12 FT.	WIRE, COPPER, #2, SOLID, 600V, SD COPPER

NOTES:

1. ISSUE RECLOSER SEPARATELY. RECLOSER WILL COME WITH ARRESTERS PRE-MOUNTED.
*2. FOR ALL V4L RECLOSER INSTALLATIONS ON VERTICAL CONSTRUCTION, INCREASE THE PHASE SPACING BETWEEN THE PRIMARY CONDUCTORS FROM 54" TO 64" AND INCREASE THE 28" DIMENSIONS TO 38".
3. SEE DWG 08.05-15B FOR BRACKET DETAILS AND BILL OF MATERIALS.
4. FOR SINGLE-PHASE AND TWO-PHASE INSTALLATIONS, USE SPACING REQUIREMENTS FROM BOTTOM UNIT CLOSEST TO NEUTRAL TOWARDS THE TOP OF THE POLE.
5. EQUIPMENT CASE GROUND TO NEUTRAL TO BE #2 SD BC.
6. IF RECLOSERS ARE USED IN MAINLINE FEEDER (336 OR 795), USE 600 AMP RECLOSER BYPASS (SEE DWG. 08.10-10) INSTEAD OF CUTOUTS WITH SOLID BLADES.
7. DISCONNECT CONNECTIONS MAY BE MADE WITH SOLID CONNECTION IN LIEU OF HOT LINE CLAMP AND STIRRUP.

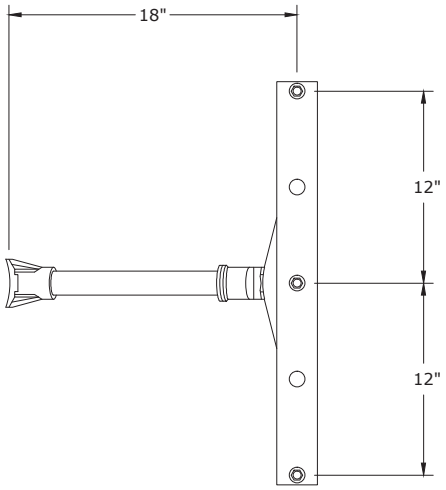
DUKE ENERGY.

REVISED	BY	CK'D	APPR.
3 11/17/15	LOOSIER	BURLISON	ADCOCK
2 4/21/15	LOOSIER	BURLISON	ADCOCK
1 3/29/11	HOFFMAN	BURLISON	ELKINS
0 10/6/10	HOFFMAN	GUINN	ELKINS

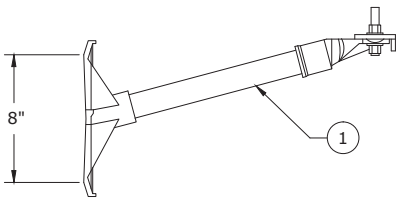
RECLOSER ASSEMBLY, VERTICAL CONSTRUCTION

DEC	DEM	DEP	DEF
			X

08.05-15A



TOP VIEW



SIDE VIEW

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	BKTEQ1824FGF	1	9220201401	1	BRACKET, FG, CUTOUT MTG BKT, 3 HOLE
				13264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				13308	2	WASHER, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				152107	2	BOLT, MACH, SQ. NUT, 5/8" X 12"

NOTES:

1. SEE DWG 08.05-15A FOR RECLOSER INSTALLATION DETAILS.
2. USE ONE CU PER RECLOSER INSTALLED.

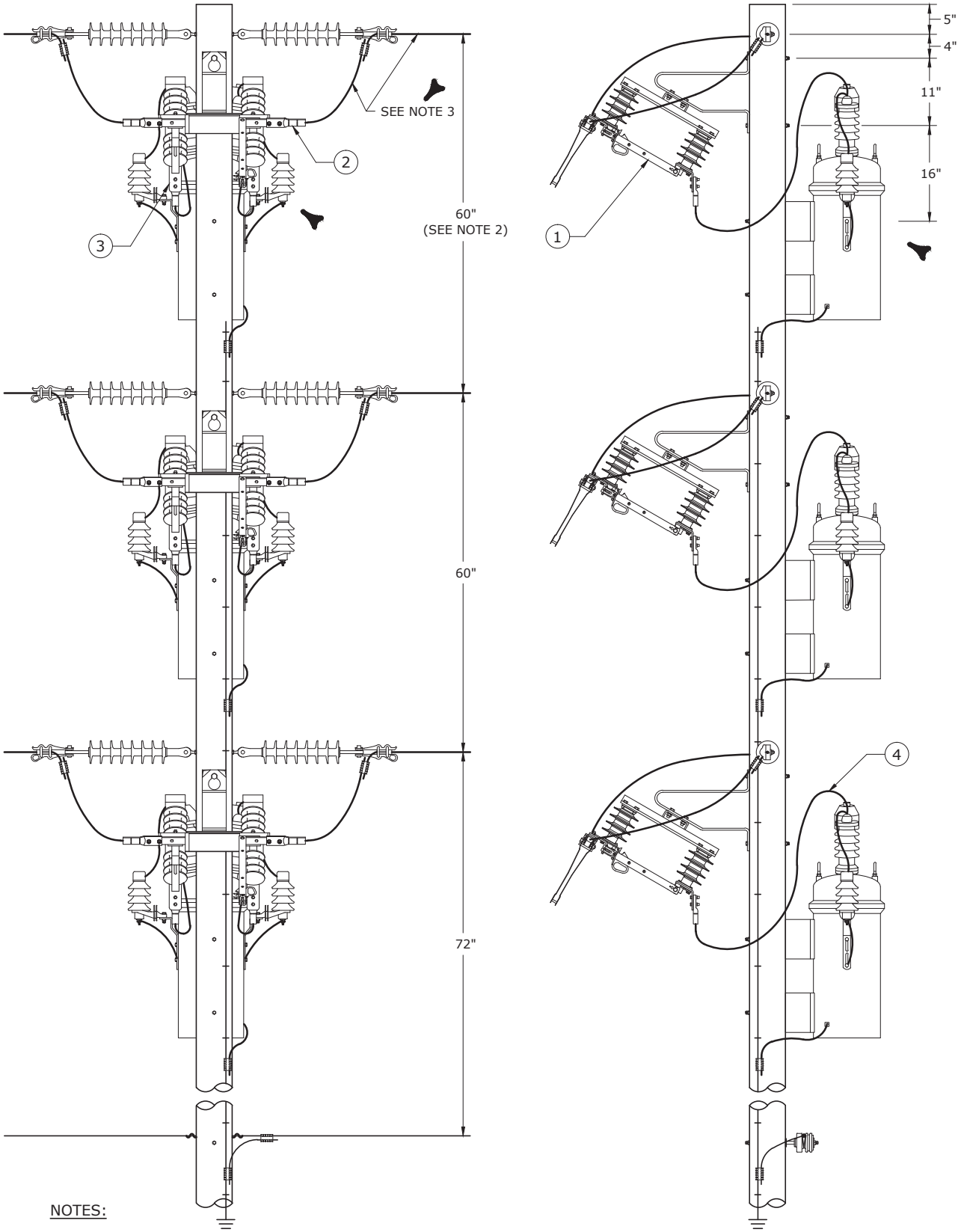
3				
2				
1				
0	10/11/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OIL CIRCUIT RECLOSER - SINGLE-PHASE INSTALLATION BYPASS CUTOUT BRACKET

Duke Energy®

FLA

DWG. 08.05-15B



NOTES:

1. SEE DWG. 08.05-16B FOR BILL OF MATERIALS.
2. FOR ALL V4L RECLOSER INSTALLATIONS ON VERTICAL CONSTRUCTION, INCREASE THE PHASE SPACING BETWEEN THE PRIMARY CONDUCTORS FROM 60" TO 64".
3. RISER SIZE SHOULD MATCH PRIMARY CONDUCTOR SIZE.

REVISED		BY	CK'D	APPR.
5	11/17/15	LOOSIER	BURLISON	ADCOCK
4	8/27/15	LOOSIER	BURLISON	ADCOCK
3	4/21/15	LOOSIER	BURLISON	ADCOCK
0	9/28/11	BURLISON	BURLISON	ELKINS

RECLOSER ASSEMBLY, VERTICAL CONSTRUCTION, FEEDER

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.05-16A

BILL OF MATERIALS								
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D			CATALOG NUMBER	QTY PER CU	DESCRIPTION
			1Ø	2Ø	3Ø			
-	1	SW156BYPF	1	2	3	010928	8	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
						0012277	8	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE THRD.
						013128	8	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
						013264	2	SPRING, DOUBLE COIL, STEEL, FOR, 5/8", BOLT, GALV.
						013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
						013407	16	WASHER, ROUND, FLAT, STAINLESS, STEEL, 304, ALLOY, FOR, 1/2"
						152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
						260123	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 15KV, LBK, HOOKS, 600A, LEFT
	2	KLC2H50ALF	2	4	6	010928	2	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
						012277	2	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE THRD.
						013163	4	WASHER, FLAT, 1/2 IN, SILICON BRONZE, FLAT, ROUND
						155326	1	LUG, COMPRESSIN, 2H-795AL
						10542504	2	WASHER, ROUND, RD, 1/2, SS, 1.375" OD
	3	KLC2H50AL90DF	2	4	6	010928	2	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
						012277	2	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE THRD.
						013163	4	WASHER, FLAT, 1/2 IN, SILICON BRONZE, FLAT, ROUND
						10542504	2	WASHER, ROUND, 1/2, SS, 1.375" OD
						9220068102	1	LUG, 2-HOLE, TIN-PLATED, NEMA
	4	RCRISER500ALF	2	4	6	202112	12	CABLE, XLP UG AL 500

NOTES:

1. ISSUE RECLOSER SEPARATELY. RECLOSER WILL COME WITH ARRESTERS PREMOUNTED.

2. SEE DWG. 08.05-16A FOR DESIGN SPECIFICATIONS.

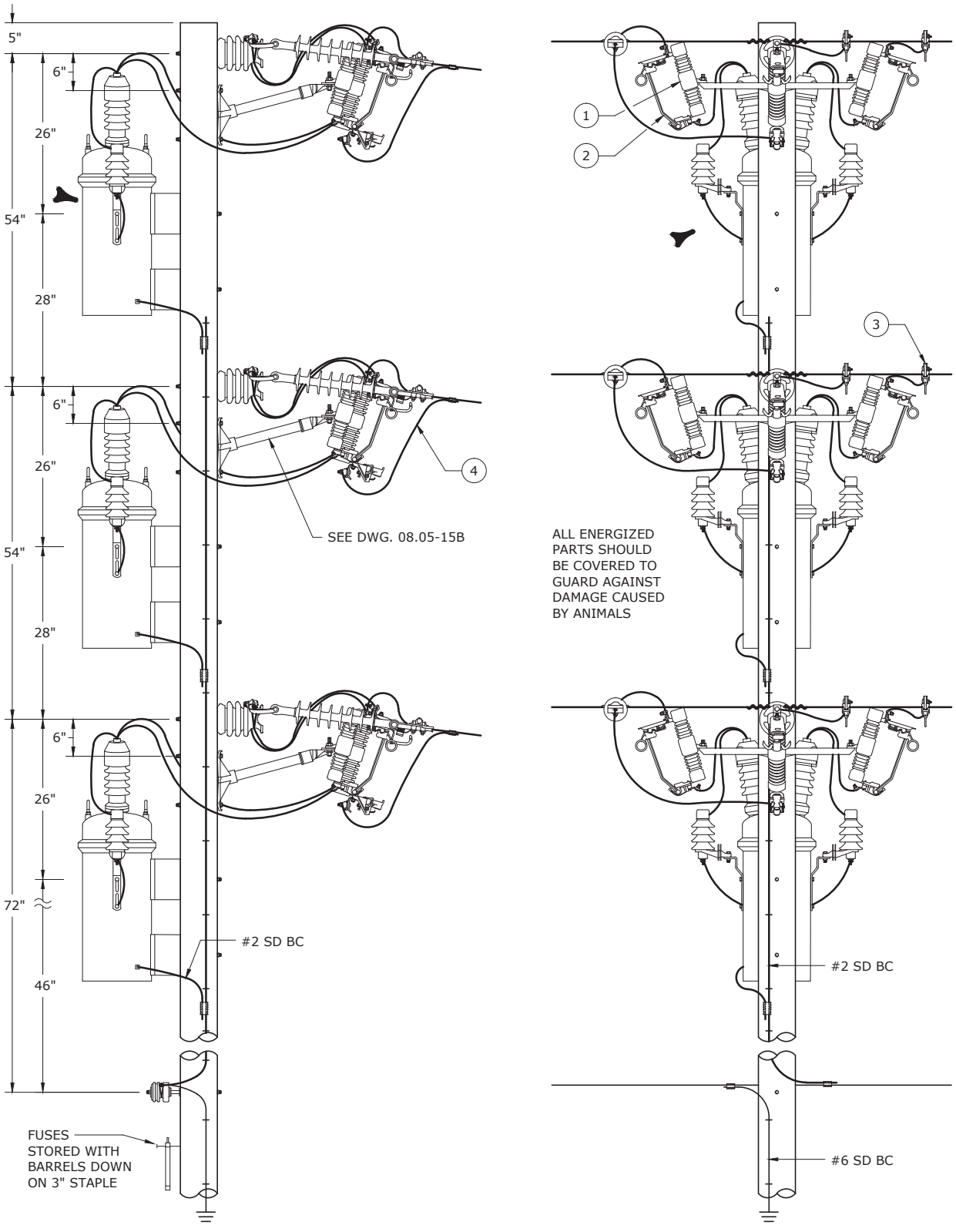
3				
2				
1				
0	5/28/14	LOOSIER	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

RECLOSER ASSEMBLY,
VERTICAL CONSTRUCTION, FEEDER

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.05-16B



SIDE VIEW

FRONT VIEW

NOTES:

1. SEE DWG. 08.05-18B FOR PLAN VIEW, BILL OF MATERIALS AND NOTES.

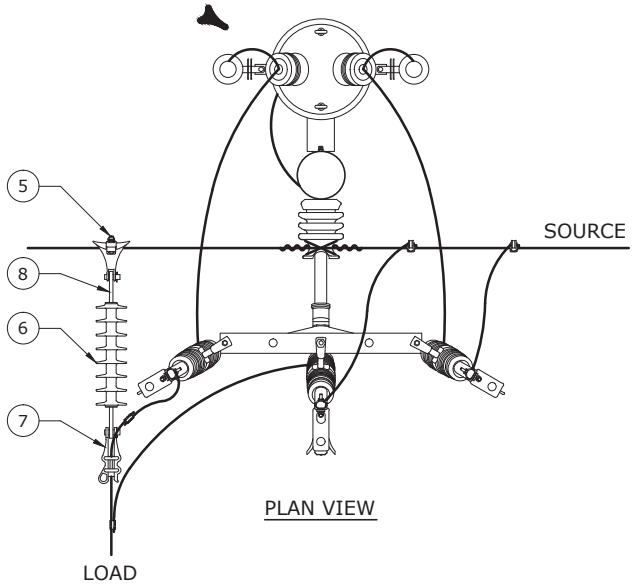
REVISED		BY	CK'D	APPR.
3				
2	11/17/15	LOOSIER	BURLISON	ADCOCK
1	4/21/15	LOOSIER	BURLISON	ADCOCK
0	12/6/13	SALAS	DANNA	ADCOCK

RECLOSER ASSEMBLY, VERTICAL CONSTRUCTION
SLACK SPAN TAP

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.05-18A



PLAN VIEW

BILL OF MATERIALS								
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D			ITEM NUMBER	QTY PER CU	DESCRIPTION
			1Ø	2Ø	3Ø			
-	1	FUSE15CO100F	1	2	3	0000221112	1	CUTOUT, LB, 15KV, 100A, 16KA,100KV BILL
	2	SW153COSBDF	2	4	6	9220210916	1	CUTOUT, BLADE, BLADE,SLD,NONLOADBREAK,300A,15 KV
	3	KHLC40N6F	3	6	9	9220184790	1	CLAMP, HOT LINE, ALUMINUM, SMALL
	4	RCRISERN2CUF	1	2	3	9220218857	12FT.	WIRE, COPPER, #2 SOLID, COPPER, 600V, SD COPPER
	5	SCLMP10AAACF	1	2	3	0000090306	1	CLAMP, ANGLE, SUSPENSION,ANGLE,ALUMINUM,0.25-0.75"
	6	IDES25PF	1	2	3	080577	1	INSULATOR, POLYMER, 25KV, DE, SI, RATED 15KV
	7	DECLMP10AAACF	1	2	3	0000100708	1	CLAMP, DEADEND, DE,SO,6-4/0 ACSR,6-4/0 CU, 4-4/0 AL
	8	MIDSPANTAPF	1	2	3	0000115428	1	LINK, CHAIN,TWISTED,90,25M,3-3/8",LONG

NOTES:

1. ISSUE RECLOSER SEPARATELY. RECLOSER WILL COME WITH ARRESTERS PRE-MOUNTED.
2. FOR ALL V4L RECLOSER INSTALLATIONS ON VERTICAL CONSTRUCTION, INCREASE THE PHASE SPACING BETWEEN THE PRIMARY CONDUCTORS FROM 54" TO 64" AND INCREASE THE 28" DIMENSIONS TO 38".
3. SEE DWG 08.05-15B FOR BRACKET DETAILS AND BILL OF MATERIALS.
4. SEE DWG 03.18-03 FOR ALTERNATE SLACK SPAN CONSTRUCTION DETAILS.
5. SEE DWG. 08.05-18A FOR DESIGN SPECIFICATIONS.
6. FOR SINGLE-PHASE AND TWO-PHASE INSTALLATIONS, USE SPACING REQUIREMENTS FROM BOTTOM UNIT CLOSEST TO NEUTRAL TOWARDS THE TOP OF THE POLE.
7. EQUIPMENT CASE GROUND TO NEUTRAL TO BE #2 SD BC.
8. IF RECLOSERS ARE USED IN MAIN LINE FEEDER (336 OR 795), USE 600 AMP RECLOSER BYPASS (SEE DWG. 08.10-10) INSTEAD OF CUTOUTS WITH SOLID BLADES.
9. DISCONNECT CONNECTIONS MAY BE MADE WITH SOLID CONNECTION IN LIEU OF HOT LINE CLAMP AND STIRRUP.

DUKE ENERGY.

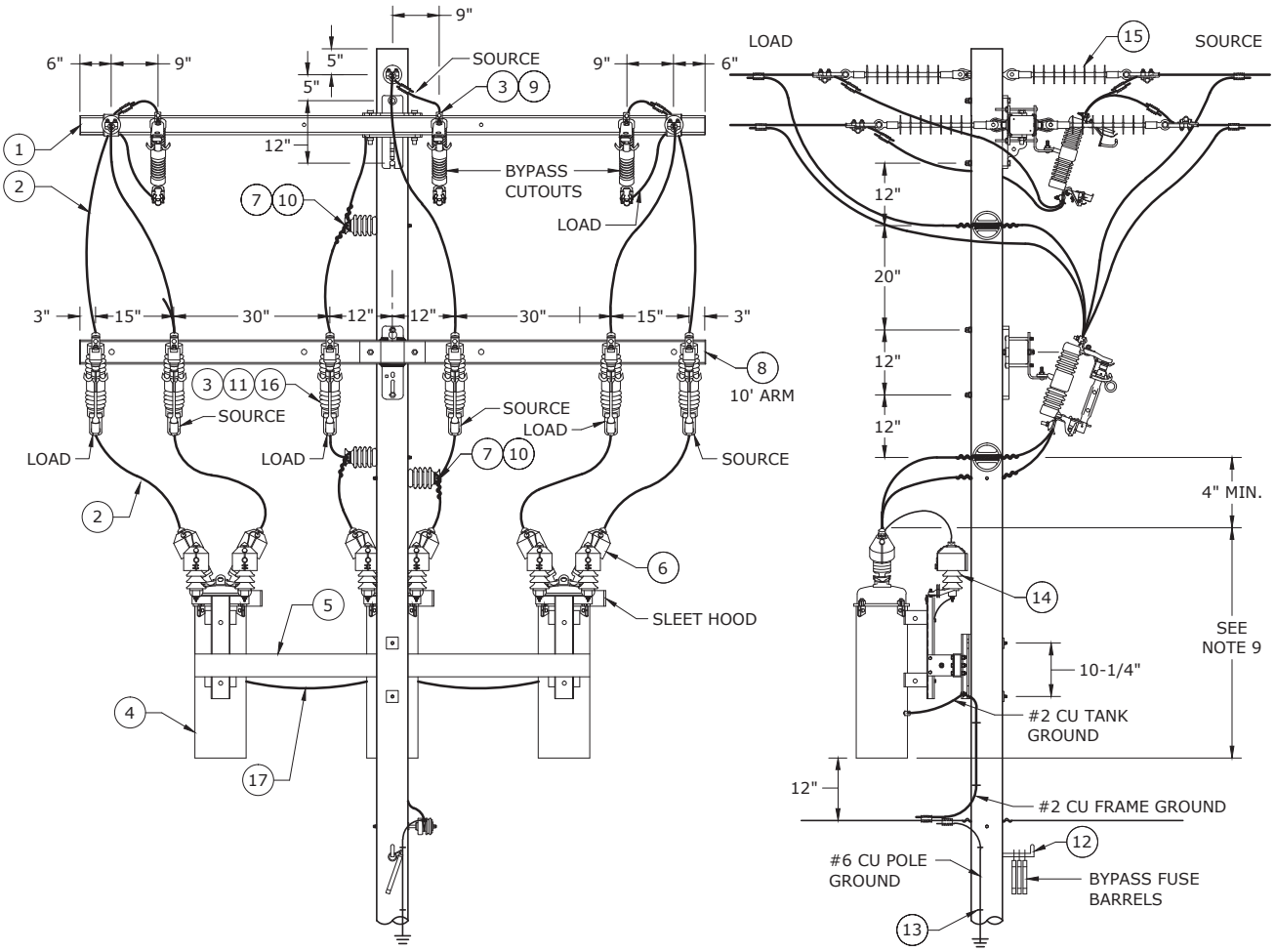
REVISED		BY	CK'D	APPR.
3				
2				
1	11/17/15	LOOSIER	BURLISON	ADCOCK
0	12/6/13	SALAS	DANNA	ADCOCK

RECLOSER ASSEMBLY, VERTICAL CONSTRUCTION

SLACK SPAN TAP

DEC	DEM	DEP	DEF
			X

08.05-18B



FRONT VIEW

SIDE VIEW

NOTES:

1. ALL SWITCHING SHALL BE DONE WITH TELESCOPIC STICK AS PER WORK STANDARDS. SOURCE AND LOAD CUTOUTS ARE TO HAVE SOLID BLADES.

2. HANG FUSE BARRELS FROM BY-PASS CUTOUTS ON A DRIVE HOOK OR LAG SCREW NEAR THE NEUTRAL. HANG BARRELS BY THE PULL RING SO WATER AND DEBRIS CANNOT COLLECT INSIDE BARREL.

3. ARRESTERS ARE TO BE CONNECTED TO BOTH SOURCE AND LOAD SIDE BUSHINGS AND INSTALLED ON THE RECLOSER BRACKET DIRECTLY BEHIND THE RECLOSER BUSHING AS SHOWN.

4. SOURCE BUSHING IS LOCATED OVER THE MANUAL (YELLOW) HANDLE. ROTATE HEAD TO HAVE THE HANDLE VISIBLE FROM NORMAL APPROACH (TYPICALLY ROAD SIDE).

5. BOND RECLOSERS TO THE RECLOSER MOUNTING BRACKET WITH #2 CU AND CONNECT TO SYSTEM NEUTRAL.

6. SINGLE-PHASE RECLOSERS HAVE DIFFERENT OPERATING CURVES: 2A2B, 2A2C, ETC. WHEN INSTALLING OR REPLACING A RECLOSER, **BE SURE** THE UNIT HAS THE CORRECT OPERATING CURVES AS WELL AS THE CORRECT AMPERE RATING TYPE.

7. SEE DWG. 08.05-114B FOR TABLES FOR RECLOSER TAP CONDUCTOR AND SWITCH SIZING AND BILL OF MATERIALS.

8. SEE SYSTEM PROTECTION FOR BY-PASS SWITCH DETAILS.

9. SEE DWG. 08.05-02 FOR RECLOSER HEIGHT MEASUREMENT.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/16/15	LOOSIER	BURLISON	ADCOCK
0	11/17/15	BRUINS	BURLISON	ADCOCK

OIL CIRCUIT RECLOSERS, THREE-PHASE INSTALLATION,
HORIZONTAL CONSTRUCTION
SINGLE-PHASE UNITS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

08.05-114A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	ARMSDE120HFF	1	9220272389	1	CROSSARM, DEADEND, HD, FIBERGLASS
			152122	2	BOLT, HEX, 3/4 IN, 10"X12 STEEL, A307
			13346	2	WASHER SQUARE, RB, CRV, 3"X3"
			13265	2	WASHER, LOCK, 3/4 IN DBL COIL
2	RCRISERN2CUF	6	9220218857	12	CONDUCTOR, COPPER, WP #2 AWG
2	RCRISER10ALF	6	54008800	12	CONDUCTOR, AAAC, 1/0, AAAC, 7-STR, 6201-T81 ALUMINUM ALLOY
2	RCRISER40ALF	6	202111	12	CABLE, XLP UG AL 4/0
3	FUSE15CO100F	3	202112	1	CUTOUT, NON LOADBREAK, 15KV,100A
3	SW153COSBDF	6	9220210916	1	CUTOUT, BLADE, BLADE,SLD,NONLOADBREAK,300A,15 KV
4	RCL(VARIES)	3	-	3	RECLOSER TYPE L (VARIABLE AMP AND CURVE)
5	BKTTFMRSMALF	1	12912507	1	BRACKET, MOUNTING, MTG,RACK,TF,SM THREE POS, 5-50KVA
			152122	2	BOLT, SQUAREHEAD, 3/4 IN, 12 IN, S, A307, GLV, 10, UNC
			13346	2	WASHER SQUARE, RB, CRV, 3"X3"
			13265	2	WASHER, LOCK, 3/4 IN DBL COIL
			152104	6	BOLT, MACHINE, 5/8 IN, 2 IN, ASTM A307, A, GALVANIZED, SQ
6	WGEQBUSHSNAPF	6	470114	1	GUARD, ANIMAL, 9 INCH HT
	-	6	9220284709	1	GUARD, ANIMAL, 5 1/2 INCH HT
7	IHPTT35F	3	80217	1	INSULATOR, POST, LINE, 35KV ROUND BASE TIE TOP
	ISSTUDBOLT5812F	3	72367	1	STUD, LINE POST, LP 5/8 INCH X 12 INCH
			13264	1	WASHER, LOCK, 5/8 IN, STEEL, GLV, LK,5/8,COIL,DBL,GLV
8	ARMS120FF	1	9220201451	1	CROSSARM, TANGENT, 10 FT, FIBERGLASS, BRACELESS, TANGENT
			152107	2	BOLT, MACHINE, 5/8 IN, 11 INX 12 IN, STEEL
			13346	2	WASHER SQUARE, RB, CRV, 3"X3"
			13264	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, LK,5/8,COIL,DBL,GLV
9	BKTCOLASTLXARMF	3	70101	1	BRACKET, MOUNTING, 8 7/8 IN X 2 1/2 IN IN, GALVANIZED STEEL
			11213	2	BOLT, CARRIAGE, 1/2 IN, 6 IN, STEEL, GLV
10	-	1	9220284739	1	TIE, COMPOSITE FOR #2 TO #2/0
10	-	1	9220284740	1	TIE, COMPOSITE FOR #2/0 TO #4/0
11	BKTCOLASTLXARMF	6	70101	1	BRACKET, MOUNTING, 8 7/8 IN X 2 1/2 IN IN, GALVANIZED STEEL
			11213	2	BOLT, CARRIAGE, 1/2 IN, 6 IN, STEEL, GLV
12	-	1	14114	1	SCREW, LAG, 1/4 IN X 2 IN, STEEL, GLV, LAG,HX,1/4-INCH O.D.
13	GOWE2F	1	9220162221	40	CONDUCTOR, COPPER, #2 SOLID, SOFT DRAWN, BARE
			15280	40	STAPLE, DIAMOND POINT, GALV STL 2X5/8X3/16
			153111	1	CONNECTOR, COMPRESSION, COMP, AL
			160182	2	CONNECTOR, GROUND, TF,GND,EYEBOLT
			162205	2	CONNECTOR, VISE TYPE 2 CU
	GRODFRF	1	160123	1	CLAMP, GROUND, GRD,BRN,5/8 CAST BRONZE GROUND ROD CLAMP
			9220192319	1	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD, THREADLESS 5/8" X 5'
	GAR1F	3	60136	1	COUPLING, ROD, 5/8 IN, COPPER PLATED STEEL, ROD,GRD,5/8
			9220192319	1	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD, THREADLESS 5/8" X 5'
14	AREQOH10F	6	220202	1	ARRESTER, METAL OXIDE, 10KV,METOX DIST CLASS, METAL OXIDE
15	IDES25PF	6	80577	1	INSULATOR, DEADEND, POLYMER,28KV,DEADEND,SILICONE
	DECLMP(VARIES)	6	-	1	DEADEND CLAMP (VARIES WITH WIRE SIZE)
16	-	6	-	1	BLADES COME WITH SW253COSBDC

NOTES:

1. SEE DWG. 08.05-114A FOR DESIGN SPECIFICATIONS AND NOTES.

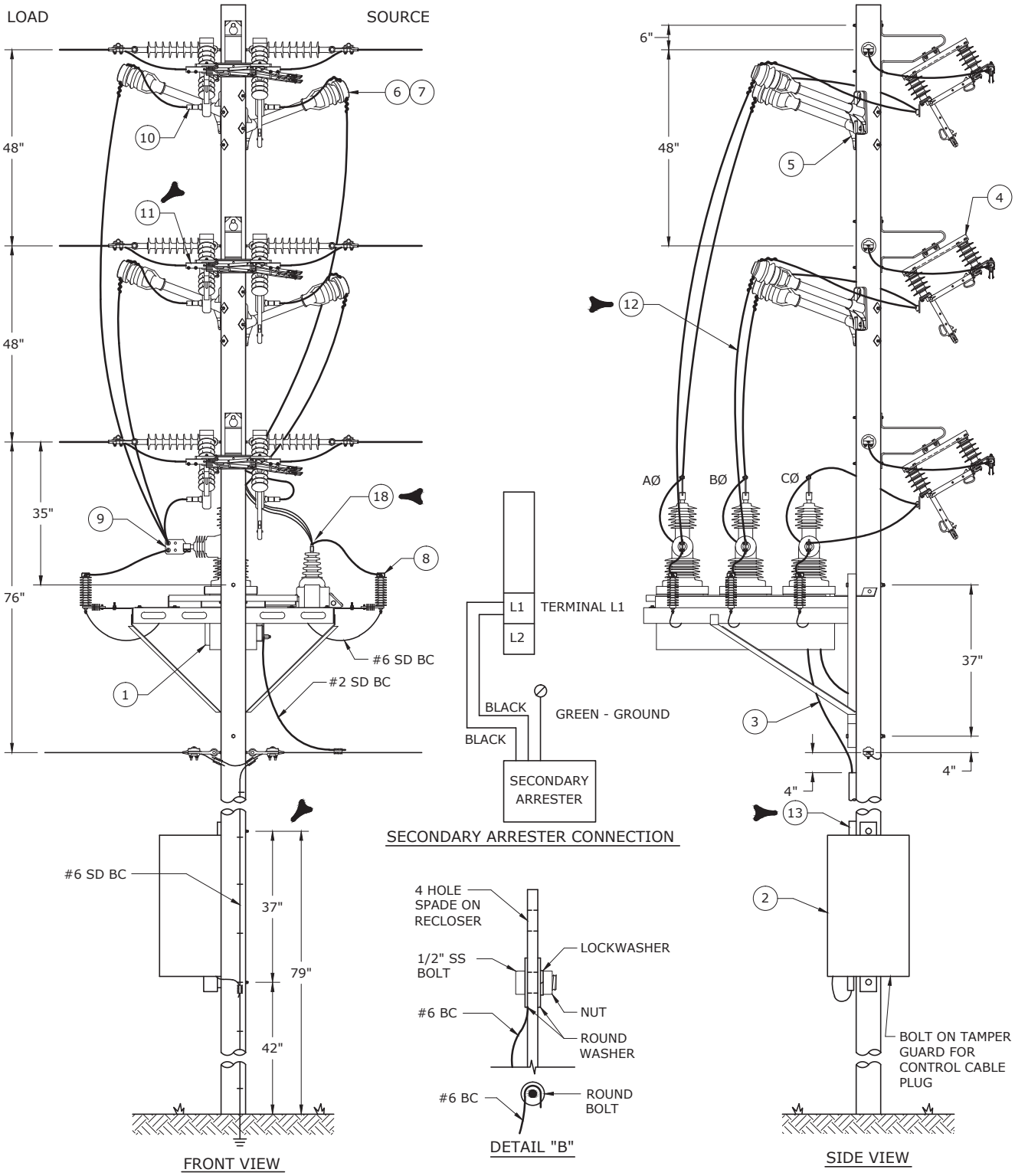
REVISED		BY	CK'D	APPR.
3				
2				
1	12/16/15	LOOSIER	BURLISON	ADCOCK
0	11/17/15	BURLISON	EANES	ADCOCK

OIL CIRCUIT RECLOSERS, THREE-PHASE INSTALLATION,
HORIZONTAL CONSTRUCTION
SINGLE-PHASE UNITS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.05-114B



FRONT VIEW

SECONDARY ARRESTER CONNECTION

DETAIL "B"

SIDE VIEW

NOTES:

1. SWITCHES TO BE ON ROAD SIDE.
2. PT TO BE LOCATED ON SOURCE SIDE.
3. SIX ARRESTERS REQUIRED: 3 ON EACH SIDE. CONNECT TO TERMINALS OF RECLOSER WITH CONNECTOR UNDER WILDLIFE PROTECTORS.
4. A 45' CLASS 4 POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION.
5. TOTAL WEIGHT OF THE RECLOSER AND FRAME IS 850 LBS.
6. ISSUE TAPS TO SWITCHES SEPARATELY (WIRE, CONNECTORS, AND LUGS). BOLTS WILL BE ON SWITCH.
7. ALL BOLTS ON PRIMARY CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS. **DO NOT EXCEED!**
8. UNIT SHOULD NOT BE "REVERSED" IN ITS BRACKET AS IT PLACES THE EMERGENCY TRIP HANDLE AGAINST THE POLE.
9. SEE DWG. 08.06-08B FOR BILL OF MATERIALS.

REVISED		BY	CK'D	APPR.
5	8/9/16	BRAVO	BURLISON	ADCOCK
4	12/19/14	BURLISON	GUINN	ADCOCK
3	5/28/14	GUINN	GUINN	ADCOCK
0	10/12/10	HOFFMAN	GUINN	ELKINS

RECLOSER AND FRAME, THREE-PHASE, ABB WITH VERTICAL BYPASS SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-08A

BILL OF MATERIALS

MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	RCOVR630E15V1F	1	9220090147	1	RECLOSER, VACUUM, ABB OVR-630 AMP, 12KA, 15KV, EDGEMOUNT
				152107	16	BOLT, MACHINE, 5/8 IN, 1/2 IN, STEEL, ASTM A307 GRADE "A"
				13308	17	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				13264	15	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL, STEEL
				13128	75	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				13407	72	WASHER, ROUND, ROUND, FLAT, STAINLESS, STEEL, 304, ALLOY
				10928	36	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	36	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				9220069244	4	WIRE, TIE, #4 AWG, CU, TIE, 4-SLD, CU, SDW #4 AWG., SOLID, SOFT
	2	RCCNTL651ABBF	1	9220241354	1	CONTROL, RECLOSER, SEL 651-R, FOR ABB
	3	RCOVRCAB40F	1	9220100429	1	CABLE, RECLOSER, CONTROL, W/24 PIN CONNECTOR - 40 FT
	4	SW156BYPF	3	10928	8	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	8	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				13128	8	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL, STEEL
				13308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				13407	16	WASHER, ROUND, ROUND, FLAT, STAINLESS, STEEL, 304, ALLOY
				152107	2	BOLT, MACHINE, 5/8 IN, 1/2 IN, STEEL, ASTM A307 GRADE "A"
				260123	1	SWITCH, BY-PASS, 3-SLD BLADE DISC, 15KV, LBK HOOKS, 600A
	5	BKTFBGPIN15138F	4	13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL, STEEL
				13346	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				152107	2	BOLT, MACHINE, 5/8 IN, 1/2 IN, STEEL, ASTM A307 GRADE "A"
				9220087868	1	BRACKET, STANDOFF, FIBERGLASS, STAND-OFF, 1-3/8"
	6	IPIN25PF	4	9220091018	1	INSULATOR, 25 KV POLYMER, 1-3/8" THREAD
	7	TTIEF500COVALPF	4	9220068094	1	TIE, PLASTIC, 2-7/8", F-NECK, INSULATOR
	8	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV, SILICONE RUBBER POLY HOUS.
	9	KLC2H50ALF	5	10928	2	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	2	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				13163	4	WASHER, FLAT, ROUND, SILICON, BRONZE, FOR 1/2" BOLT
				155326	1	LUG, COMPRESSION, 2H 500 AL
				10542504	2	WASHER, ROUND, RD, 1/2, SS, 1.375" OD
	10	KLC2H50AL90DF	7	10928	2	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	2	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				13163	4	WASHER, FLAT, ROUND, SILICON, BRONZE, FOR 1/2" BOLT
				10542504	2	WASHER, ROUND, RD, 1/2, SS, 1.375" OD
				9220068102	1	LUG, 2-HOLE, TIN-PLATED, NEMA
	11	KLC2H79ALF	6	10928	2	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	2	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				13163	4	WASHER, FLAT, ROUND, SILICON, BRONZE, FOR 1/2" BOLT
				10542504	2	WASHER, ROUND, RD, 1/2, SS, 1.375" OD
				155331	1	LUG, COMPRESSION, 2H - 795 AL
	12	RCRISER500ALF	6	202112	12	CABLE, XLP UG AL 500
	13	CRIS1UGPVC225WF	3	14111	15	SCREW, LAG, 1/4 IN X 2 IN, STEEL, GALV, LAG, HX, 1/4-INCH O.D.
				323422	1	GUARD, PVC, CABLE, 2-1/4" X 10'
	14	AREQSC120F	1	220139	1	ARRESTER, LIGHTNING, SECONDARY 120-240 3 WIRE
	15	WGRCTERMGSF	3	9220102212	1	GUARD, ANIMAL, TERMINAL GUARD, STRAIGHT
	16	WGRCLSHPF	3	9220102213	1	GUARD, ANIMAL, L-SHAPED, GUARD
	17	WGRCPTTRF	3	9220102214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
	18	-	-	9220085231	3	TRANSF, POTENTIAL, 15KV/7200V (INCLUDED FROM MANUFACTURER)
	19	CABGRP2X250F	1	320456	1	GRIP, SINGLE EYE 2 X 2-1/2
	20	-	1	356683	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, WHITE

NOTES:

1. GROUND RESISTANCE TO BE 15 OHMS OR LESS.
2. A 45' CLASS 4 POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION.
3. TOTAL WEIGHT OF RECLOSER ASSEMBLY IS 850 LBS.
4. ISSUE TAPS TO SWITCHES SEPARATELY (WIRE, CONNECTORS, AND LUGS). BOLTS WILL BE ON SWITCH.
5. ALL BOLTS ON PRIMARY CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS: **DO NOT EXCEED!**
6. SEE DWG. 08.06-08A DESIGN SPECIFICATIONS.

REVISED	BY	CK'D	APPR.
5 8/8/16	BRAVO	BURLISON	ADCOCK
4 12/19/14	BURLISON	GUINN	ADCOCK
3 11/14/12	HOFFMAN	DANNA	ADCOCK
0 11/9/10	HOFFMAN	GUINN	ELKINS

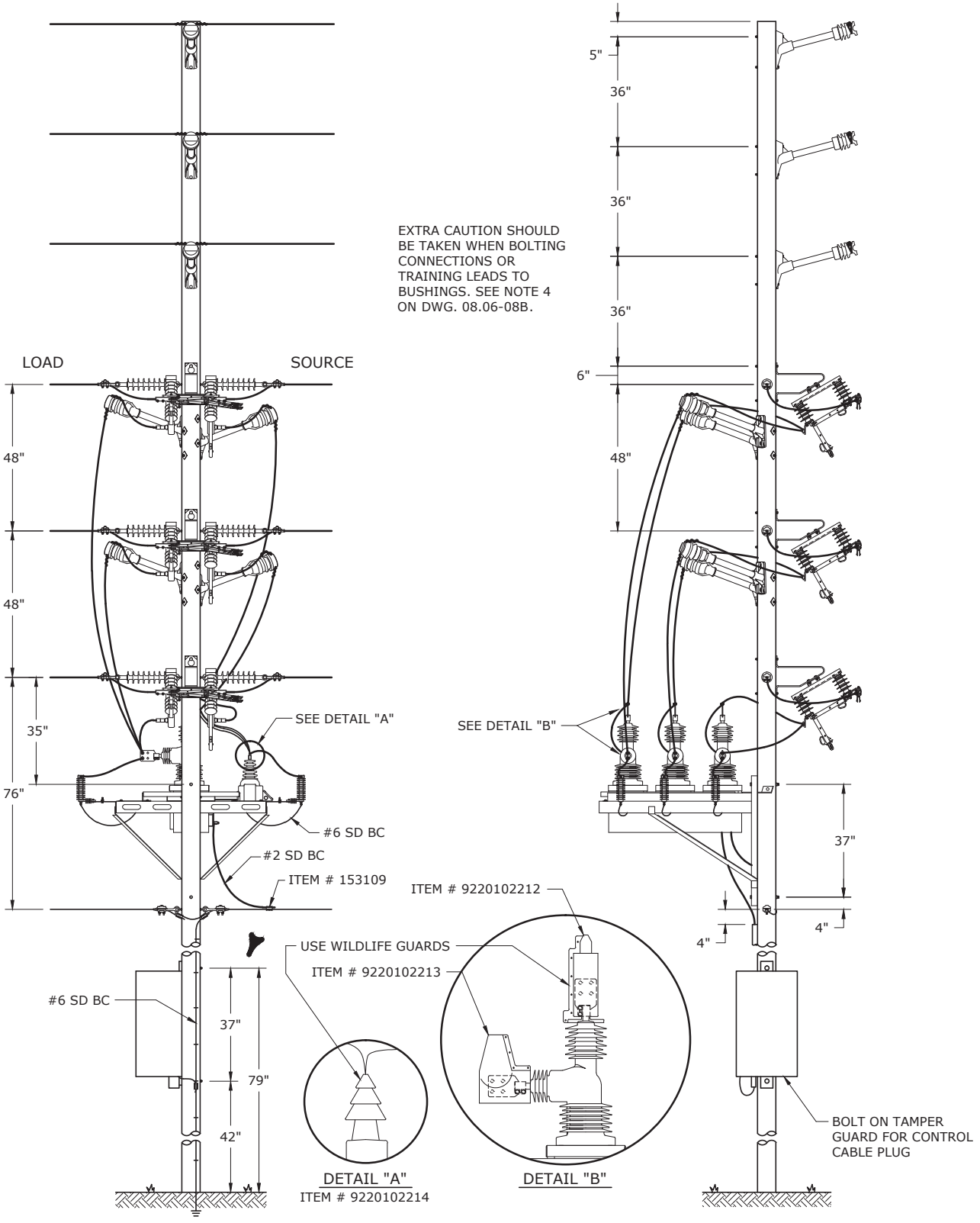
RECLOSER ASSEMBLY, THREE-PHASE, ABB

WITH VERTICAL BYPASS SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-08B



NOTES:

1. SEE DWG. 08.06-08B FOR BILL OF MATERIALS.
2. A 55' CLASS 3 POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION.
3. SEE DWG. 08.06-08A FOR MORE DETAILS ON RECLOSER INSTALLATION, INCLUDING SECONDARY AND PRIMARY ARRESTER CONNECTIONS.

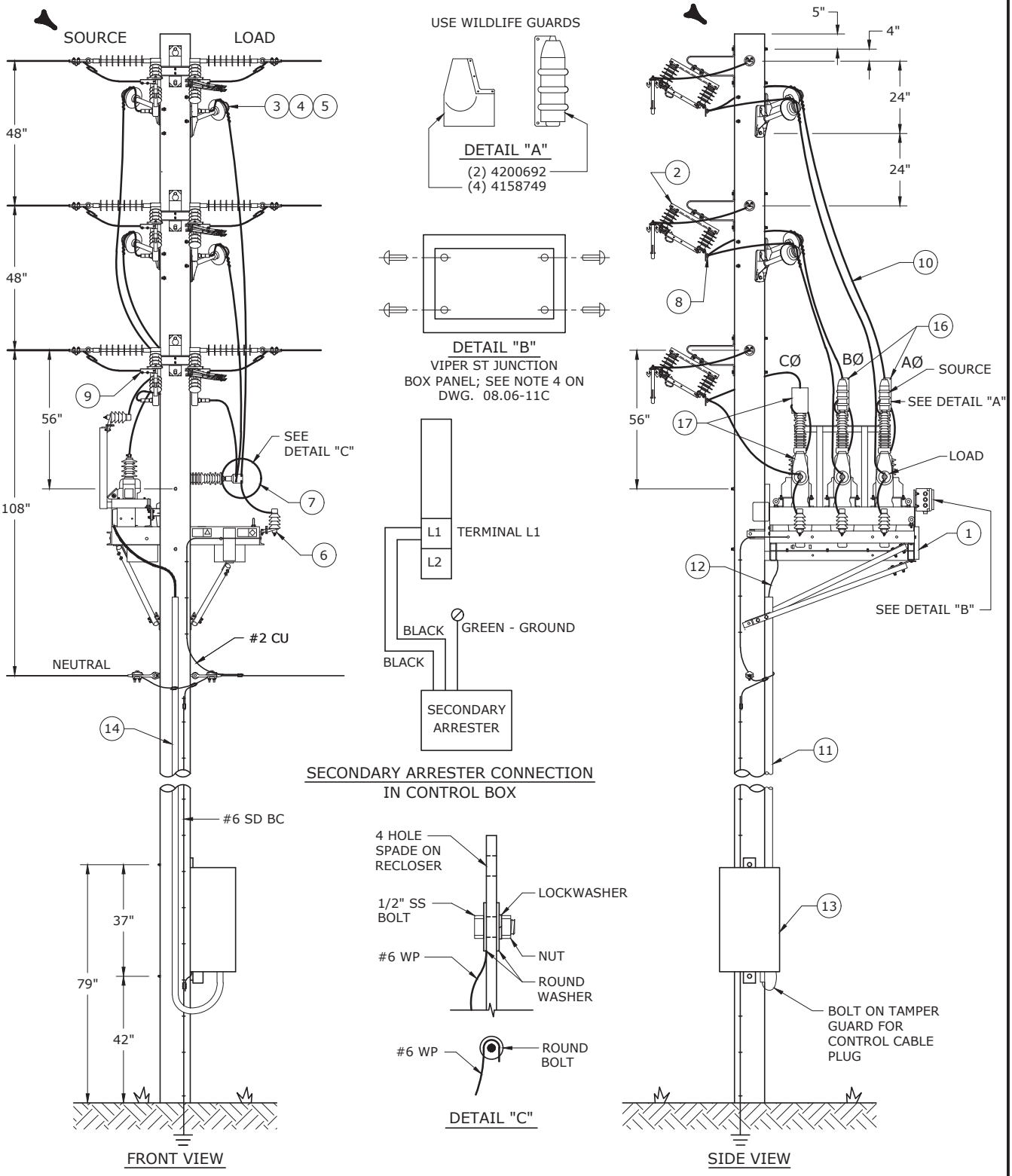
REVISED	BY	CK'D	APPR.
3 8/9/16	BRAVO	BURLISON	ADCOCK
2 12/19/14	BURLISON	GUINN	ADCOCK
1 11/8/12	HOFFMAN	DANNA	ADCOCK
0 10/12/10	HOFFMAN	GUINN	ELKINS

ABB RECLOSER ON VERTICAL DOUBLE CIRCUIT W/ VERTICAL BYPASS SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-10



NOTES:

1. SEE DWG. 08.06-11C FOR BILL OF MATERIALS AND DWG. 08.06-11D FOR NOTES.
2. BRACKET IS REVERSIBLE. DEPENDING ON HOW UNIT IS INSTALLED IN FIELD, DIAGRAMS ABOVE MAY REVERSED.
3. IN COASTAL AREAS, USE 25KV BYPASS SWITCHES.
4. PT'S TO BE LOCATED ON SOURCE SIDE.

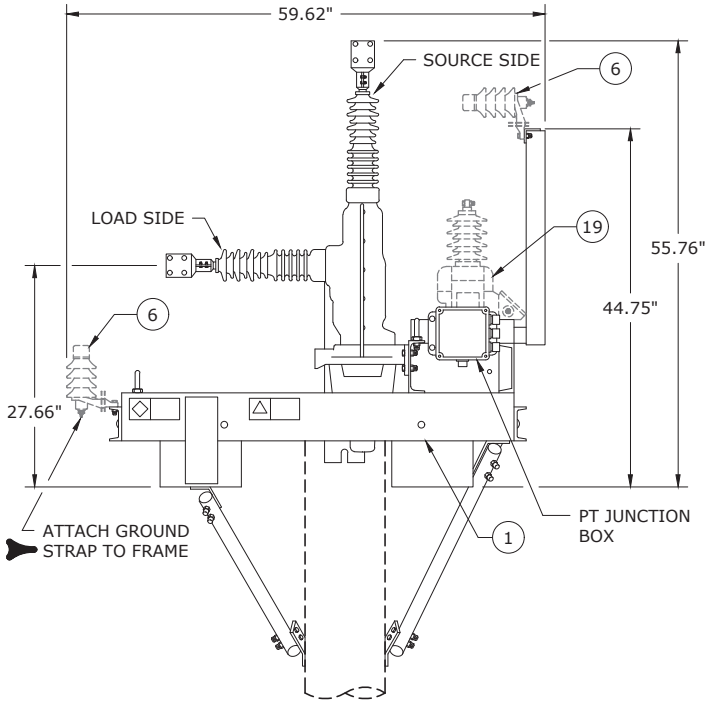
REVISED	BY	CHK'D	APPR.
9 2/26/18	BURLISON	BENDER	ADCOCK
8 1/31/18	BURLISON	BRUINS	ADCOCK
7 8/9/16	BRAVO	BURLISON	ADCOCK
0 10/12/12	HOFFMAN	BURLISON	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST, WITH VERTICAL BYPASS SWITCH

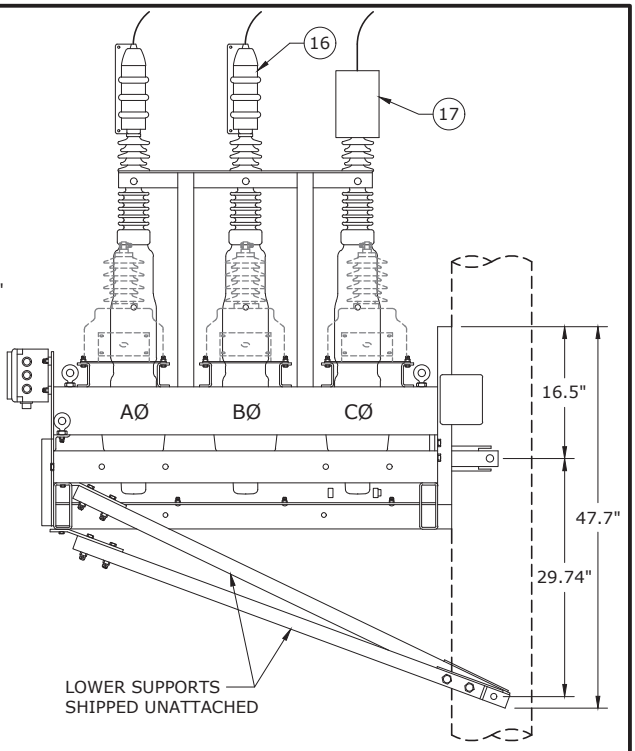
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

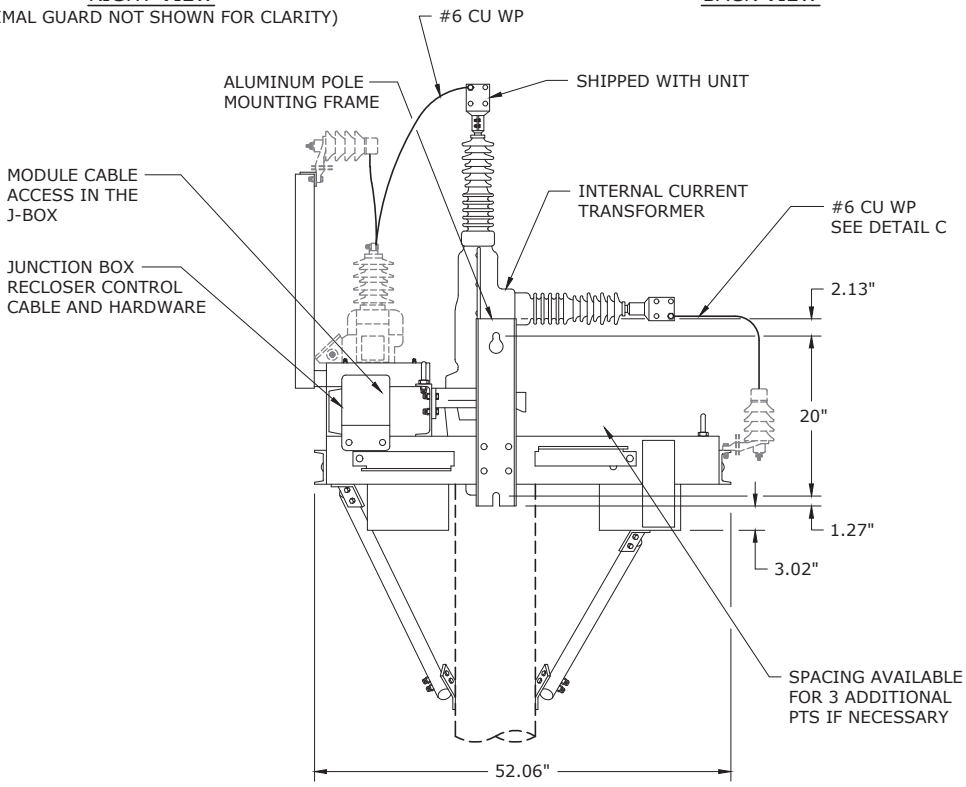
08.06-11A



RIGHT VIEW
(ANIMAL GUARD NOT SHOWN FOR CLARITY)



BACK VIEW



LEFT VIEW
(ANIMAL GUARD NOT SHOWN FOR CLARITY)

NOTES:

1. SEE DWG. 08.06-11A FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 08.06-11C FOR BILL OF MATERIALS AND DWG. 08.06-11D FOR NOTES.
3. BRACKET IS REVERSIBLE. DEPENDING ON HOW UNIT IS INSTALLED IN FIELD, DIAGRAMS ABOVE MAY BE REVERSED.

REVISED	BY	CK'D	APPR.
4 1/31/18	BURLISON	BRUINS	ADCOCK
3 7/1/15	LOOSIER	BURLISON	ADCOCK
2 7/21/14	LOOSIER	DANNA	ADCOCK
0 6/7/13	McCONNELL	DANNA	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST, WITH VERTICAL BYPASS SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-11B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-VRT-1PT-F	1	4198618	1	RECLOSER TYPE VST 800 AMP ELEC. 27KV VRT MNTG
			939033	17	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			930030	15	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			90121	75	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			1421012	108	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	36	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			94540	36	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
1	HDWR-MACH-SM-12IN-GALV-F	5	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
1	GND-EQUIP-2-BOND-F	1	4173267	5	WIRE/CABLE,ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
2	SW-BYPASS-600-15KV-1P-NLB-F	3	4003943	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 15KV, LBK, HOOKS, 600A, LEFT
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
	SW-BYPASS-600-25KV-1P-NLB-F (FOR COASTAL INSTALLATIONS)	3	4003946	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 25KV, LBK, HOOKS, 600A, LEFT
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
2	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
3	BKT-INSL-POLE-POLE-SM-FG-F	4	4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			938975	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
3	HDWR-MACH-SM-12IN-GALV-F	8	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
4	INSL-PIN-25KV-POLY-F	4	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
5	TIE-COMP-LG-COV-FNECK-F	4	301747	1	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
6	ARR-EQUIP-10KV-F	-	4003606	-	ARRESTER (INCLUDED FROM MANUFACTURER)
7	CONN-OH-LUG-COMP-500-2H-F	5	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
8	CONN-OH-LUG-COMP-500-2H-90DEG-F	7	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
9	CONN-OH-LUG-COMP-795-2H-F	6	4003033	1	LUG, COMPRESSION, 2H-795AL
			94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
10	LEAD-EQ-500-AL-COVER-F	6	4003570	12	CABLE, XLP UG AL 500
11	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, PVC, CABLE, 2-1/4" X 10'
			4001700	15	SCREW, LAG, HX, 1/4" X 2", GALV.
12	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	VIPER ST CONTROL CABLE, 40 FT.
13	CTRL-RECL-S651R-VST-F	1	4198843	1	SEL 651 CONTROL
14	CTRL-RECL-CABLE-40FT-PT-VST-F	-	4203968	-	CONTROL CABLE, 40' ARMORED 8 PIN FOR PT (INCLUDED FROM MANUF.)
16	WG-BUSH-COV-MD-F	2	4200692	1	WILDLIFE GUARD RECL SOLID STRAIGHT VERTICAL COVER
17	WG-BUSH-COV-LSHAPE-F	4	4158749	1	WILDLIFE GUARD RECL L-SHAPED COVER
18	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
19	METER-VT-60/1-15KV-F	-	4155979	-	TRANSFORMER, INSTRUMENT, POTENTIAL, 60:1 RATIO, 13.8KVAC (INCLUDED FROM MANUFACTURER)
20	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, SINGLE EYE, 2 X 2-1/2
21	CABLE-TIE-19IN-BLK-F	1	4005141	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, BLACK, 19 INCH

NOTES:

1. SEE DWGS. 08.06-11A AND 08.06-11B FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 08.06-11D FOR NOTES.

REVISED		BY	CHK'D	APPR.
3	12/31/18	BRUINS	BURLISON	ADCOCK
2	8/6/18	BURLISON	BENDER	ADCOCK
1	2/26/18	BURLISON	BENDER	ADCOCK
0	1/31/18	BURLISON	BRUINS	ADCOCK

RECLOSER ASSEMBLY, THREE-PHASE, VIPER ST WITH VERTICAL BYPASS SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-11C

NOTES:

1. RECLOSER COMES WITH 10KV ARRESTERS AND 7200V PTS FOR USE ON 12.47KV CIRCUITS. REPLACE WITH 18KV ARRESTERS AND 14400 PTS AS SHOWN IN BILL OF MATERIALS FOR 25KV CIRCUITS. (SEE DWGS. 08.06-12A AND 08.06-12B).

2. CONNECT ENDS OF POWER AND CONTROL CABLES WITH PROTECTIVE ARMORED FLEX TO CONTROL CABINET.

3. WHEN INSTALLING UNIT, OPEN JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD 3 PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.

4. A 45 FT POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION. IF JOINT USE ON POLE, CLEARANCES MAY REQUIRE 50' POLE. CLASS TO BE DETERMINED BY ENGINEERING.

5. ISSUE WIRE FROM PRIMARY TO SWITCHES SEPARATELY. BOLTS COME WITH SWITCH.

6. ALL BOLTS ON PRIMARY PRIMARY PAD CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS. DO NOT OVER TIGHTEN.

7. LOCATE PT'S ON SOURCE SIDE OF POLE AT NORMALLY CLOSED LOCATIONS.

8. SIX ARRESTERS REQUIRED - 3 ON EACH SIDE. CONNECT TO TERMINALS OF RECLOSER AS SHOWN ON DETAIL C ON DWG 08.06-11A.

9. USE #6 WP FOR ARRESTER LEADS.

10. TOTAL WEIGHT OF RECLOSER AND FRAME IS 750 LBS. DOES NOT INCLUDE WEIGHT OF PT'S AND LA'S.

11. NEUTRAL MAY BE DOUBLE DEAD-ENDED AS SHOWN OR STRAIGHT THROUGH ON SPOOL AS NEEDED.

12. 8 PIN PT CONTROL CABLE COMES WITH RECLOSER FROM MANUFACTURER.

13. GROUND RESISTANCE TO BE 15 OHMS OR LESS.

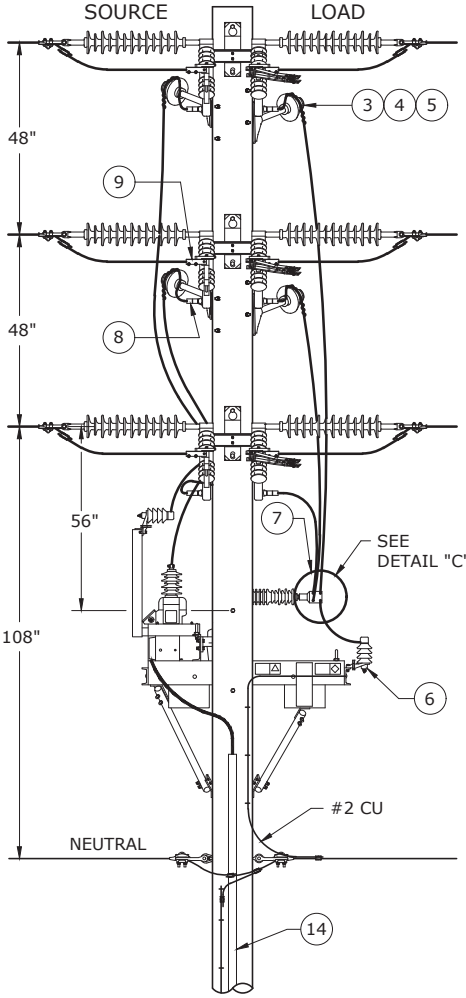
DUKE ENERGY.

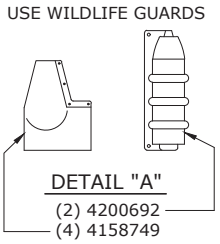
3				
2				
1				
0	1/31/18	BURLISON	BRUINS	ADCOCK
REVISED		BY	CHK'D	APPR.

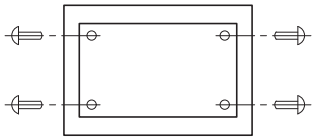
RECLOSER AND FRAME, THREE-PHASE, VIPER ST, WITH VERTICAL BYPASS SWITCH

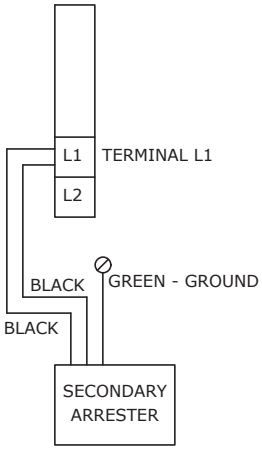
DEC	DEM	DEP	DEF
			X

08.06-11D

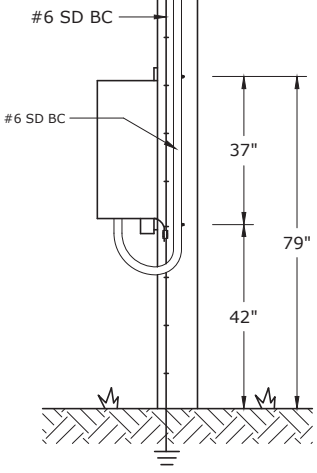




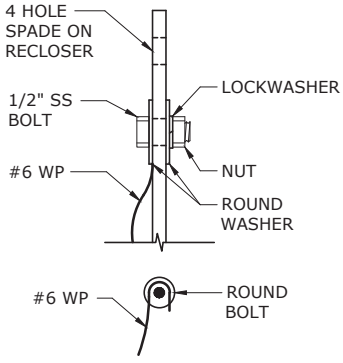




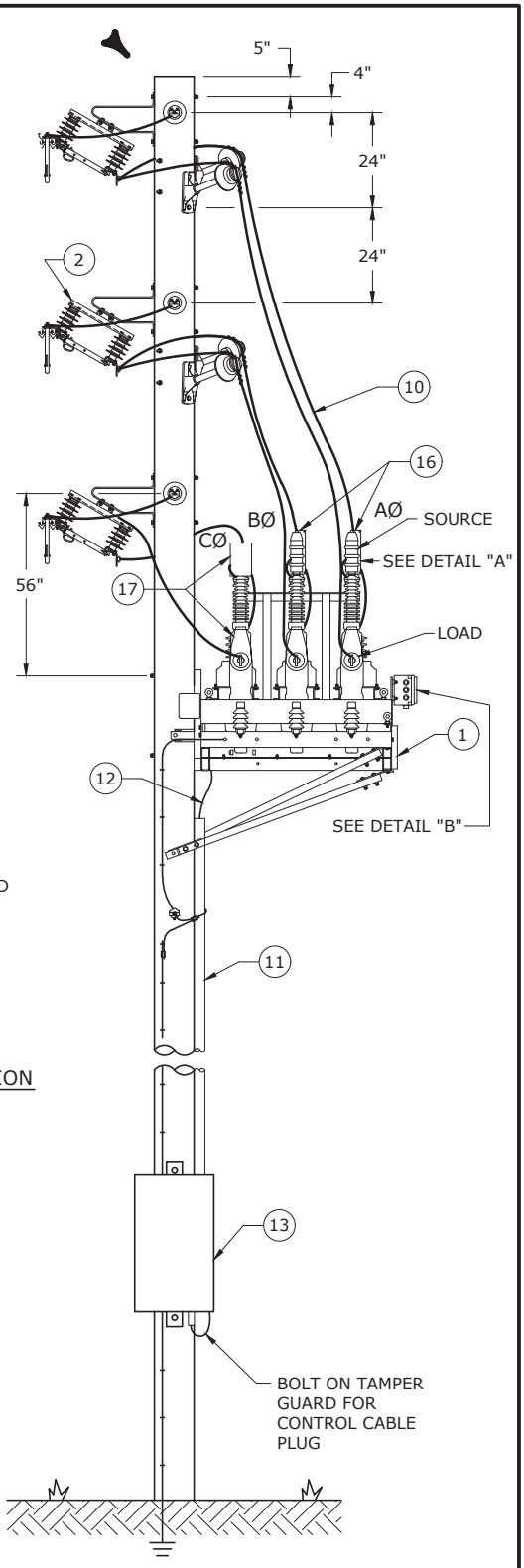
SECONDARY ARRESTER CONNECTION
IN CONTROL BOX



FRONT VIEW



DETAIL "C"



SIDE VIEW

NOTES:

1. SEE DWG. 08.06-12C FOR BILL OF MATERIALS AND NOTES.
2. BRACKET IS REVERSIBLE. DEPENDING ON HOW UNIT IS INSTALLED IN FIELD, DIAGRAMS ABOVE MAY BE REVERSED.
3. PT'S TO BE LOCATED ON SOURCE SIDE.

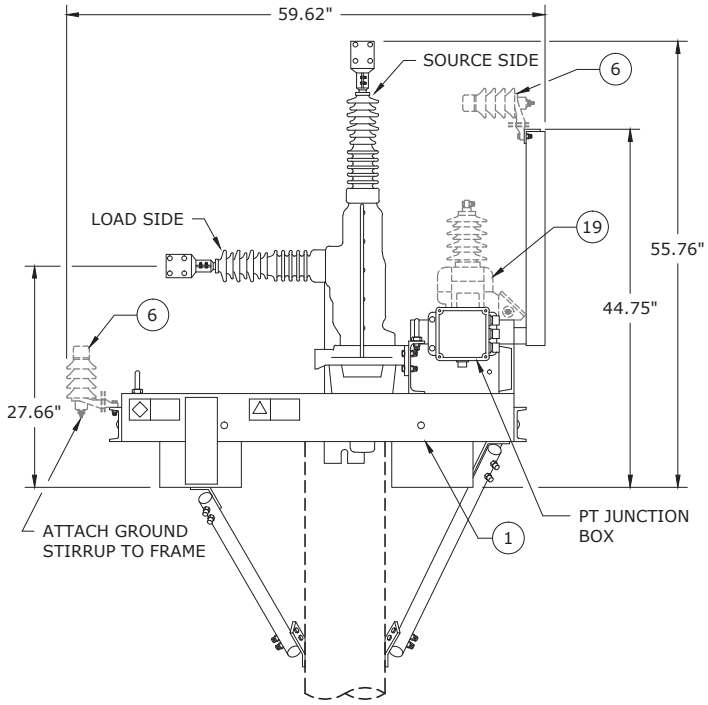
REVISED		BY	CHK'D	APPR.
6	2/26/18	BURLISON	BENDER	ADCOCK
5	1/31/18	BURLISON	BRUINS	ADCOCK
4	8/9/16	BRAVO	BURLISON	ADCOCK
0	10/7/13	SALAS	DANNA	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST, WITH VERTICAL BYPASS SWITCH - 25KV CONSTRUCTION -

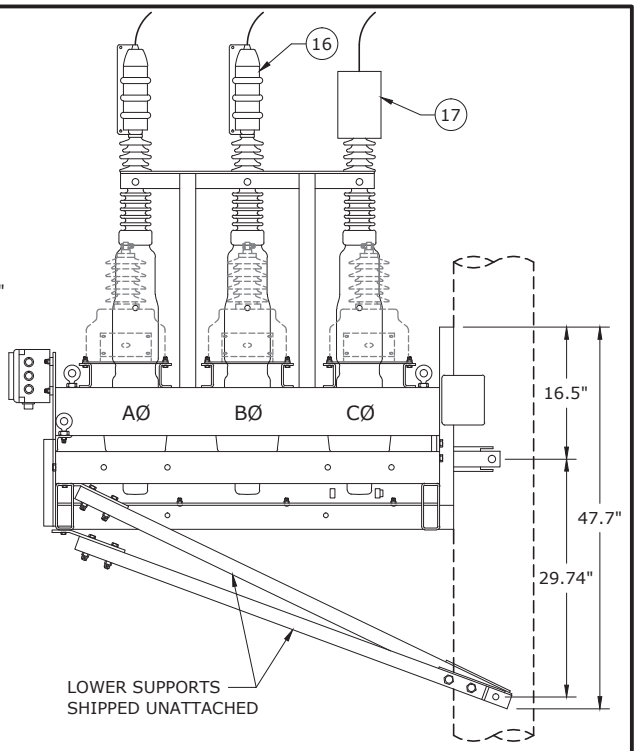
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

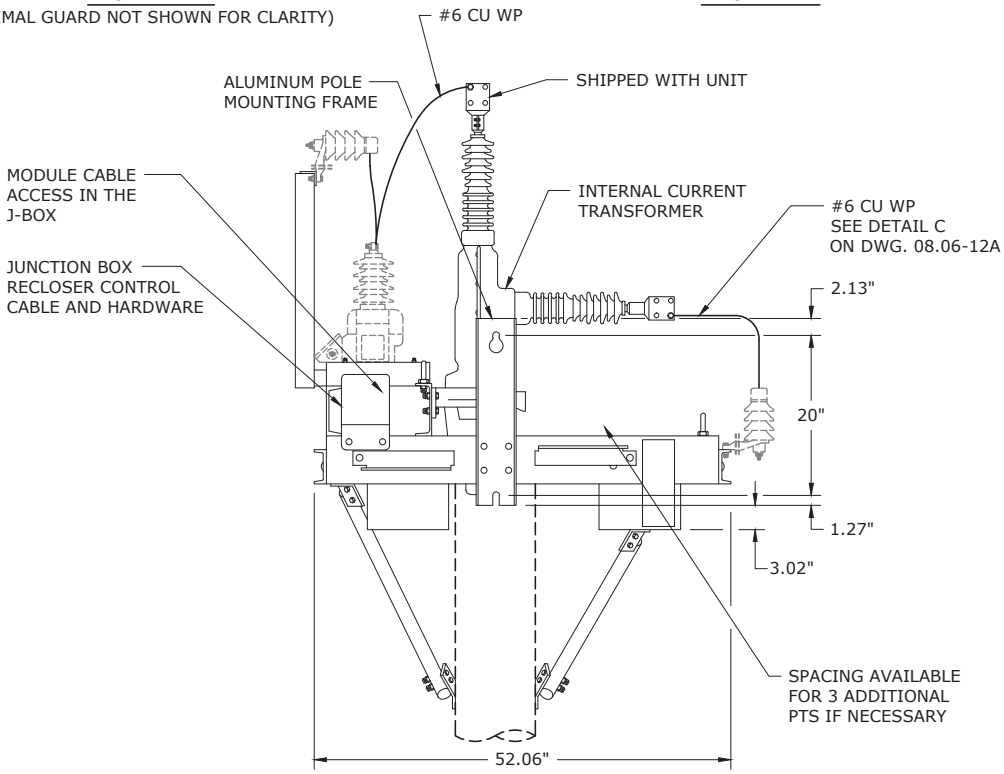
08.06-12A



RIGHT VIEW
(ANIMAL GUARD NOT SHOWN FOR CLARITY)



BACK VIEW



LEFT VIEW
(ANIMAL GUARD NOT SHOWN FOR CLARITY)

NOTES:

1. SEE DWG. 08.06-12A FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 08.06-12C FOR BILL OF MATERIALS AND NOTES.
3. BRACKET IS REVERSIBLE. DEPENDING ON HOW UNIT IS INSTALLED IN FIELD, DIAGRAMS ABOVE MAY BE REVERSED.

REVISED		BY	CK'D	APPR.
3	8/9/16	BRAVO	BURLISON	ADCOCK
2	7/17/15	LOOSIER	BURLISON	ADCOCK
1	7/21/14	LOOSIER	DANNA	ADCOCK
0	10/7/13	SALAS	DANNA	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST, WITH VERTICAL BYPASS SWITCH - 25KV CONSTRUCTION -

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-12B

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-VRT-1PT-F	1	4198618	1	RECLOSER TYPE VST 800 AMP ELEC. 27KV VRT MNTG
			939033	17	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			930030	15	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			90121	75	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			1421012	108	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	36	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			94540	36	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
1	HDWR-MACH-SM-12IN-GALV-F	5	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
1	GND-EQUIP-2-BOND-F	1	4173267	5	WIRE/CABLE,ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
2	SW-BYPASS-600-25KV-1P-NLB-F (FOR COASTAL INSTALLATIONS)	3	4003946	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 25KV, LBK, HOOKS, 600A, LEFT
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
2	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
3	BKT-INSL-POLE-POLE-SM-FG-F	4	4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			938975	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
3	HDWR-MACH-SM-12IN-GALV-F	8	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
4	INSL-PIN-25KV-POLY-F	4	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
5	TIE-COMP-LG-COV-FNECK-F	4	301747	1	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
6	ARR-EQUIP-18KV-F (SEE NOTE 1)	6	4003607	1	ARRESTER, ELECTRICAL, LIGHTNING, DISTRIBUTION, 18KV, AREA
7	CONN-OH-LUG-COMP-500-2H-F	5	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
8	CONN-OH-LUG-COMP-500-2H-90DEG-F	7	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
9	CONN-OH-LUG-COMP-795-2H-F	6	4003033	1	LUG, COMPRESSION, 2H-795AL
			94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
10	LEAD-EQ-500-AL-COVER-F	6	4003570	12	CABLE, XLP UG AL 500
11	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, PVC, CABLE, 2-1/4" X 10'
			4001700	15	SCREW, LAG, HX, 1/4" X 2", GALV.
12	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	VIPER ST CONTROL CABLE, 40 FT.
13	CTRL-RECL-S651R-VST-F	1	4198843	1	SEL 651 CONTROL
14	CTRL-RECL-CABLE-40FT-PT-VST-F	-	4203968	-	CONTROL CABLE, 40' ARMORED 8 PIN FOR PT (INCLUDED FROM MANUF.)
16	WG-BUSH-COV-MD-F	2	4200692	1	WILDLIFE GUARD RECL SOLID STRAIGHT VERTICAL COVER
17	WG-BUSH-COV-LSHAPE-F	4	4158749	1	WILDLIFE GUARD RECL L-SHAPED COVER
18	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
19	METER-VT-120/1-25KV-F (SEE NOTE 1)	3	1526624	1	TRANSFORMER, INSTR., POTENTIAL, 120:1 RATIO, 14.4KV, 150KV BIL
20	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, SINGLE EYE, 2 X 2-1/2
21	CABLE-TIE-19IN-BLK-F	1	4005141	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, BLACK, 19 INCH

NOTES:

1. RECLOSER COMES WITH 10KV ARRESTERS AND 7200V PTS FOR USE ON 12.47KV CIRCUITS. REPLACE WITH 18KV ARRESTERS AND 14400 PTS AS SHOWN IN BILL OF MATERIALS FOR 25KV CIRCUITS. (SEE DWGS. 08.06-12A AND 08.06-12B).
2. CONNECT ENDS OF POWER AND CONTROL CABLES WITH PROTECTIVE ARMORED FLEX TO CONTROL CABINET.
3. WHEN INSTALLING UNIT, OPEN JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD 3 PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.
4. A 45 FT POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION. IF JOINT USE ON POLE, CLEARANCES MAY REQUIRE 50' POLE. CLASS TO BE DETERMINED BY ENGINEERING.
5. ISSUE WIRE FROM PRIMARY TO SWITCHES SEPARATELY. BOLTS COME WITH SWITCH.
6. ALL BOLTS ON PRIMARY PRIMARY PAD CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS. DO NOT OVER TIGHTEN.
7. LOCATE PT'S ON SOURCE SIDE OF POLE AT NORMALLY CLOSED LOCATIONS.
8. SIX ARRESTERS REQUIRED - 3 ON EACH SIDE. CONNECT TO TERMINALS OF RECLOSER AS SHOWN ON DETAIL C ON DWG 08.06-11A.
9. USE #6 WP FOR ARRESTER LEADS.
10. TOTAL WEIGHT OF RECLOSER AND FRAME IS 750 LBS. DOES NOT INCLUDE WEIGHT OF PT'S AND LA'S.
11. NEUTRAL MAY BE DOUBLE DEAD-ENDED AS SHOWN OR STRAIGHT THROUGH ON SPOOL AS NEEDED.
12. 8 PIN PT CONTROL CABLE COMES WITH RECLOSER FROM MANUFACTURER.
13. GROUND RESISTANCE TO BE 15 OHMS OR LESS.

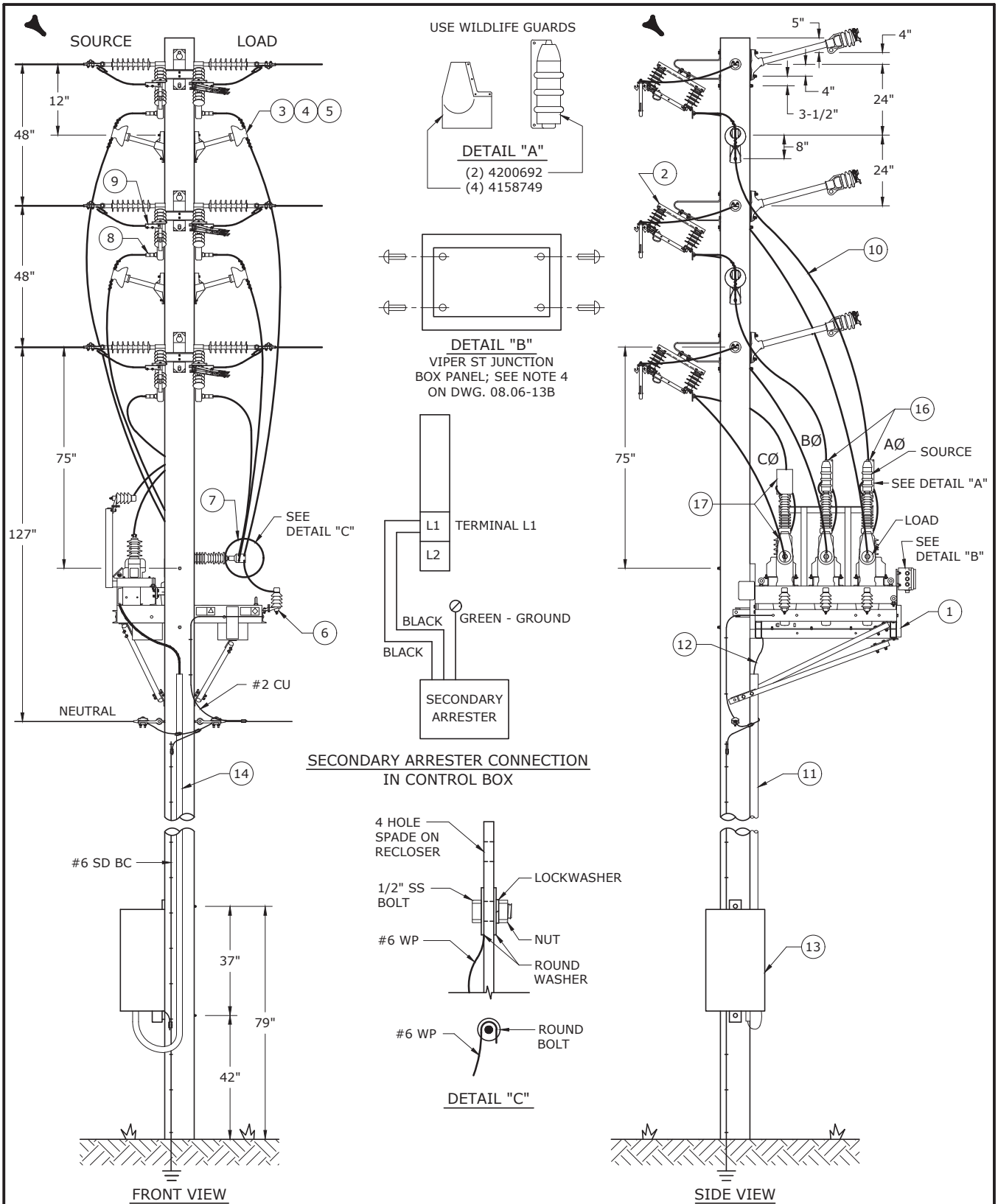
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3 12/31/18	BRUINS	BURLISON	ADCOCK
2 8/6/18	BURLISON	BENDER	ADCOCK
1 2/26/18	BURLISON	BENDER	ADCOCK
0 1/31/18	BURLISON	BRUINS	ADCOCK

RECLOSER ASSEMBLY, THREE-PHASE, VIPER ST WITH VERTICAL BYPASS SWITCH - 25KV CONSTRUCTION

DEC	DEM	DEP	DEF
			X

08.06-12C



NOTES:

1. SEE DWG. 08.06-13B FOR BILL OF MATERIALS AND DWG. 08.06-13C FOR NOTES.
2. USE 30 INCH STANDOFF BRACKETS TO SEPARATE CIRCUITS.
3. LEADS TO RECLOSER MUST BE A MINIMUM OF 14" CLEARANCE FROM THE THROUGH CIRCUIT.
4. BRACKET IS REVERSIBLE. DEPENDING ON HOW UNIT IS INSTALLED, DIAGRAMS ABOVE MAY BE REVERSED.
5. PT'S TO BE LOCATED ON SOURCE SIDE.

REVISED		BY	CHK'D	APPR.
3				
2	2/26/18	BURLISON	BENDER	ADCOCK
1	1/31/18	BURLISON	BRUINS	ADCOCK
0	2/10/17	BRAVO	BURLISON	ADCOCK

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

DOUBLE CIRCUIT, THREE-PHASE, VIPER ST

08.06-13A

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-VRT-1PT-F	1	4198618	1	RECLOSER TYPE VST 800 AMP ELEC. 27KV VRT MNTG
			939033	17	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			930030	15	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			90121	75	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			1421012	108	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	36	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			94540	36	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
1	HDWR-MACH-SM-12IN-GALV-F	5	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
1	GND-EQUIP-2-BOND-F	1	4173267	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
2	SW-BYPASS-600-15KV-1P-NLB-F	3	4003943	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 15KV, LBK, HOOKS, 600A, LEFT
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
	SW-BYPASS-600-25KV-1P-NLB-F (FOR COASTAL INSTALLATIONS)	3	4003946	1	SWITCH, BYPASS, 3-SLD BLADE DISC, 25KV, LBK, HOOKS, 600A, LEFT
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
2	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
3	BKT-INSL-POLE-POLE-SM-FG-F	4	4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			938975	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
3	HDWR-MACH-SM-12IN-GALV-F	8	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
4	INSL-PIN-25KV-POLY-F	4	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
5	TIE-COMP-LG-COV-FNECK-F	4	301747	1	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
6	ARR-EQUIP-10KV-F	-	4003606	-	ARRESTER (INCLUDED FROM MANUFACTURER)
7	CONN-OH-LUG-COMP-500-2H-F	5	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
8	CONN-OH-LUG-COMP-500-2H-90DEG-F	7	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
9	CONN-OH-LUG-COMP-795-2H-F	6	4003033	1	LUG, COMPRESSION, 2H-795AL
			94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
10	LEAD-EQ-500-AL-COVER-F	6	4003570	12	CABLE, XLP UG AL 500
11	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, PVC, CABLE, 2-1/4" X 10'
			4001700	15	SCREW, LAG, HX, 1/4" X 2", GALV.
12	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	VIPER ST CONTROL CABLE, 40 FT.
13	CTRL-RECL-S651R-VST-F	1	4198843	1	SEL 651 CONTROL
14	CTRL-RECL-CABLE-40FT-PT-VST-F	-	4203968	-	CONTROL CABLE, 40' ARMORED 8 PIN FOR PT (INCLUDED FROM MANUF.)
16	WG-BUSH-COV-MD-F	2	4200692	1	WILDLIFE GUARD RECL SOLID STRAIGHT VERTICAL COVER
17	WG-BUSH-COV-LSHAPE-F	4	4158749	1	WILDLIFE GUARD RECL L-SHAPED COVER
18	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
19	METER-VT-60/1-15KV-F	-	4155979	-	TRANSFORMER, INSTRUMENT, POTENTIAL, 60:1 RATIO, 13.8KVAC (INCLUDED FROM MANUFACTURER)
20	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, SINGLE EYE, 2 X 2-1/2
21	CABLE-TIE-19IN-BLK-F	1	4005141	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, BLACK, 19 INCH

NOTES:

1. SEE DWG. 08.06-13A FOR DESIGN SPECIFICATIONS AND DWG. 08.06-13C FOR NOTES.

REVISED	BY	CHK'D	APPR.
3 12/31/18	BRUINS	BURLISON	ADCOCK
2 8/6/18	BURLISON	BENDER	ADCOCK
1 2/26/18	BURLISON	BENDER	ADCOCK
0 1/31/18	BURLISON	BRUINS	ADCOCK

DUKE ENERGY.

DOUBLE CIRCUIT, THREE-PHASE, VIPER ST

DEC	DEM	DEP	DEF
			X

08.06-13B

NOTES:

1. RECLOSER COMES WITH 10KV ARRESTERS AND 7200V PTS FOR USE ON 12.47KV CIRCUITS. REPLACE WITH 18KV ARRESTERS AND 14400 PTS AS SHOWN IN BILL OF MATERIALS FOR 25KV CIRCUITS. (SEE DWGS. 08.06-12A AND 08.06-12B).
2. CONNECT ENDS OF POWER AND CONTROL CABLES WITH PROTECTIVE ARMORED FLEX TO CONTROL CABINET.
3. WHEN INSTALLING UNIT, OPEN JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD 3 PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.
4. A 45 FT POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION. IF JOINT USE ON POLE, CLEARANCES MAY REQUIRE 50' POLE. CLASS TO BE DETERMINED BY ENGINEERING.
5. ISSUE WIRE FROM PRIMARY TO SWITCHES SEPARATELY. BOLTS COME WITH SWITCH.
6. ALL BOLTS ON PRIMARY PRIMARY PAD CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS. DO NOT OVER TIGHTEN.
7. LOCATE PT'S ON SOURCE SIDE OF POLE AT NORMALLY CLOSED LOCATIONS.
8. SIX ARRESTERS REQUIRED - 3 ON EACH SIDE. CONNECT TO TERMINALS OF RECLOSER AS SHOWN ON DETAIL C ON DWG 08.06-11A.
9. USE #6 WP FOR ARRESTER LEADS.
10. TOTAL WEIGHT OF RECLOSER AND FRAME IS 750 LBS. DOES NOT INCLUDE WEIGHT OF PT'S AND LA'S.
11. NEUTRAL MAY BE DOUBLE DEAD-ENDED AS SHOWN OR STRAIGHT THROUGH ON SPOOL AS NEEDED.
12. 8 PIN PT CONTROL CABLE COMES WITH RECLOSER FROM MANUFACTURER.
13. GROUND RESISTANCE TO BE 15 OHMS OR LESS.

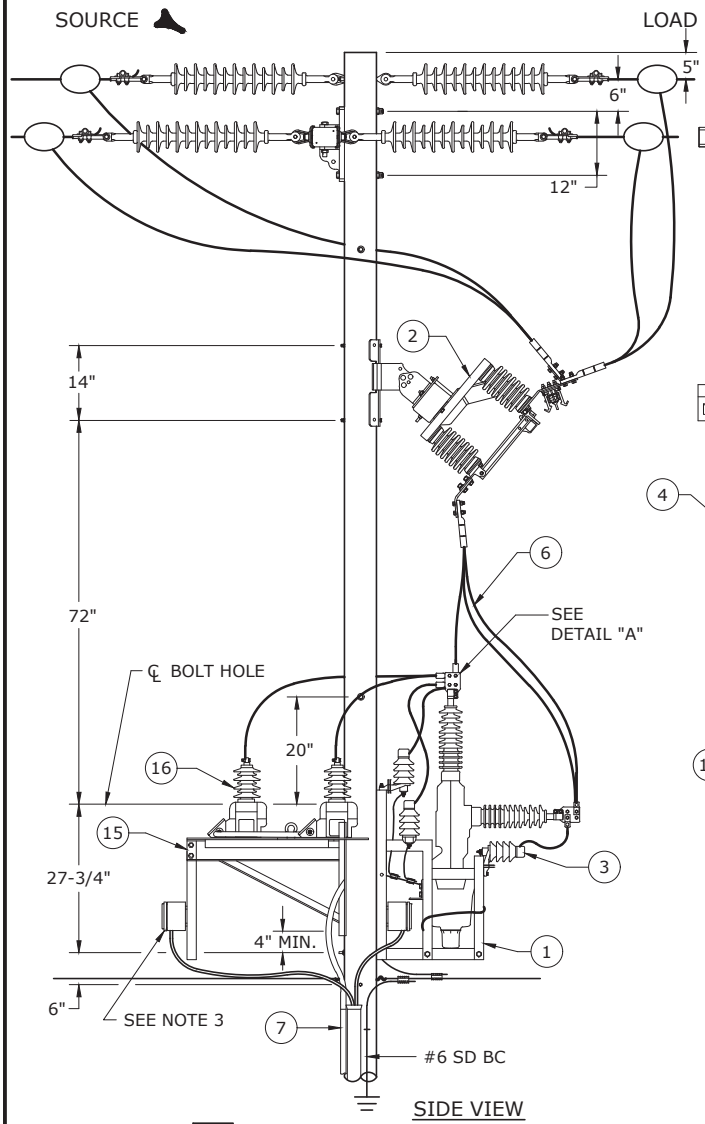
DUKE ENERGY.

3				
2				
1				
0	1/31/18	BURLISON	BRUINS	ADCOCK
REVISED		BY	CHK'D	APPR.

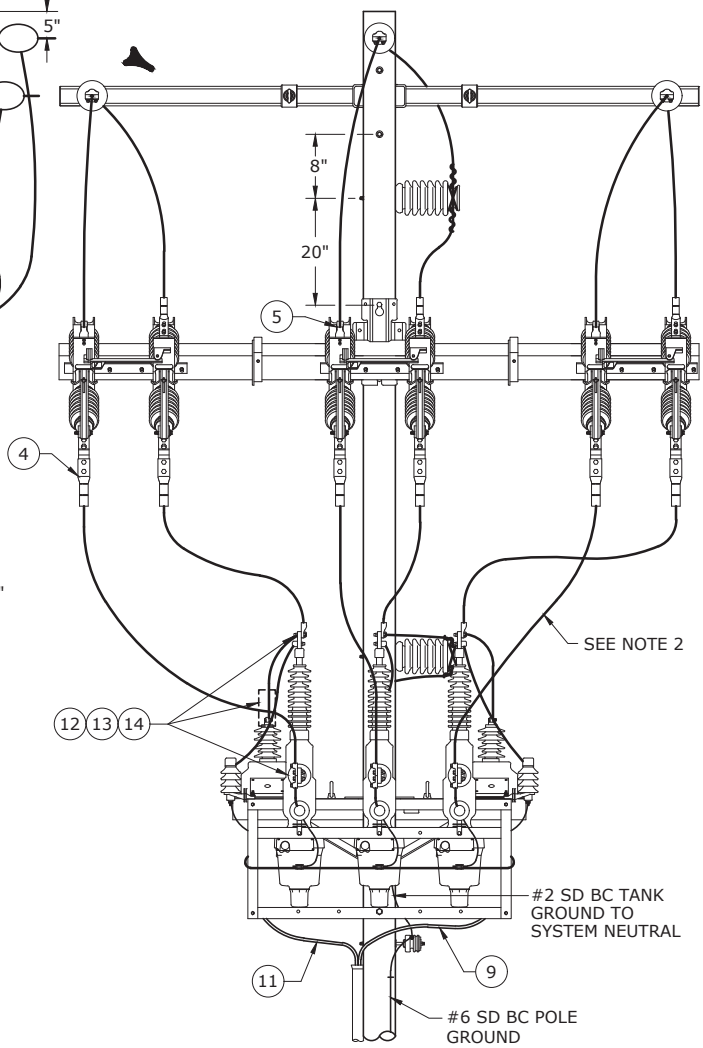
DOUBLE CIRCUIT, THREE-PHASE, VIPER ST

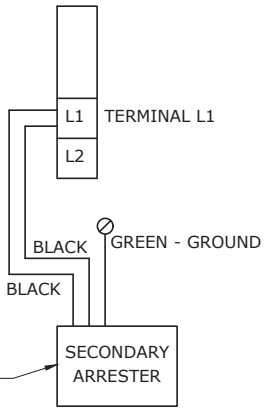
DEC	DEM	DEP	DEF
			X

08.06-13C

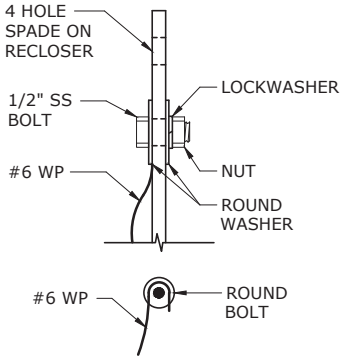


SIDE VIEW

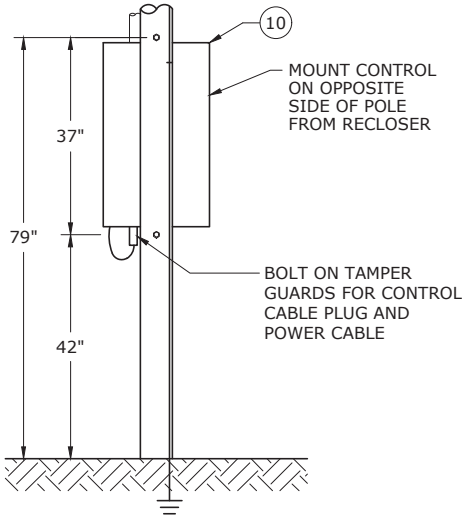




SECONDARY ARRESTER CONNECTION IN CONTROL BOX



DETAIL "A"



FRONT VIEW

NOTES:

1. SEE DWG. 08.06-14B FOR BILL OF MATERIALS AND NOTES.
2. POSITION JUMPERS TO ENSURE MINIMUM OF 10" CLEARANCE BETWEEN THEM.
3. PT'S TO BE LOCATED ON SOURCE SIDE.
4. MOUNT PT JUNCTION BOX (INCLUDED WITH RECLOSER UNIT) ON PT BRACKET. WHOLE PT ASSEMBLY CAN BE BUILT ON GROUND PRIOR TO INSTALLATION.

REVISED		BY	CHK'D	APPR.
4	1/31/18	BURLISON	BRUINS	ADCOCK
3	8/9/16	BRAVO	BURLISON	ADCOCK
2	4/22/16	BRAVO	BURLISON	ADCOCK
0	3/31/15	LOOSIER	BURLISON	ADCOCK

VIPER RECLOSER HORIZONTAL CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-14A

BILL OF MATERIALS

CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-HRZ-F	1	1535876	1	RECLOSER, ELECTRONIC, G&W VIPER-ST, HORIZ MOUNT, 27 KV, 800 A
			939033	17	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
			930030	15	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			90121	36	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			1421012	108	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			94540	36	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			93787	36	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
1	HDWR-MACH-SM-12IN-GALV-F	5	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
1	GND-EQUIP-2-BOND-F	1	4173267	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
2	SW-BYPASS-600-25KV-3P-NLB-RECL-F	1	1460379	1	SWITCH, DISCONNECT, OVERHEAD, TRIPLE BLADE BYPASS NON-LOADBREAK, 27KV 600A 125KV BIL, HOOK STICK OPERATED
			94540	24	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	72	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	24	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			930030	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL
			939033	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
2	HDWR-MACH-SM-12IN-GALV-F	6	931563	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
3	ARR-EQUIP-10KV-F	-	4003606	1	ARRESTER (INCLUDED FROM MANUFACTURER)
4	CONN-OH-LUG-COMP-500-2H-F	6	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
5	CONN-OH-LUG-COMP-750-4H-F	6	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			4003046	1	LUG, COMP. 4H, 795 AL
6	LEAD-EQ-500-AL-COVER-F	6	4003570	12	CABLE, XLP UG AL 500
7	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, PVC, CABLE, 2-1/4" X 10'
			4001700	15	SCREW, LAG, HX, 1/4" X 2", GALV.
8	ARR-SEC-120V-F	1	4003604	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE
9	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	VIPER ST CONTROL CABLE
10	CTRL-RECL-S651R-VST-F	1	4198843	1	SEL 651 CONTROL
11	CTRL-RECL-CABLE-40FT-PT-VST-F	-	4203968	-	CONTROL CABLE, 40' ARMORED 8 PIN FOR PT (INCLUDED FROM MANUF.)
12	WG-BUSH-COV-MD-F	3	4200692	1	WILDLIFE GUARD RECL SOLID STRAIGHT VERTICAL COVER
13	WG-BUSH-COV-LSHAPE-F	3	4158749	1	WILDLIFE GUARD RECL L-SHAPED COVER
14	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
15	BKT-PT-CLUST-3POS-STL-RECL-F	1	4194079	1	BRACKET, MOUNTING, 42 IN, GALVANIZED STEEL, 3 PT MOUNTING
			939033	2	WASHER, SQUARE, 2-1/4 X 2-1/4 X 3/16, GALV
			930030	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
15	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
16	METER-VT-60/1-15KV-F	3	4155979	1	TRANSFORMER, POTENTIAL, 15KV, 7200V
17	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, SINGLE EYE, 2 X 2-1/2
18	CABLE-TIE-19IN-BLK-F	1	4005141	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, BLACK, 19 INCH

NOTES:

1. SEE DWG. 08.06-14A FOR RECLOSER DESIGN SPECIFICATIONS.
2. WHEN INSTALLING UNIT, OPEN JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD 3 PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.
3. A 45' CLASS POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION.
4. ALL BOLTS ON PRIMARY CONNECTIONS ARE TO BE TORQUED AT 40 FT-LBS: **DO NOT EXCEED!**
5. PT TO BE LOCATED ON THE SOURCE SIDE.
6. USE GROUNDING LUGS ON RECLOSER AND FRAME TO PROPERLY GROUND RECLOSER.
7. NEUTRAL MAY BE DOUBLE DEADEND OR STRAIGHT THROUGH ON SPOOL AS NEEDED.

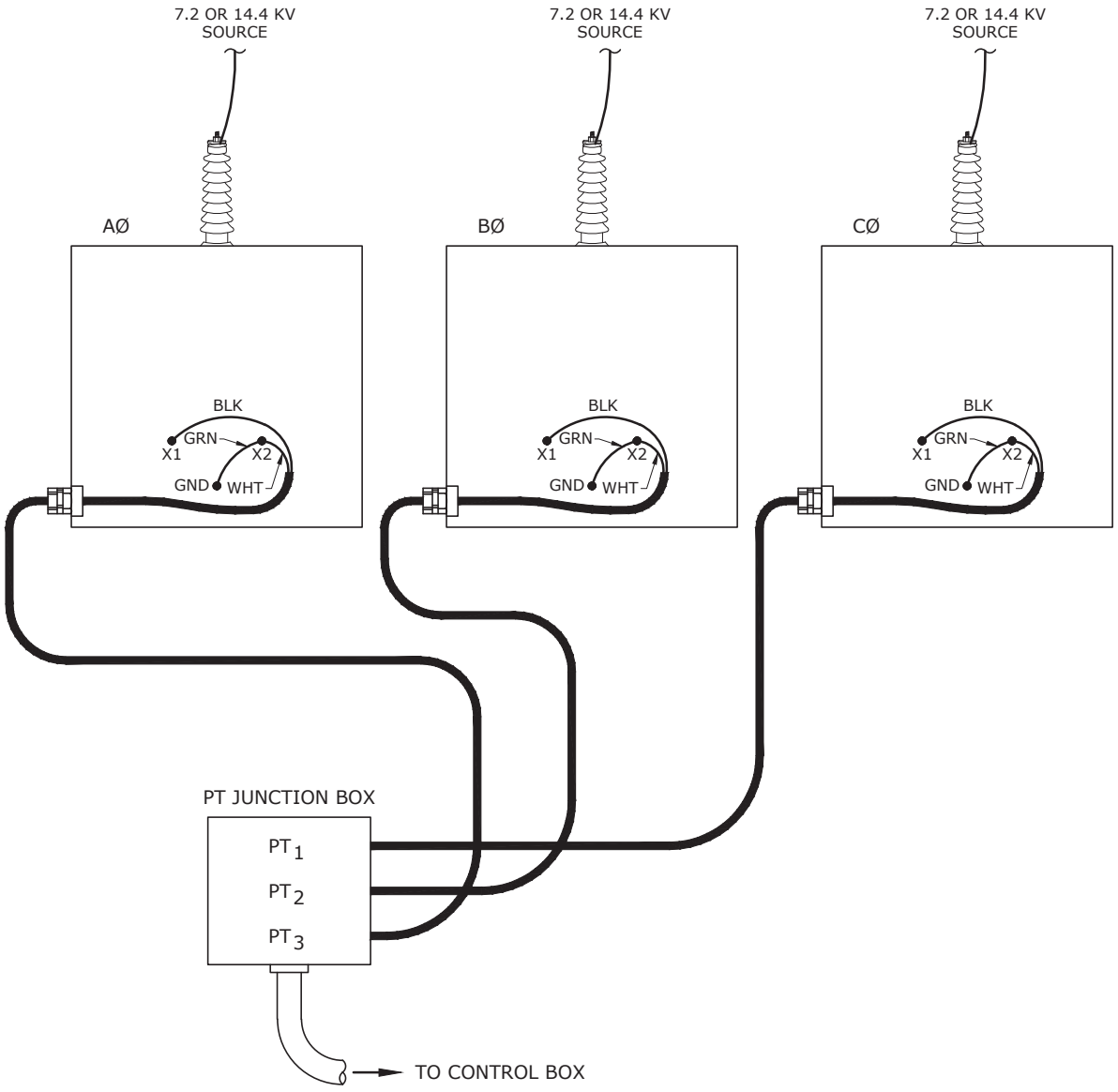
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3 12/31/18	BRUINS	BURLISON	ADCOCK
2 6/30/18	ROBBINS	BURLISON	ADCOCK
1 2/26/18	BURLISON	BENDER	ADCOCK
0 1/31/18	BURLISON	BRUINS	ADCOCK

VIPER RECLOSER HORIZONTAL CONSTRUCTION

DEC	DEM	DEP	DEF
			X

08.06-14B



BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/CU	DESCRIPTION
-	-	4179214	1	CABLE PT, REPAIR KIT FOR PTS CONNECTION, VIPER ST RECLOSER

BILL OF MATERIALS - PT CLUSTERS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/CU	DESCRIPTION
METER-VT-60/1-7KV-F	3	4155544	1	TRANSFORMER, VOLTAGE, 7.2/13.8KV, 60:1, OUTDOOR, 110 KV BIL
METER-VT-60/1-7KV-125BIL-F	3	4155979	1	TRANSFORMER, VOLTAGE, 7.2/13.8KV, 60:1, OUTDOOR, 125KV BIL
-	3	4164884	1	TRANSFORMER, VOLTAGE, 7.62/13.2 KV, 63.5:1, OUTDOOR, 110KV BIL
METER-VT-120/1-25KV-F	3	1526624	1	TRANSFORMER, VOLTAGE, 14.4/25 KV, 120:1, OUTDOOR, 150 KV BIL

NOTES:

1. X1 WIRE IS BLACK, X2 WIRE IS WHITE, GROUND WIRE IS GREEN.

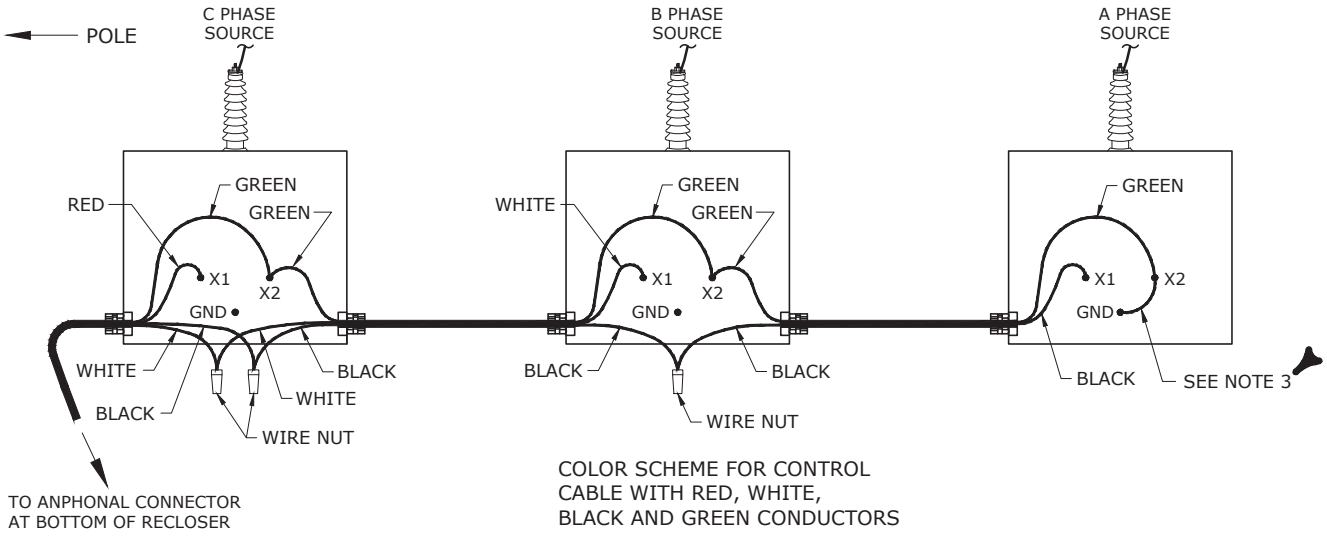
DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3 1/31/18	BURLISON	BRUINS	ADCOCK
2 8/29/17	BRAVO	BURLISON	ADCOCK
1 8/8/16	BRAVO	BURLISON	ADCOCK
0 12/19/14	BURLISON	GUINN	ADCOCK

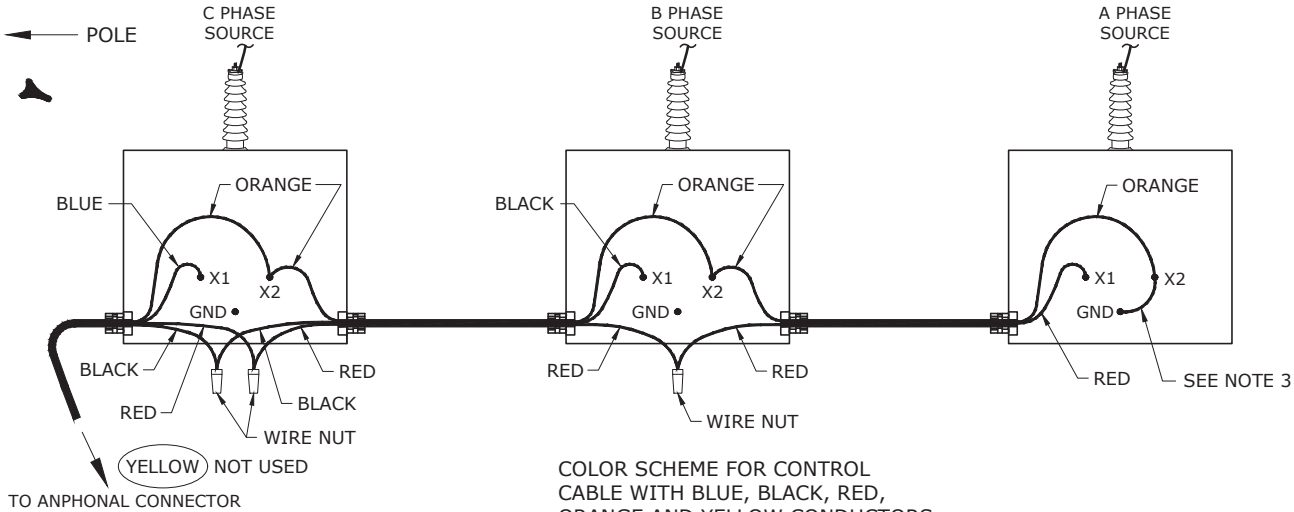
WIRING DIAGRAM FOR PT CLUSTER - G&W RECLOSERS

DEC	DEM	DEP	DEF
			X

08.06-15A



COLOR SCHEME FOR CONTROL
CABLE WITH RED, WHITE,
BLACK AND GREEN CONDUCTORS



COLOR SCHEME FOR CONTROL
CABLE WITH BLUE, BLACK, RED,
ORANGE AND YELLOW CONDUCTORS

BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/CU	DESCRIPTION
-	-	1537099	1	GRIDSHIELD CONTROL, ASSY, FIVE PRONG CONNECTOR W/ 10' LG WIRES

BILL OF MATERIALS - PT CLUSTERS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/CU	DESCRIPTION
METER-VT-60/1-7KV-F	3	4155544	1	TRANSFORMER, VOLTAGE, 7.2/13.8KV, 60:1, OUTDOOR, 110 KV BIL
METER-VT-60/1-7KV-125BIL-F	3	4155979	1	TRANSFORMER, VOLTAGE, 7.2/13.8KV, 60:1, OUTDOOR, 125KV BIL
-	3	4164884	1	TRANSFORMER, VOLTAGE, 7.62/13.2 KV, 63.5:1, OUTDOOR, 110KV BIL
METER-VT-120/1-25KV-F	3	1526624	1	TRANSFORMER, VOLTAGE, 14.4/25 KV, 120:1, OUTDOOR, 150 KV BIL

NOTES:

1. THE DIAGRAM ABOVE SHOWS THE POLE TO THE LEFT; HOWEVER, THE PT'S MAY BE ON THE OTHER SIDE. WIRING DIAGRAM WOULD BE REVERSED IF POLE IS TO THE RIGHT. FOLLOW THIS CONVENTION:

   C PHASE X1 – RED
   B PHASE X1 – WHITE
   A PHASE X1 – BLACK
   X2 ON ALL PHASES IS GREEN

2. PT'S MAY BE GROUNDED IN ONE OF TWO WAYS. 1) WITH OLDER PT'S, THE GROUNDING LUG ON THE BACK OF THE PT IS ATTACHED TO A COPPER GROUNDING BAR. 2) ON NEWER PT'S, THE GROUNDING LUG ON THE BACK OF THE PT IS BONDED TO THE FRAME THROUGH THE MOUNTING BOLT AND A PRE-INSTALLED STRAP. PT'S MUST BE GROUNDED TO THE LUG ON THE BACK OF THE PT IN ONE OF THESE TWO METHODS.

3. INSTALL JUMPER FROM THE X2 BUSHING TO THE GROUND BUSHING IN THE "A" PHASE PT.

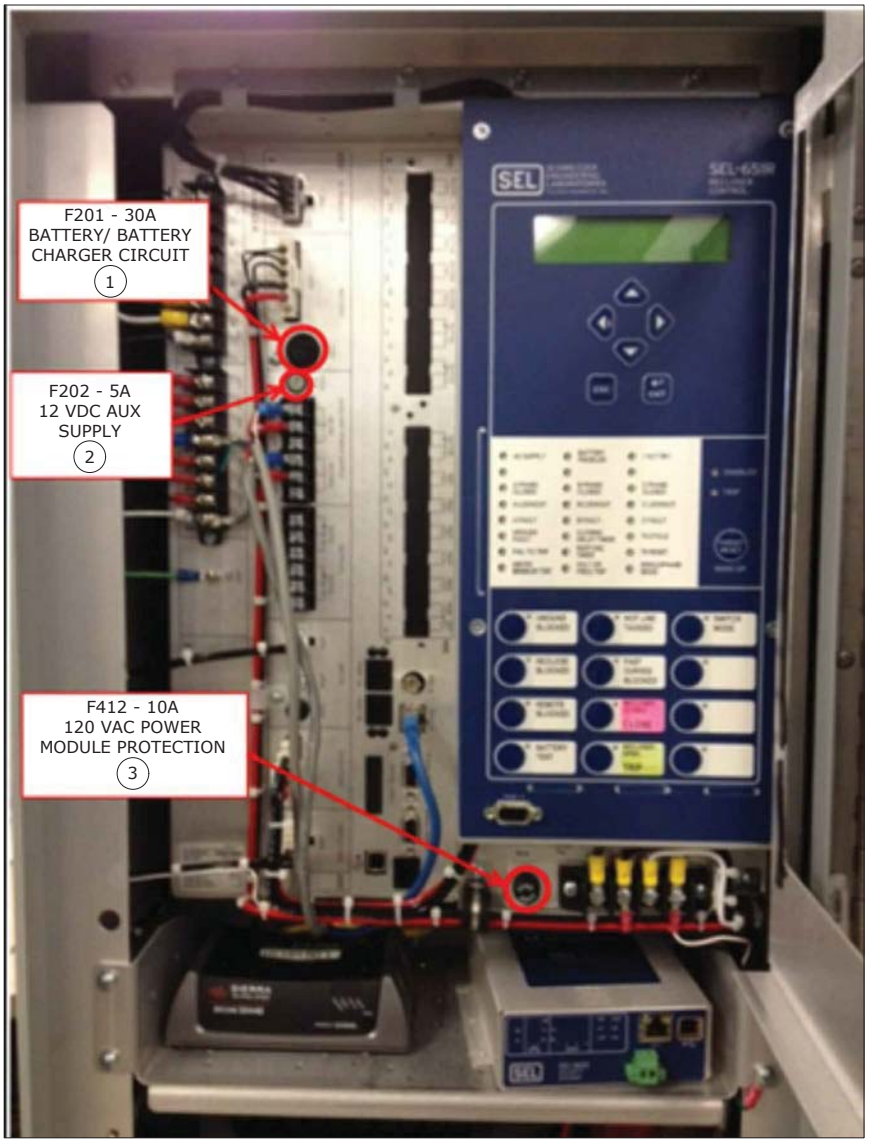
REVISED	BY	CHK'D	APPR.
3 1/31/18	BURLISON	BRUINS	ADCOCK
2 8/29/17	BRAVO	BURLISON	ADCOCK
1 8/8/16	BRAVO	BURLISON	ADCOCK
0 12/19/14	BURLISON	GUINN	ADCOCK

WIRING DIAGRAM FOR PT CLUSTER - ABB RECLOSERS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-15B



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	-	-	4206292	1	CONTROL, BATTERY CHARGER CKT, SEL 651 RECLOSER CONTROL - F201-30A
2	-	-	90501	1	CONTROL, 12VDC AUX SUPPLY, SEL 651 RECLOSER CONTROL - F202-5A
3	-	-	764371	1	CONTROL, 120VAC POWER MODULE, SEL 651 RECLOSER CONTROL - F412-10A

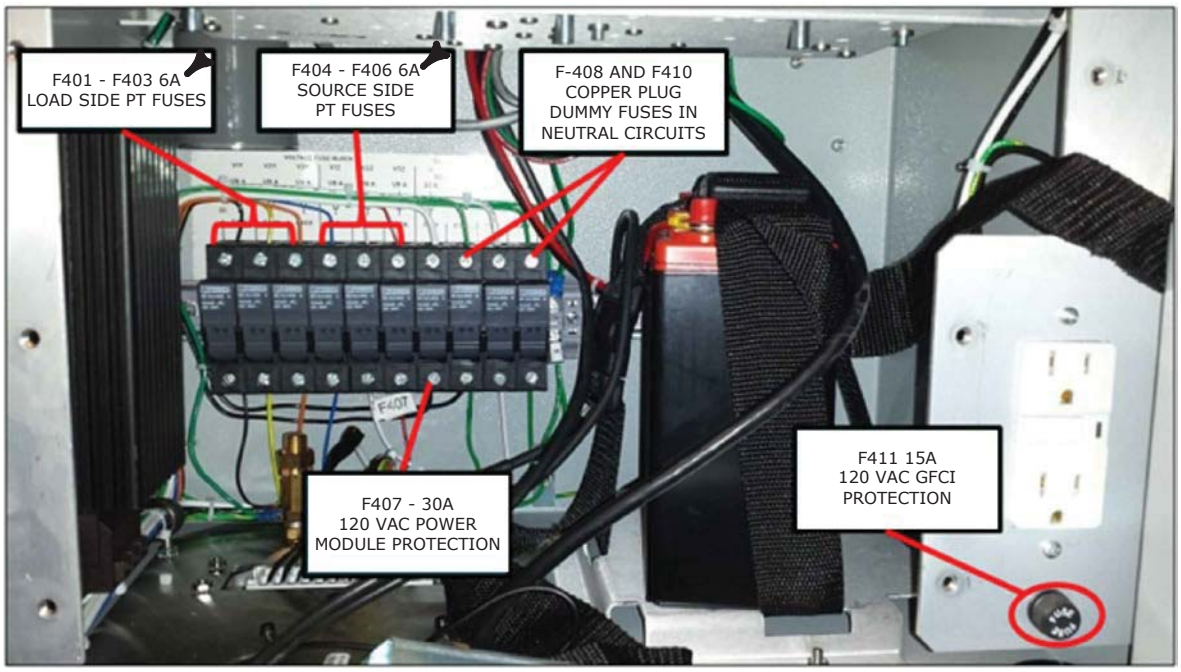
REVISED		BY	CHK'D	APPR.
3				
2				
1	1/31/18	BURLISON	BRUINS	ADCOCK
0	12/19/14	BURLISON	GUINN	ADCOCK

FUSE AND BATTERY FOR SEL 651-R2 CONTROLS
(ABB & VIPER)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-15C



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	-	-	50029972	1	CONTROL, PT VOLTAGE, SEL 651 RECLOSER CONTROL - F401-F406-6A
2	-	-	4194751	1	CONTROL, AC POWER SUPPLY & HEATER, SEL 651 RECLOSER CONTROL - F407-F410-30A
3	-	-	398565	1	CONTROL, GFCI OUTLET, SEL 651 RECLOSER CONTROL - F411-15A
4	-	-	1528040	1	BATTERY, LEAD ACID SEALED, 16 A H, SEL 651R CONTROL

REVISED		BY	CHK'D	APPR.
3	1/31/18	BURLISON	BRUINS	ADCOCK
2	2/19/16	LOOSIER	BURLISON	ADCOCK
1	7/17/15	LOOSIER	BURLISON	ADCOCK
0	12/19/14	BURLISON	GUINN	ADCOCK

FUSE AND BATTERY FOR SEL 651-R2 CONTROLS
(ABB & VIPER)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-15D

SPECIAL PROVISIONS FOR G&W VIPER ST INSTALLATIONS AT INTERCONNECTIONS WITH IPPS (INDEPENDENT POWER PRODUCERS):

1. IN DWG. 08.06-11A, THE SIDE OF THE RECLOSER REFERENCED AS THE SOURCE VERTICAL BUSHING SIDE IS TO BE CONNECTED TO THE "UTILITY" SIDE OF THE RECLOSER (TOWARDS THE UTILITY SUBSTATION).

2. IN DWG. 08.06-11A, THE SIDE OF THE RECLOSER REFERENCED AS THE LOAD HORIZONTAL BUSHING SIDE IS THE "IPP/GENERATOR" SIDE OF THE RECLOSER (TOWARDS THE GENERATING FACILITY).

3. FOR IPP INTERTIE APPLICATIONS, THE BYPASS BLADE ON THE "SWITCH" MUST BE UNBOLTED AND REMOVED FROM THE SWITCH BEFORE IT IS MOUNTED. (EACH PHASE HAS SOURCE AND LOAD DISCONNECT BLADES THAT ARE PARALLEL TO EACH OTHER, AND THESE ARE LEFT ALONE. ONLY THE BYPASS BLADE, HORIZONTAL TO THE OTHERS, IS TO BE REMOVED. WHEN READY, THE SWITCHES WILL HAVE 6 BLADES INSTEAD OF 9. THIS IS DONE BECAUSE AN IPP INTERTIE RECLOSER MUST NEVER BE BYPASSED, SINCE THERE IS NO BACKUP PROTECTION TO ASSURE PROPER OPERATION OF THE IPP WITH OPERATION OF THE IPP WITH THE UTILITY.)

4. SEL 651R RELAYS AT IPP INTERCONNECTIONS HAVE SETTINGS, DISPLAY PANELS, AND BUTTONS THAT ARE NOT THE SAME AS A REGULAR LINE RECLOSER. THE PROPER SETTINGS AND FACEPLATE LABELS ARE AVAILABLE FROM THE COMPANY PROTECTION ENGINEER AND ARE TO BE APPLIED AT TIME OF RELAY PROVISIONING.

5. SEE DWGS. 11.09-10 OR 11.09-20 FOR CONSTRUCTION DETAILS FOR THE IPP PRIMARY METERING POLE LOCATED ONE SPAN AWAY, CLOSER TO THE IPP.

DUKE ENERGY.

3				
2				
1	1/10/18	BURLISON	BRUINS	ADCOCK
0	4/18/16	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SPECIAL PROVISIONS -

G&W VIPER ST, IPP INTERCONNECTION

DEC	DEM	DEP	DEF
			X

08.06-15E

BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	-	4206198	1	ANTENNA, MODEM, MOBILEMARK, LTM300, W/ 15' CABLE & SMA CONNECTORS
-	-	1523226	1	KIT, MOUNTING, ANTENNA, FOR MOBILEMARK, LTM300, INCLUDES POLE BRACKET

ANTENNA KIT - BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	-	1536711	1	ALUM POLE BRACKET
-	-	1536709	1	8" GROUND PLANE
-	-	4206910	1	ANTENNA ADAPTER
-	-	4030706	3	STRAP, PIPE, 2 HOLE, 1”
-	-	4030705	2	STRAP, PIPE, 2 HOLE, 3/4”

NOTES:

1. INSTALL ANTENNA AND FLEX CONDUIT WITH ANTENNA WIRE INSIDE.
2. INSTALL ANTENNA 9" TO 14" ABOVE THE TOP THROUGH BOLT OF THE CONTROL (61" OF FLEX CONDUIT).
3. PIPE STRAPS ARE PROVIDED TO SECURE FLEX CONDUIT (3-1”), AND CONTROL CABLES (2-3/4”) TO THE POLE.
4. THE 8” GROUND PLANE MUST BE FLAT.
5. CONNECT THE (3) ANTENNA WIRES TO THE MODEM INSIDE CONTROL. SEE DWG. 08.06-16B FOR DETAILS.
6. ANTENNA CABLE WILL BE PLACED TO THE RIGHT SIDE OF CONTROL CABINET.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3	1/31/18	BURLISON	BRUINS	ADCOCK
2	12/20/16	BRAVO	BURLISON	ADCOCK
1	8/8/16	BRAVO	BURLISON	ADCOCK
0	12/19/14	BURLISON	GUINN	ADCOCK

ANTENNA INSTALLATION ABB AND G&W VIPER ST

DEC	DEM	DEP	DEF
			X

08.06-16A

1. THERE SHOULD BE ENOUGH SLACK IN THE CABLE TO PULL OUT AND ACCESS THE MODEM, GATEWAY AND BATTERY WITH EASE.
2. EXCESS ANTENNA WIRE SHOULD BE COILED AND TUCKED BEHIND BATTERY.

3. THERE ARE THREE CABLES COMING FROM THE ANTENNA. THE SMALL CABLE IS THE GPS AND MUST BE SCREWED INTO THE GPS CONNECTOR ON THE BACK OF THE MODEM. THE TWO LARGER CABLES ARE INTERCHANGEABLE. SCREW THEM INTO THE OTHER TWO SPOTS.

4. TIGHTEN THE CABLES USING 5/16" WRENCH TO 14 INCH-POUNDS.
5. MODEM MUST BE CONFIGURED BY TELECOM.

BILL OF MATERIALS

COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	-	1	MODEM, CELLULAR, SIERRA GX450, W/ DC POWER CABLE, RUGGEDIZED SIM

6. FOLLOWING CONSTRUCTION, LEAVE BATTERY DISCONNECTED. BATTERY WILL BE CONNECTED WHEN UNIT IS PLACED INTO SERVICE.

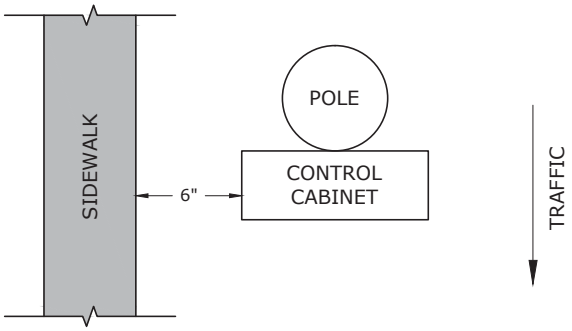
DUKE ENERGY.

3				
2				
1	8/8/16	BRAVO	BURLISON	ADCOCK
0	12/19/14	BURLISON	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

ANTENNA INSTALLATION ABB AND G&W VIPER ST

DEC	DEM	DEP	DEF
			X

08.06-16B



NOTES:

1. THE RECLOSER CONTROL CABINET MUST MAINTAIN AT LEAST 6" CLEARANCE OF PEDESTRIAN WALKWAYS IF SIDEWALK IS NOT AN ISSUE; INSTALL CABINET OPPOSITE TO DIRECTION OF TRAFFIC.

2. ID CONTROL CABINET WITH 7 DIGIT NUMBER. DO NOT USE ALPHAS.
3. BOLTS THAT SECURE THE CONTROL CABINET TO THE POLE MUST BE INSERTED FROM THE BACK OF THE POLE TOWARDS THE CABINET.
4. WHEN FACING THE CONTROL CABLES SHOULD BE PLACED ON THE LEFT SIDE OF CABINET.
5. DO NOT STAPLE CONTROL CABLES TO THE POLE.
6. CONTROL CABLES MUST BE PROTECTED BY MOULDING.
7. USE GRIP, 2.5"- (HANGING BASKET) TO SECURE THE CABLES TO THE POLE.
8. CABLE MUST BE ROLLED, TUCKED, AND TIED TO THE BASE OF THE RECLOSER.
9. BOND CONTROL CABINET TO POLE GROUND (USE # 6 CU).

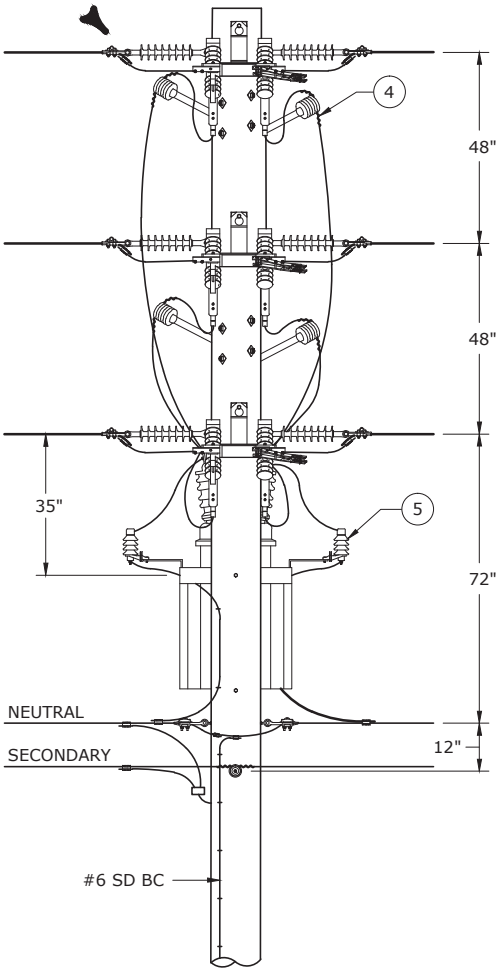
REVISED		BY	CK'D	APPR.
3				
2				
1	12/20/16	BRAVO	BURLISON	ADCOCK
0	8/8/16	BRAVO	BURLISON	ADCOCK

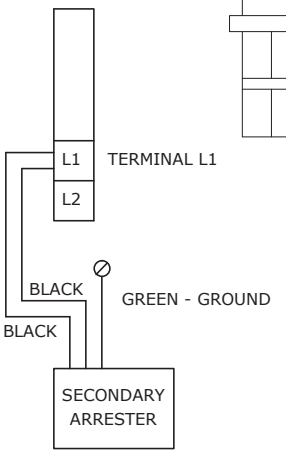
RISER AND CONTROL CABINET

DUKE ENERGY.

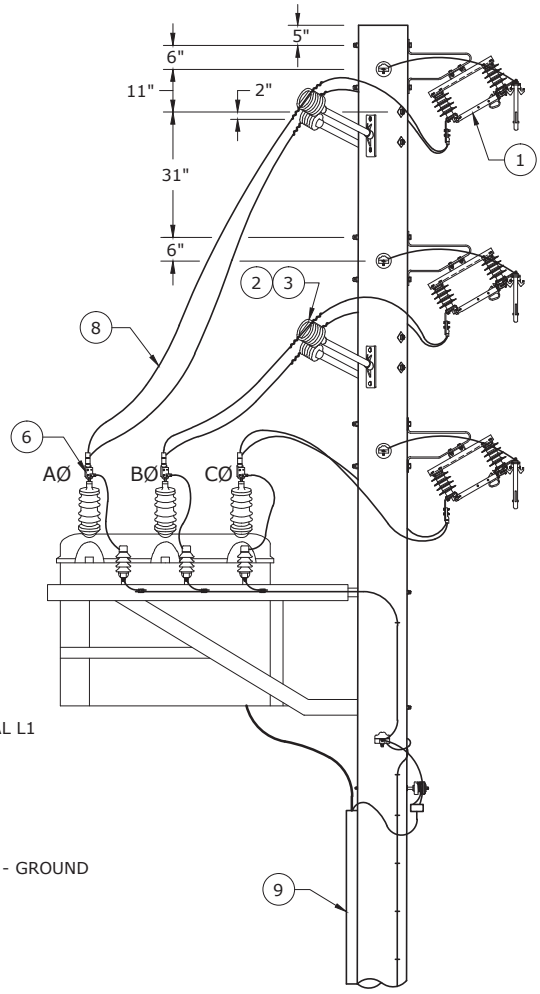
DEC	DEM	DEP	DEF
			X

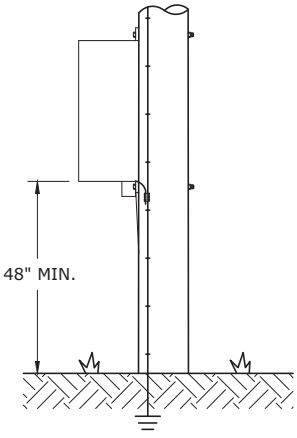
08.06-17



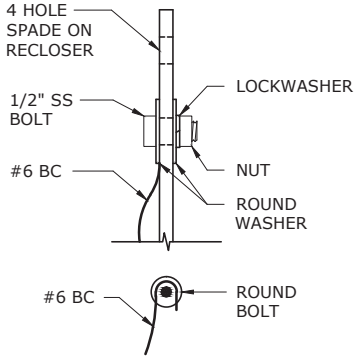


SECONDARY ARRESTER CONNECTION

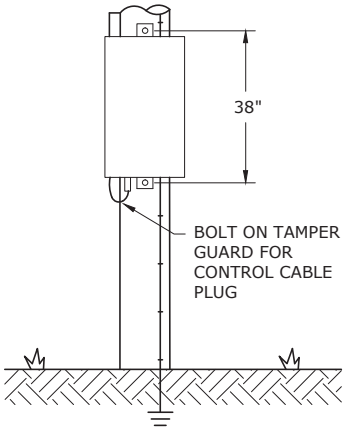




FRONT VIEW



DETAIL "B"



SIDE VIEW

NOTES:

1. SEE DWG. 08.06-22B FOR BILL OF MATERIALS.
2. CONTROL BOX AND SECONDARY REQUIRED FOR ELECTRONIC RECLOSER ONLY.
3. ISSUE RECLOSER AND ELECTRONIC CONTROL SEPARATELY.
4. RECLOSER MAY BE REVERSED IN HANGER TO ACCOMMODATE SOURCE AND LOAD POSITION.
5. WHEN END MOUNTING THREE-PHASE RECLOSER, USE A MINIMUM OF A 45 FT. CLASS 4 WOOD POLE.

REVISED		BY	CK'D	APPR.
3				
2				
1	11/6/13	SALAS	DANNA	ADCOCK
0	10/19/10	HOFFMAN	GUINN	ELKINS

RECLOSER ASSEMBLY, THREE-PHASE, VERTICAL

600 AMP SWITCH

DUKE ENERGY.

FLA

DWG. 08.06-22A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156BYPF	3	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				260123	1	SWITCH, BYPASS, 3-SLD BLADE DISC,, 15KV, LBK
	2	BKTFBGPIN15138F	4	9220087868	1	BRACKET, FIBERGLASS STAND-OFF, 1-3/8" THREAD
	3	IPIN25PF	4	9220091018	1	INSULATOR, 25 KV POLYMER, 1 3/8" THREAD
	4	TTIEF500COVALPF	4	9220068094	1	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
	5	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER POLY
	6	KLC2H50ALF	6	010928	2	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD, 1/2" X 2"
				012277	2	NUT, STAINLESS, STEEL, HEX, 304, ALLOY, COARSE THREAD
				013163	4	WASHER, FLAT, ROUND, SILICON, BRONZE, FOR 1/2" BOLT
				155326	1	LUG, COMP 2H 500 AL
				10542504	2	WASHER, ROUND, RD, 1/2, SS, 1.375" OD
	7	KLC2H50AL90DF	6	9220068102	1	LUG, 2-HOLE, TIN-PLATED, NEMA, 90 DEGREE
	8	RCRISER500ALF	6	202112	12	CABLE, XLP UG AL 500
	9	CRIS1UGPVC225CF	2	323422	1	GUARD, PVC, CABLE, 2-1/4" X 10'
				434122	0.2	BANDING, STAINLESS STEEL, 316, SS, 3/4" WIDE, .030 TH
				434142	3	BANDING, BUCKLE, SS, 3/4", FOR BANDING
	10	AREQSC120F	1	220139	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE
	11	GOCE6F	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152107	1	BOLT, MACH, SQ, NUT, 5/8" X 12"
				153111	1	CONNECTOR, COMP, AL, A=2/0STR-2SOL, B=2STR-6SOL
				160123	1	CONNECTOR, GND, 5/8, ROD, 2, CU
				190404	4	WIRE, COPPER, #6, SOFT DRAWN, CU, BR, SDW, SLD, #6

ADDITIONAL MATERIALS FOR ELECTRONIC RECLOSER ONLY						
MACRO UNIT	CU/CN ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	16	-	-	220133	1	ARRESTER, SECONDARY, 650V
	17	-	-	323422	2	CABLE GUARD, PLASTIC, 2-1/4" X 10"
	18	-	-	373379	2	CONDUIT, 90°, 1" PVC
	19	-	-	372172	1	ADAPTER, PVC, MALE, SCH 40
	20	-	-	381674	1	NUT, 1", STEEL CONDUIT
	21	-	-	372102	1	CONDUIT, 1", PVC, SCH 40
	22	-	-	-	1	CONTROL, ELECTRONIC (ISSUE SEPARATELY)

NOTES:

1. SEE DWG 08.06-22A FOR DESIGN SPECIFICATIONS.

2. SEE DWG 03.06-04 FOR PIN INSULATOR DETAILS.

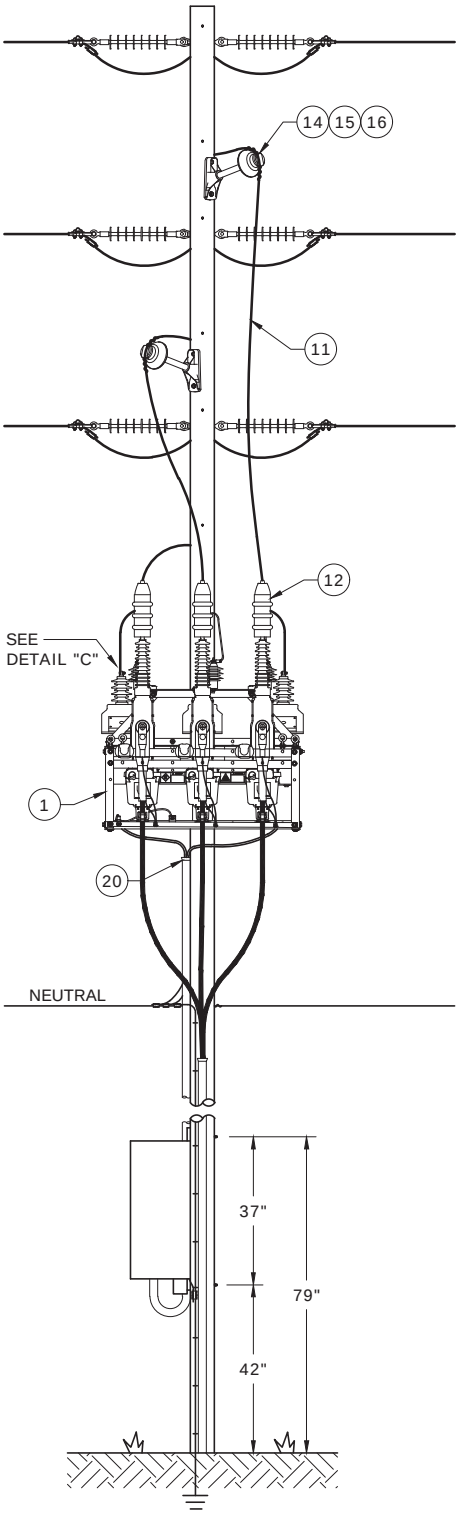
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/19/10	HOFFMAN	GUINN	ELKINS

RECLOSER ASSEMBLY, THREE-PHASE, VERTICAL,
600 AMP SWITCH

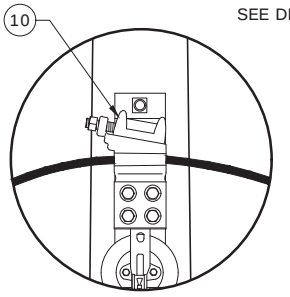
Duke Energy®

FLA

DWG. 08.06-22B

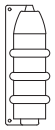


FRONT VIEW

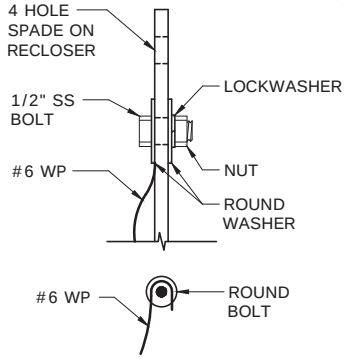


DETAIL "A"

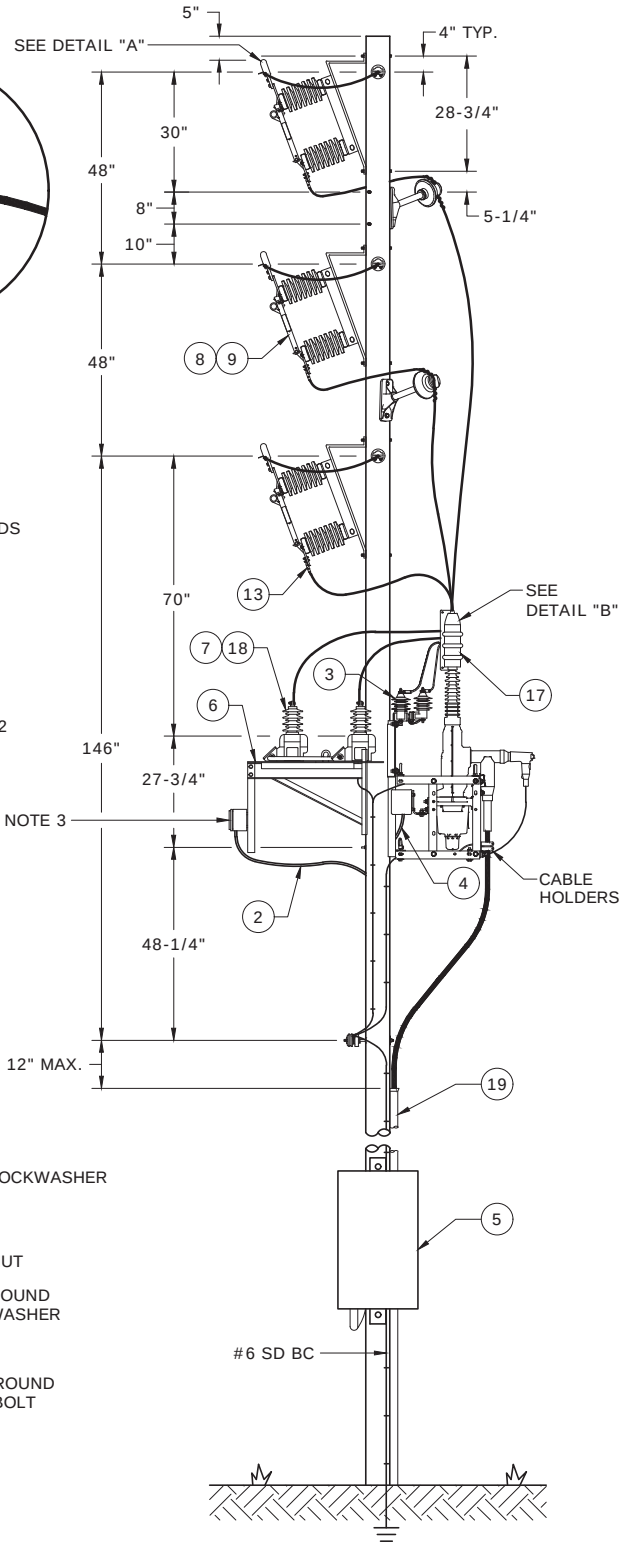
USE WILDLIFE GUARDS



DETAIL "B"
(3) ITEM # 4200692



DETAIL "C"



SIDE VIEW

NOTES:

1. SEE DWG. 08.06-115B FOR CLOSE VIEW OF RECLOSER.
2. SEE DWG. 08.06-115C FOR BILL OF MATERIALS AND DWG. 08.06-115D FOR NOTES.
3. MOUNT PT JUNCTION BOX (INCLUDED WITH RECLOSER UNIT) ON PT BRACKET. WHOLE PT ASSEMBLY CAN BE BUILT ON GROUND PRIOR INSTALLATION.
4. SEE DWGS. 21.06-125A AND 21.06-125B FOR RISER SPECIFICATIONS AND BOM.

3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

RECLOSER AND FRAME, THREE-PHASE, VIPER ST
VERTICAL CONSTRUCTION, OH-UG TRANSITION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-115A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-PR-VRT-RISER-F	1	1553642	1	RECLOSER, ELECTRONIC, 27KV, 800A, G&W VIPER-ST
			4165218	8	WASHER, SQ, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			93787	6	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			930030	8	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			94540	6	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	18	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	6	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
1	HDWR-MACH-SM-12IN-GALV-F	8	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
2	*CTR-RECL-CABLE-40FT-PT-VST-F	-	4203968	1	CORD, CONTROL, 40' LG, 8 PIN PT, ARMORED CABLE, F/ RECLOSER
3	*ARR-EQUIP-10KV-F	-	4003606	3	ARRESTER, ELECTRICAL, LIGHTNING, 10KV, MOV, HEAVY DUTY
4	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	CORD, CONTROL, 32 PIN, F/ VIPER RECLOSER SYSTEM
5	CTRL-RECL-S651R-VST-F	1	4198843	1	CONTROL, RECLOSER, F/ VIPER ST, W/ 3622 SECURITY GATEWAY
6	BKT-PT-CLUST-3POS-STL-RECL-F	1	4194079	1	BRACKET, MOUNTING, 42 IN, GALVANIZED STEEL, 3 PT MOUNTING
7	METER-VT-60/1-7KV-F	3	4155544	1	TRANSFORMER, INSTRUMENT, POTENTIAL, 60:1 RATIO, 7.2 KV AC
8	SW-VRT-600-15KV-1P-NLB-F	3	94540	4	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			4001661	4	WASHER, LOCK, RND BELLEVILLE SPRING, 1/2" NOM, 17/32" ID, 1-1/4"
			1421012	12	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			4002878	2	BOLT, MACHINE, 1/2" DIA, 2" LG, HEX HEAD, GALV STL, ASTM A307
			4003944	1	SWITCH, DISCONNECT, OVERHEAD, LOADBREAK, 15KVAC NOM 600A
9	BKT-SW-POLE-VRT-STL-F	3	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			4002336	1	BRACKET, MOUNTING, F/ SOL BLADE DISCONNECT SWITCHES
10	CONN-OH-PADTAP-BLTWDG-795AL-4H-F	3	4003434	1	CONNECTOR, ELECTRICAL, WEDGE, 795 MCM AAC CONDUCTOR
11	LEAD-EQ-500-AL-COVER-F	3	4003570	12	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
12	CONN-OH-LUG-COMP-500-2H-F	3	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
13	CONN-OH-LUG-COMP-500-2H-90DEG-F	3	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
14	BKT-INSL-POST-POLE-SM-FG-F	2	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
15	INSL-PIN-25KV-POLY-F	2	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
16	TIE-COMP-LG-COV-FNECK-F	2	301747	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
17	WG-BUSH-COV-MD-F	3	4200692	1	GUARD, ANIMAL, SOL COVER, STRAIGHT, VERT
18	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
19	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, CABLE, 2-1/4" X 10", PVC, W/ ONE BELLED END
			4001700	15	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
20	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, CABLE, SUPPORT & RISER, SGL. "U" EYE, 2 X 2-1/2 IN.
21	CABLE-TIE-15IN-WHT-F	-	4005140	1	TIE, CABLE, SELF-LOCKING, NON-RELEASE, 10"-15" LG

* INCLUDED FROM MANUFACTURER

NOTES:

1. SEE DWG. 08.06-115A FOR DESIGN SPECIFICATIONS.

2. SEE DWG. 08.06-115D FOR CONSTRUCTION NOTES.

REVISED		BY	CHK'D	APPR.
3				
2	12/31/18	BRUINS	BURLISON	ADCOCK
1	4/30/18	BRAVO	BURLISON	ADCOCK
0	3/31/18	BRAVO	BURLISON	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST
VERTICAL CONSTRUCTION, OH-UG TRANSITION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-115C

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	RECL-VST-800-ELEC-27KV-3P-PR-VRT-RISER-F	1	1553642	1	RECLOSER, ELECTRONIC, 27KV, 800A, G&W VIPER-ST
			4165218	8	WASHER, SQ, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			93787	6	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
			930030	8	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			94540	6	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	18	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	6	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
1	HDWR-MACH-SM-12IN-GALV-F	8	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
2	*CTR-RECL-CABLE-40FT-PT-VST-F	-	4203968	1	CORD, CONTROL, 40' LG, 8 PIN PT, ARMORED CABLE, F/ RECLOSER
3	*ARR-EQUIP-10KV-F	-	4003606	3	ARRESTER, ELECTRICAL, LIGHTNING, 10KV, MOV, HEAVY DUTY
4	CTRL-RECL-CABLE-40FT-VST-F	1	4198818	1	CORD, CONTROL, 32 PIN, F/ VIPER RECLOSER SYSTEM
5	CTRL-RECL-S651R-VST-F	1	4198843	1	CONTROL, RECLOSER, F/ VIPER ST, W/ 3622 SECURITY GATEWAY
6	BKT-PT-CLUST-3POS-STL-RECL-F	1	4194079	1	BRACKET, MOUNTING, 42 IN, GALVANIZED STEEL, 3 PT MOUNTING
7	METER-VT-60/1-7KV-F	3	4155544	1	TRANSFORMER, INSTRUMENT, POTENTIAL, 60:1 RATIO, 7.2 KV AC
8	SW-VRT-600-15KV-1P-NLB-F	3	94540	4	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			4001661	4	WASHER, LOCK, RND BELLEVILLE SPRING, 1/2" NOM, 17/32" ID, 1-1/4"
			1421012	12	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			4002878	2	BOLT, MACHINE, 1/2" DIA, 2" LG, HEX HEAD, GALV STL, ASTM A307
			4003944	1	SWITCH, DISCONNECT, OVERHEAD, LOADBREAK, 15KVAC NOM 600A
9	BKT-SW-POLE-VRT-STL-F	3	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			4002336	1	BRACKET, MOUNTING, F/ SOL BLADE DISCONNECT SWITCHES
10	CONN-OH-PADTAP-BLTWDG-795AL-4H-F	3	4003434	1	CONNECTOR, ELECTRICAL, WEDGE, 795 MCM AAC CONDUCTOR
11	LEAD-EQ-500-AL-COVER-F	3	4003570	12	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
12	CONN-OH-LUG-COMP-500-2H-F	3	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM COND.
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
13	CONN-OH-LUG-COMP-500-2H-90DEG-F	3	94540	2	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	2	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
			1421012	6	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			93787	2	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
14	BKT-INSL-POST-POLE-SM-FG-F	2	930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
			4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
15	INSL-PIN-25KV-POLY-F	2	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
16	TIE-COMP-LG-COV-FNECK-F	2	301747	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
17	WG-BUSH-COV-MD-F	3	4200692	1	GUARD, ANIMAL, SOL COVER, STRAIGHT, VERT
18	WG-BUSH-COV-SM-F	3	50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
19	RISER-2 1/4IN-UGUARD-1PC-F	3	4004660	1	GUARD, CABLE, 2-1/4" X 10", PVC, W/ ONE BELLED END
			4001700	15	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
20	CABLE-GRIP-SGL-MD-F	1	4004643	1	GRIP, CABLE, SUPPORT & RISER, SGL. "U" EYE, 2 X 2-1/2 IN.
21	CABLE-TIE-15IN-WHT-F	-	4005140	1	TIE, CABLE, SELF-LOCKING, NON-RELEASE, 10"-15" LG

* INCLUDED FROM MANUFACTURER

NOTES:

1. SEE DWG. 08.06-115A FOR DESIGN SPECIFICATIONS.

2. SEE DWG. 08.06-115D FOR CONSTRUCTION NOTES.

REVISED		BY	CHK'D	APPR.
3				
2	12/31/18	BRUINS	BURLISON	ADCOCK
1	4/30/18	BRAVO	BURLISON	ADCOCK
0	3/31/18	BRAVO	BURLISON	ADCOCK

RECLOSER AND FRAME, THREE-PHASE, VIPER ST
VERTICAL CONSTRUCTION, OH-UG TRANSITION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.06-115C

NOTES:

1. USE INSTALLATION ON TANGENT POLES AND LOOPED SYSTEMS ONLY.
2. A 50' CLASS 4 POLE IS THE MINIMUM TO BE USED FOR THIS INSTALLATION.
3. TOTAL WEIGHT OF THE RECLOSER AND FRAME IS 350 LBS DOES NOT INCLUDE PT'S OR LA'S.
4. ISSUE TAPS TO SWITCHES SEPARATELY (WIRE, CONNECTORS, AND LUGS). BOLTS WILL BE ON SWITCH.
5. ALL BOLTS ON OH PRIMARY CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS: DO NOT EXCEED!
6. PT'S TO BE CONNECTED TO VERTICAL BUSHINGS OF RECLOSER. USE #6 WP FOR CONNECTIONS
7. WHEN INSTALLING UNIT, OPEN CONTROL JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD THREE LEA PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.
8. THREE OH ARRESTERS REQUIRED ON VERTICAL BUSHING SIDE- CONNECT TO TERMINALS OF RECLOSER AS SHOWN ON DETAIL C ON DWG. 08.06-115A.
9. OH ARRESTERS, PT'S CONNECTING WIRES, AND 8 PIN PT CONTROL CABLE COME WITH RECLOSER FROM MANUFACTURER.
10. HORIZONTAL BUSHING DEAD FRONT CONSTRUCTION: LINE PRIMARY CABLES WILL BE TERMINATED WITH 600 AMP BOLTED DEADBREAK (NO VOLTAGE AND CURRENT) ELBOW T-BODY, AND INSTALLED ON 600 AMP BUSHING INTERFACE.
11. INSTALL ELBOW ARRESTERS ON ALL LINE CABLES USING 200 AMP BUSHING INTERFACE IN T-BODY.
12. WHEN ELBOWS, INSERTS, AND ANY OTHER ACCESSORIES ARE CONNECTED TO THE SWITCH, THE RATING OF EACH CONNECTED ASSEMBLY WILL BE THAT OF THE LOWEST RATED COMPONENT OF THE ASSEMBLY.
13. RUN GROUND FROM GROUNDING LUGS ON BACK OF RECLOSER TO SYSTEM NEUTRAL AND THEN TO GROUND AT THE BASE OF THE POLE. SEE DWG. 21.06-125A FOR GROUNDING DETAILS.
14. CONNECT ENDS OF POWER AND CONTROL CABLES WITH PROTECTIVE ARMORED FLEX TO CONTROL.
15. NEUTRAL MAY BE DOUBLE DEADENDED OR STRAIGHT THROUGH ON SPOOL AS NEEDED.
16. CABLE COULD BE ENERGIZED WHEN RECLOSER IS OPEN.
17. RECLOSER IS SCADA OPERATED AND MONITORED.
18. SEE DWG. 08.06-115A FOR DESIGN SPECIFICATIONS.
19. SEE DWG. 08.06-115B FOR CLOSE VIEW OF RECLOSER.
20. SEE DWG. 08.06-115C FOR BILL OF MATERIALS.
21. SEE DWGS. 21.08-125A AND 21.08-125B FOR RISER SPECIFICATIONS AND BILL OF MATERIALS.
22. SEE DWGS. 08.06-16A, 08.06-16B, AND 08.06-17 FOR DETAILS ON ANTENNA AND CONTROL INSTALLATION.

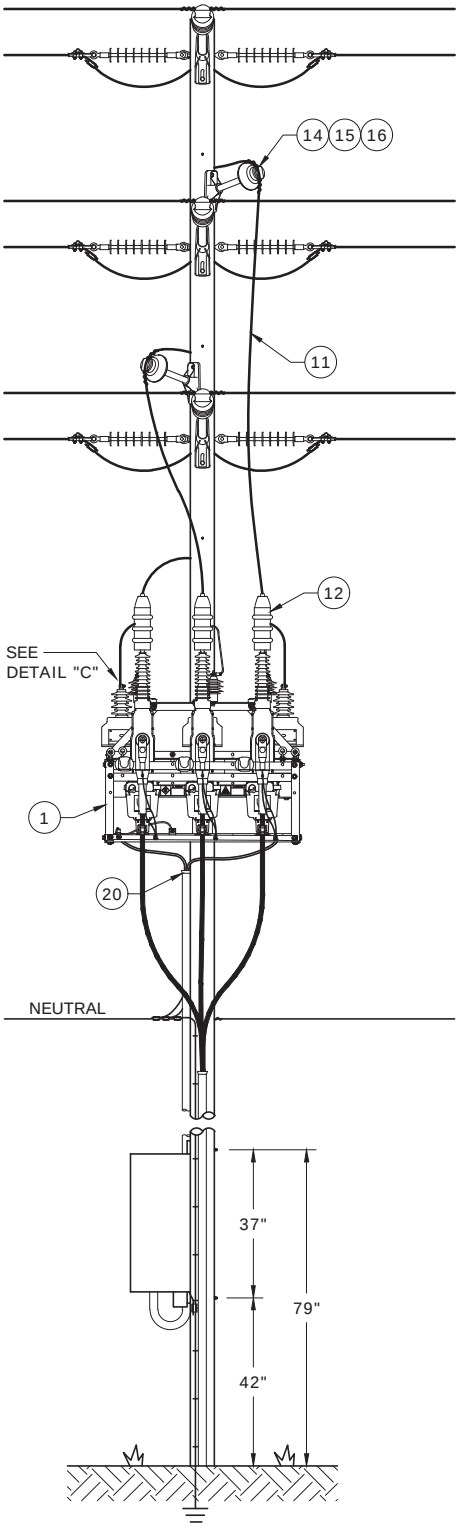
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK

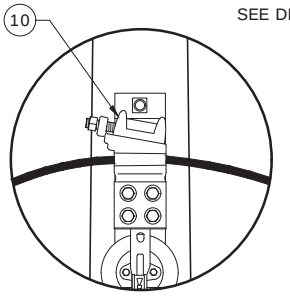
RECLOSER AND FRAME, THREE-PHASE, VIPER ST
VERTICAL CONSTRUCTION, OH-UG TRANSITION

DEC	DEM	DEP	DEF
			X

08.06-115D

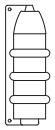


FRONT VIEW

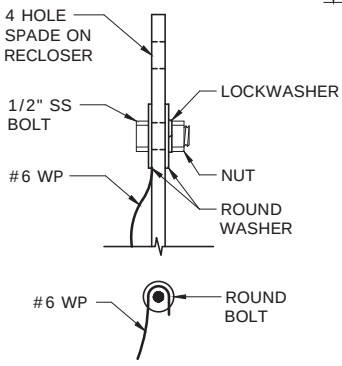


DETAIL "A"

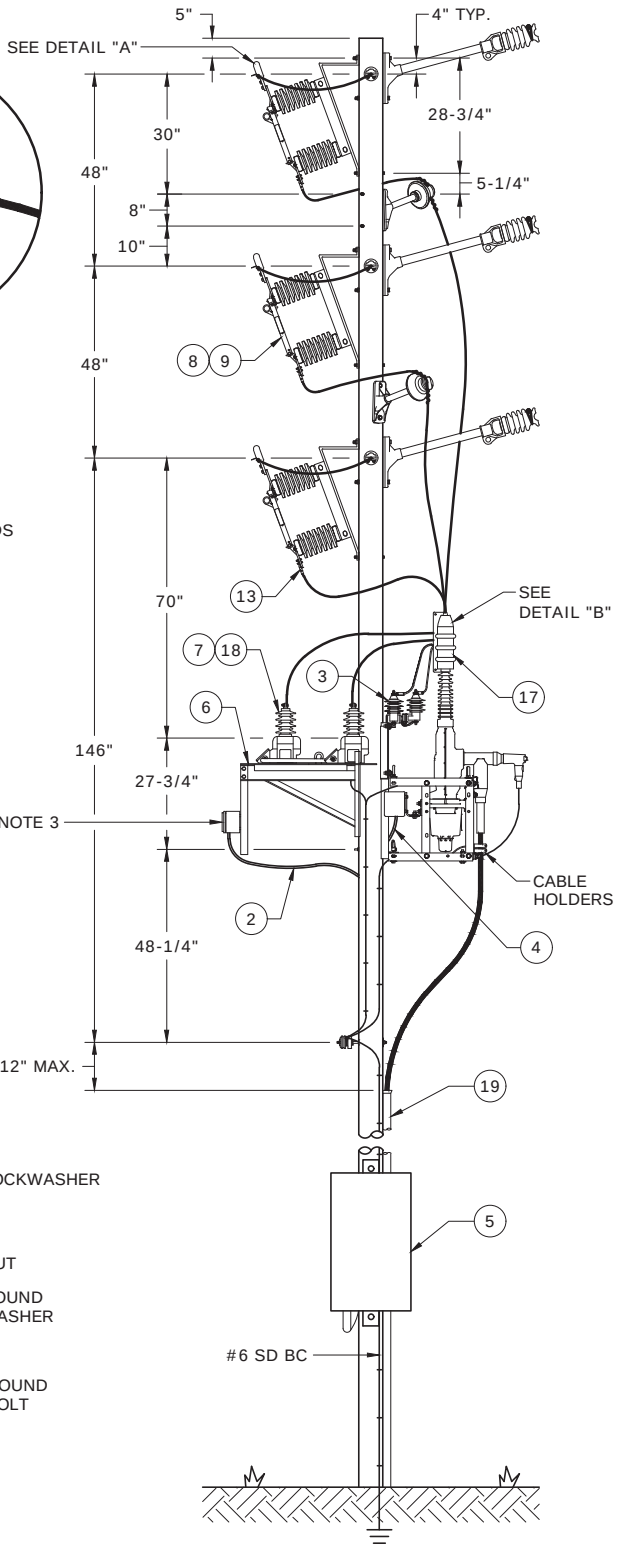
USE WILDLIFE GUARDS



DETAIL "B"
(3) ITEM # 4200692



DETAIL "C"



SIDE VIEW

NOTES:

1. SEE DWG. 08.06-115B FOR CLOSE VIEW OF RECLOSER.
2. SEE DWG. 08.06-115C FOR BILL OF MATERIALS AND DWG. 08.06-115D FOR NOTES.
3. MOUNT PT JUNCTION BOX (INCLUDED WITH RECLOSER UNIT) ON PT BRACKET. WHOLE PT ASSEMBLY CAN BE BUILT ON GROUND PRIOR INSTALLATION.
4. USE 30 INCH STANDOFF BRACKETS TO SEPARATE CIRCUITS.
5. LEADS TO RECLOSER MUST HAVE A MINIMUM OF 14" CLEARANCE FROM THE THROUGH CIRCUIT.
6. SEE DWGS. 21.06-125A AND 21.06-125B FOR RISER SPECIFICATIONS AND BILL OF MATERIALS.

DUKE ENERGY.

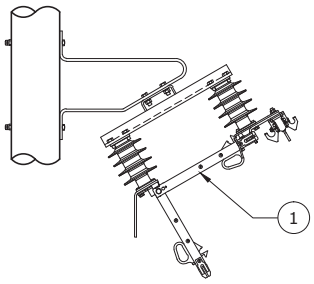
3				
2				
1				
0	3/31/18	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE CIRCUIT, THREE-PHASE, VIPER ST
VERTICAL CONSTRUCTION, OH-UG TRANSITION

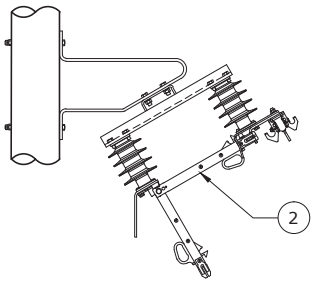
DEC	DEM	DEP	DEF
			X

08.06-115E

SWITCH, BYPASS, SINGLE-PHASE



15 KV SWITCH, BYPASS, SINGLE-PHASE
BRACKET IS INCLUDED WITH SWITCH



25 KV SWITCH, BYPASS, SINGLE-PHASE
BRACKET IS INCLUDED WITH SWITCH

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156BYPF	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				260123	1	SWITCH, BYPASS, 600A, 15KV, W/ BRACKET
	2	SW256BYPF	1	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				260552	1	SWITCH, BYPASS, 600A, 25KV, W/ BRACKET

NOTES:

1. THE FACE OF POLE SHOULD BE LEFT CLEAR FOR OPERATION OF VERTICAL MOUNTED SOLID BLADE SWITCHES. AVOID MOUNTING STREET LIGHT BRACKETS AND OTHER SIMILAR EQUIPMENT ON THESE POLES.

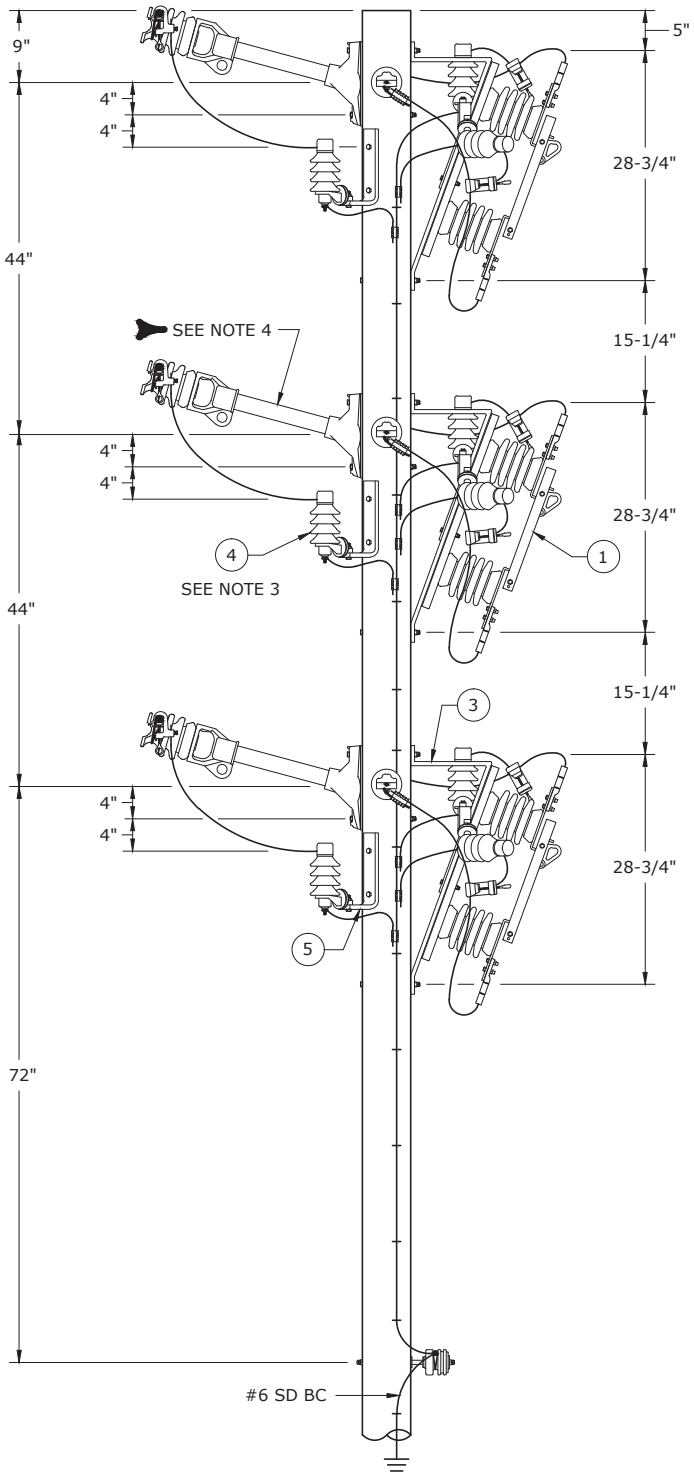
3				
2				
1				
0	8/23/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

BYPASS SWITCHES

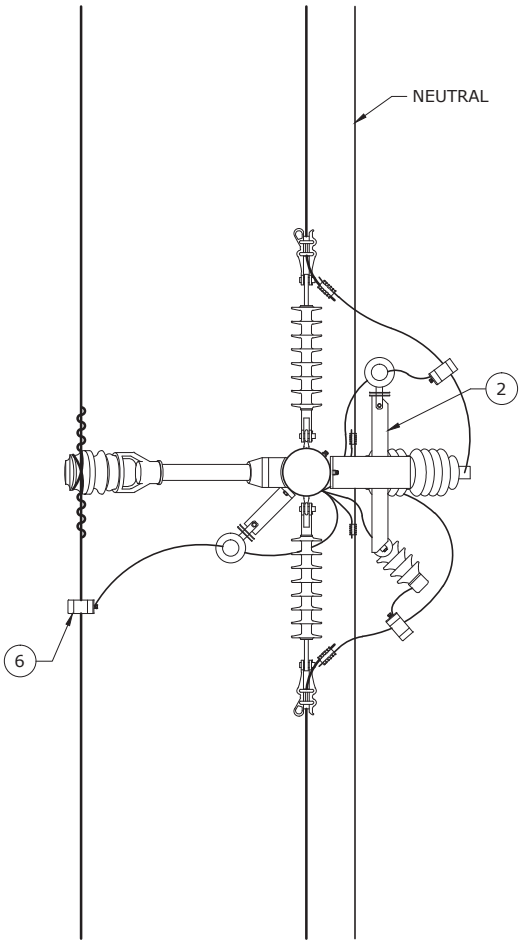
Duke Energy®

FLA

DWG. 08.10-10



FRONT VIEW



PLAN VIEW

NOTES:

1. THIS POLE SHOULD BE OFFSET WHEN POSSIBLE SO THAT CONDUCTORS STAY IN LINE.
2. SEE DWG. 08.10-12B FOR BILL OF MATERIALS.
3. ARRESTERS APPLIED ONLY IN NORMAL OPEN CONFIGURATION.
4. CAN USE EITHER 20" OR 30" STANDOFF BRACKET AS REQUIRED BY FIELD CONDITIONS.

REVISED	BY	CK'D	APPR.
3 7/1/15	LOOSIER	BURLISON	ADCOCK
2 3/31/15	LOOSIER	WHITE	ADCOCK
1 1/23/13	DANNA	DANNA	ADCOCK
0 11/29/10	HOFFMAN	GUINN	ELKINS

DUKE ENERGY.

SWITCH MOUNTING IN VERTICAL DOUBLE CIRCUIT

DEC	DEM	DEP	DEF
			X

08.10-12A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	SW156SBDF	3	010928	4	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD,1 /2"X2"
				012277	4	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL
				013128	4	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				013407	8	WASHER, ROUND, FLAT, STAINLESS STEEL, 304, ALLOY, FOR,1/2"
				152074	2	BOLT, MACH, HEX, HD, 1/2"X2"
				260136	1	SWITCH, DISCONNECT, SOLID BLADE, 15KV, 600A, 1PH, SWITCH
	2	BKTLASWBKTSTLF	3	010928	2	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD, 1/2" X 2"
				012277	2	NUT, STAINLESS, STEEL, HEX, 304, ALLOY, COARSE, THREAD
				070283	1	BRACKET, MNTG SWITCH ARSTR
				10542504	2	WASHER, RD, 1/2, SS, 1.375" OD
-	3	BKTSBDSWSTLF	3	013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				013308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16
				070282	1	BRACKET, MNTG WD/CNCR POLE
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	4	AREQOH10F	9	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER P
				193511	2	CABLE, 600V, #6 SD BC
	5	BKTCOLASNGSTLF	3	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8", BOLT, GALV.
				013308	2	WASHER, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				152106	2	BOLT, MACH, SQ, NUT, 5/8" X 10"
				311263	1	BRACKET, SGL MT
	6	KHLC7933F	6	9220184794	1	CONNECTOR, HOT LINE CLAMP, 795 MCM TO 336 MCM

NOTES:

1. SEE DWG. 08.10-12A FOR DESIGN SPECIFICATIONS.

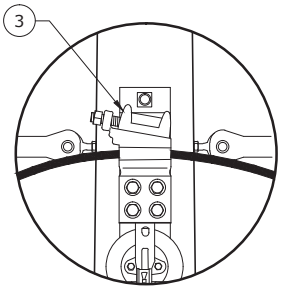
REVISED		BY	CK'D	APPR.
3				
2	4/9/13	McCONNELL	DANNA	ADCOCK
1	1/6/12	HOFFMAN	BURLISON	ELKINS
0	11/29/10	HOFFMAN	GUINN	ELKINS

SWITCH MOUNTING IN VERTICAL DOUBLE CIRCUIT

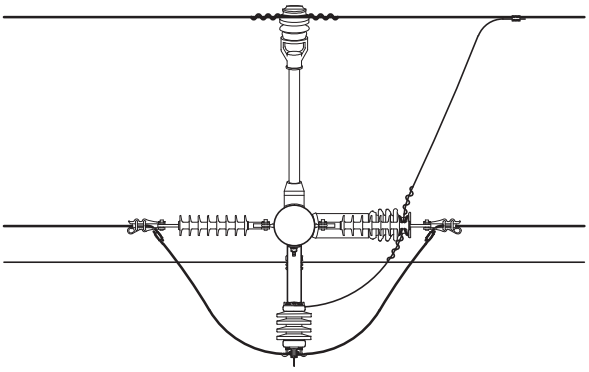
DUKE ENERGY.

FLA

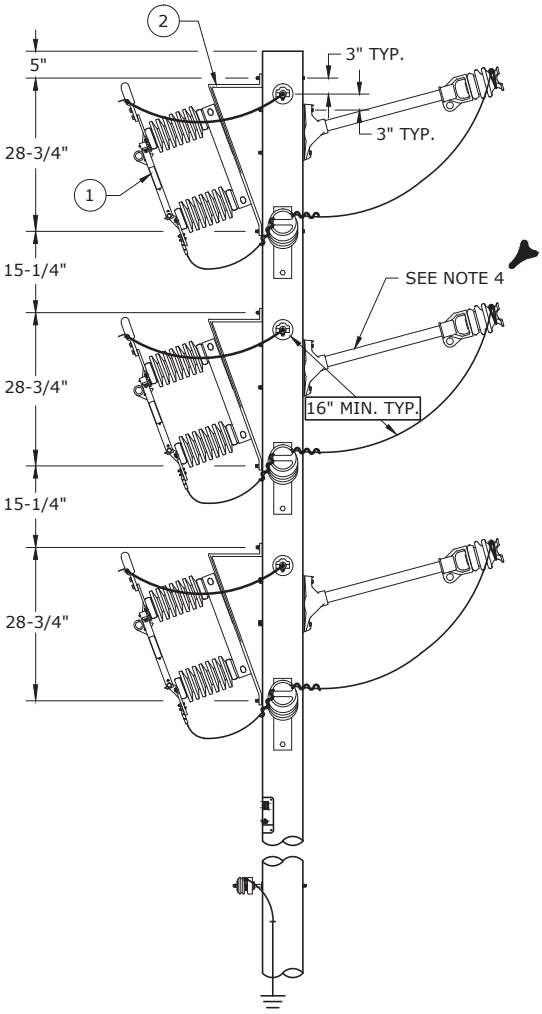
DWG. 08.10-12B



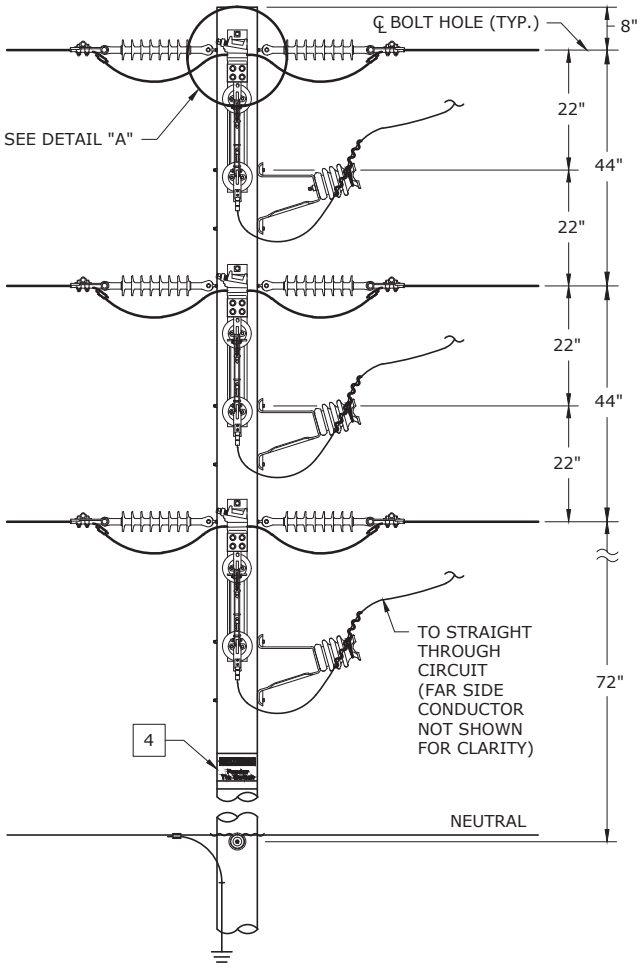
DETAIL "A"



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG 08.10-14B FOR BILL OF MATERIALS.
2. THIS POLE SHOULD BE OFFSET WHEN POSSIBLE SO THAT CONDUCTORS STAY IN LINE.
3. MAINTAIN A MINIMUM CLEARANCE OF 16" BETWEEN JUMPERS AND PHASES.
4. CAN USE EITHER 20" OR 30" STANDOFF BRACKET AS REQUIRED BY FIELD CONDITIONS.

REVISED		BY	CK'D	APPR.
3				
2	6/17/15	LOOSIER	BURLISON	ADCOCK
1	11/6/13	SALAS	DANNA	ADCOCK
0	8/23/10	GUINN	GUINN	ELKINS

600 AMP DOUBLE CIRCUIT

TIE SWITCH

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.10-14A

BILL OF MATERIALS						
MACRO UNIT	CU/CN ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156SBDF	3	260136	1	SWITCH, SOLID BLADE 600 AMP
				012277	4	NUT, SS, HEX
				013128	4	WASHER, ROUND, BELLEVILLE, SPRING
				010928	4	BOLT, MACHINE, SS, HEX HEAD, 1/2" X 2"
				013407	8	WASHER, ROUND, FLAT, SS
				152074	2	BOLT, MACHINE, HEX HEAD, 1/2" X 2"
	2	BKTSBDSWSTLF	3	070282	1	BRACKET, MOUNTING WD/CONCRETE POLE
				013264	2	WASHER, SPRING, COIL, FOR 5/8", STL, GALV.
				152107	2	BOLT, MACHINE, SQ, 5/8" X 12"
				013308	2	WASHER, 2-1/4", SQUARE FLAT, 13/16" HOLE
	3	KWP4H79F	3	165288	1	CONNECTOR, WEDGE, 4-HOLE, 795 AAC
	4	-	-	9220068328	2	SIGN, CAUTION FEEDER TIE SWITCH

NOTES:

1. SEE DWG 08.10-14A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	4/9/13	McCONNELL	DANNA	ADCOCK
0	8/23/10	GUINN	GUINN	ELKINS

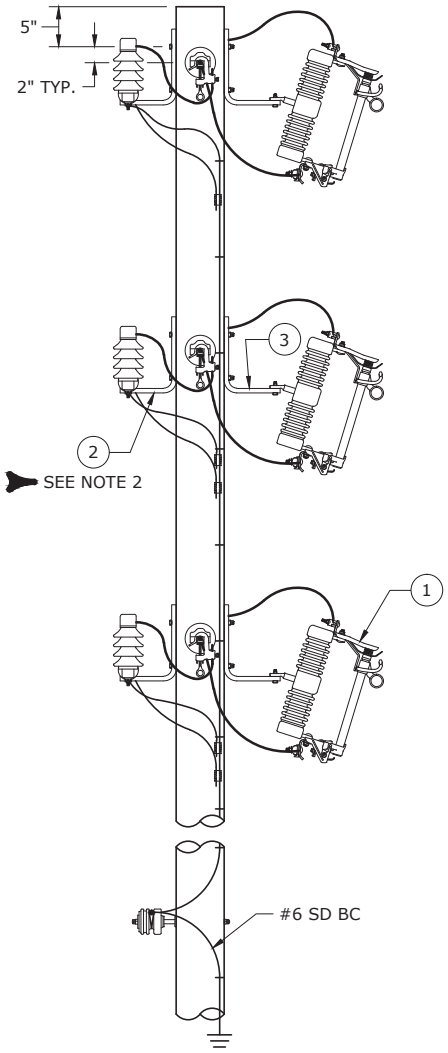
600 AMP DOUBLE CIRCUIT

TIE SWITCH

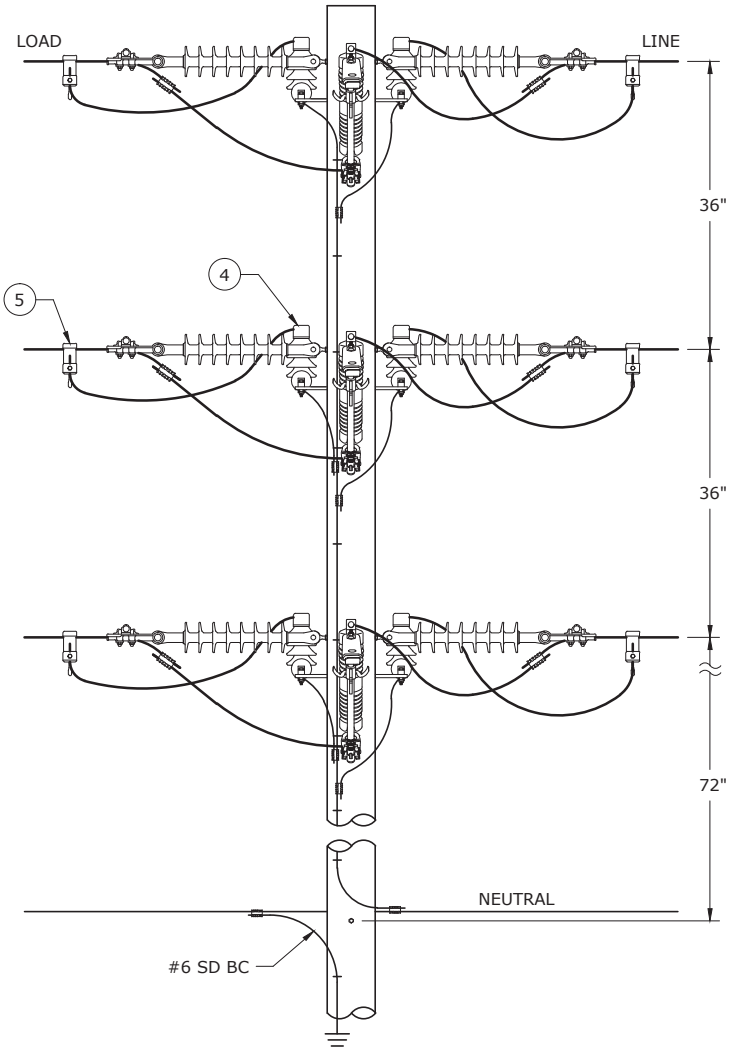
DUKE ENERGY.

FLA

DWG. 08.10-14B



SIDE VIEW



FRONT VIEW

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW153COSBDF	3	9220210916	1	15KV CUTOUT WITH 300A SOLID DOOR
	1	SW253COSBDF	3	9220210993	1	25KV CUTOUT WITH 300A SOLID DOOR
	2	BKTCOLADBLSTLF	3	013264	2	WASHER, LOCK, 5/8", STEEL, GLV, SPRING, DOUBLE COIL, STEEL, F
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLD, GLV
				070106	1	BRACKET, ARRESTER AND CUTOUT, DBL MNTG
				152107	2	BOLT, MACHINE, SQUARE, NUT, 5/8" X 12"
	3	BKTCOLASNGSTLF	3	013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8", BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16" HOLE, GALV.
				152106	2	BOLT, MACHINE, 5/8" X 10", STEEL, A-ASTM A307, GALV
				311263	1	BRACKET, SINGLE MOUNT
	4	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER POLY
-	5	KHLC40N6F	6	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
		KHLC7933F	6	9220184794	1	CLAMP, HOT LINE, ALUM, LARGE, 336-795

NOTES:

1. 300 AMP DISCONNECT IS AVAILABLE 15KV AND 25KV (COASTAL AND HOLOPAW).
2. ARRESTERS APPLIED ONLY IN NORMAL OPEN CONFIGURATION.

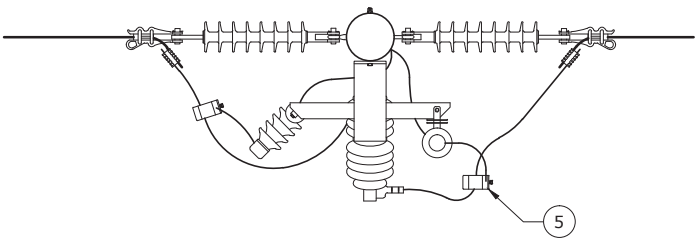
REVISED		BY	CK'D	APPR.
5	3/31/15	LOOSIER	WHITE	ADCOCK
4	5/31/13	McCONNELL	DANNA	ADCOCK
3	4/15/13	McCONNELL	DANNA	ADCOCK
0	8/23/10	GUINN	GUINN	ELKINS

SWITCH ASSEMBLY, 300 AMP, SOLID BLADE, VERTICAL

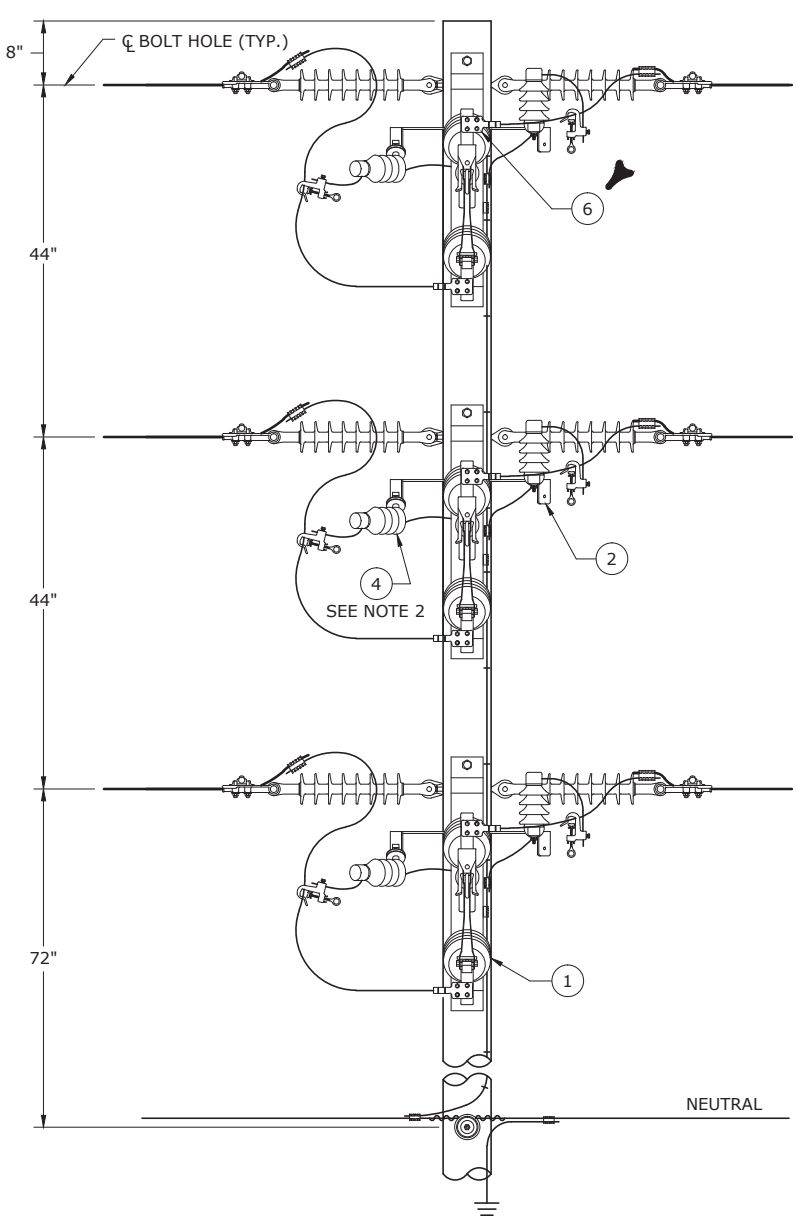
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

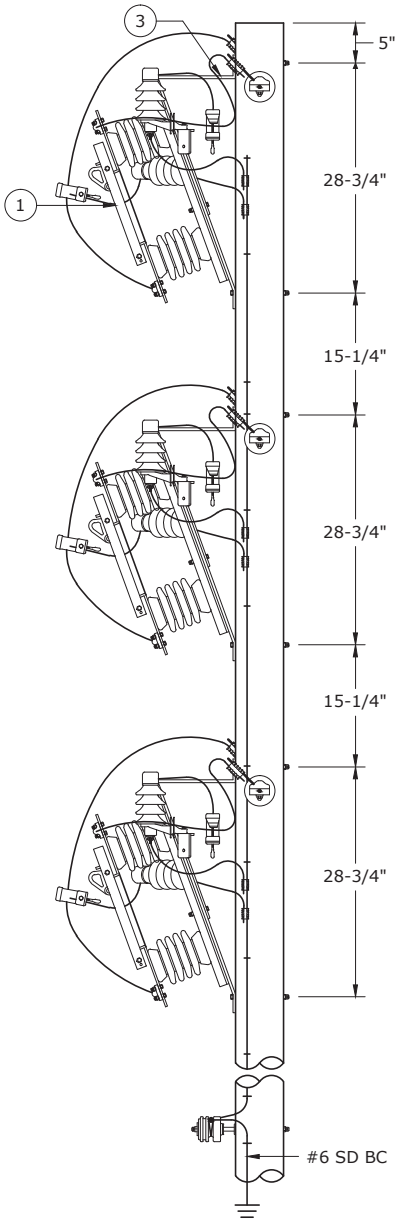
08.10-16



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 08.10-18B FOR BILL OF MATERIALS.

2. ARRESTERS APPLIED ONLY IN NORMAL OPEN CONFIGURATION.

REVISED	BY	CK'D	APPR.
5 6/17/15	LOOSIER	BURLISON	ADCOCK
4 3/31/15	LOOSIER	WHITE	ADCOCK
3 10/29/14	LOOSIER	DANNA	ADCOCK
0 11/29/10	HOFFMAN	GUINN	ELKINS

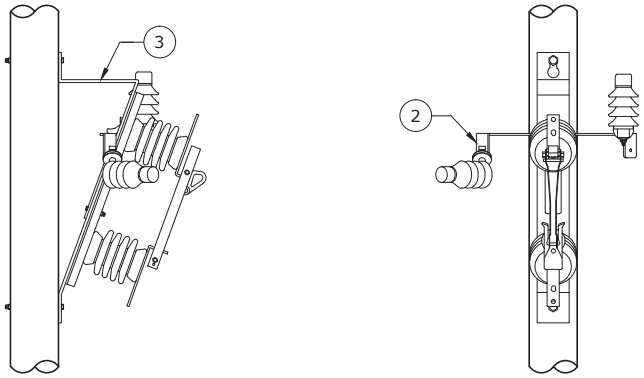
SWITCH ASSEMBLY, 600 AMP,
SOLID BLADE, VERTICAL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.10-18A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156SBDF	3	010928	4	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD,1 /2"X2"
				012277	4	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL
				013128	4	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				013407	8	WASHER, ROUND, FLAT, STAINLESS STEEL, 304, ALLOY, FOR,1/2"
				152074	2	BOLT, MACH, HEX, HD, 1/2"X2"
				260136	1	SWITCH, DISCONNECT, SOLID BLADE, 15KV, 600A, 1PH, SWITCH
	2	BKTLASWBKTSTLF	3	010928	2	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD, 1/2" X 2"
				012277	2	NUT, STAINLESS, STEEL, HEX, 304, ALLOY, COARSE, THREAD
				070283	1	BRACKET, MNTG SWITCH ARSTR
				10542504	2	WASHER, RD, 1/2, SS, 1.375" OD
	3	BKTSBDSWSTLF	3	013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				013308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16
				070282	1	BRACKET, MNTG WD/CNCR POLE
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	4	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER P
	5	KHLC7933F	6	9220184794	1	CONNECTOR, HOT LINE CLAMP, 795 MCM TO 336 MCM
	6	KLC4H79ALF	6	10928	4	BOLT, MACHINE, 1/2 IN, 2 IN, STAINLESS STEEL, 304, HEX HEAD
				12277	4	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, 304, ALLOY, COARSE
				13163	8	WASHER, FLAT, 1/2 IN, SILICON BRONZE, FLAT, ROUND, SILICON
				155464	1	LUG, COMPRESSION, 4 HOLE, 795, AAC
				10542504	4	WASHER, ROUND, 1/2, SS, 1.375" OD



DETAIL
SWITCH BRACKET

NOTES:

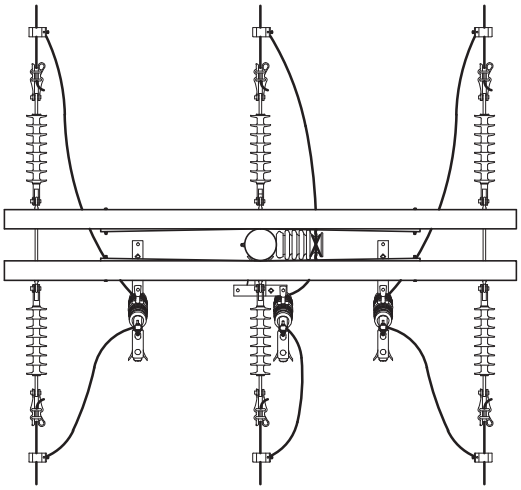
1. SEE DWG. 08.10-18A FOR DESIGN SPECIFICATIONS.

REVISED	BY	CK'D	APPR.
5 6/17/15	LOOSIER	BURLISON	ADCOCK
4 3/31/15	LOOSIER	WHITE	ADCOCK
3 7/16/14	LOOSIER	DANNA	ADCOCK
0 11/29/10	HOFFMAN	GUINN	ELKINS

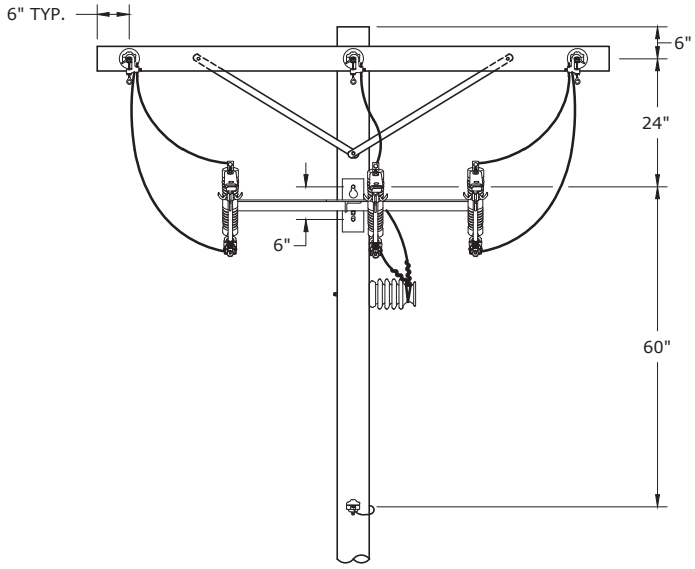
SWITCH ASSEMBLY, 600 AMP,
SOLID BLADE, VERTICAL

DEC	DEM	DEP	DEF
			X

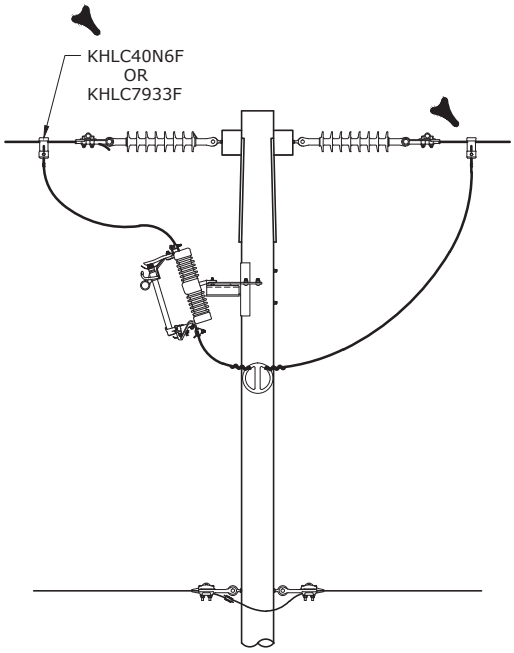
08.10-18B



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. IN LOCATIONS WHERE THE SWITCH COULD BE USED TO TRANSFER LOAD AND COULD BE LEFT IN THE OPEN POSITION FOR AN EXTENDED PERIOD OF TIME, ENGINEERING SHOULD CALL FOR LIGHTNING ARRESTERS ON BOTH SIDES OF THE SWITCH.

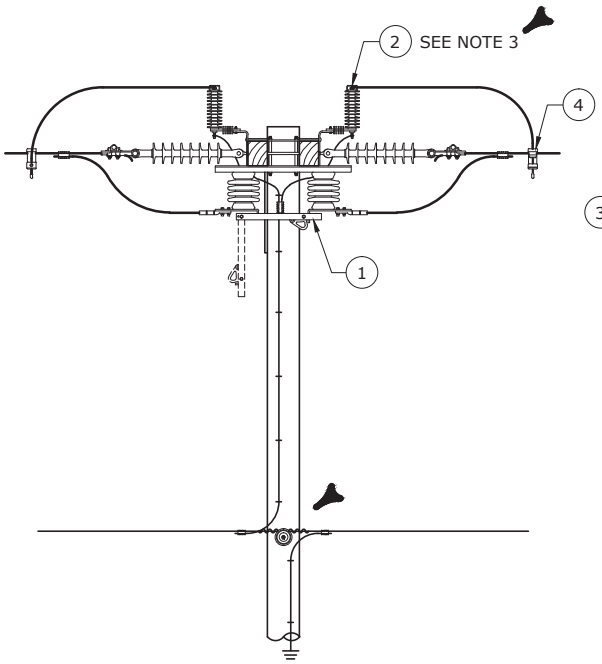
3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	11/5/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SWITCH ASSEMBLY, 300 AMP, SOLID BLADE
HORIZONTAL

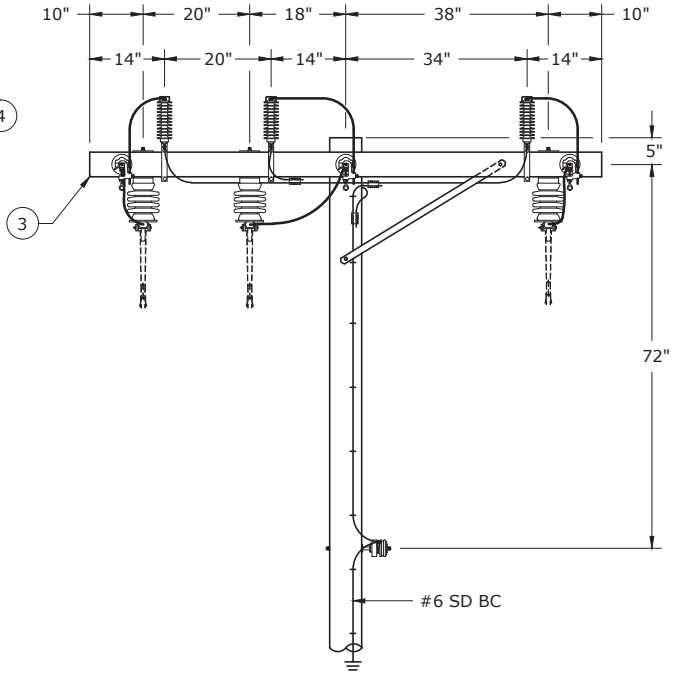
Progress Energy

FLA

DWG. 08.10-20



FRONT VIEW



SIDE VIEW

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156UHSBDF	3	260136	1	SWITCH, DISCONNECT, SOLID BLADE, 15KV, 600A, SINGLE-PHASE
				070793	1	PLATE, SW BACKING
	1	SW256UHSBDF	3	260547	1	SWITCH, DISCONNECT, SOLID BLADE, 25KV, 600A, SINGLE-PHASE
				070793	1	PLATE, SW BACKING
	2	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER POLY
	3	ARMD8LW36FSF	1	011209	4	BOLT, CARRIAGE, 3/8" X 4-1/2"
				011313	3	BOLT, DOUBLE ARMING, 5/8", 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" X 4", STEEL, GALV.
				031113	2	CROSSARM, WOOD, 8', MS-121-F, LIGHT
				071306	4	BRACE, FLAT, GALV, STEEL, 36"
	4	KHLC7933F	6	9220184794	1	CONNECTOR, HOT LINE CLAMP, 795 MCM TO 336 MCM

NOTES:

1. 600 AMP SWITCH IS AVAILABLE FOR 15KV AND 25KV (COASTAL AND HOLOPAW).
2. SEE DWG. 03.11-01B FOR REQUIRED CROSSARM.
3. ARRESTERS APPLIED ONLY IN NORMAL OPEN CONFIGURATION.

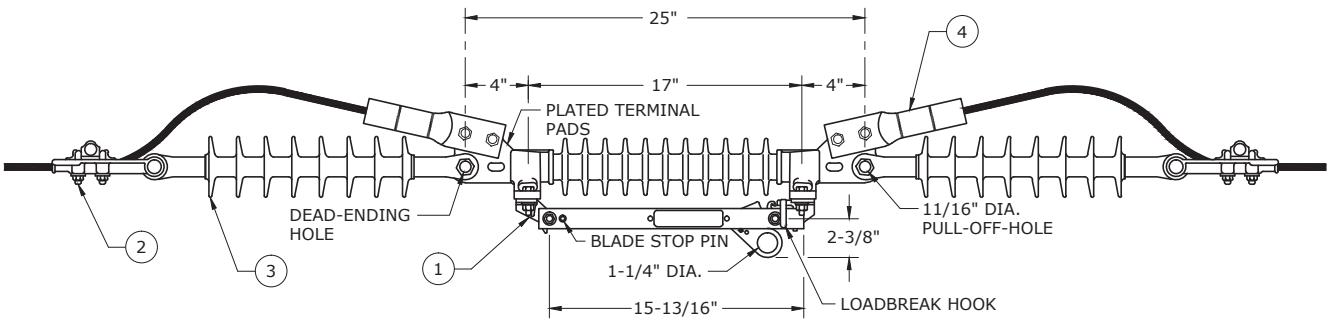
REVISED		BY	CK'D	APPR.
3				
2	3/31/15	LOOSIER	WHITE	ADCOCK
1	5/31/13	McCONNELL	DANNA	ADCOCK
0	8/23/10	GUINN	GUINN	ELKINS

SWITCH ASSEMBLY, 600 AMP, SOLID BLADE
HORIZONTAL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.10-22



BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156ILSBDF	1	0000010928	4	BOLT, MACHINE, 1/2 IN, 2 IN, SS, 304, HEX HEAD
				0000012277	4	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, HEX
				0000013128	4	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				0000013407	8	WASHER, ROUND, ROUND,FLAT,SS,304,ALLOY,FOR,1/2"
				0000434241	1	SWITCH, DISCONNECT TEMP
	2	DECLMP(WIRE)F	2	-	1	DEADEND CLAMP
	3	IDES25PF	2	0000080577	1	INSULATOR, DEADEND, POLYMER,25KV,DE,SILICONE, 15KV
	4	KLC2H(WIRE)ALF	2	-	1	LUG, COMPRESSION, 2 HOLE

NOTES:

1. SEE DWG. 08.10-18A FOR THE PREFERRED 600 AMP SWITCH INSTALLATION. INLINE SWITCHES MAY BE USED TO FACILITATE CONSTRUCTION, RESTORATION OR REPAIR. WHEN USED FOR THESE PURPOSES, THEY SHOULD BE REMOVED AT THE COMPLETION OF WORK. INLINE SWITCHES MAY BE USED FOR A PERMANENT INSTALLATION WHEN THE PREFERRED INSTALLATION IS IMPRACTICAL OR IMPOSSIBLE.

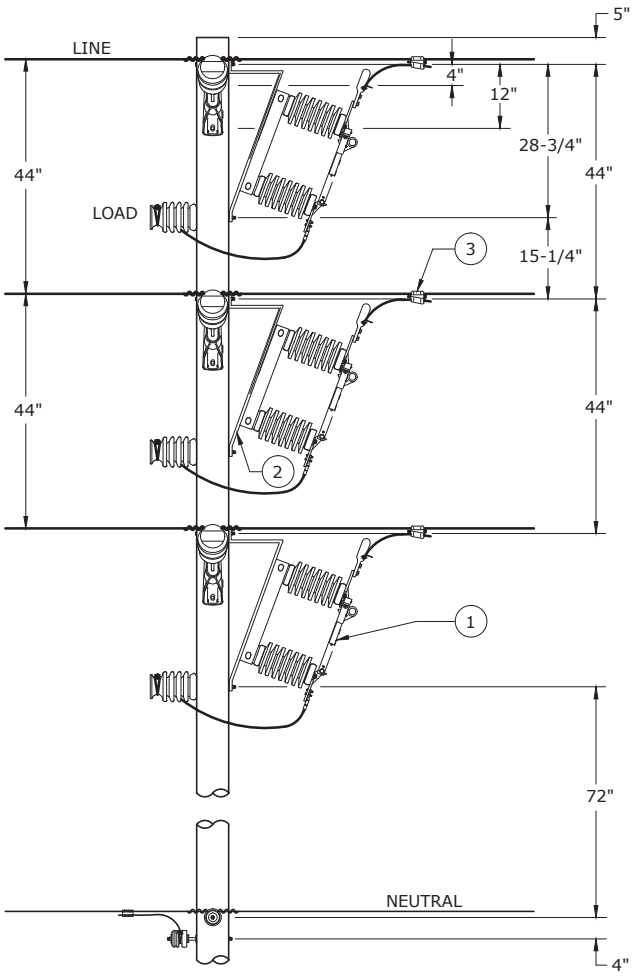
REVISED		BY	CK'D	APPR.
3				
2	9/4/14	LOOSIER	DANNA	ADCOCK
1	11/21/11	ROBESON	BURLISON	ELKINS
0	11/5/10	HOFFMAN	GUINN	ELKINS

600 AMP INLINE DISCONNECT

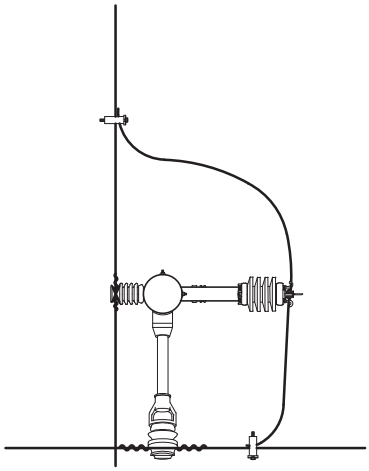
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.10-24



FRONT VIEW



PLAN VIEW
TANGENT CONSTRUCTION

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	SW156SBDF	3	260136	1	SWITCH, SOLID BLADE 600 AMP
				012277	4	NUT, SS, HEX
				013128	4	WASHER, ROUND, BELLEVILLE, SPRING
				010928	4	BOLT, MACHINE, SS, HEX HEAD, 1/2" X 2"
				013407	8	WASHER, ROUND, FLAT, SS
				152074	2	BOLT, MACHINE, HEX HEAD, 1/2" X 2"
	2	BKTSBDSWSTLF	3	070282	1	BRACKET, MOUNTING WD/CONCRETE POLE
				013264	2	WASHER, SPRING, COIL, FOR 5/8", STL, GALV.
				152107	2	BOLT, MACHINE, SQ, 5/8" X 12"
				013308	2	WASHER, 2-1/4", SQUARE FLAT, 13/16" HOLE
	3	KWP4H79F	3	165288	1	CONNECTOR, WEDGE, 4-HOLE, 795 AAC

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.

REVISED		BY	CK'D	APPR.
3				
2	4/9/13	McCONNELL	DANNA	ADCOCK
1	3/21/13	McCONNELL	DANNA	ADCOCK
0	1/23/13	ROBESON	GUINN	ADCOCK

VERTICAL TANGENT CROSSING WITH 600 AMP DISCONNECTS

DUKE ENERGY.

FLA

DWG. 08.10-26

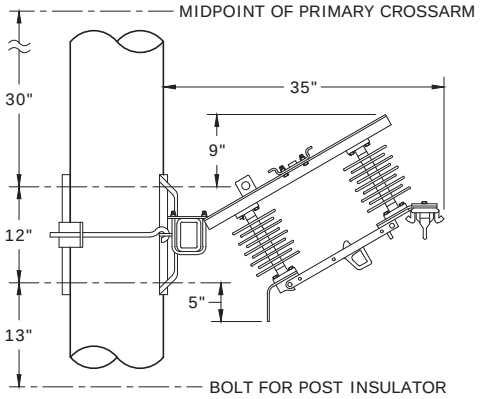
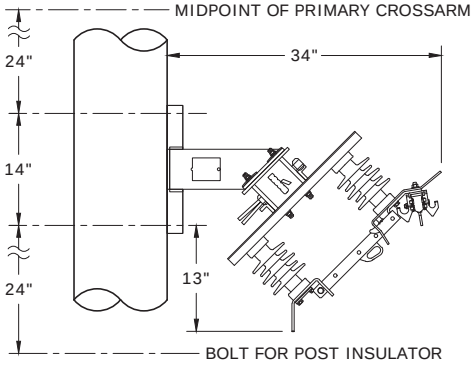
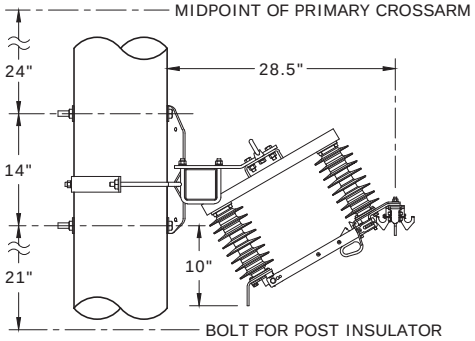


ABB 27KV



EATON 27KV



HUBBELL 27KV

BILL OF MATERIALS

COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
SW-BYPASS-600-25KV-3P-NLB-RECL-F	1	1460379	1	SWITCH, DISC, OH, TRIPLE BLADE BYPASS NON-LOADBRK 27KV 600A 125KV BIL
		930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
		939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL

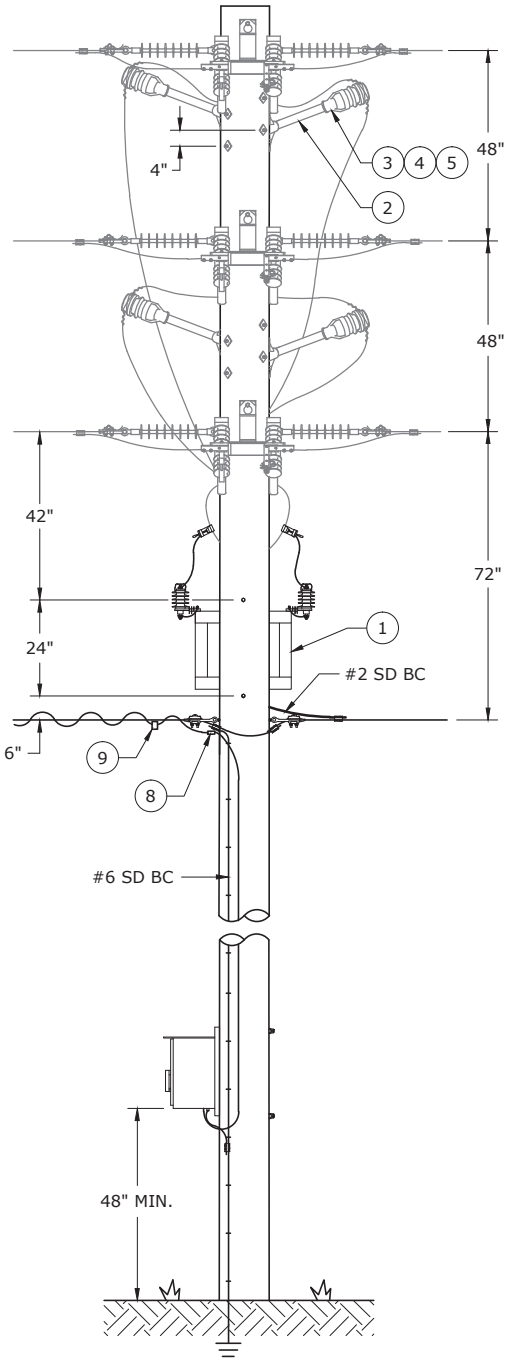
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	12/31/18	BRUINS	BURLISON	ADCOCK

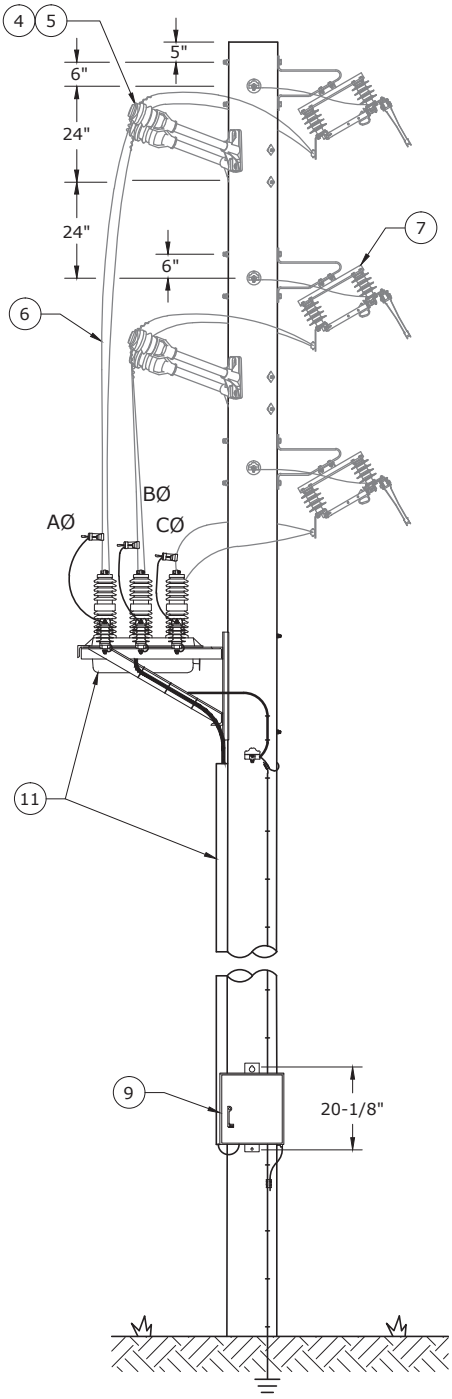
TRIPLE-BLADE BYPASS SWITCH
ABB - EATON - HUBBELL
BOLT SPACING DETAILS

DEC	DEM	DEP	DEF
			X

08.10-110



FRONT VIEW



SIDE VIEW

NOTES:

1. ENGINEER MUST SPECIFY JUMPER AND PRIMARY CONNECTOR SIZE.
2. REFER TO DWG. 08.12-04C FOR WIRING DIAGRAM.
3. SEE DWG. 08.12-04B FOR BILL OF MATERIALS.
4. BOND TANK AND FRAME WITH #2 SD BC TO SYSTEM NEUTRAL.
5. ON A PRIMARY METERED CUSTOMER, PLACE THE VERSAVAC SWITCH ON THE LOAD SIDE OF THE PRIMARY METERING INSTALLATION.

3				
2				
1				
0	5/1/15	DANNA	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

VERSAVAC LOAD CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-04A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
SWOVLRFRMFM	1	BKTLCVVACEPF	1	9220278631	1	BRACKET, VERSAVAC, 3PH TY 3H E-P
	2	BKTFBFGPIN15138F	4	013264	2	WASHER, LOCK, 5/8 IN, STEEL, GLV, SPRING, DOUBLE COIL, F
				013346	2	WASHER,3", SQUARE, CURVED, 13/16", HOLE
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				9220087868	1	BRACKET, FIBERGLASS STAND-OFF, 1-3/8" THREAD
	3	ISSTUDBOLT5814F	8	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				072368	1	STUD, LINE POST, 5/8" X 14"
	4	IPIN25PF	4	9220091018	1	INSULATOR, 25 KV POLYMER, 1-3/8" THREAD
	5	TTIEF500COVALPF	4	9220068094	5	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
	6	RCRISER40ALF	6	202111	8	CABLE, XLP UG AL 4/0
	7	SW156BYPF	3	260123	1	SWITCH, BY-PASS, 3-SLD BLADE DISC, 15KV, LBK HOOKS, 600A
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16", HOLE, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				010928	8	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD, 1/2" X 2"
				013128	8	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				013407	16	WASHER, ROUND, STAINLESS STEEL, 304 ALLOY, FOR 1/2" BOLT
				012277	8	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, COARSE, THREAD, 1
	8	AREQSC120F	1	220139	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE*
	9	SWOSCADACNTKITF	1	263165	1	RISER, KIT-SCADA CONTROL
	10	FUSESEC30F	1	230464	1	FUSE, SEC INS 30 AMP
VERSAVAC SWITCH USED FOR LOAD CONTROL - SWITCH AND CONTROL CABLE						
-	11	SW152VVACF	1	9220278629	1	SWITCH, VACUUM, 15KV 200A
				264219	1	CABLE, IS1 VLR SW CNTRL 35
				192281	30	CABLE, CONTROL, #10, 2 - CONDUCTOR
				0011060100	5	WIRE, TIE, #4 ALUMINUM, SLD
				470114	6	GUARD, TRANSFORMER, WILDLIFE, ROUND, GRAY MIN. 9"
	12	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV, HD MOV
	13	KHLC40N6F	6	9220184790	1	CLAMP, HOT LINE, ALUM, SMALL, 4/0
VLR SWITCH - FOR REMOVAL ONLY						
-	-	SW154VLRF	1	263138	1	SWITCH, OH, 15KV, 400A, COOPER VLR, LD BRK
	-	SWOHASTCNTLAKF	1	263136	1	SWITCH, OH, 15KV, 400A, COOPER VLR, W/FAULT BLOCK, LD BRK

NOTES:

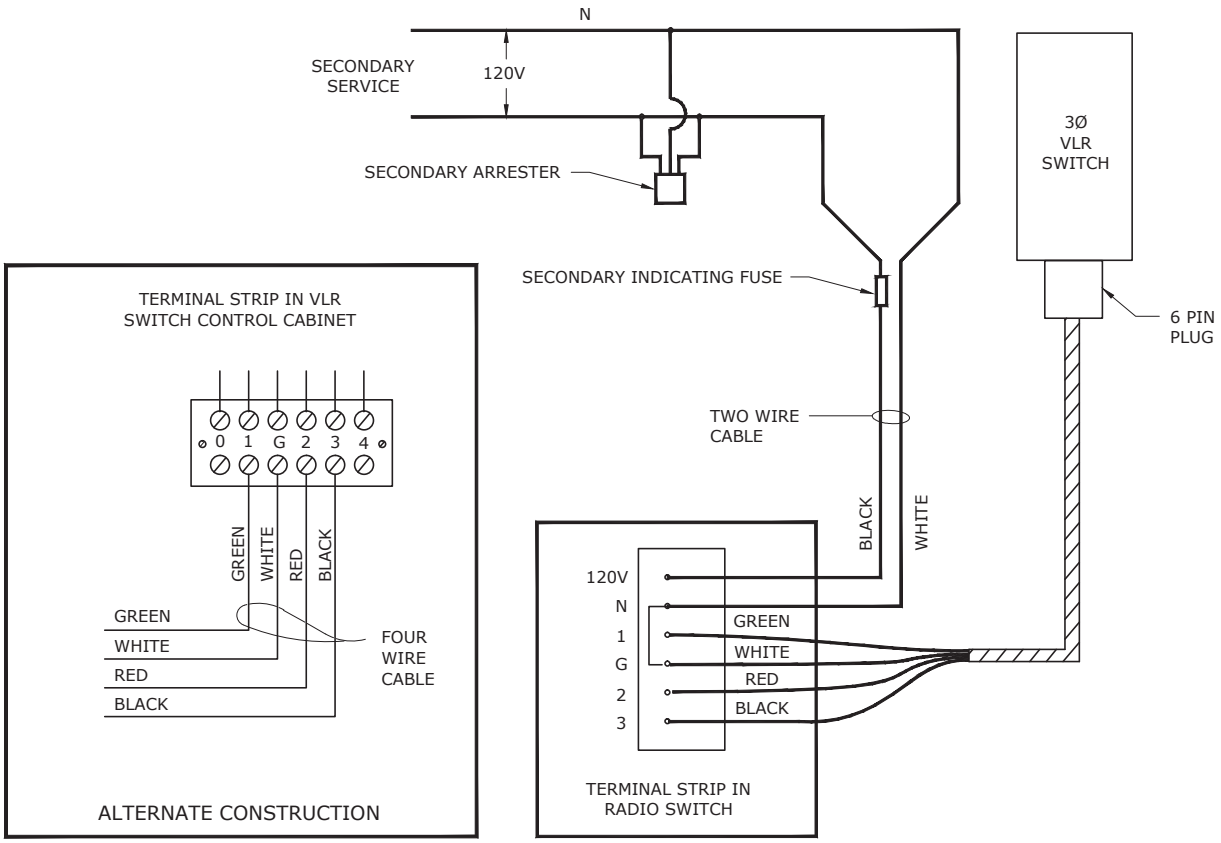
1. SEE DWG. 08.12-04A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/2/15	LOOSIER	BURLISON	ADCOCK
0	5/1/15	DANNA	BURLISON	ADCOCK

VERSAVAC LOAD CONTROL

DEC	DEM	DEP	DEF
			X

08.12-04B



TERMINAL	WIRE	FUNCTION
120V	BLACK	120V FROM SOURCE
N	WHITE	NEUTRAL FROM SOURCE
1	GREEN	POWER TO SWITCH
G	WHITE	NEUTRAL TO SWITCH
2	RED	CLOSE
3	BLACK	TIP

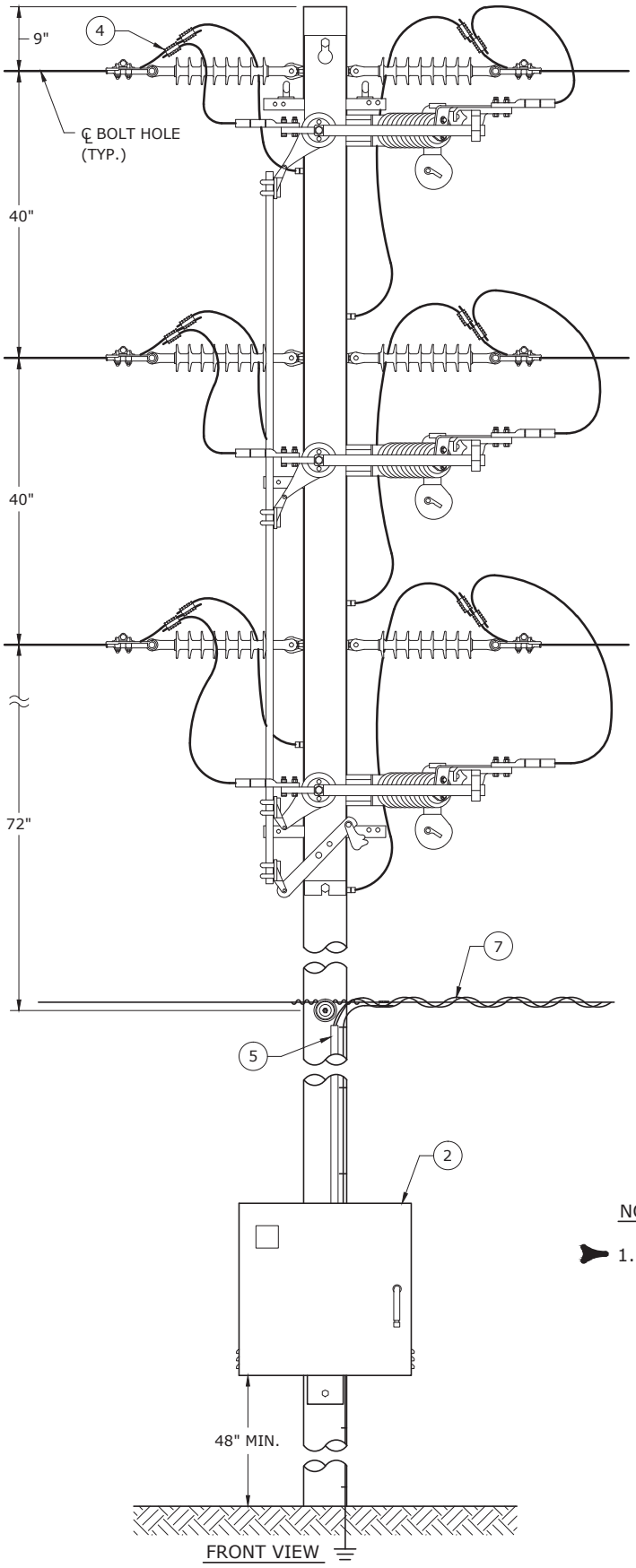
3				
2				
1				
0	5/1/15	DANNA	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

CONNECTION DIAGRAM FOR
VERSAVAC SWITCH

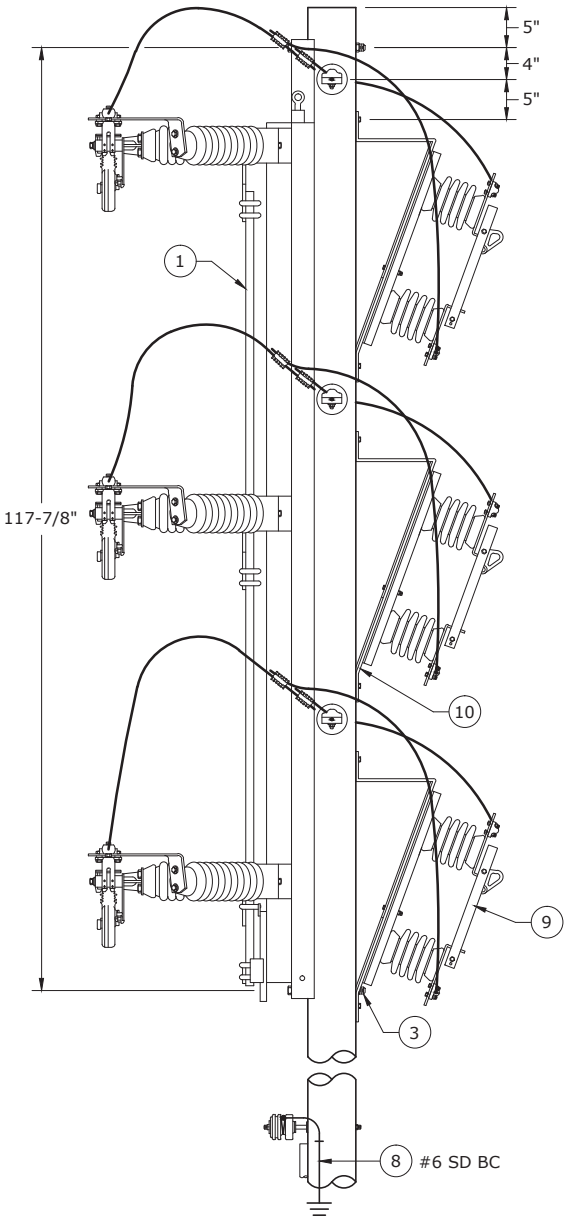
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-04C



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 08.12-06B FOR PLAN VIEW, NOTES AND BILL OF MATERIALS.

3				
2				
1	1/26/16	LOOSIER	BURLISON	ADCOCK
0	8/27/15	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

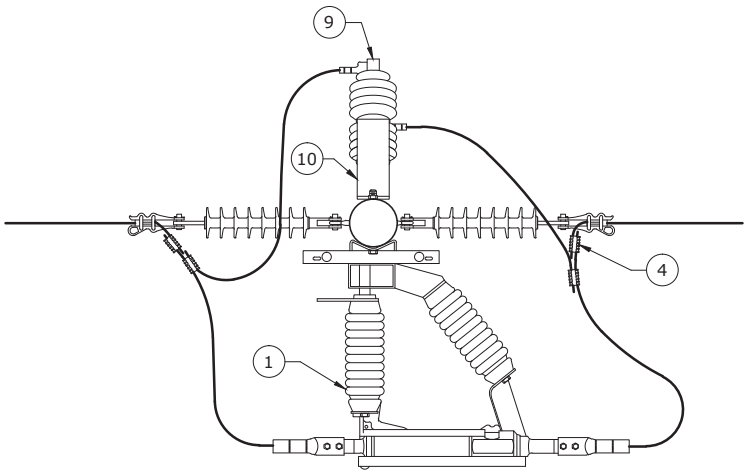
LOAD CONTROL SWITCH

600 AMP

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-06A



PLAN VIEW
(CONTROL OPERATOR REMOVED FOR CLARITY)

BILL OF MATERIALS

MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	SW2512ALDF	1	9220270022	1	SWITCH, OVERHEAD, 15KV 1200A, 3PH, ALDUTI-RUPTER, FBGLASS
				013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				13307	2	WASHER, 2-1/4",SQUARE,FLAT,11/16",HOLE
				152107	2	BOLT, MACHINE, SQ NUT, 5/8" X 12"
	2	SWOHASTCNTLAKF	1	9220269976	1	SWITCH, CONTROL, OPERATOR, ALDUTI-RUPTER SWITCH, KIRK KEY
				013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				13307	2	WASHER, 2-1/4",SQUARE,FLAT,11/16",HOLE
				152107	2	BOLT, MACHINE, SQ NUT, 5/8" X 12"
	2	SWOHASTCNTLAF	1	9220279778	1	SWITCH, CONTROL, OPERATOR, ADULTI-RUPTER, W/O KIRK KEY
				013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				13307	2	WASHER, 2-1/4",SQUARE,FLAT,11/16",HOLE
				152107	2	BOLT, MACHINE, SQ NUT, 5/8" X 12"
	3	-	-	152107	2	BOLT, MACHINE, SQ NUT, 5/8" X 12"
	4	-	-	155331	6	LUG, COMPRESSION, 2H - 795 AL
	5	CRIS1UGPVC10WF	15	014111	15	SCREW, LAG, 1/2" X 2"
				323421	1	1" X 10 FT U GUARD
	6	CABGRP1X125F	1	320452	1	CABLE GRIP, SINGLE EYE
	7	WUSNGDPXRF	1	202107	30	#6 DPX 600V SL CABLE
	8	-	-	-	-	#6 CU GND
	9	SW156SBDF	3	010928	4	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD,1 /2"X2"
				012277	4	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL
				013128	4	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				013407	8	WASHER, ROUND, FLAT, STAINLESS STEEL, 304, ALLOY, FOR,1/2"
				152074	2	BOLT, MACH, HEX, HD, 1/2"X2"
				260136	1	SWITCH, DISCONNECT, SOLID BLADE, 15KV, 600A, 1PH, SWITCH
	10	BKTSBDSWSTLF	3	013264	2	WASHER, SPRING, COIL, STEEL, 5/8", BOLT, GALV
				013308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16
				070282	1	BRACKET, MNTG WD/CNCR POLE
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"

NOTES:

1. SEE DWG. 08.12-06A FOR DESIGN SPECIFICATIONS.
2. JUMPERS SHALL MATCH CONDUCTOR SIZE.
3. USE AS A LOAD CONTROL SWITCH WHERE A KIRK KEY SYSTEM IS IN PLACE.
4. PLACE SWITCH ON LOAD SIDE OF PRIMARY METERED CUSTOMERS.
5. FOR SWITCH OPERATOR WITHOUT KIRK KEY, USE ITEM # 9220279778.

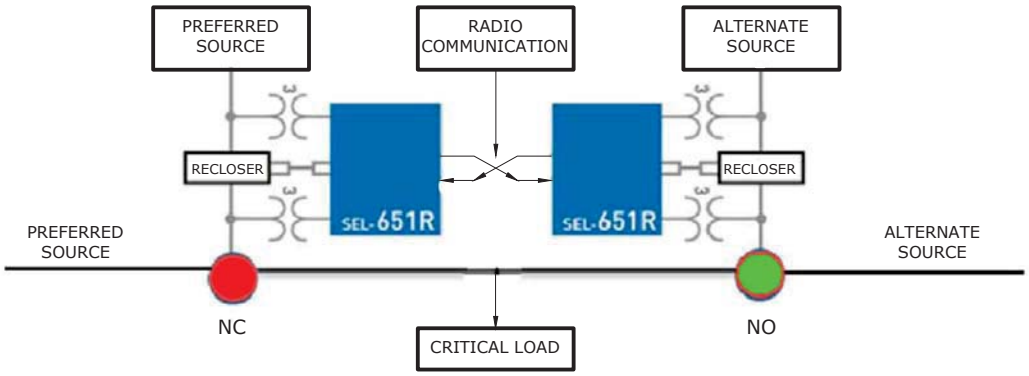
3				
2				
1	12/2/15	LOOSIER	BURLISON	ADCOCK
0	8/27/15	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

LOAD CONTROL SWITCH
600 AMP

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-06B



AN OVERHEAD AUTOMATIC TRANSFER SCHEME IS SHOWN IN THE ABOVE DRAWING. A MINIMUM OF 3 POLES ARE REQUIRED FOR THE INSTALLATION. THE LOAD IS CONNECTED TO THE CIRCUIT BETWEEN THE TWO VIPERS RECLOSERS. RADIO COMMUNICATION CONNECTS THE (2) 651R SEL RELAYS. THE TRANSFER RECLOSERS WILL MAKE AN OPEN TRANSFER (OPEN AND THEN CLOSE) UPON LOSS OF ONE OR MORE PHASE VOLTAGES (THREE PHASE SENSING) ON THE PREFERRED SOURCE PROVIDED A FAULT IS NOT IN THE TRANSFERRED CIRCUIT (FAULT BLOCK FEATURE). EITHER SOURCE CAN BE CHOSEN AS THE PREFERRED SOURCE FROM THE CONTROL SELECTIONS, THE RETRANSFER TIME AND OPEN OR CLOSE TRANSITION ARE SELECTABLE.

NOTES:

1. FOR VIPER ST RECLOSER INSTALLATION/ BOM SEE DWGS. 08.06-11A, 08.06-11B, 08.06-11C, 08.06-15A, 08.06-15C, 08.06-15D, 08.06-16A, 08.06-16B AND 08.06-17.

2. SEE DWG. 08.13-102 FOR RADIO/ ANTENNA INSTALLATION.

3. SEE DWG. 08.13-103 FOR RADIO/ANTENNA WIRING.

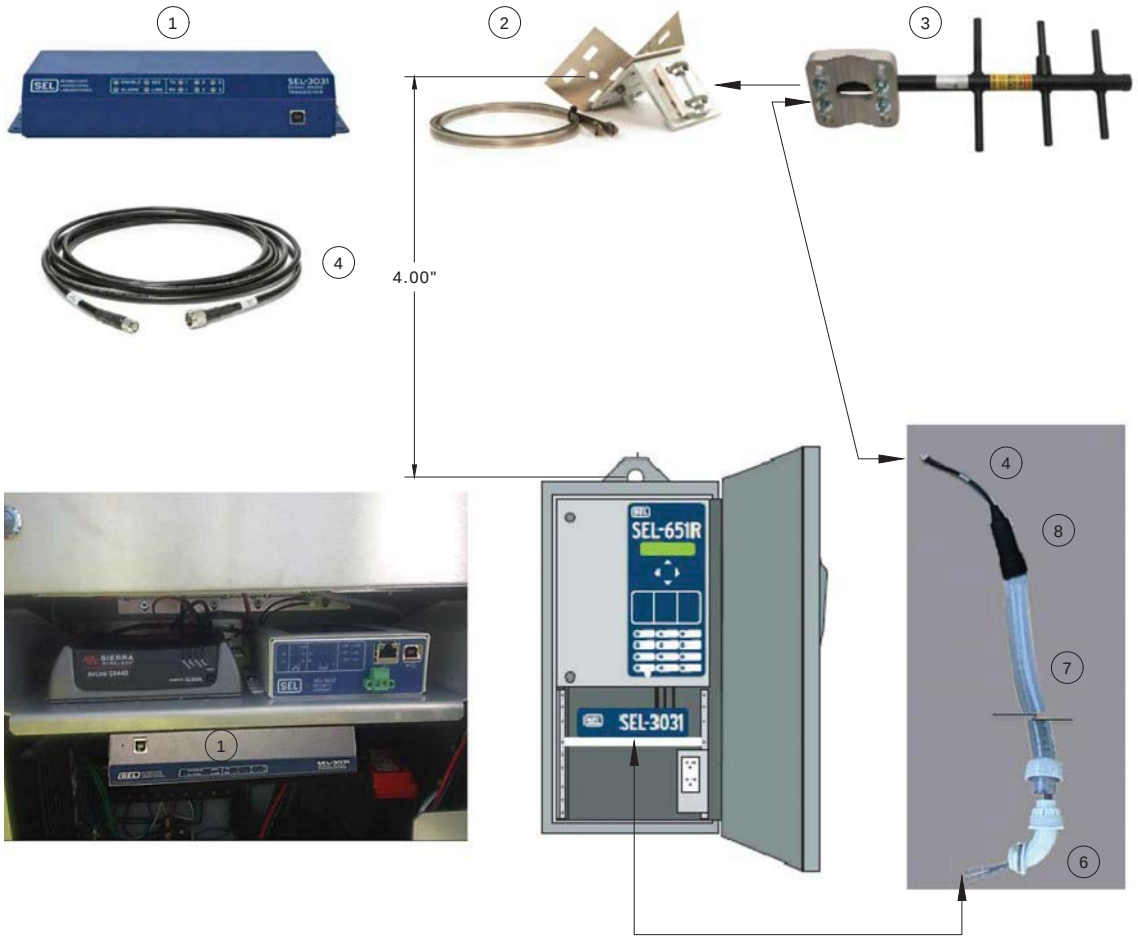
3				
2				
1				
0	7/31/17	BRAVO	LOOSIER	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

OVERHEAD AUTOMATIC TRANSFER SCHEME

DEC	DEM	DEP	DEF
			X

08.13-101



BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	COMM-ANT-YAGI-10FT-KIT-RADIO-S3031-F	2	1546215	1	RADIO, 900MHZ, SEL 3031, W/ MOUNTING KIT, HOPPING/WALL MOUNT/ 9-30 VDC/ EIA -232/ENCRYPTION CARD, BELOW SHELF
2	-	-	1546206	1	BRACKET, ANTENNA, YAGI, F/ 14" DIA POLE MAX. (INCLUDED IN RADIO CU)
3	-	-	1546205	1	ANTENNA, DIRECTIONAL, 902-938MHZ, N FEMALE CONNECTOR, 8.5 DBI GAIN (INCLUDED IN RADIO CU)
4	-	-	1546207	1	CABLE, FEED LINE, 10' LG, RG-8X TNC MALE TO N MALE COAXIAL (INCLUDED IN RADIO CU)
5	-	-	-	1	RADIO MOUNTING KIT: INCLUDE POWER WIRE, GROUND WIRE, SERIAL CABLE, AND ANCILIARIES (INCLUDED IN RADIO CU)
6	RISER-1IN-COMM-FLEX-YAGI-F	2	4006681	1	CONNECTOR, CABLE/CONDUIT, 1" HUB, 90 DEG, NON METALLIC, END
7			4006679	9 FT.	CONDUIT, FLEXIBLE LIQUIDTIGHT NON METALLIC, 1", GRAY PVC
8			4004757	1	COVER, INSULATING, F/ #6 THRU 350 MCM
9			4030706	7	STRAP, CONDUIT, 2 HOLE, 1", FOR FLEX CONDUIT

NOTES:

1. CUT COVER (ITEM # 4004757) ON THE 1/0 RING AND CUT ALONG TO ALLOW COAXIAL CABLE CONNECTOR TO GO THROUGH- USE AQUA SEAL AND TAPE TO PREVENT WATER INTRUSION.
2. ANTENNAS TO FACE EACH OTHER- VERTICAL ORIENTATION.
3. BOTH POLE RECLOSER-RADIO-ANTENNA INSTALLATIONS ARE IDENTICAL.
4. SEE DWG. 08.13-101 FOR OVERVIEW OF ENTIRE OVERHEAD AUTOMATIC TRANSFER SCHEME.
5. SEE DWG. 08.13-103 FOR RADIO/ ANTENNA WIRING.

DUKE ENERGY.

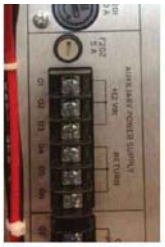
3				
2				
1	7/13/18	BRAVO	BURLISON	ADCOCK
0	7/31/17	BRAVO	LOOSIER	ADCOCK
REVISED		BY	CHK'D	APPR.

OVERHEAD AUTOMATIC TRANSFER SCHEME

RADIO-ANTENNA MOUNTING

DEC	DEM	DEP	DEF
			X

08.13-102



TO YAGI ANTENNA

TO 12 VDC AUX POWER SUPPLY ON RELAY (DO NOT CONNECT POWER BEFORE ANTENNA CONNECTION)

TO PORTS # 2 AND 3 IN RELAY

CABLE, SERIAL CONNECTION, EIA 232 PORTS

WIRE, 2X14 AWG WITH CONNECTORS

RG-8X TNC MALE TO N MALE CABLE 10 FEET

SEL-3031 WALL-MOUNT REAR PANEL

WIRE, 12 AWG WITH CONNECTORS

TO GROUND

NOTES:

1. DO NOT CONNECT POWER TO RADIO BEFORE CONNECTING THE ANTENNA TO THE RADIO.
2. SEE DWG. 08.13-101 FOR OVERVIEW OF ENTIRE OVERHEAD AUTOMATIC TRANSFER SCHEME.
3. SEE DWG. 08.13-102 FOR RADIO/ ANTENNA MOUNTING.

3				
2				
1				
0	7/31/17	BRAVO	LOOSIER	ADCOCK
REVISED		BY	CHK'D	APPR.

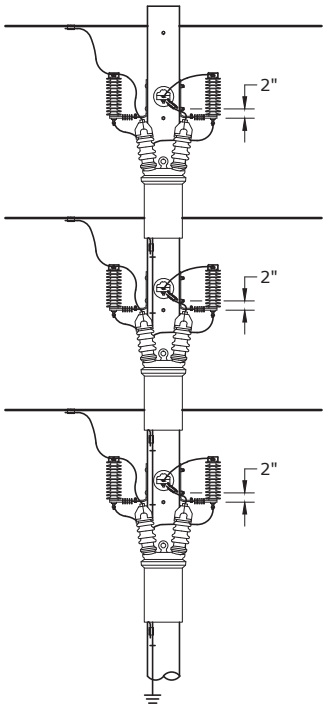
AUTOMATIC TRANSFER RADIO CONNECTIONS

DUKE ENERGY.

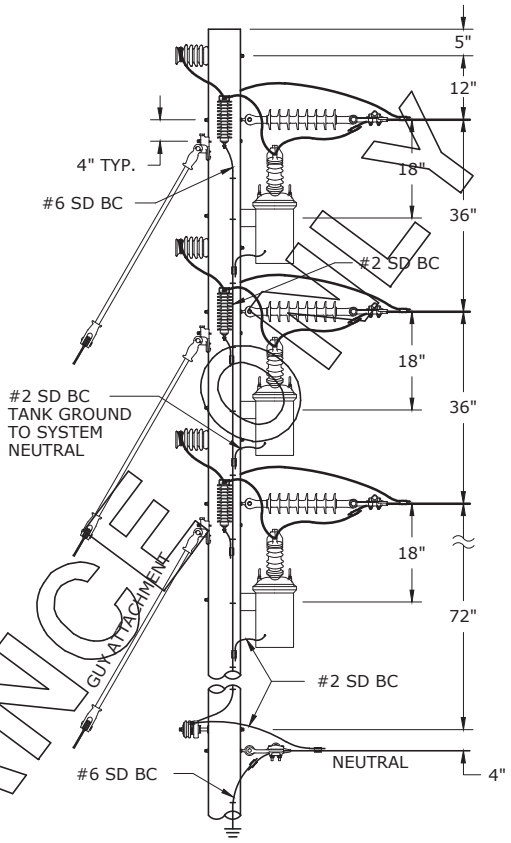
DEC	DEM	DEP	DEF
			X

08.13-103

TANGENT TO DEADEND

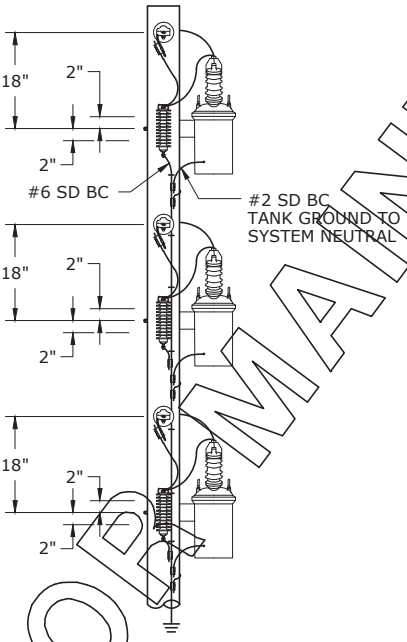


FRONT VIEW

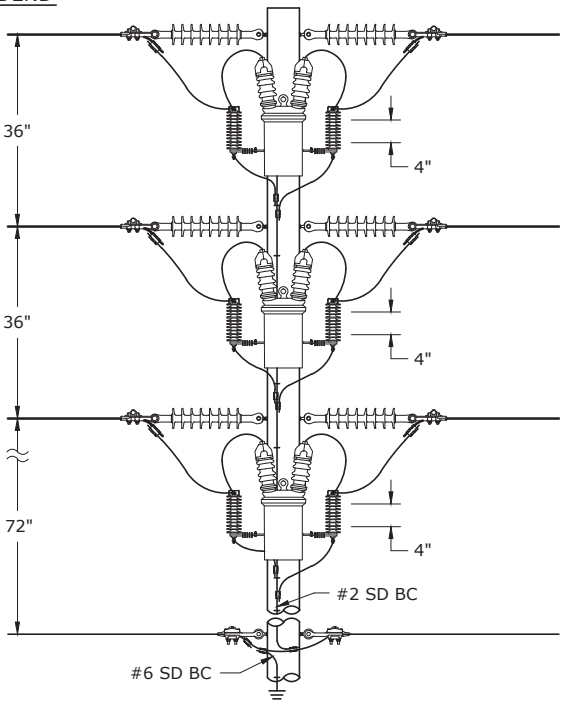


SIDE VIEW

DEADEND TO DEADEND



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

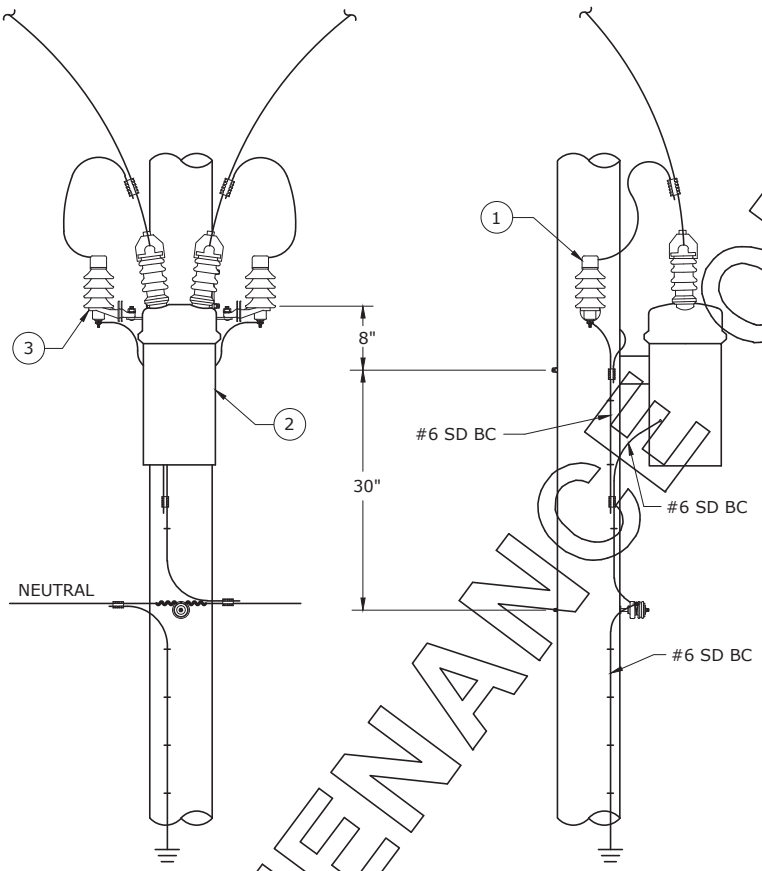
3				
2				
1				
0	10/13/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VERTICAL CONSTRUCTION TO VERTICAL CONSTRUCTION WITH OIL SECTIONALIZER (FMO)

Duke Energy®

FLA

DWG. 08.04-06



FRONT VIEW SIDE VIEW

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	AREQOH10F	2	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE
				193511	2	CABLE, 600V #6 SOLID SD CU
	2	SECT	1	-	1	SECTIONALIZER
	3	BKTCOLASTLXARMF	2	070101	1	BRACKET, LA AND CO TY A

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
2. ARRESTERS TO BE MOUNTED ON SOURCE AND LOAD SIDE.

3				
2				
1				
O	10/13/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

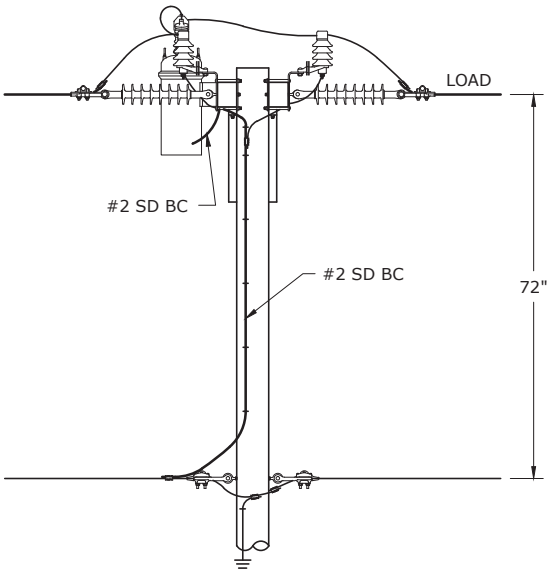
SECTIONALIZER ASSEMBLY,
OIL TYPE, VERTICAL (FMO)

Duke Energy

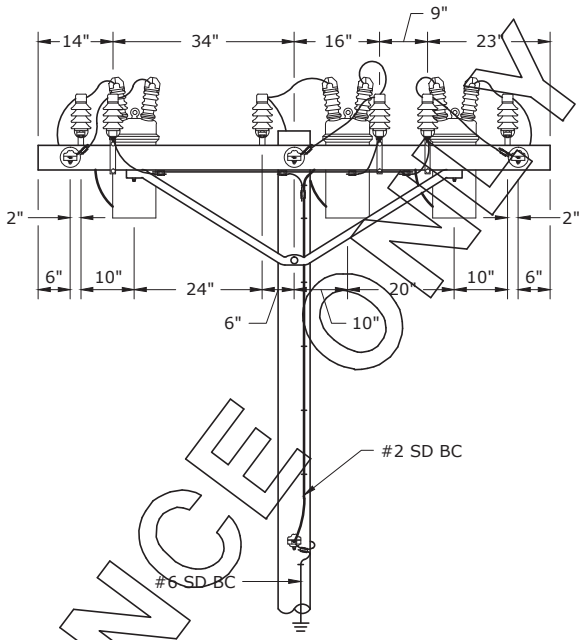
FLA

DWG. 08.04-08

DEADEND TO DEADEND

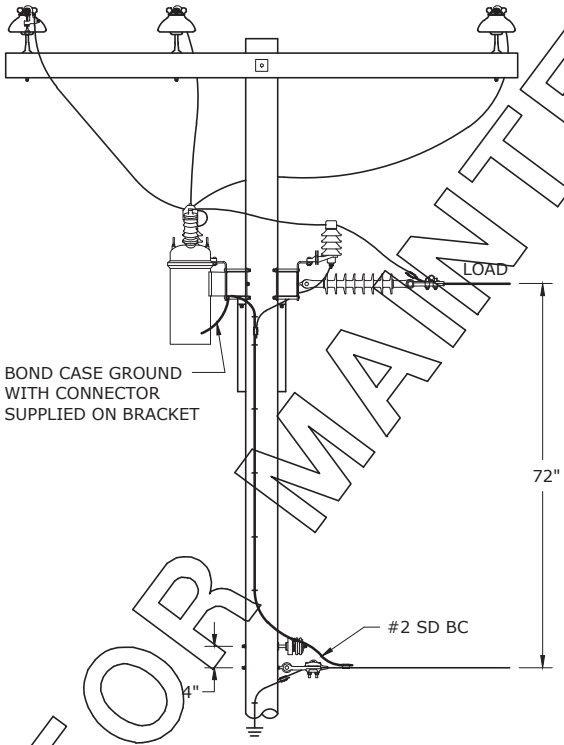


SIDE VIEW

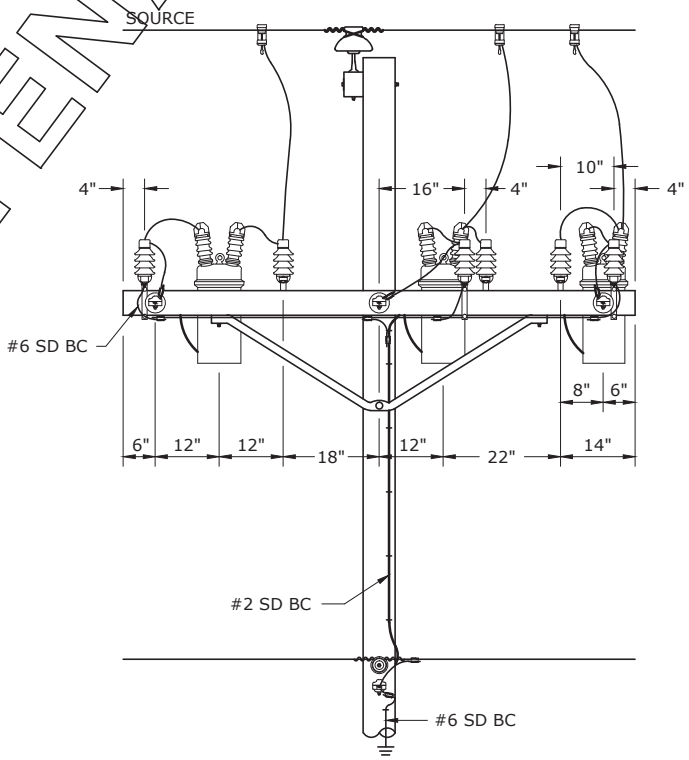


FRONT VIEW

TANGENT TO DEADEND



SIDE VIEW



FRONT VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
2. RUN #2 SD BC UNDER CROSSARM TO B0ND SECTIONALIZERS TO SYSTEM NEUTRAL.

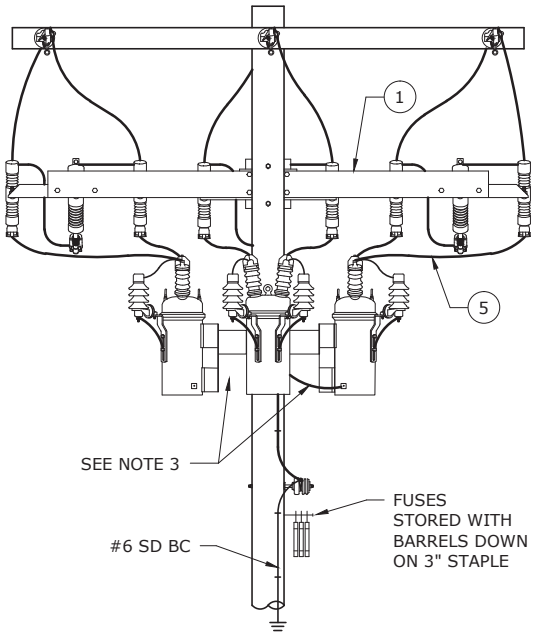
3				
2				
1				
0	10/13/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

HORIZONTAL CONSTRUCTION TO HORIZONTAL CONSTRUCTION WITH OIL SECTIONALIZER (FMO)

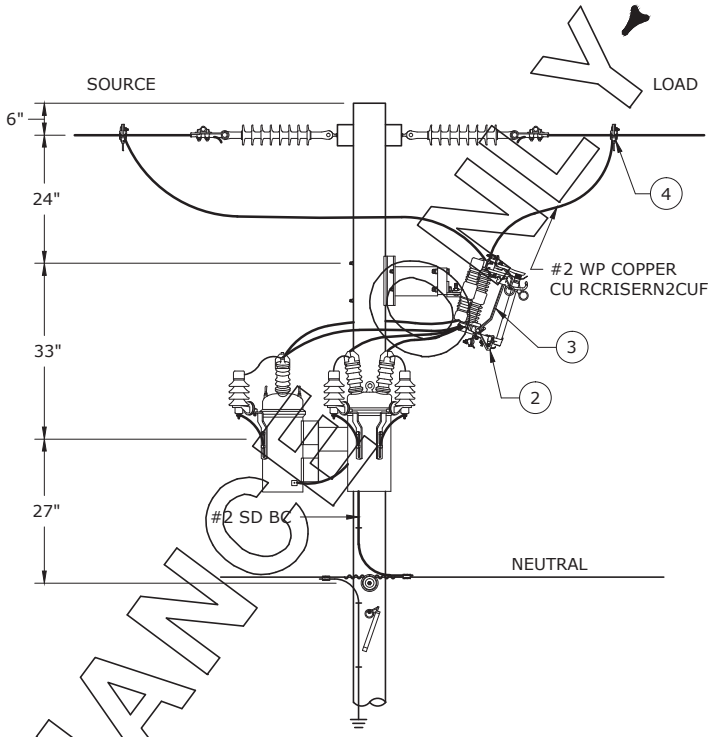
Duke Energy®

FLA

DWG. 08.04-12



FRONT VIEW



SIDE VIEW

NOTES:

1. ISSUE RECLOSER SEPARATELY. RECLOSER WILL COME ARRESTERS PRE-MOUNTED.
2. SEE DWG. 08.01-11 FOR CUTOUT MOUNTING DETAILS
3. EQUIPMENT CASE GROUND TO NEUTRAL TO BE #2 SD BC.
4. SEE DWG. 08.05-17B FOR BILL OF MATERIALS AND DETAILS ON ALUMINUM CROSSARM.
5. FOR TWO-PHASE HORIZONTAL INSTALLATIONS, ONLY INSTALL RECLOSERS AND SWITCHES ON OUTSIDE TWO PHASES.

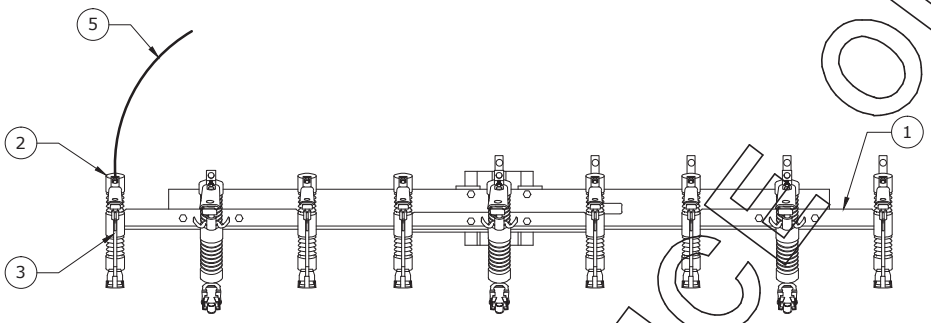
REVISED	BY	CK'D	APPR.
3 1/6/16	LOOSIER	BURLISON	ADCOCK
2 11/17/15	LOOSIER	BURLISON	ADCOCK
1 8/7/14	SALAS	GUINN	ADCOCK
0 10/6/10	HOFFMAN	GUINN	ELKINS

DUKE ENERGY.

RECLOSER ASSEMBLY, HORIZONTAL CONSTRUCTION (FMO)

DEC	DEM	DEP	DEF
			X

08.05-17A



FRONT VIEW

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D 2Ø	QTY REQ'D 3Ø	ITEM NUMBER	QTY PER CU	DESCRIPTION
-	1	BKTCOLA8AALF	1	1	9220205263	1	BRACKET, CUTOUT, BYPASS CUTOUT, 9 POSITION, AL, 97-1/2"
					10034908	2	BOLT, MCH, SQ, GLV, 5/8" X 12"
					10540102	2	WASHER, SQ., RB, CRV, 3" X 3"
					10544005	2	WASHER, LK, 5/8", COIL, DBL, GLV.
	2	FUSE15CO100F	2	3	221112	1	CUTOUT, LB, 15KV, 100A, 16KA, 110KV BIL
	3	SW153COSBDF	4	6	221112	1	CUTOUT, LB, 15KV, 100A, 16KA, 110KV BIL
					269046	1	BLADE, SOLID, CUTOUT, 15KV, 300A
	4	KHLC40N6F	4	6	9220184790	1	CLAMP, HOT LINE, ALUMINUM, SMALL
	5	RCRISERN2CUF	2	3	193513	1	CABLE, 600V, #2 SD CU, 7 STR.

NOTES:

1. SEE DWG. 08.05-17A FOR DESIGN SPECIFICATIONS AND NOTES.

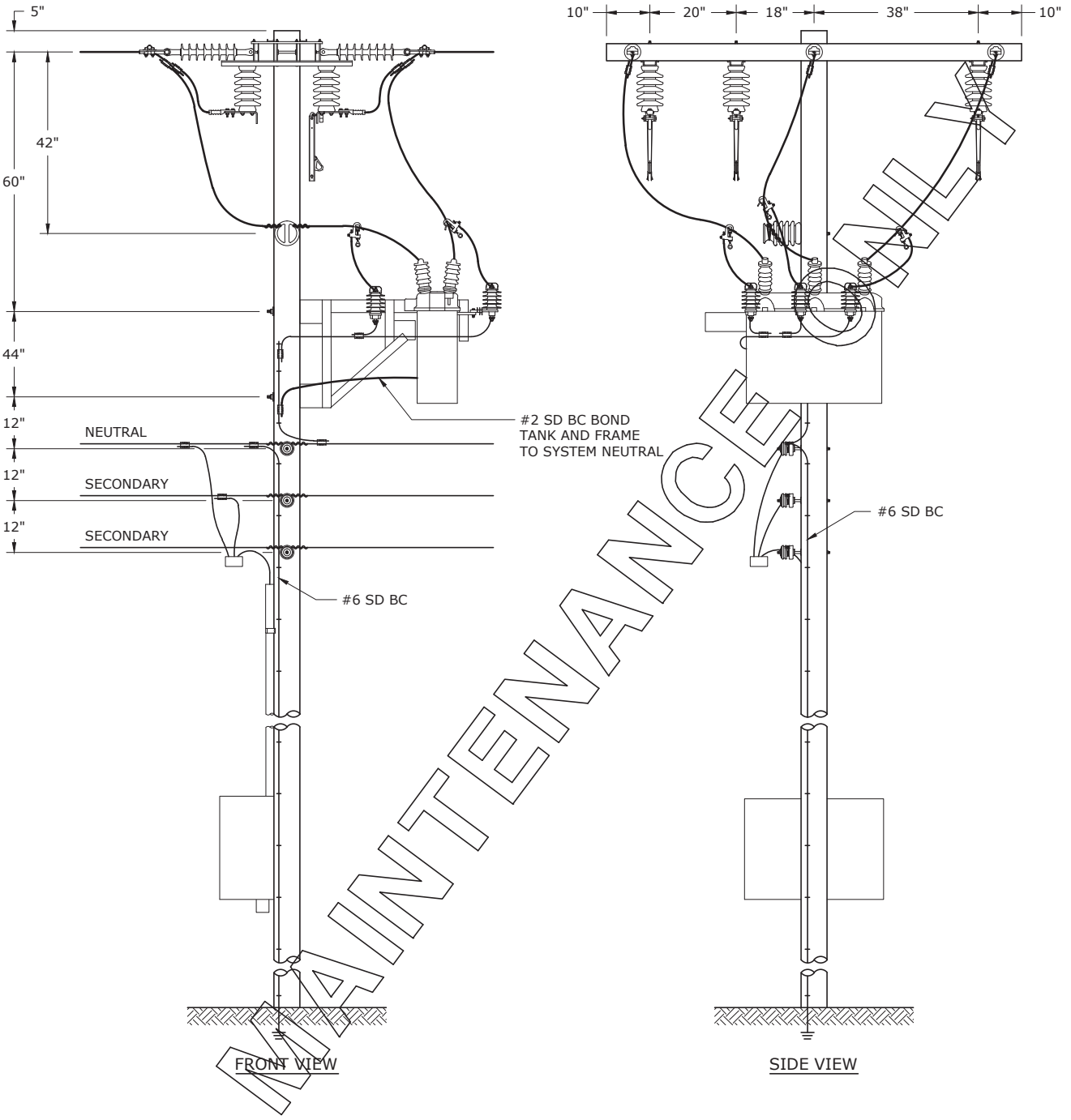
REVISED		BY	CK'D	APPR.
3				
2				
1	1/6/16	LOOSIER	BURLISON	ADCOCK
0	10/6/10	HOFFMAN	GUINN	ELKINS

RECLOSER ASSEMBLY,
HORIZONTAL CONSTRUCTION (FMO)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.05-17B



NOTES:

1. CONTROL BOX AND SECONDARY REQUIRED FOR ELECTRONIC RECLOSER ONLY.
2. ISSUE RECLOSER AND ELECTRONIC CONTROL SEPARATELY.
3. RECLOSER MAY BE REVERSED IN HANGER TO ACCOMMODATE SOURCE AND LOAD POSITION.
4. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

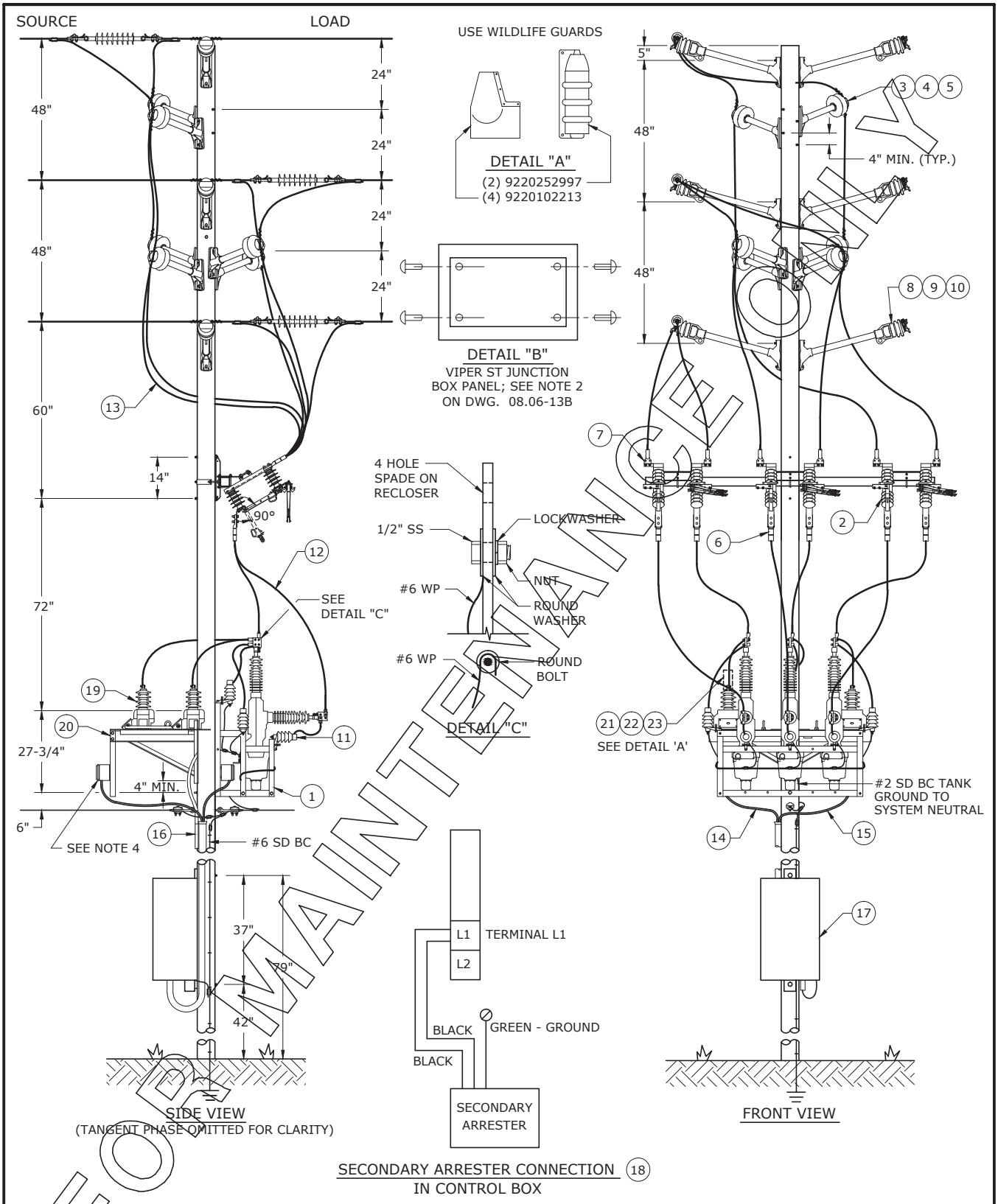
3				
2				
1				
0	10/11/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

RECLOSER ASSEMBLY, THREE-PHASE, HORIZONTAL, 600 AMP SWITCH (FMO)

Duke Energy®

FLA

DWG. 08.06-12



NOTES:

1. SEE DWG. 08.06-13G FOR BILL OF MATERIALS AND NOTES.
2. LEADS TO RECLOSER MUST BE A MINIMUM OF 14 INCHES CLEARANCE FROM THROUGH CIRCUIT.
3. PT'S TO BE LOCATED ON SOURCE SIDE.
4. MOUNT PT JUNCTION BOX (INCLUDED WITH RECLOSER UNIT) ON PT BRACKET. WHOLE PT ASSEMBLY CAN BE BUILT ON GROUND PRIOR TO INSTALLATION.

3				
2				
1				
0	2/10/17	BRAVO	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DOUBLE CIRCUIT, THREE-PHASE, VIPER ST (FMO)

DEC	DEM	DEP	DEF
			X

08.06-13F

BILL OF MATERIALS

MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
	1	RCVST800E27HF	1	9220285091	1	RECLOSER, ELECTRONIC, G&W VIPER-ST, HORIZ MOUNT, 27 KV
	2	SW256RECBYPF	1	152107	2	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
				13308	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT, 13/16", HOLE, GALV.
				13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL
				9220248288	1	SWITCH, RECLOSER BY-PASS, THREE-PHASE HORIZONTAL
	3	BKTFBGPIN15138F	6	13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL
				13346	2	WASHER, 3", SQUARE, CURVED, 13/16" HOLE
				152107	2	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
				9220087868	1	BRACKET, STANDOFF, FIBERGLASS STAND-OFF, 1-3/8" THREAD
	4	IPIN25PF	6	9220091018	1	INSULATOR, 25 KV POLYMER, 1 3/8" THREAD
	5	TTIEF500COVALPF	6	9220068094	1	TIE, PLASTIC, 2-7/8", F-NECK, INSULATOR
	6	KLC2H50ALF	6	10928	2	BOLT, MACHINE, 1/2 IN X 2 IN, STAINLESS STEEL, HEX HEAD
				12277	2	NUT, HEX, 1/2 IN, STAINLESS STEEL
				13163	4	WASHER, FLAT, 1/2 IN, SILICON BRONZE, ROUND
				155326	1	LUG, COMPRESSION, 2H 500AL
				10542504	2	WASHER, ROUND, 1/2", SS, 1.375" OD
	7	KLC4H79ALF	6	10928	2	BOLT, MACHINE, 1/2 IN X 2 IN, STAINLESS STEEL, HEX HEAD
				12277	2	NUT, HEX, 1/2 IN, STAINLESS STEEL
				13163	4	WASHER, FLAT, 1/2 IN, SILICON BRONZE, ROUND
				10542504	2	WASHER, ROUND, 1/2", SS, 1.375" OD
				155464	1	LUG, COMPRESSION, 4HOLE, 795, AAC
	8	IHPTT15F	6	80212	1	INSULATOR, POST, TIE, TOP, 25KV
-	9	BKTFPIS30F	6	13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL
				13346	2	WASHER, 3", SQUARE, CURVED, 13/16" HOLE
				70431	1	BRACKET, STANDOFF, 30 IN, FIBERGLASS
				72361	1	STUD, LINE POST, 5/8" X 1-3/4"
				152107	2	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
	10	STIE795ALF	6	121434	1	TIE, E-Z, SIDE, F-NECK, 795, AAC
	11	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV, SIL. RUBBER POLY HOUSING
	12	RCRISER500ALF	6	202112	12	CABLE, XLP UG AL 500
	13	JUMP795ALF	12	9220218861	8	CONDUCTOR, ALUMINUM, AAC
	14	-	-	9220267667	-	CONTROL CABLE, 40' ARMORED 8 PIN FOR PT (INCL'D FRM MANUF.)
	15	RCVIPCAB40F	1	9220244739	1	VIPER ST CONTROL CABLE
	16	CRIS1UGPVC225WF	3	323422	1	GUARD, PVC, CABLE, 2-1/4" X 10'
				14111	15	SCREW, LAG, HX, 1/4' X 2', GALV
	17	RCCNTL651GWF	1	9220244823	1	SEL 651 CONTROL
	18	AREQSC120F	1	220179	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE
	19	RCPTREC15F	3	9220085231	1	TRANSFORMER, POTENTIAL, 15KV, 7200V
	20	BKT3PTRCTRISTLF	1	9220224674	1	BRACKET, MOUNTING, 42 IN, GALVANIZED STEEL, 3 PT MOUNTING
				152107	2	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
				9220132411	2	WASHER, SQUARE, 5/8 INCH SS, 2-1/4 INCH X 2-1/4 INCH
				13264	2	WASHER, LOCK, 5/8 IN, STEEL, GALV, SPRING, DOUBLE COIL
	21	WGRCSLDSVF	3	9220252997	1	GUARD, ANIMAL, SOLID COVER, STRAIGHT, VERTICAL
	22	WGRCLSHPF	3	9220102213	1	GUARD, ANIMAL, L-SHAPED, GUARD
	23	WGRCPTTRF	3	9220102214	1	GUARD, ANIMAL, PT OR VOLTAGE TRANSFORMER
	24	CABGRP2X250F	1	320456	1	GRIP, SINGLE EYE, 2 X 2-1/2
	25	-	-	356683	1	TIE, CABLE, PLASTIC, SELF-LOCKING, NON-RELEASE, WHITE

NOTES:

1. SEE DWG. 08.06-13F FOR DESIGN SPECIFICATIONS.
2. WHEN INSTALLING UNIT, OPEN JUNCTION BOX PANEL BY REMOVING SCREWS, RECORD 3 PT CORRECTION FACTORS LISTED AND PLACE ON INSIDE DOOR OF CONTROL. CLOSE JUNCTION BOX PANEL.
3. MINIMUM 55' POLE REQUIRED. WHEN DESIGNING, CONSIDER VERTICAL TENSION ON ADJACENT POLES.
4. ALL BOLTS ON PRIMARY CONNECTIONS ARE TO BE TORQUED TO 40 FT-LBS: **DO NOT EXCEED!**
5. PT'S TO BE LOCATED ON SOURCE SIDE. POWER SOURCE FOR PT'S FROM UNIT 1.
6. USE GROUNDING LUGS ON RECLOSER FRAME TO PROPERLY GROUND RECLOSER.
7. NEUTRAL MAY BE DOUBLE DEADENDED OR STRAIGHT THROUGH ON SPOOL AS NEEDED.

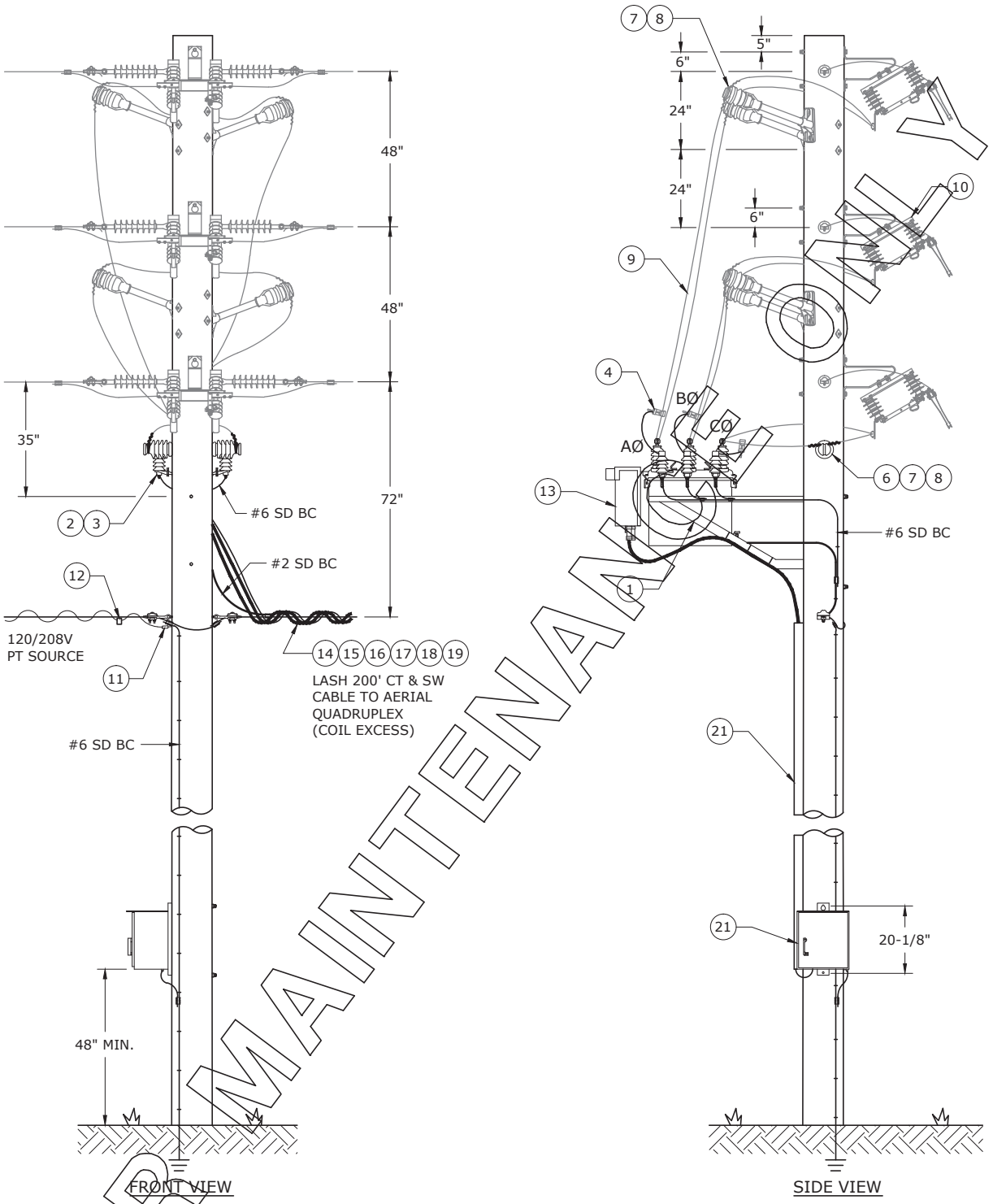
3				
2				
1				
0	2/10/17	BRAVO	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DOUBLE CIRCUIT, THREE-PHASE, VIPER ST (FMO)

DEC	DEM	DEP	DEF
			X

08.06-13G



NOTES:

1. ENGINEER MUST SPECIFY JUMPER AND PRIMARY CONNECTOR SIZE.
2. SEE DWG. 08.12-02B FOR BILL OF MATERIALS.
3. BOND TANK AND FRAME WITH #2 SD BC TO SYSTEM NEUTRAL.

REVISED	BY	CK'D	APPR.
3 7/31/17	BRAVO	LOOSIER	ADCOCK
2 11/11/13	DANNA	DANNA	ADCOCK
1 5/24/13	McCONNELL	DANNA	ADCOCK
0 11/29/10	HOFFMAN	GUINN	ELKINS

AUTO TRANSFER CONTROL SWITCH (FMO)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-02A

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
VLR VERTICAL FRAMING - ORDER SWITCH, CONTROL AND CABLES SEPARATELY						
SWOVLRFRMFM	1	BKTOSVLREPF	1	070467	1	BRACKET, RCLSR 3PH TY 3H E-P
				013229	12	WASHER, ROUND, FLAT, 1/2", BOLT
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				152094	6	BOLT, MACHINE, 1/2" X 3-1/2"
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
	2	AREQOH10F	6	220202	1	ARRESTER, LIGHTNING, 10KV HD MOV W/SILICONE RUBBER POLY
	3	BKTCOLASTLXARMF	6	070101	1	BRACKET, LA & CO TY A
	4	KHLC40N6F	6	9220184790	1	CLAMP, HOT LINE, ALUMINUM
	5	BKTFPIS20F	4	070430	1	BRACKET, FIBERGLASS, STAND-OFF, 20"
				072361	1	STUD, LINE POST, 5/8" X 1-3/4"- 3/4 X 1
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				013346	2	WASHER, 3", SQUARE, CURVED, 13/16", HOLE
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
	6	ISSTUDBOLT5814F	2	013264	1	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				072368	1	STUD, LINE POST, 5/8" X 14"
	7	IPIN25PF	6	9220091018	1	INSULATOR, 25 KV POLYMER, 1-3/8" THREAD
	8	TTIEF500COVALPF	6	9220068094	5	PLASTIC TIE WRAP FOR 2-7/8" F-NECK INSULATOR
	9	RCRISER40ALF	6	202111	8	CABLE, XLP UG AL 4/0
	10	SW156BYPF	3	260123	1	SWITCH, BY-PASS, 3-SLD BLADE DISC, 15KV, LBK HOOKS, 600A
				013264	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
				013308	2	WASHER, SQUARE, 2-1/4", FLAT, 13/16", HOLE, GALV.
				152107	2	BOLT, MACH, SQ, NUT, 5/8" X 12"
				010928	8	BOLT, MACHINE, STAINLESS, STEEL, HEX, HEAD, 1/2" X 2"
				013128	8	WASHER, ROUND, BELLEVILLE SPRING, FOR 1/2" BOLT
				013407	16	WASHER, ROUND, STAINLESS STEEL, 304 ALLOY, FOR 1/2" BOLT
				012277	8	NUT, HEX, 1/2 IN, A304, STAINLESS STEEL, COARSE, THREAD, 1
	11	AREQSC120F	1	220139	1	ARRESTER, LIGHTNING, SEC 120-240 3 WIRE*
	12	FUSESEC30F	1	230464	1	FUSE, SEC INS 30 AMP
VLR SWITCH USED FOR AUTO SOURCE TRANSFER SCHEME - SWITCH ONLY - ORDER CABLES SEPARATELY						
-	13	SW154VLRFBF	1	263136	1	SWITCH, AUTO, XFER FAULT BL
	14	SWOS1CAB35F	1	264219	1	CABLE, IS1 VLR SW CNTRL 35'
	15	SWOS1CAB45SWF	1	264210	1	CABLE, CNTL, TYPE S, 45' SW
	16	SWOS1CAB45CTF	1	264208	1	CABLE, CNTL, TYPE S, 45' CT
	17	SWOS1CAB200CTF	1	264211	1	CABLE, CNTL, TYPE S, 200' CT
	18	SWOS1CAB200SWF	1	264212	1	CABLE, CNTL, TYPE S, 200' SW
	19	SWOS1CAB45FBF	1	264209	1	CABLE, CNTL, TYPE S, 45' FB
-	20	CRIS1UGPVC225CF	1	323422	1	GUARD, PVC, CABLE, 2-1/4"X10'
				434122	0.2	BANDING, STAINLESS STEEL, 316, SS, 3/4", WIDE, .030, TH
				434142	3	BANDING, BUCKLE, SS, 3/4", FOR BANDING
TYPE S CONTROL - SPECIAL ORDER						
-	21	SWOHASTCNTLSF	1	264207	1	CONTROL, OILSW TYPE S 3PH

NOTES:

1. SEE DWG. 08.12-02A FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 08.13-05 FOR AUTO TRANSFER WIRING DETAIL.

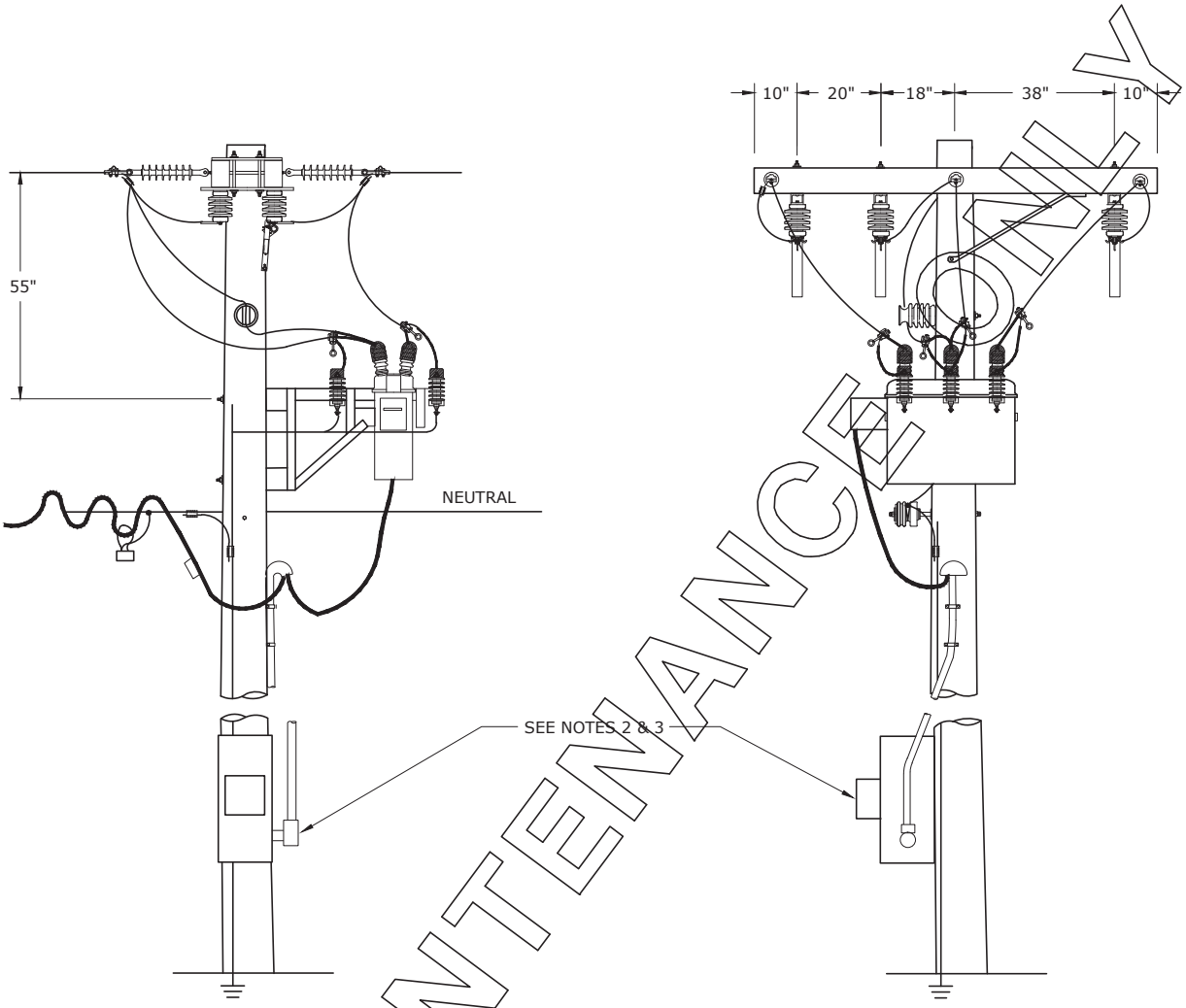
REVISED		BY	CK'D	APPR.
3				
2	7/31/17	BRAVO	LOOSIER	ADCOCK
1	5/24/13	McCONNELL	DANNA	ADCOCK
0	11/29/10	HOFFMAN	GUINN	ELKINS

AUTO TRANSFER CONTROL SWITCH (FMO)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.12-02B



NOTES:

1. ENGINEER MUST SPECIFY JUMPER AND PRIMARY CONNECTOR SIZE.
2. REFER TO DWG. 08.12-01 FOR WIRING DIAGRAM.
3. RADIO SWITCH MUST BE SET FOR PURCHASE BY INSTALLING JUMPER PINS AS SPECIFIED IN CONTROL BOX.

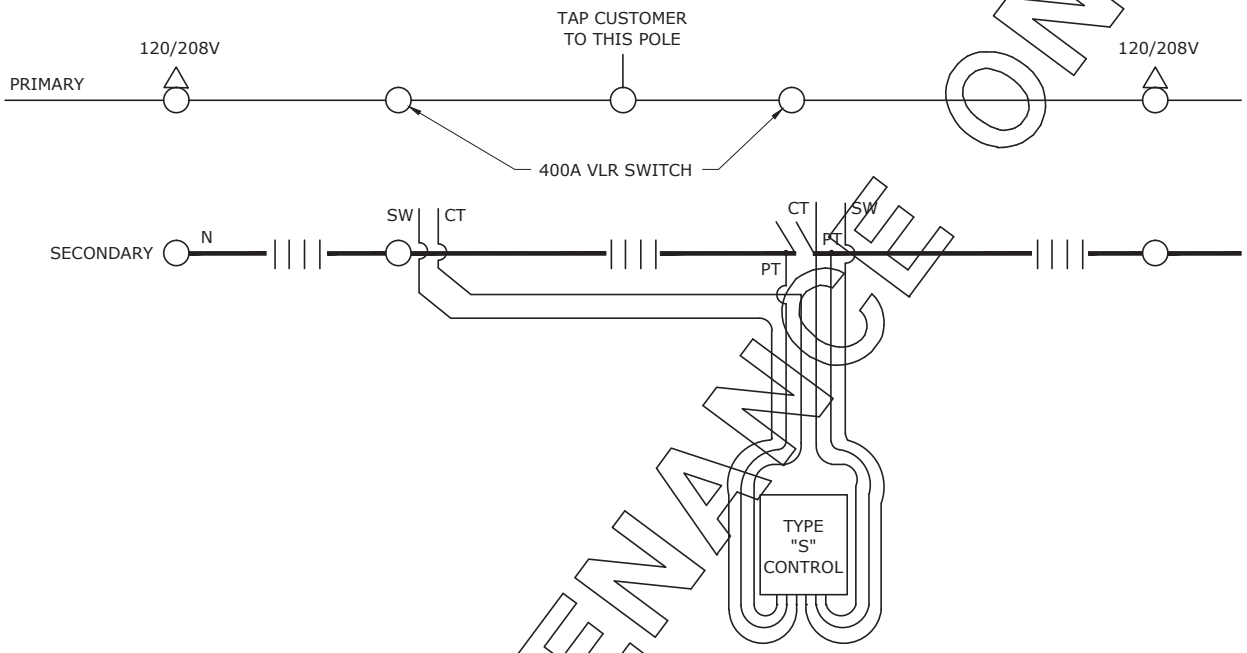
3				
2				
1				
0	11/29/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOAD CONTROL SWITCH ASSEMBLY, (VLR),
THREE-PHASE
HORIZONTAL WITH 600 AMP BYPASS (FMO)

Duke Energy®

FLA

DWG.
08.12-06



AN OVERHEAD AUTOMATIC TRANSFER SCHEME IS SHOWN IN THE ABOVE DRAWING. A MINIMUM OF FIVE POLES ARE REQUIRED FOR THE INSTALLATION. THE TWO OUTSIDE POLES EACH HAVE A THREE-PHASE WYE-WYE 120/208V TRANSFORMER STATION. THESE STATIONS ARE CONSTRUCTED WITH SMALL KVA TRANSFERS AND ARE CONNECTED TO A SMALL QUADRUPLEX CABLE WHICH RUNS TO THE NEUTRAL POSITION OF THE POLE WITH THE TYPE "S" AUTOMATIC TRANSFER CONTROL. THE QUADRUPLEX CABLE IS OPENED AT THIS POLE AND SPLICED TO THE TWO 45' PT CABLES WHICH CONNECT TO THE TYPE "S" CONTROL. THE 45' CT AND 45' SW CABLES ARE CONNECTED TO THE 400A VLR SWITCH ON THE SAME POLE AS THE TYPE "S" CONTROL. THE 200' CT AND THE 200' SW CABLE ARE INSTALLED UP THE POLE WITH THE TYPE "S" CONTROL AND THEN LASHED TO THE QUADRUPLEX CABLE GOING TO THE OTHER 400A VLR SWITCH. THE LOAD IS CONNECTED TO THE CIRCUIT BETWEEN THE TWO VLR SWITCHES. THE TRANSFER SWITCHES WILL MAKE AN OPEN TRANSFER (OPEN & THEN CLOSE) UPON LOSS OF ONE OR MORE PHASE VOLTAGES (THREE-PHASE SENSING) ON THE PREFERRED SOURCE PROVIDED THE FAULT IS NOT ON THE TRANSFERRED CIRCUIT (FAULT BLOCK FEATURE). EITHER SOURCE CAN BE CHOSEN AS THE PREFERRED SOURCE FROM THE CONTROL SELECTIONS. THE RETRANSFER TIME AND OPEN OR CLOSE TRANSITION IS SELECTABLE. IT IS ALSO POSSIBLE TO SELECT NO PREFERRED SOURCE IN WHICH CASE NO RETRANSFER OCCURS.

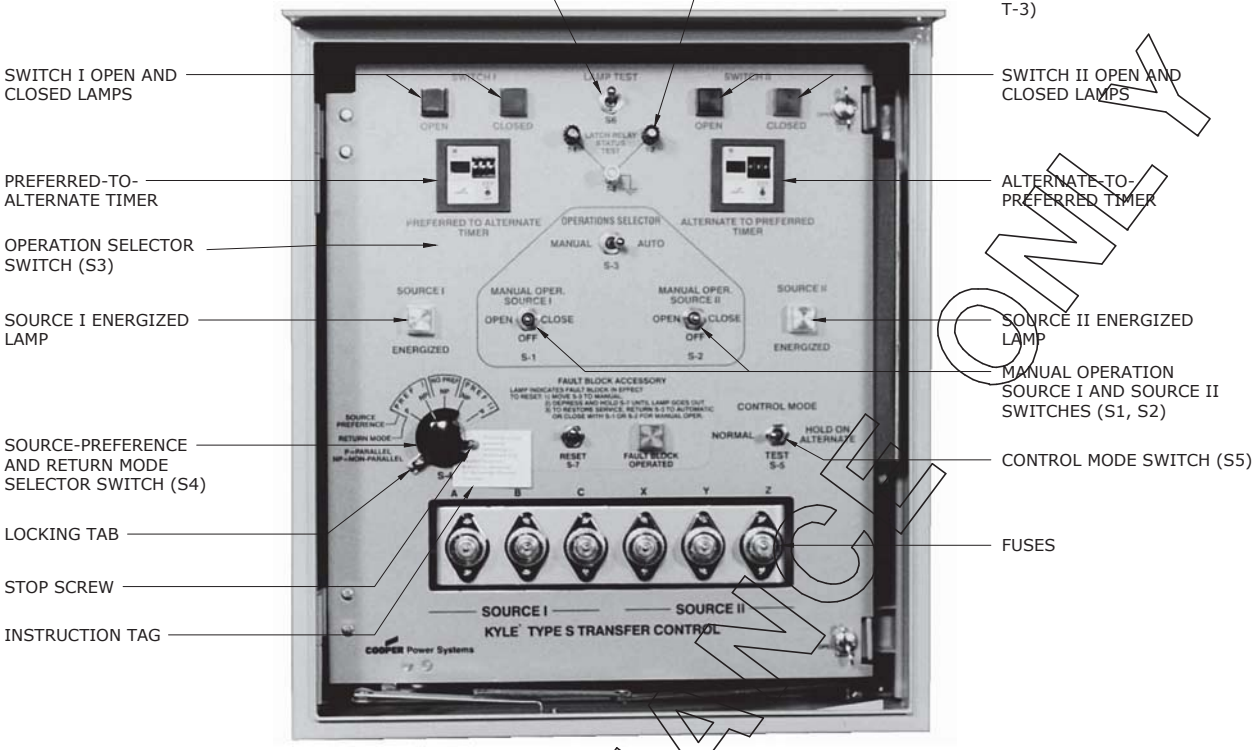
3				
2				
1	7/31/17	BRAVO	LOOSIER	ADCOCK
0	8/25/10	HOFFMAN	GUINN	ELKINS
REVISED		BY	CHK'D	APPR.

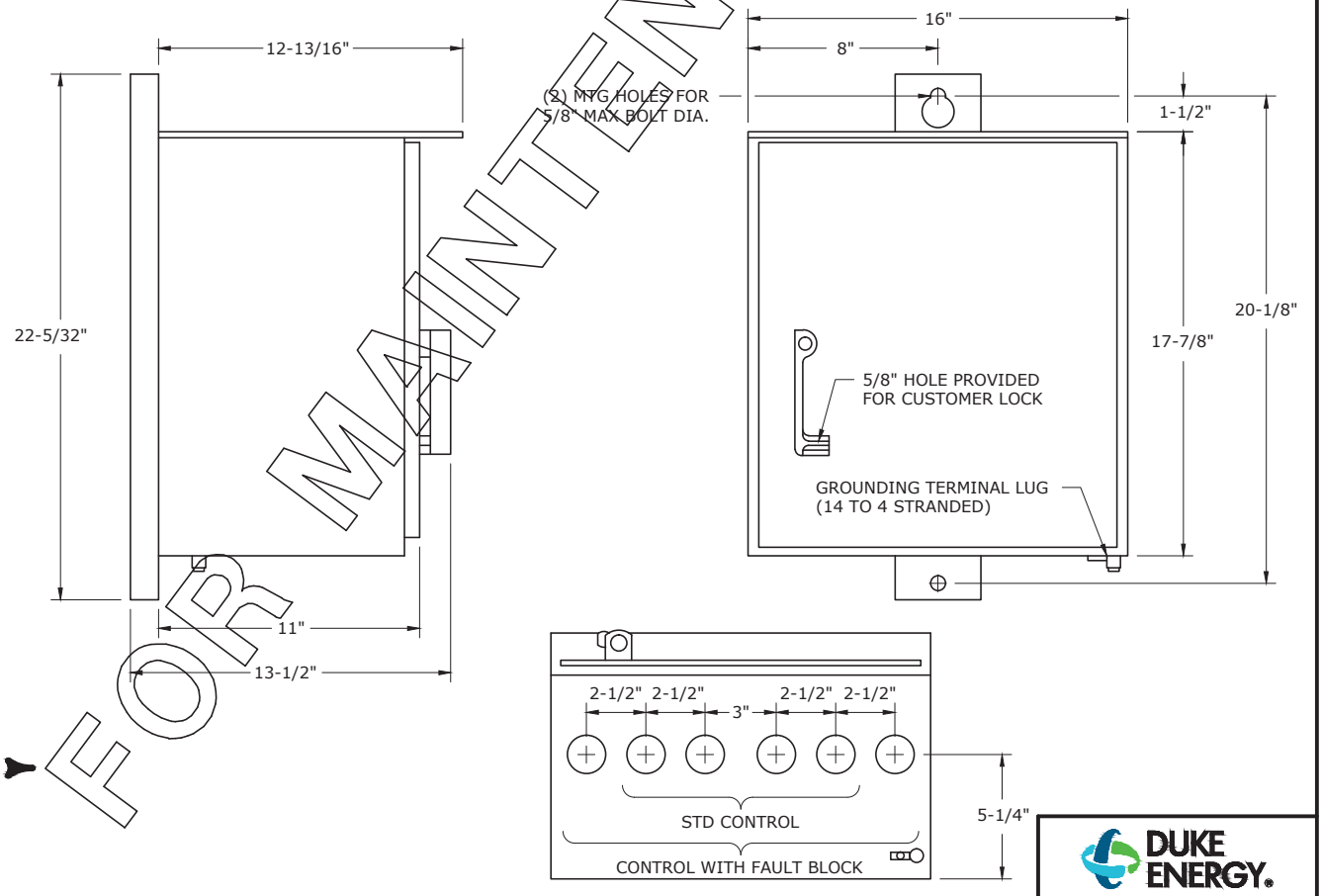
OVERHEAD AUTOMATIC TRANSFER SCHEME (FMO)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.13-01





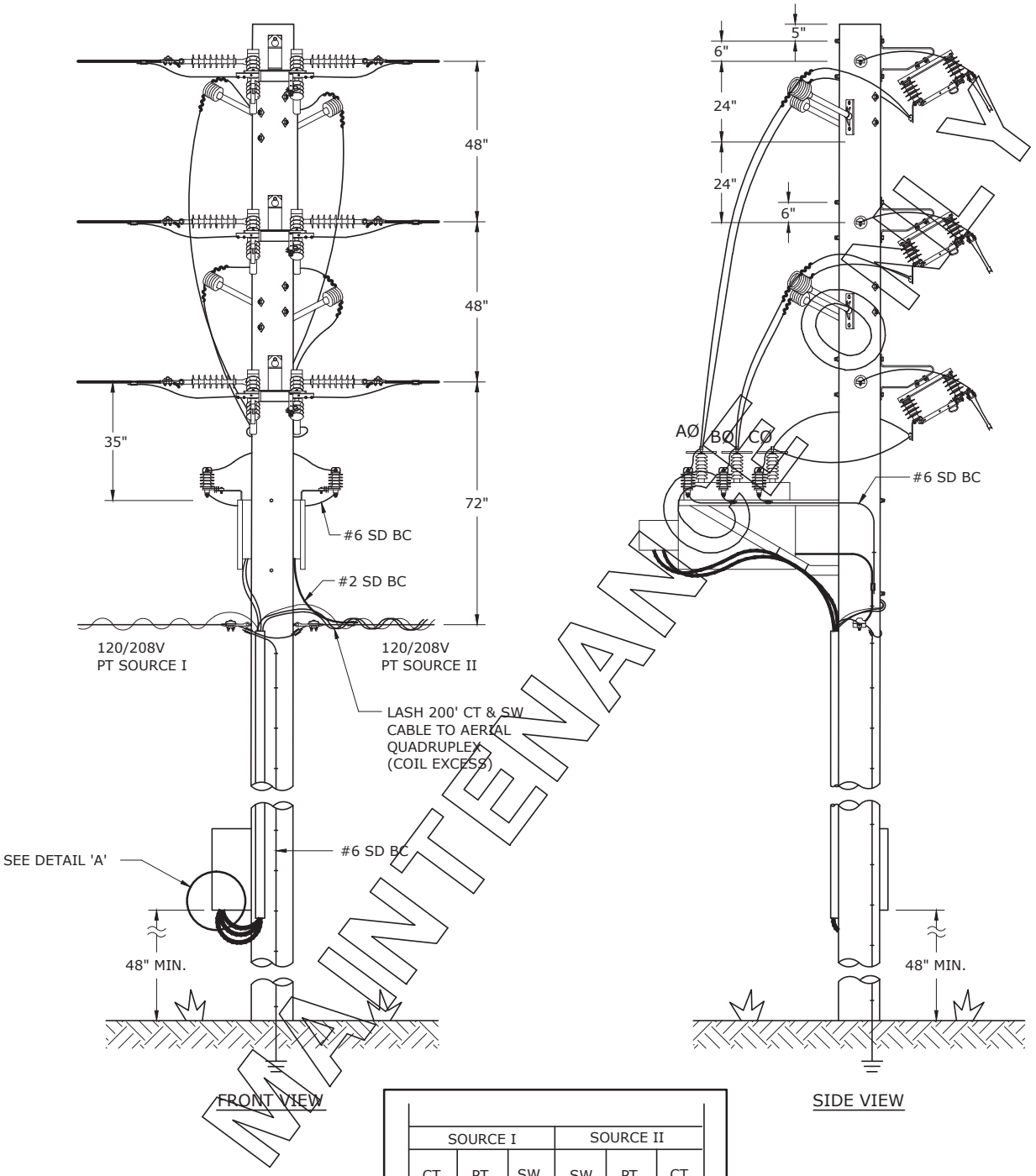
3				
2				
1	7/31/17	BRAVO	LOOSIER	ADCOCK
0	9/7/10	GUINN	GUINN	ELKINS
REVISED		BY	CHK'D	APPR.

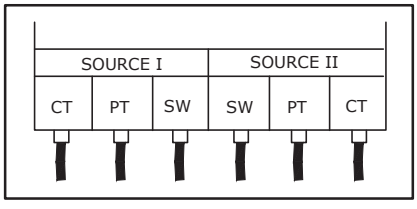
VLR TYPE S TRANSFER CONTROL (FMO)

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

08.13-03





DETAIL "A"

NOTES:

1. SEE DWG. 08.13-01 FOR OVERVIEW OF ENTIRE OVERHEAD AUTOMATIC TRANSFER SCHEME.
2. SEE DWG. 08.12-02B FOR BILL OF MATERIALS.
3. BOND TANK AND FRAME WITH #2 SD BC TO SYSTEM NEUTRAL.
4. THE OTHER POLE IN TRANSFER SCHEME WILL BE IDENTICAL, EXCEPT NO S TRANSFER CONTROL.

3				
2				
1	7/31/17	BRAVO	LOOSIER	ADCOCK
0	11/29/10	GUINN	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

AUTOMATIC TRANSFER SWITCH ASSEMBLY, (VLR), CONTROL WIRING DETAIL (FMO)

DEC	DEM	DEP	DEF
			X

08.13-05

DUKE ENERGY.

3				
2				
1				
0	6/30/14	KATIGBAK	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 10 - CLEARANCES AND JOINT USE

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
X	X	X	X

10.07 JOINT USE CLEARANCES

10.08 JOINT USE ANTENNAS

GENERAL INFORMATION

THE FOLLOWING INFORMATION APPLIES TO ALL DUKE ENERGY STANDARDS THAT REQUIRE COMPLIANCE WITH THE NATIONAL ELECTRICAL SAFETY CODE (NESC).

- THE CLEARANCES OR SPACING LISTED IN THE DUKE ENERGY STANDARDS REPRESENT INFORMATION TAKEN FROM THE NESC, 2012 EDITION. THESE VALUES REPRESENT THE MINIMUM ALLOWABLE CLEARANCE OR SPACING THAT IS TO BE OBTAINED UNDER THE MOST COMMON APPLICATION CIRCUMSTANCES. DESIGNERS MUST ALLOW FOR NORMAL DEVIATIONS IN THE DESIGN AND CONSTRUCTION PROCESS WHEN LAYING OUT AND DESIGNING DUKE ENERGY FACILITIES. ADDITIONAL CLEARANCE OR SPACING SHOULD BE INCLUDED IN THESE DESIGNS TO ACCOMMODATE NORMAL VARIATIONS IN CONSTRUCTION.

- THE NESC MAY CONTAIN FOOTNOTES, EXCEPTIONS, OR OTHER CLARIFICATIONS THAT WILL ALLOW LESSER CLEARANCES OR SPACING THAN THOSE DEFINED IN THESE STANDARDS. THE DESIGNER MUST REVIEW ALL OF THE CIRCUMSTANCES PERTAINING TO THE PROJECT AND CLEARLY IDENTIFY THE CRITERIA THAT WILL ALLOW HIM/HER TO USE CLEARANCES LESS THAN THOSE LISTED IN THE GENERAL STANDARDS. PROPER APPROVALS FROM DISTRIBUTION STANDARDS MUST BE OBTAINED BEFORE USING LESSER CLEARANCES.

- NESC STANDARDS OR DUKE ENERGY'S CONSTRUCTION STANDARDS, WHICHEVER ARE MORE STRINGENT, APPLY TO ALL NEW INSTALLATIONS. FOR EXISTING INSTALLATIONS, WHERE CONDUCTORS OR EQUIPMENT ARE ADDED, ALTERED OR REPLACED ON AN EXISTING STRUCTURE, THE STRUCTURE OR THE FACILITIES ON THE STRUCTURE DO NOT NEED TO BE MODIFIED OR REPLACED IF THE RESULTING INSTALLATION WILL BE IN COMPLIANCE WITH THE RULES THAT WERE IN EFFECT AT THE TIME OF THE ORIGINAL INSTALLATION. IF IT CANNOT BE DETERMINED WHICH RULES WERE IN EFFECT AT THE TIME OF THE ORIGINAL INSTALLATION, THE STRUCTURE OR FACILITIES ON THE STRUCTURE SHOULD BE UPGRADED TO MEET, AT A MINIMUM, THE CURRENT NESC STANDARDS.

- WHEN A STANDARD DEFINES A VERTICAL OR HORIZONTAL CLEARANCE, THESE CLEARANCES ARE TO BE BASED ON WHICHEVER OF THE FOLLOWING CONDITIONS PRODUCES THE MAXIMUM SAG OR MINIMUM CLEARANCE VALUE WITH NO WIND DISPLACEMENT:

  A. CONDUCTORS AT 120° F, FINAL SAG (USED FOR PRIMARY CONDUCTORS IF NO OTHER MAXIMUM TEMPERATURE IS KNOWN AND FOR NEUTRAL CONDUCTORS) OR
  B. CONDUCTORS AT THE MAXIMUM OPERATING TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, FINAL SAG OR
  C. CONDUCTORS AT 32° F, WITH THE RADIAL THICKNESS OF ICE REQUIRED BY DWG 10.00-05, FINAL SAG OR
  D. CONDUCTORS AT THE MINIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, INITIAL SAG (IT IS RARE THAT THIS SITUATION IS USED. IT IS MAINLY INTENDED FOR INSTANCES WHEN A CONDUCTOR PASSES UNDER A STRUCTURE, RATHER THAN OVER. CONTACT MANAGEMENT OR DISTRIBUTION STANDARDS BEFORE APPLYING THIS CRITERION).

- IF THE HORIZONTAL DISPLACEMENT OF THE WIND MUST BE CONSIDERED IN A DESIGN, THE CONDUCTORS SHALL BE CONSIDERED TO BE DISPLACED FROM REST TOWARD THE INSTALLATION BY A 6 LB/FT2 WIND AT FINAL SAG AT 60° F. THE DISPLACEMENT OF CONDUCTORS SHALL INCLUDE DEFLECTION OF SUSPENSION INSULATORS. THE DISPLACEMENT OF CONDUCTORS SHALL ALSO INCLUDE DEFLECTION OF A FLEXIBLE STRUCTURE IF THE HIGHEST CONDUCTOR ATTACHMENT IS 60' OR MORE ABOVE GRADE.

- HORIZONTAL CLEARANCES GOVERN TO A POINT ABOVE THE LEVEL OF A ROOF OR TOP OF AN INSTALLATION TO THE POINT WHERE THE DIAGONAL EQUALS THE VERTICAL CLEARANCE REQUIREMENT. SIMILARLY, THE HORIZONTAL CLEARANCE GOVERNS ABOVE OR BELOW PROJECTIONS FROM BUILDINGS, SIGNS, OR OTHER INSTALLATIONS TO THE POINT WHERE THE DIAGONAL EQUALS THE VERTICAL CLEARANCE REQUIREMENT. FROM THIS POINT THE TRANSITIONAL CLEARANCE SHALL EQUAL THE VERTICAL CLEARANCE.

- CLEARANCES IN THESE STANDARDS ARE REQUIRED FOR PERMANENT AND TEMPORARY INSTALLATIONS.

- CLEARANCES FOR EMERGENCY INSTALLATIONS ARE DEFINED IN NESC 230.A.2

- UNLESS OTHERWISE STATED, ALL CLEARANCES SHALL ME MEASURED FROM SURFACE TO SURFACE AND ALL SPACINGS SHALL BE MEASURED CENTER TO CENTER. FOR CLEARANCE MEASUREMENTS, LIVE METALLIC HARDWARE ELECTRICALLY CONNECTED TO SUPPLY LINE CONDUCTORS AND COMMUNICATION EQUIPMENT CONNECTED TO COMMUNICATION LINE CONDUCTORS SHALL BE CONSIDERED A PART OF THE LINE CONDUCTORS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/31/14	ROBESON	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

GENERAL INFORMATION

DEC	DEM	DEP	DEF
X	X	X	X

10.00-01

- VOLTAGE ADDER IS THE INCREASED CLEARANCE NEEDED WHEN THE VOLTAGE IS HIGHER THAN CERTAIN LIMITS. THE VOLTAGE ADDER CAN BE DIFFERENT DEPENDING ON THE PARTICULAR REQUIREMENT BY THE NESC, BUT IN ALL CASES, WILL BE CALCULATED AS SHOWN BELOW. THE THRESHOLD VALUES OF 8.7KV AND 22KV ARE PHASE TO GROUND VOLTAGES. THE VALUES IN THE TABLES BELOW DO NOT INCLUDE ALL POSSIBLE VOLTAGES THAT MAY BE ENCOUNTERED. THEY ARE REPRESENTATIVE ONLY.

- FOR TRANSMISSION CROSSINGS, CONTACT THE APPROPRIATE TRANSMISSION LINE DESIGN RESOURCE. NEVER RELY SOLELY ON FIELD MEASUREMENTS FOR THIS, SINCE THE MAXIMUM FINAL SAG VALUES OF THE TRANSMISSION LINE MUST BE USED TO DETERMINE THE APPROPRIATE CLEARANCE WITH DISTRIBUTION FACILITIES.

- **VOLTAGE ADDER FOR VOLTAGES IN EXCESS OF 8.7KV**
  IN SOME NESC RULES, THE CLEARANCE MUST BE INCREASED AT THE RATE OF 0.4" FOR EACH 1000V OR 1KV IN EXCESS OF 8.7KV. THESE APPLY TO VERTICAL CLEARANCES ANYWHERE IN THE SPAN ON THE SAME SUPPORTING STRUCTURE BETWEEN SUPPLY CONDUCTORS OR BETWEEN SUPPLY CONDUCTORS AND COMMUNICATIONS CONDUCTORS AT SUPPORT. THE MINIMUM CALCULATED ADDERS FOR VOLTAGES OF COMMON DUKE ENERGY CIRCUITS ARE SHOWN BELOW. ALL VALUES ARE ROUNDED UP TO THE NEXT INCH.

CIRCUIT VOLTAGE	ADDER FOR VOLTAGE IN EXCESS OF 8.7KV	CALCULATION
24KV	3"	((24.0/√3)-8.7) X 0.4
34.5KV GRD Y	5"	((34.5/√3)-8.7) X 0.4
34.5KV (DELTA)	11"	(34.5-8.7) X 0.4
69KV	13" OR 1'-1"	((69/√3)-8.7) X 0.4

- **VOLTAGE ADDER FOR VOLTAGES IN EXCESS OF 22KV**
  THE CLEARANCES MUST BE INCREASED AT THE RATE OF 0.4" FOR EACH 1000V OR 1KV IN EXCESS OF 22KV. THESE APPLY TO VERTICAL CLEARANCES ABOVE GROUND OR RAILS AND VERTICAL CLEARANCES BETWEEN CONDUCTORS CARRIED ON DIFFERENT SUPPORTS. THE MINIMUM CALCULATED ADDERS FOR THE VOLTAGES FOR COMMON DUKE ENERGY CIRCUITS ARE SHOWN BELOW. ALL VALUES ARE ROUNDED UP TO THE NEXT INCH.

CIRCUIT VOLTAGE	ADDER FOR VOLTAGE IN EXCESS OF 22KV	CALCULATION
34.5KV (DELTA)	5"	(34.5-22) X 0.4
44KV	2"	((44/√3)-22) X 0.4
69KV	8"	((69/√3)-22) X 0.4
138KV	26" OR 2'-2"	((138/√3)-22) X 1.10) X 0.4

- ALL CLEARANCES FOR LINES OVER 50KV LINE TO GROUND ARE BASED ON THE MAXIMUM OPERATING VOLTAGE OF THE SYSTEM PER NESC RULE 234G2. UNLESS ACTUAL VALUES ARE KNOWN, ASSUME A MAXIMUM OPERATING VOLTAGE OF TEN PERCENT OVER THE NOMINAL VOLTAGE. THEREFORE, ANY VOLTAGE OF 100KV AND ABOVE WILL HAVE A TEN PERCENT (10%) MULTIPLIER TO DETERMINE THE VOLTAGE ADDER.

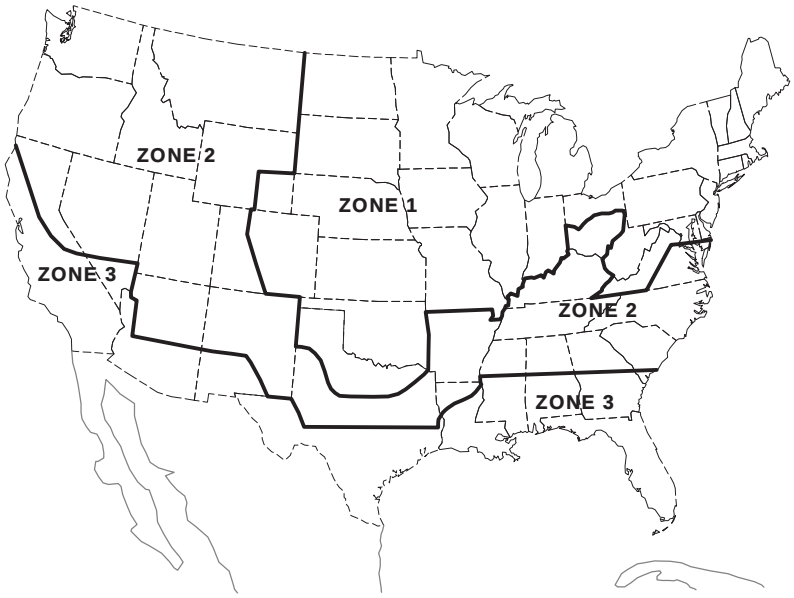
DUKE ENERGY.

3				
2				
1				
0	6/30/14	EARNES	EARNES	ADCOCK
REVISED		BY	CK'D	APPR.

CALCULATION OF VOLTAGE ADDER REQUIRED BY NESC CLEARANCE TABLES

DEC	DEM	DEP	DEF
X	X	X	X

10.00-03



CLEARANCE ZONE MAP OF THE CONTIGUOUS UNITED STATES, NESC FIGURE 230-1

ICE THICKNESS FOR PURPOSES OF CALCULATING CLEARANCES, NESC TABLE 230-1			
RADIAL THICKNESS OF ICE	CLEARANCE ZONE (FOR USE WITH RULES 232, 233, 234 AND 235)		
	ZONE 1	ZONE 2	ZONE 3
(IN)	0.50	0.25	0

NOTES:

1. APPLICABLE ZONES FOR THE AREA IN QUESTION MUST BE DETERMINED PRIOR TO MAKING ANY DETERMINATION OF CONDUCTOR CLEARANCES, VERTICAL OR HORIZONTAL.

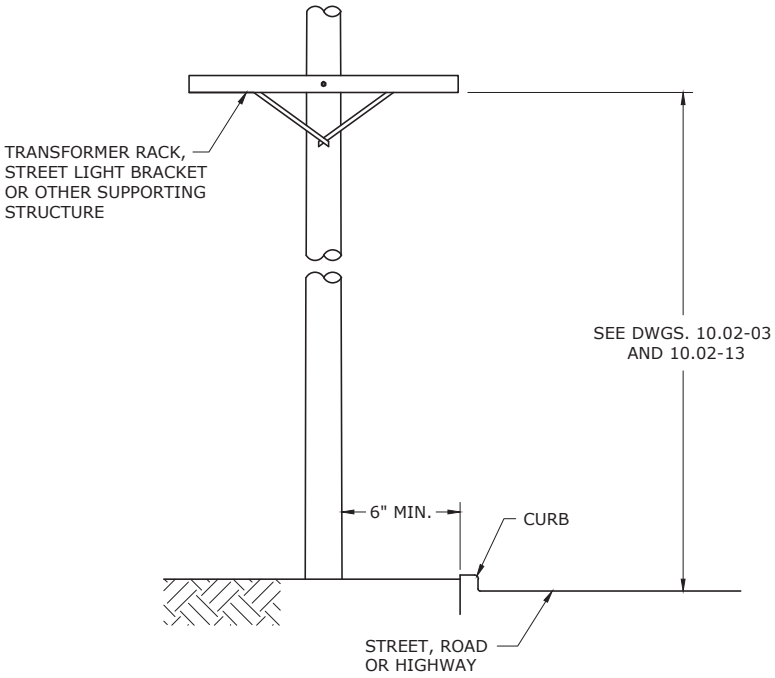
2. ONLY AFTER DETERMINING THE PROPER CLEARANCE ZONE CAN VALUES FOR FINAL SAG (SF) BE CALCULATED FOR USE IN CLEARANCE DETERMINATIONS.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

NESC LOADING ZONES

DEC	DEM	DEP	DEF
X	X	X	X

10.00-05



NOTES:

1. WHERE THERE ARE CURBS: SUPPORTING STRUCTURES, SUPPORT ARMS, ANCHOR GUYS, OR OTHER EQUIPMENT UP TO 15 FT. (HIGHER FOR DOT MAINTAINED ROADS, SEE DWG. 10.02-03) ABOVE THE ROAD SURFACE SHALL BE LOCATED A SUFFICIENT DISTANCE FROM THE STREET SIDE OF THE CURB TO AVOID CONTACT BY ORDINARY VEHICLES USING AND LOCATED ON THE TRAVELED WAY. FOR A REDIRECTIONAL CURB, SUCH DISTANCE SHALL NOT BE LES THAN 6". FOR PAVED OR CONCRETE SWALE-TYPE CURBS, SUCH FACILITIES SHALL BE LOCATED BEHIND THE CURB.

2. WHERE THERE ARE NO CURBS, SUPPORTING STRUCTURES SHOULD BE LOCATED A SUFFICIENT DISTANCE FROM THE ROADWAY TO AVOID CONTACT BY ORDINARY VEHICLES USING AND LOCATED ON THE TRAVELED WAY.

3. GOVERNMENTAL AUTHORITIES HAVING ISSUED PERMITS OR OTHER APPROVALS FOR LOCATIONS SHALL TAKE PRECEDENCE WHERE APPLICABLE.

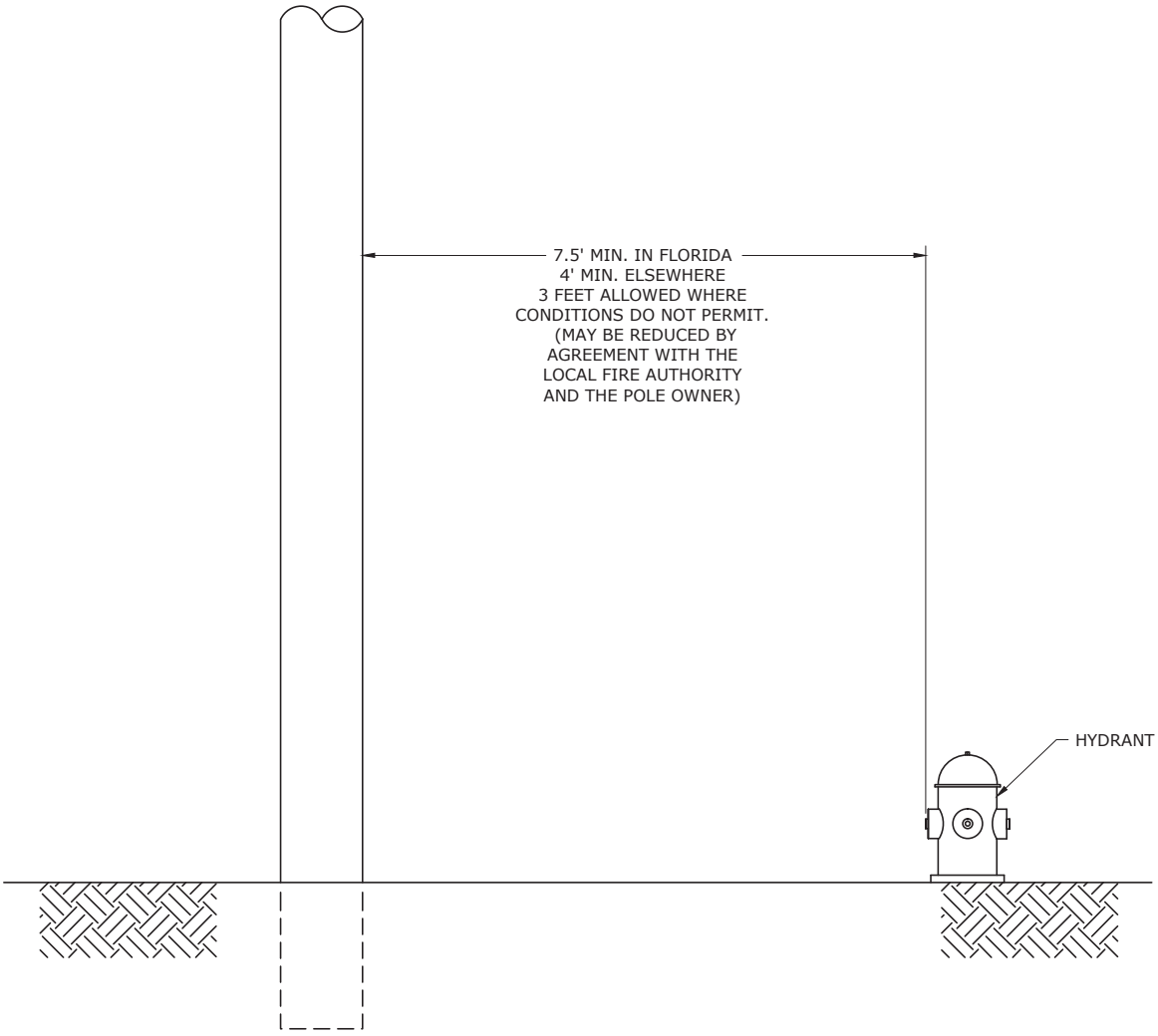
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CLEARANCE OF POLES AND SUPPORTING STRUCTURES FROM THE CURB AND ROAD

DEC	DEM	DEP	DEF
X	X	X	X

10.01-01



NOTES:

1. GREATER DISTANCE REQUIRED BY FLORIDA IS PER FLORIDA ADMINISTRATIVE CODE.

2. 4' MINIMUM PER NESC 231.A.

3. LESSER VALUES PERMITTED BY NESC 231.A, EXCEPTION 1 AND EXCEPTION 2.

3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CLEARANCE OF POLES FROM FIRE HYDRANTS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.01-03

NATURE OF SURFACE UNDERNEATH WIRES, CONDUCTORS OR CABLES.	INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.)	TRIPLEX AND QUADRUPLEX CABLES, 0 TO 750 V, AND NON-INSULATED COMMUNICATIONS CONDUCTORS (FT.)	OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.)	OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.)
	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED
1. ROADS, STREETS, AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC.	15.5 (SEE NOTE 4)	16 (SEE NOTE 4)	16.5 (SEE NOTE 4)	18.5 (SEE NOTE 4)
2. DRIVEWAYS, PARKING LOTS, AND ALLEYS	15.5 (SEE NOTE 3)	16 (SEE NOTE 3)	16.5 (SEE NOTE 3)	18.5
3. OTHER LAND TRAVERSED BY VEHICLES, SUCH AS CULTIVATED, GRAZING, FOREST, ORCHARD, ETC. (SEE NOTE 5)	15.5	16	16.5	18.5
4. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY	9.5	12.0 (SEE NOTE 3)	12.5 (SEE NOTE 3)	14.5
5. WATER AREAS NOT SUITABLE FOR SAILBOATING OR WHERE SAILBOATING IS PROHIBITED	14.0	14.5	15.0	17.0
6. WATERWAYS / BODIES OF WATER SUITABLE FOR SAILBOATING	SEE DWG. 10.02-07 FOR CLEARANCES			
7. PUBLIC OR PRIVATE LAND AND WATER AREAS POSTED FOR RIGGING OR LAUNCHING SAILBOATS	CLEARANCE ABOVE GROUND SHALL BE 5 FT. GREATER THAN ON DWG. 10.02-07			
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 FOLLOWING ICE AND WIND CONDUCTOR LOADING. THE VALUES CAN BE FOUND IN THE SAG AND TENSION TABLES. USE THE FOLLOWING LOADING CONDITION THAT PRODUCES THE GREATEST SAG:

   - CONDUCTOR TEMPERATURE 120°F AND NO WIND DISPLACEMENT, OR
   - MAXIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE AND NO WIND DISPLACEMENT, OR
   - 32°F WITH RADIAL ICE THICKNESS SPECIFIED ON DWG. 10.00-05, NO WIND DISPLACEMENT.

2. REFER TO NATIONAL ELECTRICAL SAFETY CODE (NESC) RULE 232 FOR MINOR EXCEPTIONS AND REFINEMENTS.

3. WHERE HEIGHT OF ATTACHMENT TO BUILDING DOES NOT PERMIT TRIPLEX SERVICE DROPS TO MEET THIS VALUE, THE CLEARANCE MAY BE REDUCED TO THOSE VALUES IN NESC TABLE 232-1, FOOTNOTES 7 AND 8.

4. THE MINIMUM VERTICAL CLEARANCE OF ALL CONDUCTORS, CABLES, GUYS, ETC. MAY BE GREATER FOR DOT MAINTAINED HIGHWAYS OR LIMITED ACCESS HIGHWAYS. SEE DWG. 10.02-03.

5. WHEN DESIGNING A LINE TO ACCOMMODATE OVERSIZED VEHICLES, THESE CLEARANCE VALUES SHALL BE INCREASED BY THE DIFFERENCE BETWEEN THE KNOWN HEIGHT OF THE VEHICLE AND 14 FT.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/26/15	EANES	BURLISON	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

VERTICAL FINAL SAG CLEARANCES ABOVE GROUND

ADAPTED FROM NESC TABLE 232-1

DEC	DEM	DEP	DEF
X	X	X	X

10.02-01

STATE	REQUIRED CLEARANCE OVER STATE MAINTAINED D.O.T. ROADS (FT.)	REQUIRED CLEARANCE OVER LIMITED ACCESS HIGHWAYS (FT.)	REFERENCE MANUAL
FLORIDA	18	24	UTILITIES ACCOMMODATION MANUAL, 4.2A AND 4.8.2
INDIANA	18	18	UTILITY ACCOMMODATION POLICY, 6.0 (2)
KENTUCKY	18	24	PERMITS GUIDANCE MANUAL 202-2 AND 202-3
NORTH CAROLINA	18	24 (SEE NOTE 6)	POLICIES AND PROCEDURES FOR ACCOMMODATING UTILITIES ON HIGHWAY RIGHTS OF WAY, P41
OHIO	16.5	16.5	POLICY FOR ACCOMMODATION OF UTILITIES, 8108.01.C
SOUTH CAROLINA	15.5	15.5	UTILITIES ACCOMMODATION MANUAL, 6.2.1

NOTES:

1. THE VALUES IN THE ABOVE TABLE APPLY TO ALL UTILITY LINES, NOT JUST THOSE OWNED BY DUKE ENERGY. THE DESIGNER SHOULD ENSURE ENOUGH HEIGHT IS OBTAINED AT THE SUPPORTING STRUCTURE TO PROVIDE ADEQUATE VERTICAL CLEARANCE FOR THE LOWEST ATTACHING UTILITY WHILE ALSO MAINTAINING THE APPROPRIATE MID-SPAN CLEARANCES BETWEEN UTILITIES.

2. AT NO TIME SHALL DUKE ENERGY LINES BE LESS THAN THE MINIMUM VALUES REQUIRED BY THE NESC.

3. THE VALUES IN THE ABOVE TABLE ARE BASED ON WHICHEVER OF THE FOLLOWING CONDITIONS PRODUCES THE MAXIMUM SAG OR MINIMUM CLEARANCE VALUE WITH NO WIND DISPLACEMENT:

   A. CONDUCTORS AT 120°F, FINAL SAG (USED FOR PRIMARY CONDUCTORS IF NO OTHER MAXIMUM TEMPERATURE IS KNOWN AND FOR NEUTRAL CONDUCTORS) OR
   B. CONDUCTORS AT THE MAXIMUM OPERATING TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, FINAL SAG OR
   C. CONDUCTORS AT 32°F, WITH THE RADIAL THICKNESS OF ICE REQUIRED BY DWG. 10.00-05, FINAL SAG.

4. THE VALUES IN THE ABOVE TABLE ARE FOR THE GROUNDED NEUTRAL (WHERE THERE ARE NO JOINT USERS) FOR ALL STATES, PRIMARY CONDUCTORS MUST BE 18.5 FEET MINIMUM OVER ALL ROADWAYS AND 24' FOR FOR SOME STATES OVER LIMITED ACCESS HIGHWAYS.

5. SEE NESC TABLE 232-1 FOR ADDITIONAL INFORMATION IF NEEDED.

6. ALL **NEW** CONTROLLED ACCESS CROSSINGS MUST MEET THE NEW 24' CLEARANCE REQUIREMENT. EXISTING CROSSINGS ARE GRANDFATHERED, INCLUDING SITUATIONS WHERE ROUTINE MAINTENANCE WORK IS CONDUCTED. ROUTINE MAINTENANCE INCLUDES ITEMS SUCH AS POLE REPLACEMENT, CROSSARM REPLACEMENT, GUY WIRE REPAIR, ETC. THE ONLY TIME WE NEED TO UPGRADE AN EXISTING CROSSING TO THE 24' REQUIREMENT IS WHEN NON-ROUTINE MAINTENANCE WORK SUCH AS REPLACING EXISTING CONDUCTORS, CONVERTING SINGLE-PHASE TO THREE-PHASE, CONVERTING FROM SINGLE CIRCUIT TO DOUBLE CIRCUIT, ETC. OVER THE HIGHWAY.

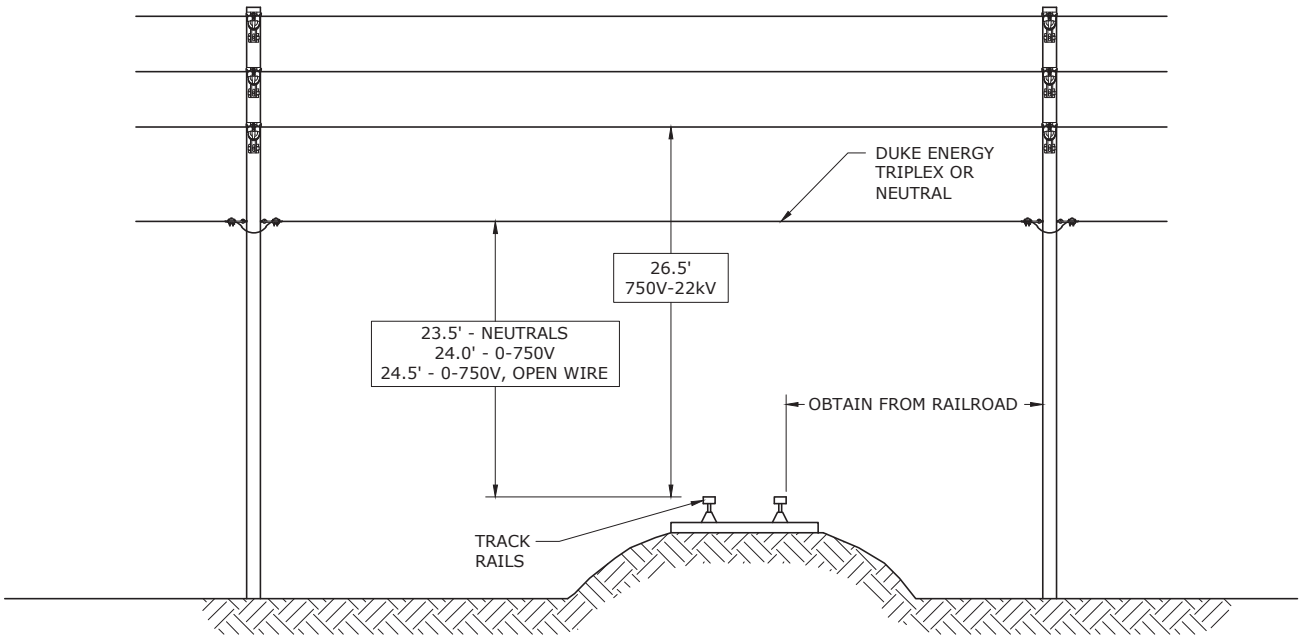
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	10/31/14	GUINN	GUINN	ADCOCK
1	8/25/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

D.O.T. CLEARANCES OVER STATE MAINTAINED ROADS AND LIMITED ACCESS HIGHWAYS

DEC	DEM	DEP	DEF
X	X	X	X

10.02-03



	INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.)	TRIPLEX AND QUADRUPLEX CABLES, 0 TO 750 V AND NON-INSULATED COMMUNICATIONS CONDUCTORS (FT.)	OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.)	OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.)
NATURE OF SURFACE UNDERNEATH WIRES, CONDUCTORS OR CABLES.	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED
TRACK RAILS OF RAILROADS	23.5	24.0	24.5	26.5 (SEE NOTE 1)

CAUTION: SEE NOTE 2

NOTES:

1. ALL VOLTAGES ARE Ø TO GROUND. CLEARANCES SHALL BE INCREASED AT THE RATE OF 0.4 INCHES PER KILOVOLT IN EXCESS OF 22kV.
2. CLEARANCES SHOWN HERE ARE NESC MINIMUMS. INDIVIDUAL RAILROAD CLEARANCE REQUIREMENTS WILL LIKELY EXCEED THESE VALUES. CONTACT THE APPROPRIATE DUKE ENERGY PERMIT COORDINATOR FOR ACTUAL VERTICAL AND HORIZONTAL CLEARANCES PRIOR TO SUBMITTING APPLICATION.
3. REFER TO APPLICABLE ENGINEERING AND CONSTRUCTION MANUALS FOR CONSTRUCTION GUIDELINES (DEAD-ENDS, GUYING, ETC.)

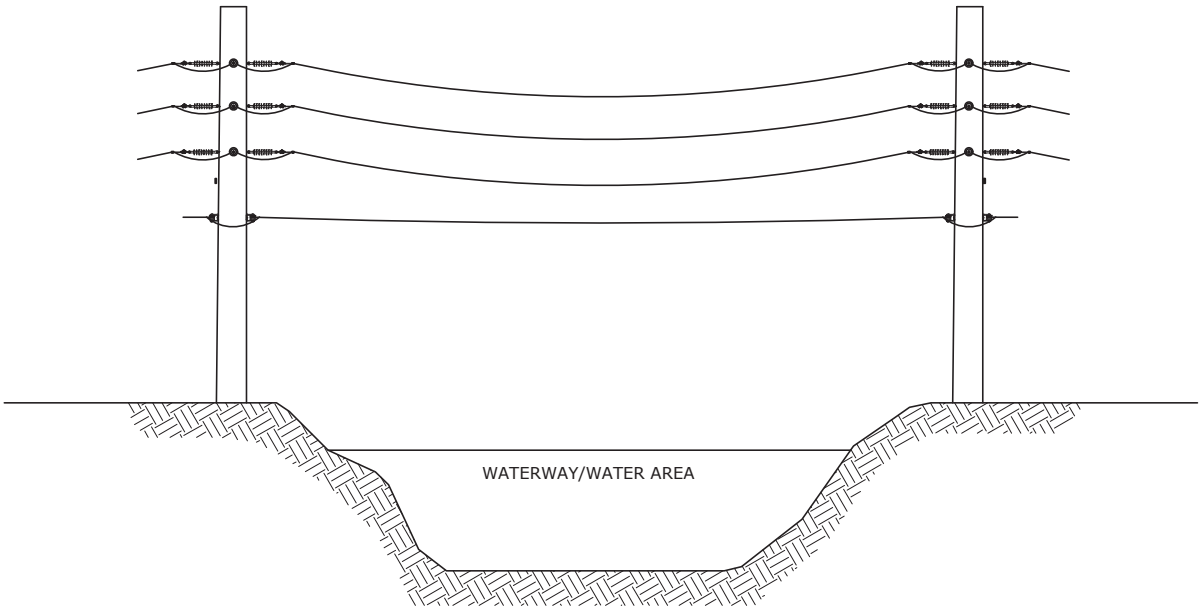
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

RAILROAD CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

10.02-05



	INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.)	TRIPLEX AND QUADRUPLEX CABLES, 0 TO 750 V AND NON-INSULATED COMMUNICATIONS CONDUCTORS (FT.)	OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.)	OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.)
NATURE OF SURFACE UNDERNEATH WIRES, CONDUCTORS OR CABLES.	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED	NESC MINIMUM REQUIRED
WATERWAYS / WATER AREAS NOT SUITABLE FOR SAILBOATING OR WHERE SAILBOATING IS PROHIBITED	14.0	14.5	15.0	17.0
WATERWAYS / WATER AREAS SUITABLE FOR SAILBOATING (SEE NOTE 1)	37.5	38.0	38.5	40.5
PUBLIC OR PRIVATE LAND AND WATER AREAS POSTED FOR RIGGING OR LAUNCHING SAILBOATS	CLEARANCE ABOVE GROUND SHALL BE 5 FT. GREATER THAN SHOWN ABOVE.			

NOTES:

1. THESE VALUES ARE THE NESC MINIMUM CLEARANCES FOR LAKES AND BODIES OF WATER OVER 2000 ACRES IN SIZE. SINCE IT IS OFTEN DIFFICULT TO DETERMINE THE SIZE OF A LAKE OR BODY OF WATER AND THE HEIGHT OF SAILBOATS THAT MAY BE ON THE WATER IN QUESTION, IT IS PREFERRED THAT THESE CLEARANCES BE USED FOR NEW INSTALLATIONS OR UPGRADES TO EXISTING INSTALLATIONS. IF IT IS DETERMINED THAT HEIGHTS OF SAILBOATS ARE LIMITED BY OTHER OBSTACLES, LESSER CLEARANCES MAY BE USED. REFER TO NESC TABLE 232-1 FOR ADDITIONAL INFORMATION.

2. WHERE THE US ARMY CORPS OF ENGINEERS, OR THE STATE, OR SURROGATE THEREOF HAS ISSUED A CROSSING PERMIT, CLEARANCES OF THAT PERMIT SHALL GOVERN.

3. THESE SAILBOAT CLEARANCES OVER NAVIGABLE WATERS ASSUME NO BRIDGE CROSSINGS ARE INVOLVED. WHERE THERE IS ALSO A BRIDGE CROSSING, THE PERMIT ISSUER'S CLEARANCES MUST BE MAINTAINED OVER THE BRIDGE RATHER THAN WATER.

4. REFER TO APPLICABLE ENGINEERING AND CONSTRUCTION MANUALS FOR CONSTRUCTION GUIDELINES (DEAD-ENDS, GUYING, ETC.)

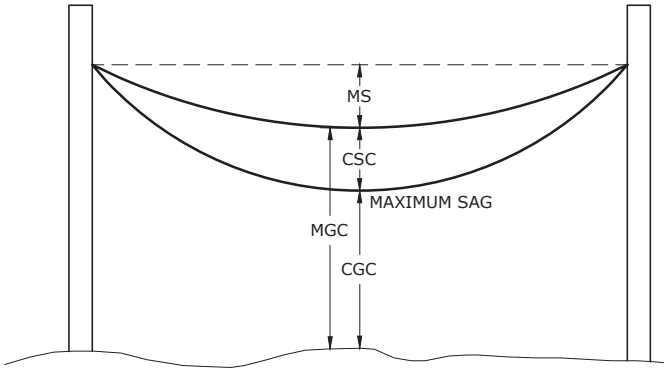
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK

CLEARANCE OVER WATERWAYS, WATER AREAS SUITABLE FOR SAILBOATING AND AREAS POSTED FOR RIGGING OR LAUNCHING SAILBOATS

DEC	DEM	DEP	DEF
X	X	X	X

10.02-07



MGC = MEASURED GROUND CLEARANCE
MS = MEASURED SAG
CSC = CALCULATED SAG CHANGE FROM MEASURED VALUE TO MAXIMUM SAG CONDITION DUE TO THERMAL OR ICE LOADING
CGC = CALCULATED GROUND CLEARANCE AT MAXIMUM SAG

THIS METHOD IS USED TO DETERMINE ADEQUATE GROUND CLEARANCE FOR EXISTING INSTALLATIONS. THE FIELD ENGINEER WILL NEED TO OBTAIN THE EXISTING GROUND CLEARANCE (MGC) AT MID-SPAN OR THE POINT OF CONCERN ALONG WITH THE MEASURED SAG OF THE SPAN AND THE AMBIENT TEMPERATURE AT WHICH THE MEASUREMENTS ARE TAKEN.

EXAMPLE

GIVEN AN EXISTING CROSSING IN NORTH CAROLINA, DETERMINE IF THE CLEARANCE IS ADEQUATE UNDER THE FOLLOWING CONDITIONS. ASSUME IT WAS INSTALLED USING THE APPROPRIATE SAG AND TENSION AND HAS BEEN THROUGH AT LEAST ONE THERMAL LOADING CYCLE.

- 12.47 / 7.2 KV, 3-PHASE, 4-WIRE CIRCUIT, ASSUME BOTH PRIMARY AND NEUTRAL CONDUCTORS ARE AT THE SAME HEIGHT IN THE CROSSING.
- 280′ SPAN OF 1/0 ACSR CONDUCTOR, DEAD-ENDED ON EITHER SIDE OF THE SPAN.
- THE CROSSING IS OVER A STREET SUBJECT TO TRUCK TRAFFIC (NESC MINIMUMS ARE ADEQUATE, THERE IS NO LOCAL AUTHORITY WITH A MORE STRINGENT REQUIREMENT).
- AMBIENT TEMPERATURE IS 50F; AT THE TIME OF MEASUREMENT THERE IS LITTLE OR NO LOAD ON THE CIRCUIT.
- MAXIMUM OPERATING TEMPERATURE OF THE CONDUCTOR IS 120°F.
- MEASURED GROUND CLEARANCE (MGC) DURING THE FIELD VISIT IS 19′.
- MEASURED SAG (MS) DURING THE FIELD VISIT IS 24″.

SOLUTION

DETERMINE MAXIMUM FINAL SAG (SF) FROM THE FOLLOWING CONDITIONS, USING SAG TABLES PROVIDED IN THE OVERHEAD CONDUCTOR SECTIONS OF THIS MANUAL.

- 120°F, WITH NO WIND DISPLACEMENT, SF = 47″.
- MAXIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, WITH NO WIND DISPLACEMENT, SF = 47″.
- 32°F, WITH NO WIND DISPLACEMENT, WITH RADIAL THICKNESS OF ICE SPECIFIED ON DWG. 10.00-05, SF = 36″ (USING THE MEDIUM CLEARANCE ZONE FOR NORTH CAROLINA AND THE CORRESPONDING 1/4″ OF ICE).

SO, SF = 47″

NEXT, DETERMINE THE CALCULATED SAG CHANGE, CSC.

CSC = MAXIMUM FINAL SAG – MEASURED SAG = 47″ – 24″, OR 23″ OF SAG CHANGE FROM PRESENT CONDITIONS TO MAXIMUM SAG CONDITIONS.

DETERMINE CALCULATED GROUND CLEARANCE AT MAXIMUM SAG, CGC.

CGC = MEASURED GROUND CLEARANCE – CALCULATED SAG CHANGE = 19′ – 1′-11″, OR 17′-1″.

SO, WHILE THIS LINE MAY HAVE APPEARED TO MAINTAIN THE MINIMUM NESC REQUIREMENT OF 18′-6″ (TABLE 232-1) DURING THE FIELD VISIT, AT MAXIMUM FINAL SAG CONDITIONS, THIS LINE ULTIMATELY **DOES NOT** MEET CODE AND CONSEQUENTLY MUST BE CORRECTED.

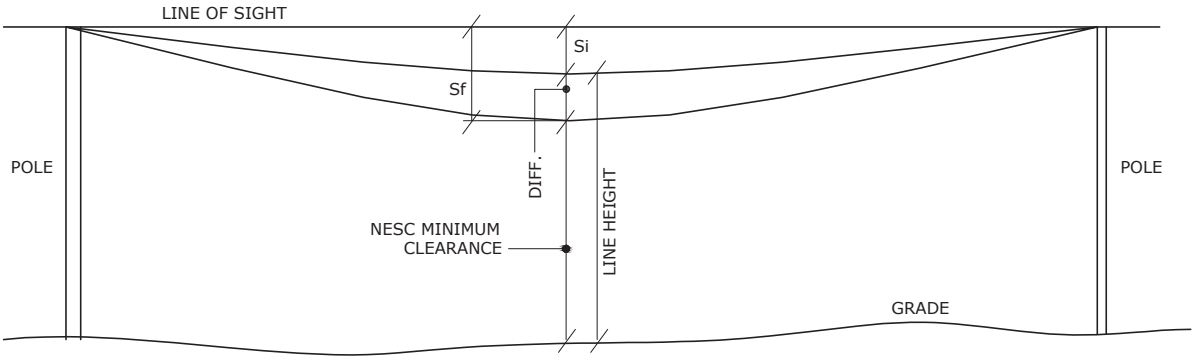
DUKE ENERGY.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DETERMINING SAG CLEARANCES OF EXISTING INSTALLATIONS

DEC	DEM	DEP	DEF
X	X	X	X

10.02-09



KEY	Si	INITIAL SAG @ 60°F, NO WIND (FROM SAG TABLES)
	Sf	THE GREATER OF FINAL SAG AT MAXIMUM OPERATING TEMPERATURE NO WIND, OR 32°F W/ APPROPRIATE ICE LOADING FROM DWG. 10.00-05
	DIFF.	Sf - Si

NOTES:

1. USE THIS METHOD WITH THE TABLE ON DWG. 10.02-01 WHEN DETERMINING MINIMUM LINE HEIGHTS ABOVE GROUND, RAILS, ETC.
2. LINE HEIGHT (AT MID SPAN) = REQUIRED MINIMUM CLEARANCE (SEE DWG. 10.02-01) PLUS (Sf - Si).
3. ROUND UP "DIFF." (Sf-Si) VALUES TO NEAREST 1/2 FT. (E.G., 32" WOULD BECOME 3'-0".)
4. ASSUMING THE NEUTRAL IS THE LOWEST CONDUCTOR, USE A MAXIMUM OPERATING TEMPERATURE OF 120° F.

EXAMPLES OF USE OF INITIAL AND FINAL SAG (ASSUME THE LINE IS IN NORTH CAROLINA):

1. 3-Ø 477 AAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 300 FT. SPAN -

   REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD (FROM DWG. 10.02-01). . . . . .15.5 FT.

   DIFFERENCE BETWEEN INITIAL SAG @ 60° F AND FINAL SAG @ 120° F FOR 1/0 ACSR, 300 FT. SPAN . . . . . .3.0 FT.

   REQUIRED HEIGHT OF NEUTRAL ABOVE ROAD SURFACE AT INSTALLATION . . . . . .18.5 FT.

   (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

2. 3-Ø 477 AAC PRIMARY WITH 1/0 ACSR NEUTRAL LINE CROSSING ROAD, 150 FT. SPAN -

   REQUIRED NESC MINIMUM NEUTRAL CLEARANCE ABOVE ROAD (FROM DWG. 10.02-01). . . . . .15.5 FT.

   DIFFERENCE BETWEEN INITIAL SAG @ 60° F AND FINAL SAG @ 120° F FOR 1/0 ACSR, 150 FT. SPAN . . . . . .1.5 FT.

   REQUIRED HEIGHT OF NEUTRAL ABOVE ROAD SURFACE AT INSTALLATION . . . . . .17.0 FT.

   (CHECK MINIMUM DOT ROAD CLEARANCES FOR LOCAL CONDITIONS)

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK

DETERMINING SAG CLEARANCES OF NEW INSTALLATIONS

DEC	DEM	DEP	DEF
X	X	X	X

10.02-11

VERTICAL CLEARANCE OF EQUIPMENT CASES, SUPPORT ARMS, PLATFORMS, BRACES AND UNGUARDED RIGID LIVE PARTS ABOVE GROUND, ROADWAY OR WATER SURFACES

VOLTAGES ARE PHASE TO GROUND FOR EFFECTIVELY GROUNDED CIRCUITS AND THOSE OTHER CIRCUITS WHERE ALL GROUND FAULTS ARE CLEARED BY PROMPTLY DE-ENERGIZING THE FAULTED SECTION, BOTH INITIALLY AND FOLLOWING SUBSEQUENT BREAKER OPERATIONS.

NATURE OF SURFACE BELOW	NONMETALLIC OR EFFECTIVELY GROUNDED SUPPORT ARMS, SWITCH HANDLES, PLATFORMS, BRACES AND EQUIPMENT CASES (FT.)	UNGUARDED RIGID LIVE PARTS OF 0 TO 750V AND UNDERGROUND CASES THAT CONTAIN EQUIPMENT CONNECTED TO CIRCUITS OF NOT MORE THAN 750V (FT.)	UNGUARDED RIGID LIVE PARTS OF OVER 750V TO 22KV AND UNDERGROUND CASES THAT CONTAIN EQUIPMENT CONNECTED TO CIRCUITS OF OVER 750V TO 22KV (FT.)
1. WHERE RIGID PARTS OVERHANG			
A. ROADS, STREETS AND OTHER AREAS SUBJECT TO TRUCK TRAFFIC (SEE NOTE 4)	15.0	16.0	18.0
B. DRIVEWAYS, PARKING LOTS, AND ALLEYS	15.0	16.0 (SEE NOTE 6)	18.0
C. OTHER AREAS TRAVERSED BY VEHICLES SUCH AS CULTIVATED, GRAZING, FOREST AND ORCHARD LANDS, INDUSTRIAL AREAS, COMMERCIAL AREAS, ETC. (SEE NOTE 3)	15.0 (SEE NOTE 3)	16.0	18.0
D. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY (SEE NOTE 5)	11.0 (SEE NOTE 7)	12.0 (SEE NOTE 1)	14.0
2. WHERE RIGID 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	15.0 (SEE NOTE 7)	16.0	18.0
B. ROADS WHERE IT IS UNLIKELY THAT VEHICLES WILL BE CROSSING UNDER THE LINE	13.0 (SEE NOTE 5)	14.0 (SEE NOTE 1)	16.0
3. WATER AREAS NOT SUITABLE FOR SAILBOATING OR WHERE SAILBOATING IS PROHIBITED (SEE NOTE 8)	14.0	14.5	15.0

NOTES:

1. FOR INSULATED LIVE PARTS LIMITED TO 150V TO GROUND, THIS VALUE MAY BE REDUCED TO 10 FT.
2. WHERE A SUPPLY LINE ALONG A ROAD IS LIMITED TO 300V TO GROUND AND IS LOCATED RELATIVE TO FENCES, DITCHES, EMBANKMENTS, ETC., SO THAT THE GROUND UNDER THE LINE WOULD NOT BE EXPECTED TO BE TRAVELED EXCEPT BY PEDESTRIANS, THIS CLEARANCE MAY BE REDUCED TO 12 FT.
3. WHEN DESIGNING A LINE TO ACCOMMODATE OVERSIZED VEHICLES, THESE CLEARANCE VALUES SHALL BE INCREASED BY THE DIFFERENCE BETWEEN THE KNOWN HEIGHT OF THE OVERSIZED VEHICLE AND 14 FT.
4. FOR THE PURPOSE OF THIS RULE, TRUCKS ARE DEFINED AS ANY VEHICLE EXCEEDING 8 FT. IN HEIGHT. AREAS NOT SUBJECT TO TRUCK TRAFFIC ARE AREAS WHERE TRUCK TRAFFIC IS NOT NORMALLY ENCOUNTERED NOR REASONABLY ANTICIPATED.
5. SPACES AND WAYS SUBJECT TO PEDESTRIANS OR RESTRICTED TRAFFIC ONLY ARE THOSE AREAS WHERE RIDERS ON HORSEBACK OR OTHER LARGE ANIMALS, VEHICLES OR OTHER MOBILE UNITS EXCEEDING 8 FT. IN HEIGHT, ARE PROHIBITED BY REGULATION OR PERMANENT TERRAIN CONFIGURATIONS OR ARE OTHERWISE NOT NORMALLY ENCOUNTERED NOR REASONABLY ANTICIPATED.
6. THIS CLEARANCE MAY BE REDUCED TO THE FOLLOWING VALUES FOR DRIVEWAYS, PARKING LOTS AND ALLEYS NOT SUBJECT TO TRUCK TRAFFIC:

   (a) INSULATED LIVE PARTS LIMITED TO 300V TO GROUND 12 FT.
   (b) INSULATED LIVE PARTS LIMITED TO 150V TO GROUND 10 FT.

7. EFFECTIVELY GROUNDED SWITCH HANDLES AND SUPPLY OR COMMUNICATIONS EQUIPMENT CASES (SUCH AS FIRE ALARM BOXES, CONTROL BOXES, COMMUNICATION TERMINALS, METERS OR SIMILAR EQUIPMENT CASES) MAY BE MOUNTED AT A LOWER LEVEL FOR ACCESSIBILITY, PROVIDED SUCH CASES DO NOT UNDULY OBSTRUCT A WALKWAY. SEE ALSO RULE 234J2c.
8. WHERE THE U.S. ARMY CORP OF ENGINEERS, OR THE STATE, OR THE SURROGATE THEREOF HAS ISSUED A CROSSING PERMIT, CLEARANCES OF THAT PERMIT SHALL GOVERN.

DUKE ENERGY.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

VERTICAL CLEARANCE OF EQUIPMENT, ETC.
ABOVE GROUND
ADAPTED FROM NESC TABLE 232-2

DEC	DEM	DEP	DEF
X	X	X	X

10.02-13

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 (FT.)	OPEN WIRE SECONDARY, 0-750V (FT.)	OPEN SUPPLY CONDUCTORS OVER 750V TO 22 kV (FT.)
EFFECTIVELY GROUNDED GUYS, SPAN WIRES, NEUTRAL CONDUCTORS AND LIGHTNING PROTECTION WIRES	2	2	2	2	2 (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)	2 (SEE NOTE 5)
OPEN WIRE SECONDARY, 0-750 V	4	2	2	2	2 (SEE NOTE 5)
OPEN SUPPLY CONDUCTORS, 750 V TO 22 kV	5 (SEE NOTE 3, 6)	2	4 (SEE NOTE 6)	4 (SEE NOTE 5)	2 (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. NESC MINIMUM CLEARANCES ARE SHOWN. TO ACCOUNT FOR SAG CONDITIONS OF OTHER UTILITIES, 4' IS PREFERRED.
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 DUKE 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.
11. FOR VOLTAGES ABOVE 22kV TO GROUND, CLEARANCES SHOULD BE CALCULATED ACCORDING TO NESC RULE 233C.

DUKE ENERGY.

3					
2					
1					
0	6/30/14	ROBESON	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

LINE CROSSING CLEARANCES

ADAPTED FROM NESC TABLE 233-1

DEC	DEM	DEP	DEF
X	X	X	X

10.03-01

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
				OVER 750 V - 22 kV (PHASE TO GROUND)
1. LIGHTING AND TRAFFIC SIGNAL SUPPORTS; POLES & SUPPORTS OF ANOTHER LINE:				
A. HORIZONTAL	3'	5' (3' IF <300V)	5' (3.5') **	5' (4.5') **
B. VERTICAL	2'	4.5' (2' IF <300V)	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, RAMPS, DECKS AND LOADING DOCKS ACCESSIBLE TO VEHICLES BUT NOT SUBJECT TO TRUCK TRAFFIC	10.5'	11'	11.5'	13.5'
4. OVER ROOFS, RAMPS, DECKS AND LOADING DOCKS 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. 10.04-13.				

*BRIDGES WITH SUPPORTING STRUCTURES ABOVE THE ROADWAY MAY SERVE AS SUPPORTING STRUCTURES FOR ELECTRICAL LINES. THE CLEARANCE SHOWN FOR ATTACHED AND NOT ATTACHED IS THE CLEARANCE ABOVE THE BRIDGE SUPPORTING STRUCTURES. SEE DWG. 10.04-11 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. SUBTRACT THE WIND DISPLACEMENT FROM THE REQUIRED CLEARANCE AT REST. THE REMAINING CLEARANCE MUST BE EQUAL TO OR MORE THAN THE CLEARANCES SHOWN IN PARENTHESES.

DUKE ENERGY.

3					
2					
1					
0	6/30/14	ROBESON	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

CLEARANCES TO BUILDINGS AND OTHER INSTALLATIONS ADAPTED FROM NESC RULE 234 AND TABLE 234-1

DEC	DEM	DEP	DEF
X	X	X	X

10.04-01A

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 (FT.)	INSULATED SUPPLY CABLES 0 - 750 V (TRIPLEX & QUADRUPLEX) (FT.)	0 - 750 V OPEN WIRE SECONDARY & SERVICES; CABLED PRIMARY (FT.)	OPEN WIRE PRIMARY: OVER 750 V - 22 kV (PHASE TO GROUND) (FT.)
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 DWGS. 10.04-15 AND 10.04-17	

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 WITH APPROPRIATE RADIAL ICE THICKNESS SPECIFIED ON DWG. 10.00-05.

   ALL OTHER COLUMNS FOR ENERGIZED CONDUCTORS IN THE TABLE:

   - MAXIMUM CONDUCTOR OPERATING TEMPERATURE OR 120°F, WHICHEVER IS GREATER.
   - 32°F WITH APPROPRIATE RADIAL ICE THICKNESS SPECIFIED ON DWG. 10.00-05.
   - 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 APPLICABLE TABLES FOR CONDUCTOR WIND SWINGS.

3. THIS TABLE DOES NOT APPLY TO CLEARANCE BETWEEN A SERVICE AND THE BUILDING TO WHICH IT ATTACHES, BUT DOES APPLY TO CLEARANCE BETWEEN SERVICES AND ADJACENT BUILDINGS.

4. FOR BUILDINGS UNDER CONSTRUCTION, THESE CLEARANCES MUST BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION.

5. REFER TO NESC RULE 234 FOR EXCEPTIONS AND REFINEMENTS.

6. CLEARANCE TO RAILROAD IS FOR NESC REFERENCE ONLY. BEFORE DESIGNING A RAILROAD CROSSING OR FACILITY NEXT TO A RAILROAD, CHECK WITH COMPANY PERMIT COORDINATOR FOR SPECIFIC RAILROAD COMPANY CLEARANCE REQUIREMENTS. THEY MAY REQUIRE MORE CLEARANCE THAN THE NESC.

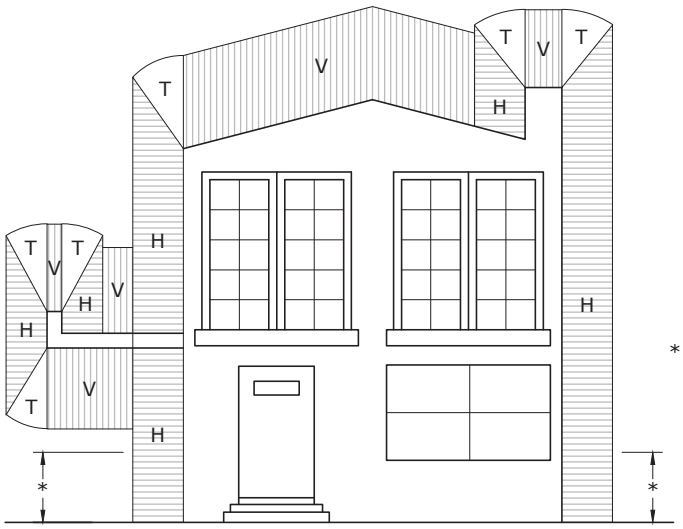
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK

CLEARANCES TO BUILDINGS
AND OTHER INSTALLATIONS
ADAPTED FROM NESC RULE 234 AND TABLE 234-1

DEC	DEM	DEP	DEF
X	X	X	X

10.04-01B



* FOR AREAS BEYOND THE SHADED PORTIONS OF THE SKETCH, SEE NESC RULE 232 OR DWG. 10.02-01 FOR APPROPRIATE CLEARANCES

HORIZONTAL CLEARANCES (SEE NOTE 2)	EFFECTIVELY GROUNDED NEUTRALS; SPAN & LIGHTNING PROTECTION WIRES; GUYS & MESSENGERS; CABLED PRIMARY (FT.)	INSULATED SUPPLY CABLES 0 - 750V (TRIPLEX & QUADRUPLEX) (FT.)	0 - 750V OPEN WIRE SECONDARY & SERVICES (FT.)	OPEN WIRE PRIMARY OVER 750V TO 22kV (PHASE TO GROUND) (FT.)
1. TO WALLS, PROJECTIONS AND GUARDED WINDOWS	4.5	5.0	5.5 (3.5) (SEE NOTE 2)	7.5 (4.5) (SEE NOTE 2)
2. TO UNGUARDED WINDOWS	4.5	5.0	5.5 (3.5) (SEE NOTE 2)	7.5 (4.5) (SEE NOTE 2)
3. TO BALCONIES AND AREAS READILY ACCESSIBLE TO PEDESTRIANS	4.5	5.0	5.5 (3.5) (SEE NOTE 2)	7.5 (4.5) (SEE NOTE 2)
VERTICAL CLEARANCES				
1. OVER OR UNDER ROOFS OR PROJECTIONS NOT READILY ACCESSIBLE TO PEDESTRIANS	3.0	3.5	10.5	12.5
2. OVER OR UNDER BALCONIES AND ROOFS READILY ACCESSIBLE TO PEDESTRIANS	10.5	11.0	11.5	13.5
3. OVER ROOFS, RAMPS, DECKS AND LOADING DOCKS ACCESSIBLE TO VEHICLES BUT NOT SUBJECT TO TRUCK TRAFFIC (SEE NOTE 1)	10.5	11.0	11.5	13.5
4. OVER ROOFS, RAMPS, DECKS AND LOADING DOCKS ACCESSIBLE TO TRUCK TRAFFIC (SEE NOTE 1)	15.5	16.0	16.5	18.5

FOR REFERENCE SEE NESC RULE 234, TABLE 234-1

NOTES:

1. TRUCKS ARE DEFINED AS ANY VEHICLE OVER 8 FT. IN HEIGHT.

2. CLEARANCES ARE SHOWN 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 APPROPRIATE SAG TABLES. SUBTRACT THE WIND DISPLACEMENT FROM THE REQUIRED CLEARANCE AT REST. THE REMAINING CLEARANCE MUST BE EQUAL TO OR MORE THAN THE CLEARANCES SHOWN IN PARENTHESES.

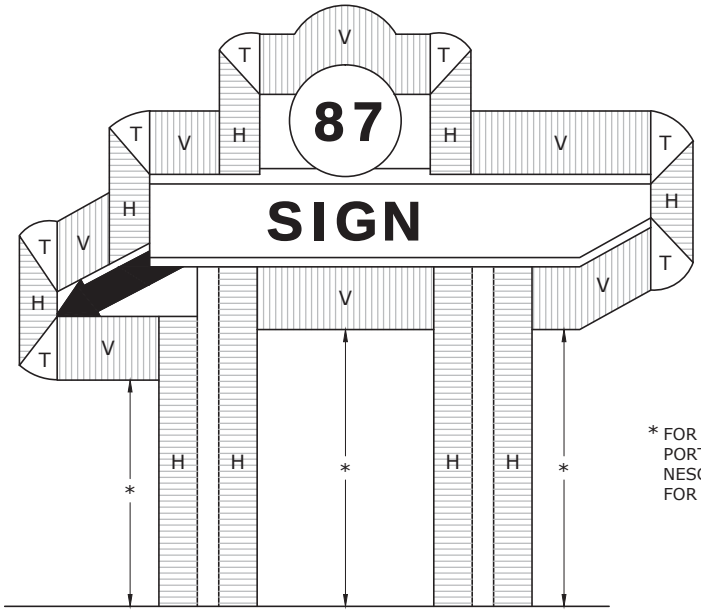
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CLEARANCE TO BUILDINGS, ILLUSTRATION

DEC	DEM	DEP	DEF
X	X	X	X

10.04-03



* FOR AREAS BEYOND THE SHADED PORTIONS OF THE SKETCH, SEE NESC RULE 232 OR DWG. 10.02-01 FOR APPROPRIATE CLEARANCES.

HORIZONTAL CLEARANCES	EFFECTIVELY GROUNDED NEUTRALS; SPAN & LIGHTNING PROTECTION WIRES; GUYS & MESSENGERS; CABLED PRIMARY (FT.)	INSULATED SUPPLY CABLES 0 - 750V (TRIPLEX & QUADRUPLEX) (FT.)	0 - 750V OPEN WIRE SECONDARY & SERVICES (FT.)	OPEN WIRE PRIMARY OVER 750V TO 22kV (PHASE TO GROUND) (FT.)
1. TO PORTIONS THAT ARE READILY ACCESSIBLE TO PEDESTRIANS	4.5	5.0	5.5 (3.5) (SEE NOTE 1)	7.5 (4.5) (SEE NOTE 1)
2. TO PORTIONS THAT ARE NOT READILY ACCESSIBLE TO PEDESTRIANS	3.0	3.5	5.5 (3.5) (SEE NOTE 1)	7.5 (4.5) (SEE NOTE 1)
VERTICAL CLEARANCES				
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

FOR REFERENCE SEE NESC RULE 234, TABLE 234-1

NOTES:

1. CLEARANCES ARE SHOWN 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 APPROPRIATE SAG TABLES. SUBTRACT THE WIND DISPLACEMENT FROM THE REQUIRED CLEARANCE AT REST. THE REMAINING CLEARANCE MUST BE EQUAL TO OR MORE THAN THE CLEARANCES SHOWN IN PARENTHESES.

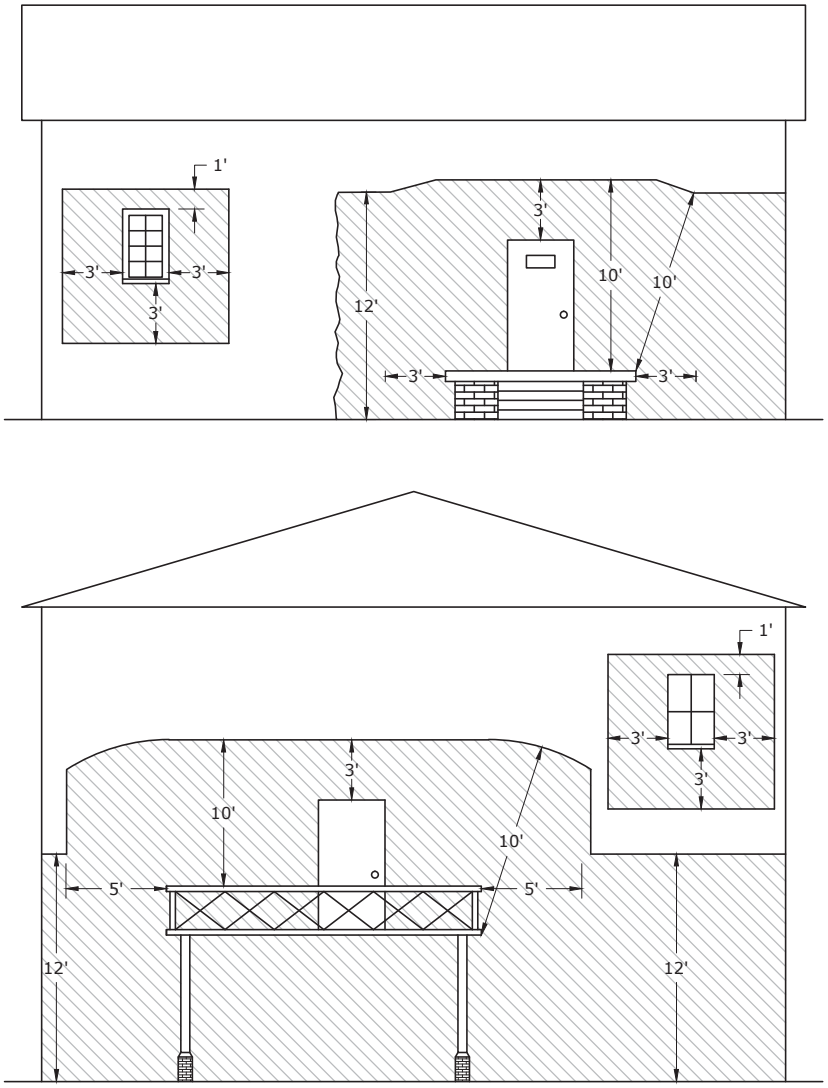
3					
2					
1					
0	6/30/14	ROBESON	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

DUKE ENERGY.

CLEARANCE TO SIGNS, ILLUSTRATION

DEC	DEM	DEP	DEF
X	X	X	X

10.04-05



MINIMUM CLEARANCE REQUIREMENTS FOR A TRIPLEX CONDUCTOR ATTACHMENT TO A RESIDENTIAL HOME

NOTES:

1. TRIPLEX CONDUCTORS SHALL HAVE A CLEARANCE OF NOT LESS THAN 12' FROM THE GROUND OR 10' FROM ANY PLATFORM OR PORCH FROM WHICH THEY MIGHT BE REACHED. NOT LESS THAN 16' IS REQUIRED OVER DRIVEWAYS (SEE DWG. 10.02-13 FOR EXCEPTIONS).

2. TRIPLEX CONDUCTORS SHALL HAVE A CLEARANCE OF NOT LESS THAN 3' FROM WINDOWS, DOORS, PORCHES, FIRE ESCAPES OR SIMILAR LOCATIONS.

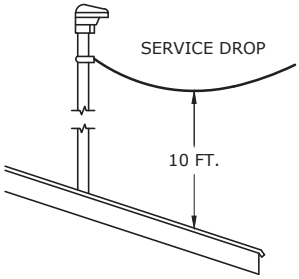
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CLEARANCE OF SERVICE DROP CABLE AT RESIDENCES

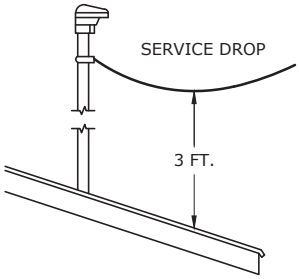
DEC	DEM	DEP	DEF
X	X	X	X

10.04-07

ALL SERVICE DROPS, INCLUDING DRIP LOOPS, MUST MAINTAIN THE FOLLOWING MINIMUM VERTICAL CLEARANCES ABOVE ROOFS FOR ROOFS OR BALCONIES THAT ARE NOT READILY ACCESSIBLE PER NESC 234C 3d.



CONDUCTORS, INCLUDING DRIP LOOPS, SHALL HAVE A VERTICAL CLEARANCE OF NOT LESS THAN TEN FEET FROM THE HIGHEST POINT OF ROOFS OR BALCONIES OVER WHICH THEY PASS.



EXCEPTION #1:

THREE FEET OF CLEARANCE IS ALLOWED IF:

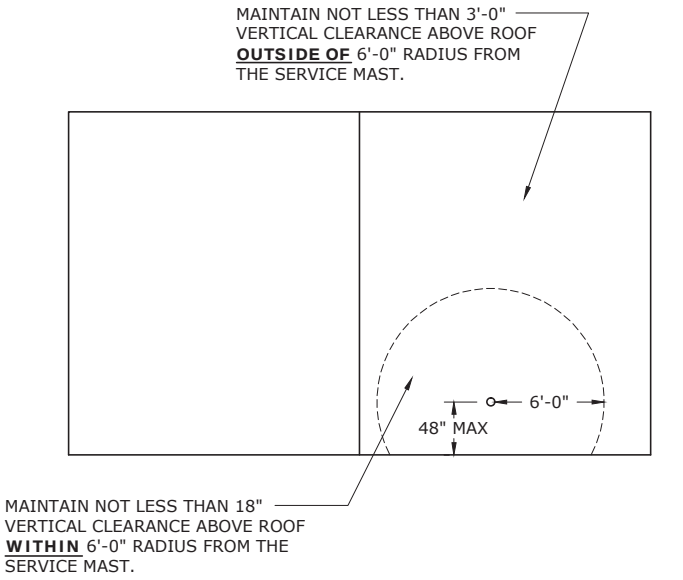
- THE PHASE-TO-PHASE VOLTAGE IS LESS THAN 300 VOLTS, AND
- THE ROOF OR BALCONY IS NOT READILY ACCESSIBLE, AND
- SERVICE DROP IS TRIPLEX OR QUADRUPLEX CABLE DESIGN.

3				
2				
1				
0	7/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

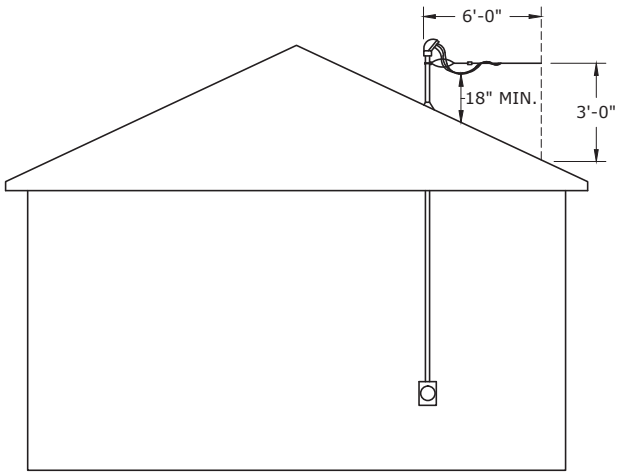
SERVICE CLEARANCE OVER ROOFS

DEC	DEM	DEP	DEF
X	X	X	X

10.04-09A



PLAN VIEW



SIDE VIEW

EXCEPTION #2:

EIGHTEEN INCHES OF CLEARANCE IS ALLOWED IF:

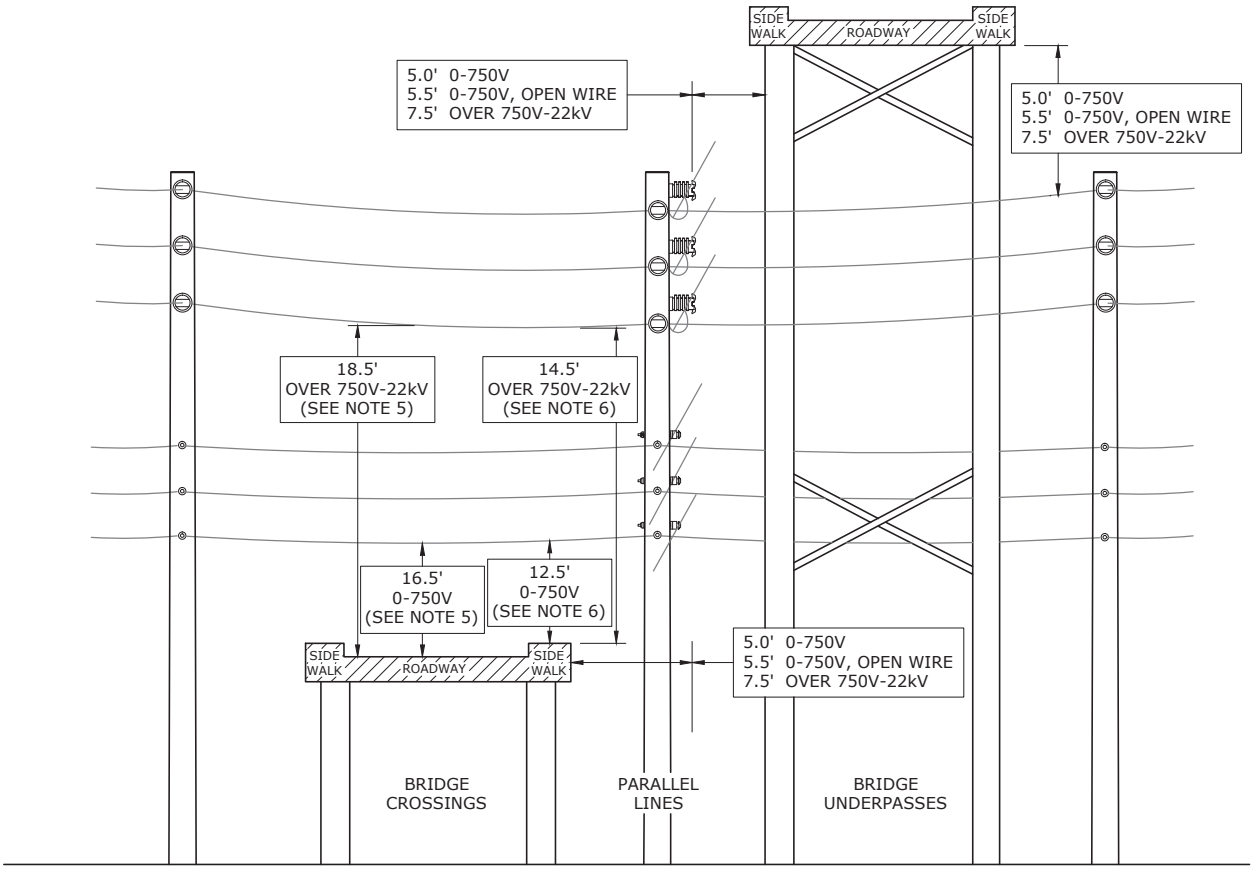
- THE PHASE-TO-PHASE VOLTAGE IS LESS THAN 300 VOLTS, AND
- THE CONDUCTORS DO NOT PASS OVER MORE THAN 48 INCHES OF ROOF OVERHANG, AND
- THE CONDUCTORS ARE TERMINATED AT A THROUGH-THE-ROOF RACEWAY OR APPROVED SUPPORT, AND
- THE ROOF OR BALCONY IS NOT READILY ACCESSIBLE.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

SERVICE CLEARANCE OVER ROOFS

DEC	DEM	DEP	DEF
X	X	X	X

10.04-09B



NOTES:

1. ALL VOLTAGES ARE Ø-G.
2. DIMENSIONS GIVEN ARE MINIMUMS. ADDITIONAL CLEARANCE SHOULD BE PROVIDED IF POSSIBLE. BRIDGE CROSSINGS HERE ARE NOT OVER NAVIGABLE WATERWAYS.
3. DOT OR HIGHWAY PERMITS MAY DICTATE CLEARANCE HEIGHTS.
4. SEE DWG. 10.04-01A FOR LINE CLEARANCES ABOVE BRIDGES WITH A SUPER STRUCTURE ABOVE THE ROADWAY.
5. THESE ARE NESC MINIMUM CLEARANCES TO THE ROADWAY SURFACE OF THE BRIDGE. REFER TO DWG. 10.02-03 FOR APPLICABLE STATE GUIDELINES.
6. THESE CLEARANCES ARE TO THE SIDEWALK WHERE ONLY RESTRICTED TRAFFIC IS NORMALLY EXPECTED. NO HORSEBACK RIDERS OR VEHICLES GREATER THAN 8 FOOT IN HEIGHT.

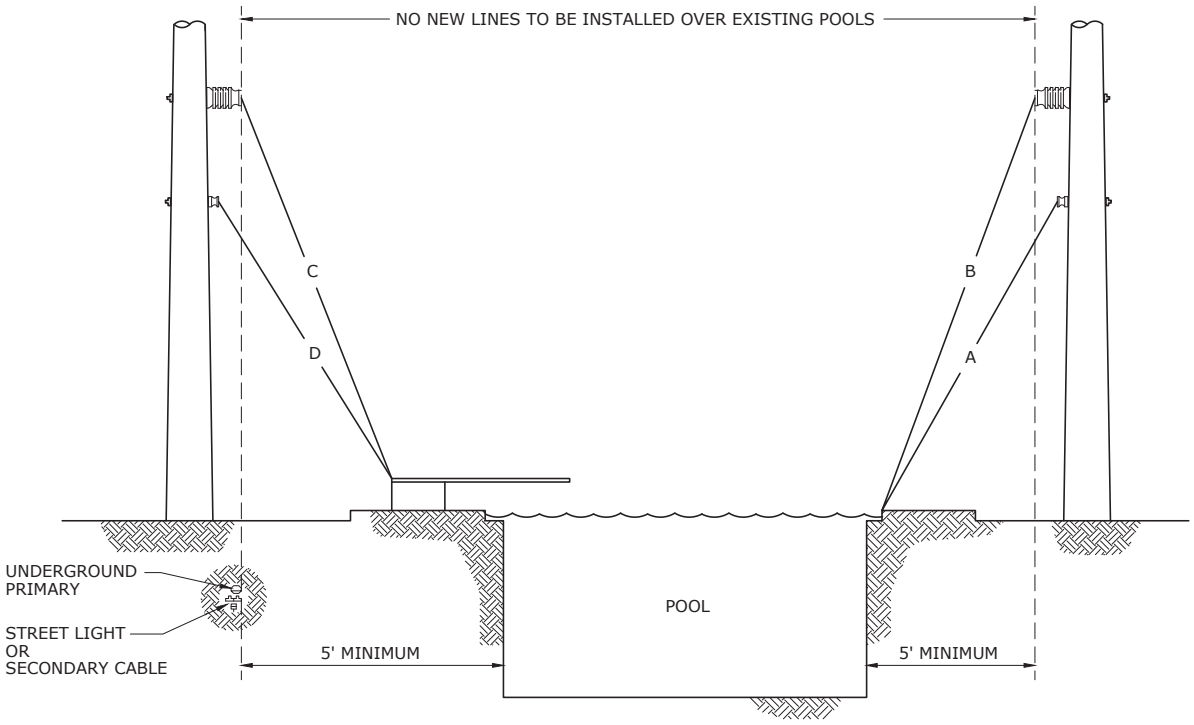
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CLEARANCE TO BRIDGES

DEC	DEM	DEP	DEF
X	X	X	X

10.04-11



ANGLE	INSULATED COMMUNICATION CONDUCTORS AND CABLES; MESSENGERS; GROUNDED GUYS; NEUTRAL CONDUCTORS, (FT.)	TRIPLEX AND QUADRUPLEX CABLES, 0 TO 750 V, AND NON-INSULATED COMMUNICATIONS CONDUCTORS (FT.)	OPEN WIRE SERVICE / SECONDARY CONDUCTORS, 0 TO 750 V (FT.)	OVERHEAD PRIMARY CONDUCTORS, OVER 750V TO 22kV (FT.)
A	22	22.5	23	-
B	-	-	-	25
C	-	-	-	17
D	14	14.5	15	-

NOTES:

1. FIVE (5) FEET MINIMUM MUST ALSO BE MAINTAINED FOR UNDERGROUND PRIMARY AND SECONDARY CABLES. IF FIVE (5) FEET IS NOT ATTAINABLE, LESSER DISTANCES ARE PERMITTED PER NESC RULE 351c. WITH CONSIDERATION FOR FUTURE OPERATIONAL NEEDS, THE DESIGNER SHOULD STILL MAINTAIN AS MUCH CLEARANCE AS POSSIBLE. ALL INSTALLATIONS WITHIN FIVE (5) FEET MUST BE IN CONDUIT.

2. SEE DWG. 10.04-01A, "CLEARANCES TO BUILDINGS" 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. 10.04-01A, "CLEARANCES TO BUILDINGS" FOR ACTUAL CLEARANCE REQUIREMENTS.

4. ANGLES 'C' AND 'D' ARE MEASURED FROM THE DIVING PLATFORM OR WATER SLIDE. ANGLES 'A' AND 'B' ARE MEASURED FROM THE WATER OR EDGE OF POOL.

5. FOR POOLS INSTALLED UNDER EXISTING LINES, SEE NESC TABLE 234-3 AND FIGURE 234-3.

6. POOL CONTRACTORS MUST MEET THE GREATER OF THE FOLLOWING CODES:
   - DUKE ENERGY POOL CLEARANCE POLICY.
   - CITY AND/OR COUNTY ELECTRICAL CODES.
   - STATE ELECTRICAL CODES.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CLEARANCE OVER IN-GROUND POOLS

DEC	DEM	DEP	DEF
X	X	X	X

10.04-13

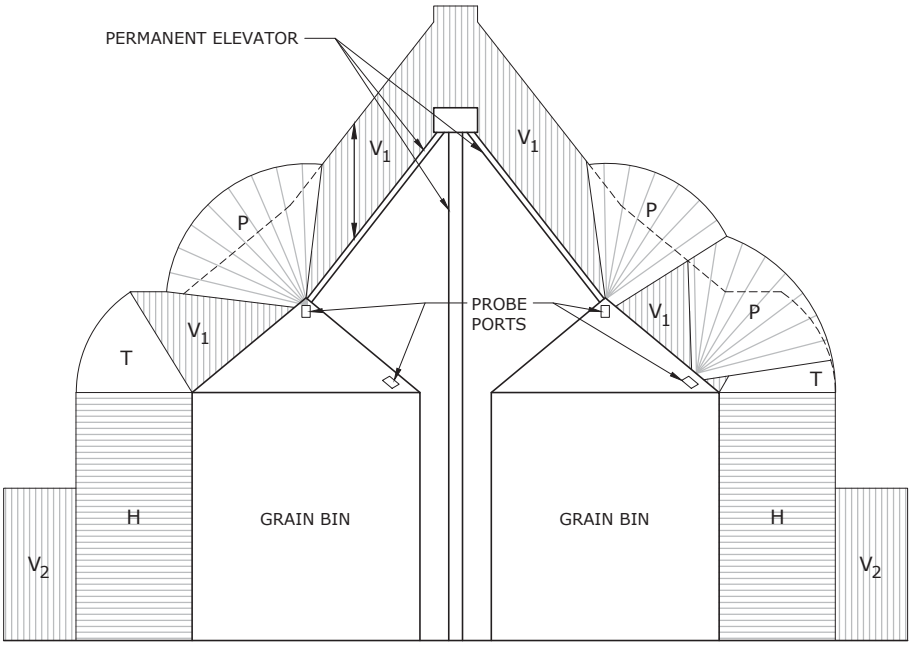
P= PROBE CLEARANCE 18 FT. REQUIRED BY NESC RULE 234F1A

H= HORIZONTAL CLEARANCE 15 FT. REQUIRED BY NESC RULE 234F1B

T = TRANSITION CLEARANCE

V_1 = VERTICAL CLEARANCE ABOVE A BUILDING REQUIRED BY NESC RULE 234C, SEE DWG. 10.04-03.

V_2 = VERTICAL CLEARANCE ABOVE LAND REQUIRED BY NESC RULE 232. SEE DWG. 10.02-01.



FOR REFERENCE SEE NESC RULE 234F

NOTES:

1. CLEARANCES OUTSIDE THE AREA GOVERNED BY NESC RULE 234F REVERT TO THE STANDARD CLEARANCES REQUIRED BY NESC RULE 234C AND DWG 10.04-03.
2. PROBE CLEARANCES OF NOT LESS THAN 18 FT. IN ALL DIRECTIONS ABOVE THE GRAIN BIN SHALL BE MAINTAINED FROM EACH PROBE PORT IN THE GRAIN BIN ROOF FOR ALL WIRES, CONDUCTORS AND CABLES.
3. A HORIZONTAL CLEARANCE OF NOT LESS THAN 15 FT. SHALL BE MAINTAINED BETWEEN GRAIN BINS AND OPEN SUPPLY CONDUCTORS, 0 TO 22KV. APPLY CALCULATED ADDER FOR VOLTAGES IN EXCESS OF 22KV.
4. THE VERTICAL CLEARANCE OR V_1 SHALL BE THE SAME CLEARANCE AS REQUIRED FOR A BUILDING. SEE NESC RULE 234C OR DWG. 10.04-03.
5. VERTICAL CLEARANCE OR V_2 BEYOND THE HORIZONTAL CLEARANCE, USE THE VERTICAL CLEARANCE OF CONDUCTORS ABOVE GROUND OR RAILS. SEE NESC RULE 232 OR DWG. 10.02-01.

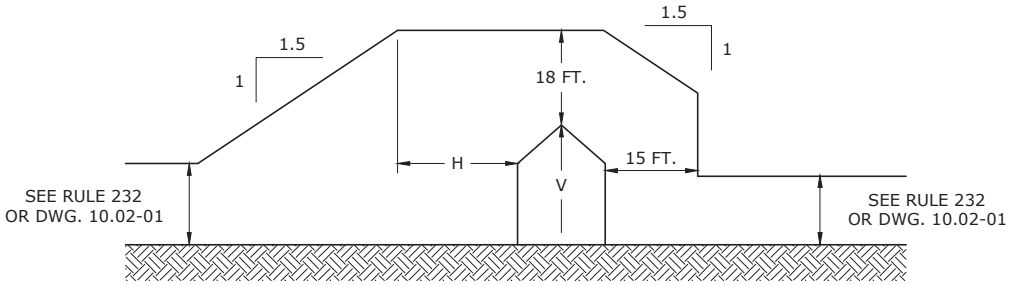
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CLEARANCES TO PERMANENTLY INSTALLED GRAIN BINS AND EQUIPMENT

DUKE ENERGY.

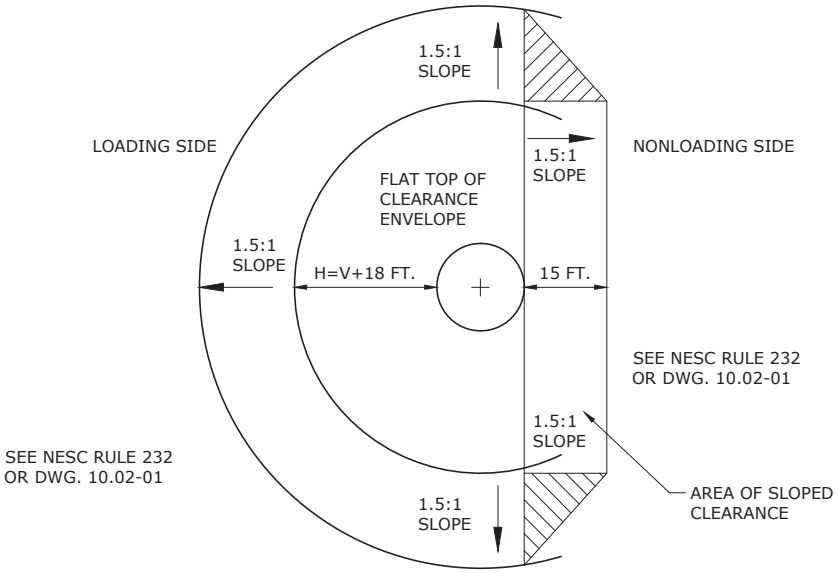
DEC	DEM	DEP	DEF
X	X	X	X

10.04-15



V = HEIGHT OF HIGHEST FILLING OR PROBING PORT ON GRAIN BIN

H = V+18 FT.



FOR REFERENCE SEE NESC RULE 234F

NOTES:

1. CLEARANCES OUTSIDE THE AREA GOVERNED BY NESC RULE 234F REVERT TO THE STANDARD CLEARANCES REQUIRED BY NESC RULE 234C AND DWG. 10.04-03.

2. A CLEARANCE OF NOT LESS THAN 18 FT. IN ALL DIRECTIONS ABOVE THE GRAIN BIN SHALL BE MAINTAINED FROM EACH PROBE PORT IN THE GRAIN BIN ROOF FOR ALL WIRES, CONDUCTORS AND CABLES.

3. A HORIZONTAL CLEARANCE OF NOT LESS THAN 15 FT. SHALL BE MAINTAINED BETWEEN GRAIN BINS AND OPEN SUPPLY CONDUCTORS, 0 TO 22KV. APPLY CALCULATED ADDER FOR VOLTAGE IN EXCESS OF 22KV.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CLEARANCES TO GRAIN BINS WITH
PORTABLE AUGERS, CONVEYORS OR ELEVATORS

DEC	DEM	DEP	DEF
X	X	X	X

10.04-17

CONDUCTORS AND CABLES USUALLY AT LOWER LEVELS	CONDUCTORS AND CABLES USUALLY AT UPPER LEVELS			
	EFFECTIVELY GROUNDED NEUTRALS, TRIPLEX AND QUADRUPLEX (IN)	OPEN SUPPLY CONDUCTORS		
		0 TO 8.7KV (IN)	OVER 8.7KV TO 50KV (PHASE TO GROUND)	
			SAME UTILITY (SEE NOTE 5) (IN)	DIFFERENT UTILITIES (SEE NOTE 5) (IN)
1. COMMUNICATION CONDUCTORS AND CABLES				
A. LOCATED IN THE COMMUNICATION SPACE	40	40	40	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)
B. LOCATED IN THE SUPPLY SPACE	16	16	40	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)
2. SUPPLY CONDUCTORS AND CABLES				
A. OPEN WIRE SECONDARY, TRIPLEX, QUADRUPLEX AND EFFECTIVELY GROUNDED NEUTRALS	16 (SEE NOTE 6)	16 (SEE NOTE 2)	16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)
B. OPEN CONDUCTORS OVER 750V TO 8.7KV		16 (SEE NOTE 2)	16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)
C. OPEN CONDUCTORS OVER 8.7KV TO 22KV				
(1) IF WORKING ON ENERGIZED WITH LIVE-LINE TOOLS AND ADJACENT CIRCUITS ARE NEITHER DE-ENERGIZED NOR COVERED WITH SHIELDS OF PROTECTORS			16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTE 4)
(2) IF WORKING ON ENERGIZED EXCEPT WHEN ADJACENT CIRCUITS (EITHER ABOVE OR BELOW) ARE DE-ENERGIZED OR COVERED BY SHIELDS OR PROTECTORS, OR BY THE USE OF LIVE-LINE TOOLS NOT REQUIRING LINE WORKERS TO GO BETWEEN LIVE WIRES			16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTES 3 & 4)	16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTES 3 & 4)
D. OPEN CONDUCTORS EXCEEDING 22KV, BUT NOT EXCEEDING 50KV			16 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTES 3 & 4)	40 PLUS 0.4 PER KV IN EXCESS OF 8.7 KV (SEE NOTES 3 & 4)

NOTES:

1. VALUES SHOWN ARE NESC MINIMUMS. CLEARANCES MAY NEED TO BE ADJUSTED TO OBTAIN PROPER MID-SPAN CLEARANCES AS WELL. DUKE ENERGY'S CONSTRUCTION STANDARDS WILL LIKELY EXCEED THESE MINIMUMS AND SHOULD ALWAYS BE USED AS A DESIGN STANDARD.
2. WHERE CONDUCTORS ARE OPERATED BY DIFFERENT UTILITIES, A VERTICAL CLEARANCE OF NOT LESS THAN 40 INCHES IS RECOMMENDED.
3. THESE VALUES DO NOT APPLY TO CONDUCTORS OF THE SAME CIRCUIT OR CIRCUITS BEING CARRIED ON ADJACENT CONDUCTOR SUPPORTS.
4. THE GREATER OF PHASOR DIFFERENCE OR PHASE-TO-GROUND VOLTAGE.
5. SEE EXAMPLES OF CALCULATIONS ON DWGS. 10.05-05A AND 10.05-05B.
6. NO CLEARANCE IS SPECIFIED BETWEEN TRIPLEX OR QUADRUPLEX CABLES AND EFFECTIVELY GROUNDED NEUTRALS.

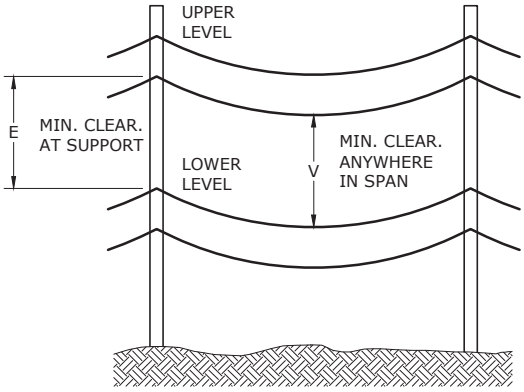
DUKE ENERGY.

3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

VERTICAL CLEARANCE BETWEEN CONDUCTORS AT SUPPORTS

DEC	DEM	DEP	DEF
X	X	X	X

10.05-01



NOTES:

1. LINE WIRES, CONDUCTORS AND CABLES SUPPORTED AT DIFFERENT LEVELS ON THE SAME STRUCTURES SHALL HAVE VERTICAL CLEARANCES AT THE SUPPORTING STRUCTURES SO ADJUSTED THAT THE CLEARANCE AT ANY POINT SHALL NOT BE LESS THAN 75% OF THAT REQUIRED AT THE SUPPORTS AS IN DWG. 10.05-01, FOR VOLTAGES LESS THAN 50KV BETWEEN CONDUCTORS.

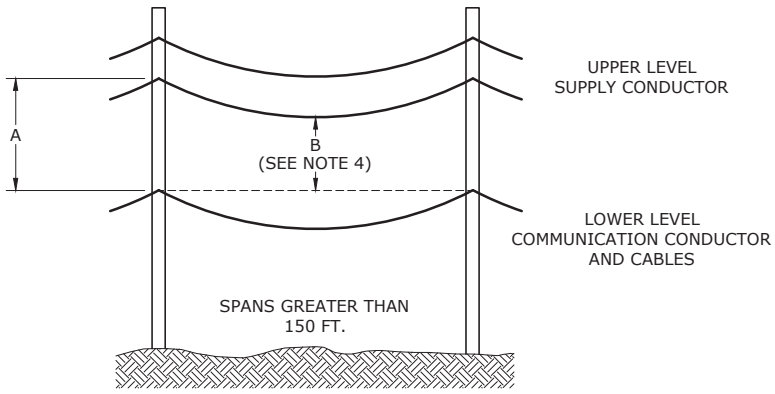
   EXAMPLE

   GIVEN A TRIPLEX CONDUCTOR AT THE UPPER LEVEL AND A COMMUNICATION CONDUCTOR BELOW, FROM DWG 10.05-01 THE REQUIRED CLEARANCE AT THE SUPPORT IS 40" (DIMENSION 'E'). THE REQUIRED CLEARANCE BETWEEN THE TWO AT ANY POINT IN THE SPAN IS THEREFORE 40" (0.75), OR 30" (DIMENSION V).

2. THE CLEARANCE AT ANY POINT IN THE SPAN BETWEEN AN EFFECTIVELY GROUNDED NEUTRAL AND COMMUNICATION CABLES IN THE COMMUNICATIONS SPACE MAY BE REDUCED TO NO LESS THAN 12", PROVIDED THAT A CLEARANCE OF 30" IS MAINTAINED BETWEEN THE TWO AT THE SUPPORTING POLES. THIS EXCEPTION APPLIES **ONLY** IF THE SUPPLY NEUTRAL AND COMMUNICATIONS MESSENGER ARE BONDED AT THE PROPER INTERVALS SPECIFIED IN RULE 092C1.

3. FOR VOLTAGES GREATER THAN 50KV BETWEEN CONDUCTORS, THE REQUIRED VERTICAL CLEARANCE AT ANY POINT IN THE SPAN IS 75% OF THAT REQUIRED AT THE SUPPORT UP TO 50KV, **PLUS** 100% OF THE REQUIRED CLEARANCE FOR THE PORTION IN EXCESS OF 50KV.

   FOR THE SAME UTILITY, THIS IS: [16 + (50 - 8.7)(4)] X 0.75 PLUS 0.4" PER KV IN EXCESS OF 50KV.
   FOR DIFFERENT UTILITIES, THIS IS: [40 + (50 - 8.7)(4)] X 0.75 PLUS 0.4" PER KV IN EXCESS OF 50KV.



4. FOR SPANS GREATER THAN 150 FT, AND FOR CONDUCTORS OPERATING AT VOLTAGES BETWEEN 750V AND 50KV, DIMENSION 'A' MUST BE ADJUSTED SO THAT DIMENSION 'B' IS ALWAYS GREATER THAN ZERO, NESC RULE 235C2B3.

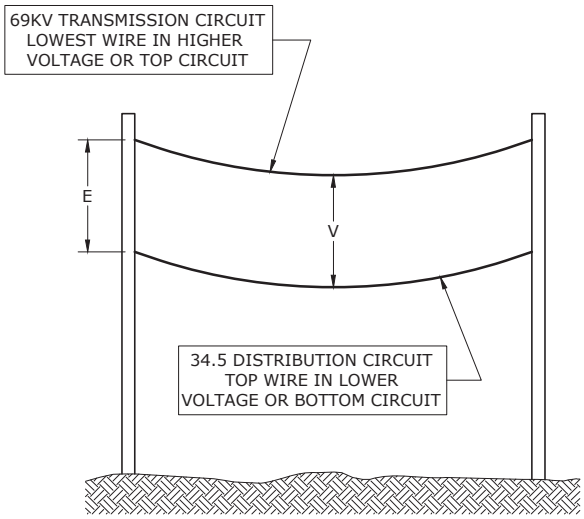
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

VERTICAL CLEARANCE BETWEEN
CONDUCTORS AT ANY POINT IN THE SPAN

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.05-03



WHAT IS THE MINIMUM SPACING ON THE POLES BETWEEN A 69KV AND A 34.5KV DISTRIBUTION CIRCUIT?

THE LINE IS IN INDIANA. THE 69KV LINE HAS 4/0 AAAC PHASES AND THE 34.5KV DISTRIBUTION UNDERBUILD HAS 1/0 AAAC PHASES. THE RULING SPAN FOR THE LINE IS 210 FT. BOTH CIRCUITS ARE OWNED BY THE SAME UTILITY.

- THE SOLUTION TO THIS PROBLEM HAS MULTIPLE PARTS. WHILE WE ARE ULTIMATELY TRYING TO DETERMINE THE VERTICAL SPACING ON THE POLES (DIMENSION 'E'), IT IS DICTATED BY THE SEPARATION REQUIREMENT AT ANY POINT IN THE SPAN, OR DIMENSION 'V'.

- TO DETERMINE THESE CLEARANCES, FIRST DETERMINE THE APPLICABLE VOLTAGE BETWEEN THE CIRCUITS. BECAUSE THE CLEARANCE IS BETWEEN DIFFERENT CIRCUITS, THE PHASOR DIFFERENCE IN VOLTAGE MUST BE USED TO CALCULATE THE CLEARANCE. WHEN THE ACTUAL PHASOR RELATIONSHIP IS UNKNOWN, ASSUME A WORST-CASE DIFFERENCE OF 180 DEGREES. THE RESULT OF THIS ASSUMPTION IS THAT THE PHASE TO GROUND VOLTAGES OF THE CIRCUITS ARE ADDED TOGETHER, SO OUR VOLTAGE BETWEEN CIRCUITS IS 69/1.732 + 34.5/1.732, OR 59.8 KV.

  FROM DWG. 10.05-01 (OR NESC TABLE 235-5), THE CLEARANCE BETWEEN CONDUCTORS OWNED BY THE SAME UTILITY IS 16", PLUS 0.4" PER KV IN EXCESS OF 8.7 KV, THIS LOOKS LIKE THE FOLLOWING:

  16" + (59.8 - 8.7)*0.4" =
  16" + 20.4" = 36.4"

  THIS IS THE VALUE FOR DIMENSION 'E', WITHOUT ACCOUNTING FOR SAG-RELATED CLEARANCES. IT IS VERY IMPORTANT, THIS IS **NOT** THE FINAL ANSWER.

- FROM DWG. 10.05-03 IT IS STATED IN NOTE 1 THAT THE CLEARANCE AT ANY POINT IN THE SPAN SHALL NOT BE LESS THAN 75% OF THAT REQUIRED AT THE SUPPORTS. AT FIRST IT WOULD APPEAR THIS IS SIMPLY 36.4" (0.75), OR 28" (ROUNDED UP FROM 27.3"). **HOWEVER**, NOTE 3 FROM THE SAME DRAWING ALSO STATES THAT 75% IS REQUIRED FOR VOLTAGES UP TO 50 KV, PLUS 100% OF THE REQUIRED CLEARANCE IN EXCESS OF 50 KV. SO, THE REQUIRED CLEARANCE AT ANY POINT IN THE SPAN IS:

  (16 + (50 - 8.7)*0.4)(.75) + (59.8 - 50)(0.4) =
  24.4" + 3.9" = 28.3", OR 29"

  THIS CREATES ONLY A SMALL CHANGE BUT NEVERTHELESS STILL SHOULD BE ACCOUNTED FOR.

- NEXT, WE NEED TO ADJUST THE CLEARANCE AT THE SUPPORTS (DIMENSION 'E') TO ACCOUNT FOR SAG-RELATED CLEARANCES. FROM DWG. 10.02-09 AND NESC RULE 234A, THE CONDITION THAT CREATES THE MAXIMUM FINAL SAG IS SELECTED FROM THE FOLLOWING:

  - 120° F, WITH NO WIND DISPLACEMENT
  - MAXIMUM CONDUCTOR TEMPERATURE FOR WHICH THE LINE IS DESIGNED TO OPERATE, IF GREATER THAN 120° F, WITH NO WIND DISPLACEMENT
  - 32° F, WITH NO WIND DISPLACEMENT AND RADIAL THICKNESS OF ICE SPECIFIED IN DWG. 10.00-05.

(CONTINUED ON DWG. 10.05-05B)

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK

EXAMPLE CALCULATION OF VERTICAL CLEARANCE
IN THE SPAN AND AT THE SUPPORTING STRUCTURES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.05-05A

(CONTINUED FROM DWG. 10.05-05A)

INDIANA IS LOCATED WITHIN ZONE 1, WHICH IS A HEAVY LOADING AREA. USING THE APPROPRIATE SAG CHART FOR 4/0 AAAC AND A 225' RULING SPAN, THE SAGS FOR EACH CONDITION ARE:

- AT 120° F, 3'-11"
- AT THE MAXIMUM OPERATING TEMPERATURE OF 212°F (FOR TRANSMISSION CIRCUITS IN INDIANA), 5'-8"
- AT 32° F WITH 1/2" RADIAL THICKNESS OF ICE, 3'-6"

THE MAXIMUM SAG CONDITION OF 5'-8" OCCURS AT THE MAXIMUM OPERATING TEMPERATURE

- THE SAG OF THE LOWER CONDUCTOR IS CALCULATED AT THE CONDITIONS SET FORTH IN NESC RULE 235C2b(1)(c). THE SAME AMBIENT CONDITIONS AS THE UPPER CONDUCTOR APPLY, WITH NO ELECTRICAL LOADING. SINCE THE MAXIMUM SAG OF THE UPPER CONDUCTOR OCCURS AT THE MAXIMUM OPERATING TEMPERATURE, AND **NOT** AT A DEFINED AMBIENT TEMPERATURE, IT IS NECESSARY TO DETERMINE SAGS AT TWO POINTS, 32° F AND AN APPROPRIATE MAXIMUM AMBIENT TEMPERATURE. FOR THE SAKE OF THIS EXAMPLE WE WILL SELECT 95° F.

- FOR 1/0 AAAC AND A 250' RULING SPAN (THE CLOSEST TABLE VALUE TO 225' THAT WAS PROVIDED), THE SAG AT 32°F IS 1'-0" AND AT 95°F IS 2'-6", DETERMINED BY INTERPOLATING BETWEEN 90°F AND 105°F.

NOTE: THE NESC STATES THAT THE SAG BETWEEN CONDUCTORS MUST BE CHECKED FOR 2 CASES. ONE IS SHOWN ABOVE (WITH THE TOP CONDUCTOR AT MAXIMUM TEMPERATURE AND THE BOTTOM AT AMBIENT WITH NO LOAD) AND THE OTHER IS WITH THE UPPER CONDUCTOR AT 32°F AND APPROPRIATE ICE LOAD AND THE LOWER CONDUCTOR AT AMBIENT WITH NO ELECTRICAL LOAD AND NO ICE LOADING. AN EXCEPTION TO THIS IS PROVIDED WHEN EXPERIENCE HAS SHOWN THAT DIFFERENT ICE CONDITIONS DO NOT OCCUR BETWEEN THE UPPER AND LOWER CONDUCTORS, AND WE ARE ASSUMING THAT HERE. OTHERWISE, WE WOULD ALSO NEED TO CHECK THE SECOND CASE.

THE WORST-CASE SCENARIO FOR CLEARANCE IS CREATED AT THE MINIMUM SAG CONDITION AT THE TWO TEMPERATURES CONSIDERED, OR 1'-0". IF WE WERE TO STRING BOTH THE UPPER AND LOWER CONDUCTORS AT THE SAME LOCATION AT THE SUPPORT, THE UPPER WOULD SAG 4'-8" MORE THAN THE LOWER (5'-8" MINUS 1'-0"). THIS DISTANCE MUST BE ADDED TO THE 29" CLEARANCE WE MUST MAINTAIN IN THE SPAN, SO OUR OVERALL SEPARATION BETWEEN CONDUCTORS AT THE POLE IS:

(4'-8") + (2'-3") = 6'-11"

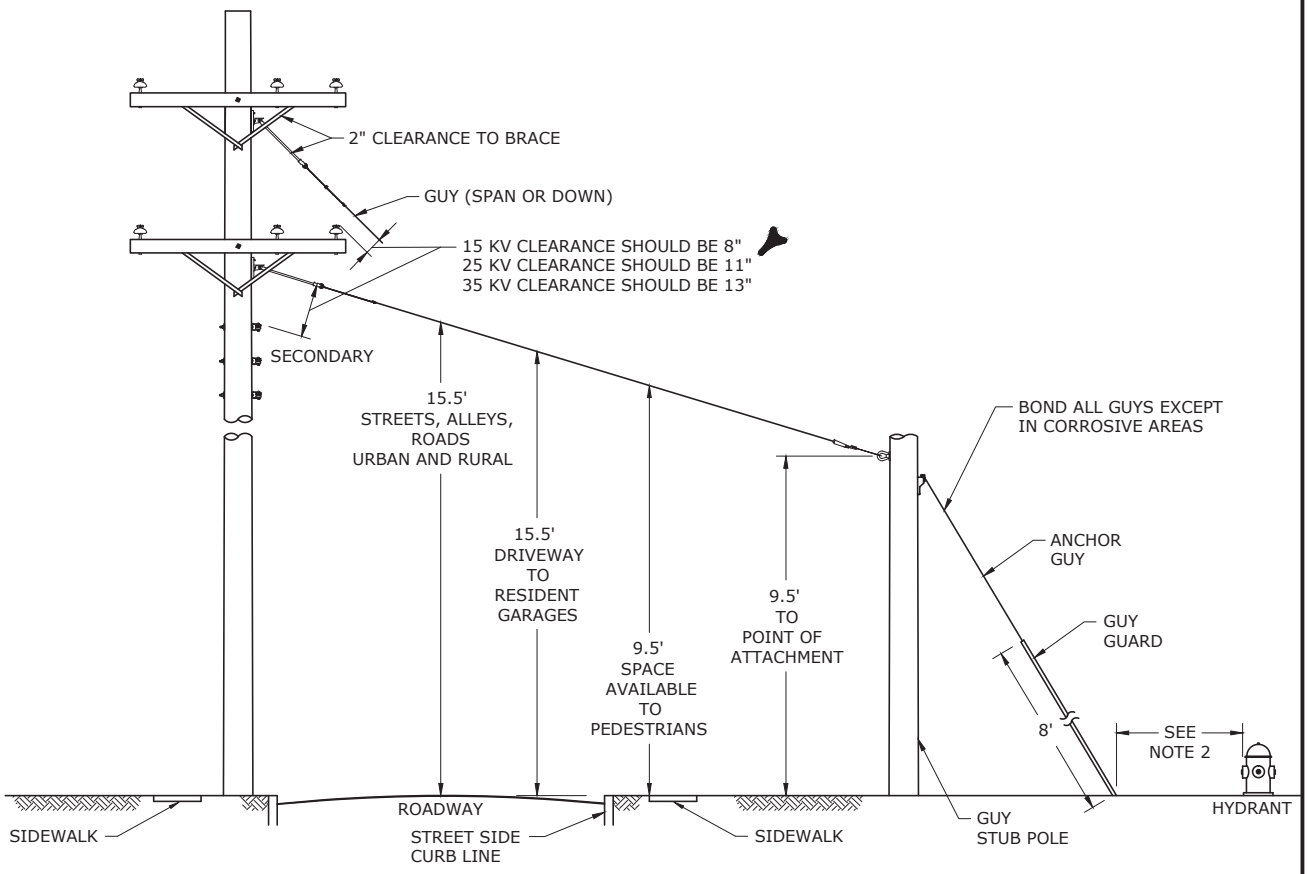
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK

EXAMPLE CALCULATION OF VERTICAL CLEARANCE IN THE SPAN AND AT THE SUPPORTING STRUCTURES

DEC	DEM	DEP	DEF
X	X	X	X

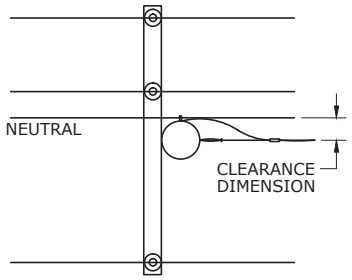
10.05-05B



MINIMUM CLEARANCE SPECIFICATION FOR THE INSTALLATION
OF GUYS ON THE COMPANY'S DISTRIBUTION SYSTEM

NOTES:

1. GUY CLEARANCES FROM SUPPLY CONDUCTORS ATTACHED TO THE SAME STRUCTURE



TYPE OF GUY	MINIMUM CLEARANCES IN ALL DIRECTIONS TO CONDUCTORS			
	TO SECONDARY	15 KV	25 KV	35 KV
SPAN GUY PARALLEL TO SUPPLY CONDUCTORS	12"	15"	19"	23"
ANCHOR GUYS PARALLEL TO SUPPLY CONDUCTORS	6"*	8"	11"	13"
OTHER GUYS (i.e. SPAN GUY NOT PARALLEL)	6"	9"	13"	17"

*6" CLEARANCE FROM MULTIPLEX TO ANCHOR GUYS IF PRACTICAL. IN NO CASE SHALL IT BE LESS THAN 3".

NOTE: THE ABOVE CLEARANCES ARE BETWEEN THE CONDUCTOR AND THE GUY. DOWN GUYS ATTACHED DIRECTLY TO THRU BOLTS ON OPPOSITE SIDE OF POLE FROM DEAD END OR VERTICAL ANGLE ASSEMBLIES WILL MEET THE ABOVE CLEARANCE REQUIREMENTS.

2. 7.5' REQUIRED IN FLORIDA, 4' ELSEWHERE. THIS CLEARANCE MAY BE NEGOTIATED TO 3' BY MUTUAL AGREEMENT.

3. FOR MINOR EXCEPTIONS, SEE TABLES 232-1, 235-6, AND 239-2 OF THE NESC.

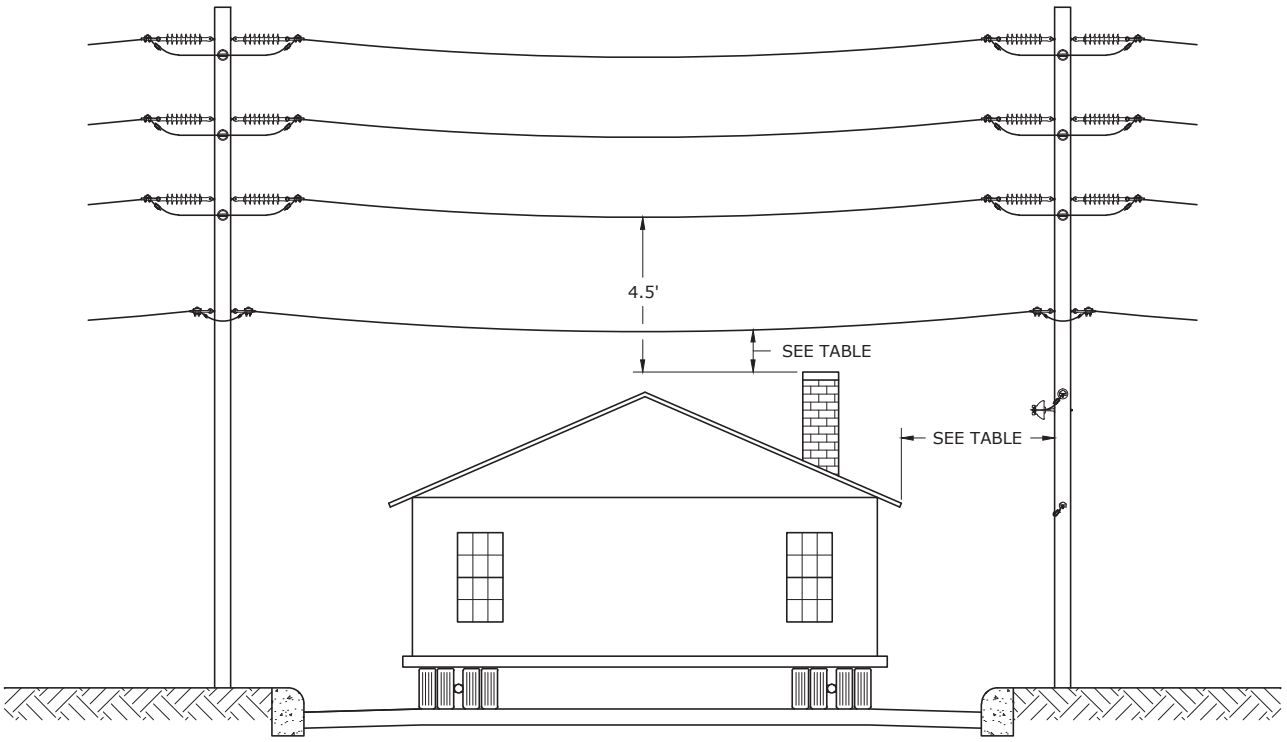
REVISED		BY	CK'D	APPR.
3				
2				
1	7/17/15	EANES	BURLISON	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

MINIMUM GUY CLEARANCES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.06-01



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
MULTIPLEX CONDUCTORS	2	3.5
OPEN WIRE CONDUCTORS	2.5	5.5
PRIMARY (751V-22 KV PHASE TO GROUND)	4.5	7

NOTES:

1. IF THE ABOVE CLEARANCES ARE DETERMINED TO BE MET AFTER A DUKE ENERGY DESIGNER RIDES THE PERMITTED ROUTE, NO FURTHER ACTION IS REQUIRED AND THE MOVE WILL OCCUR WITHOUT A DUKE ENERGY ESCORT.

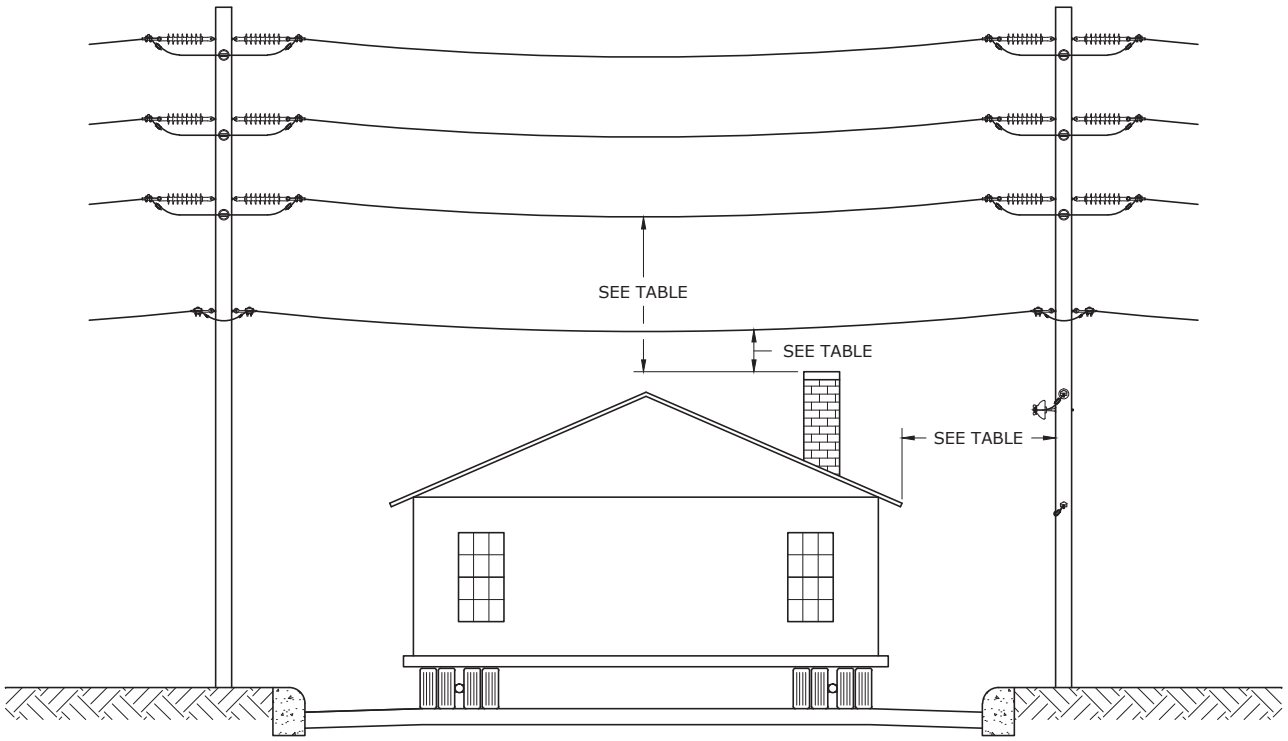
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

LINE CLEARANCES FOR OVERSIZED LOAD MOVES
(UNESCORTED)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.06-03A



MINIMUM APPROACH DISTANCE WHEN ESCORTED BY A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER (FROM NESC 431-1)	
VOLTAGE RANGE (PHASE-TO-PHASE)	DISTANCE
0 TO 300V	6 IN
301 TO 750V	1 FT-1 IN
751 TO 15KV	2 FT-2 IN
15.1 TO 36KV	3 FT-0 IN

NOTES:

1. NORMAL CLEARANCES DEFINED ON DWG. 10.06-03A CAN BE REDUCED IF:

   - A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER(S) ACCOMPANIES THE OVERSIZED LOAD.
   - CONTROLLED PASSAGE UNDER THE CONDUCTORS IS MAINTAINED. CONTROLLED PASSAGE INCLUDES 3-WAY COMMUNICATION BETWEEN DUKE ENERGY LEAD PIC (PERSONNEL IN CHARGE), A DUKE ENERGY DESIGNATED QUALIFIED ELECTRICAL WORKER, AND THE DRIVER OF THE OVERSIZED LOAD VEHICLE.

2. AT NO TIME SHALL THE CLEARANCES BETWEEN THE OVERSIZED LOAD AND DUKE ENERGY FACILITIES BE LESS THAN THE VALUES SHOWN IN THE TABLE ABOVE.

   - TABLE VALUES APPLY TO COVERED AND NON-COVERED CONDUCTORS.
   - PRIMARY NEUTRALS SHALL BE CONSIDERED 0 TO 300V.

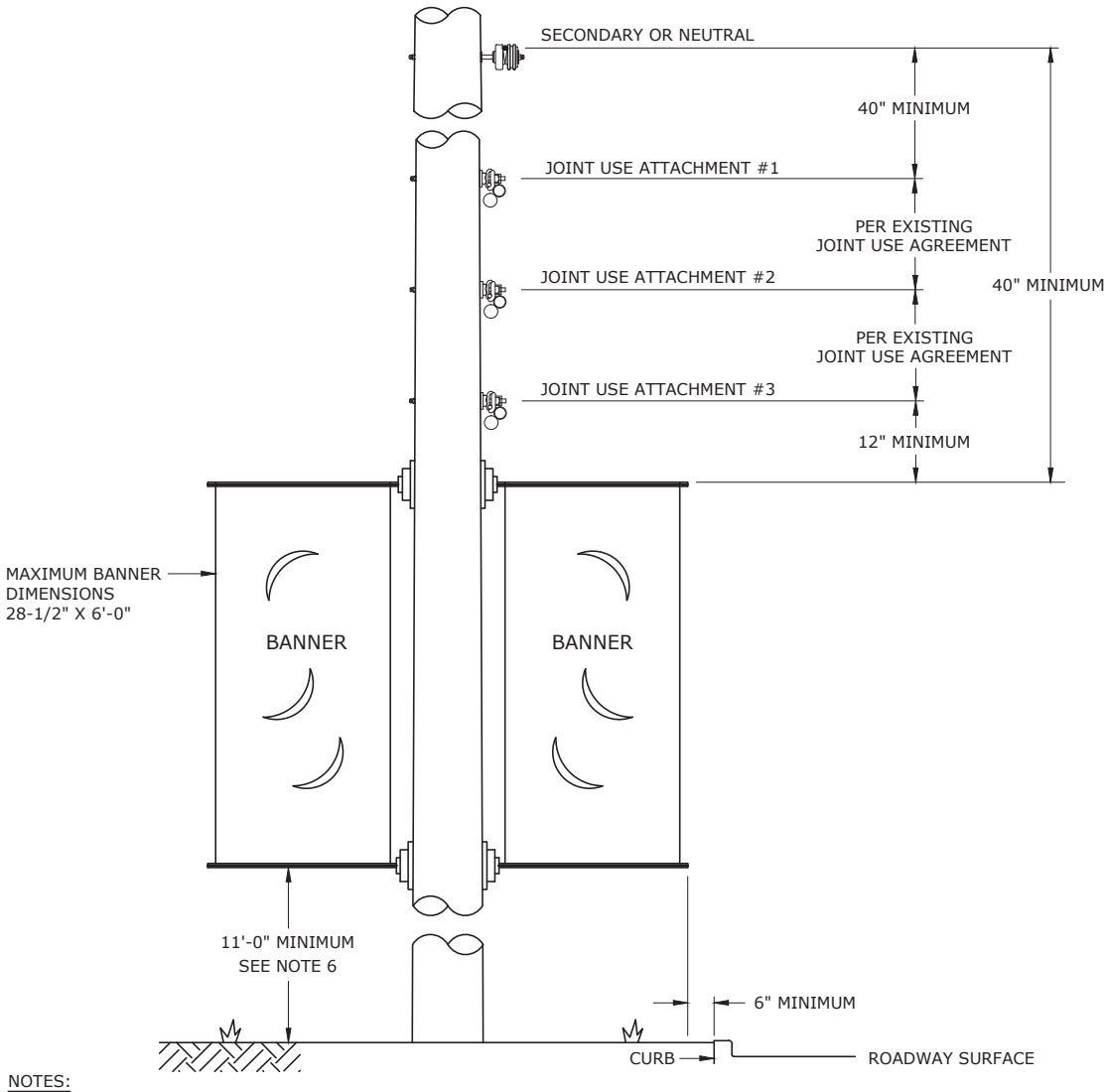
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK

LINE CLEARANCES FOR OVERSIZED LOAD MOVES (ESCORTED)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.06-03B



NOTES:

1. INSTALLATION OF BANNERS ON COMPANY DISTRIBUTION POLES IS AT THE SOLE DISCRETION OF THE COMPANY, AND IS LIMITED TO GOVERNMENTAL ENTITIES SUCH AS CITIES, TOWNS, MUNICIPALITIES, ETC. THE CONTENTS OF THIS DOCUMENT CANNOT SUPERSEDE ANY JOINT-USE AGREEMENT ALREADY IN PLACE.
2. POLES MUST BE TRUCK ACCESSIBLE AND INSPECTED FOR STRUCTURAL INTEGRITY PRIOR TO BANNER ATTACHMENT.
3. BANNER INSTALLATION AND DESIGN SHOULD BE SUCH THAT CONTACT WITH COMPANY CONDUCTORS OR FACILITIES IS AVOIDED IN THE EVENT THE BANNER IS TORN OR BECOMES UNATTACHED FROM ITS SUPPORTS OR MOUNTING HARDWARE.
4. A BANNER AGREEMENT MUST BE COMPLETED PRIOR TO ATTACHMENT TO COMPANY DISTRIBUTION POLES. ANY MESSAGING OR IMAGES MUST BE APPROVED AS A PART OF THIS AGREEMENT. "POLE TO POLE" OR "POLE TO STRUCTURE" BANNERS ARE NOT PERMITTED.
5. BANNERS ATTACHED TO POLES SHOULD BE PERPENDICULAR TO POWER LINES.
6. BANNERS THAT EXTEND OVER ROADWAY MUST HAVE 15'-0" VERTICAL CLEARANCE FROM ROAD SURFACE. IF ROADWAY IS DOT MAINTAINED, SEE DWG. 10.02-03.
7. THE BANNERS MUST HAVE HALF CIRCLE AIR POCKETS CUT INTO THEM.
8. FOR WOODEN DISTRIBUTION POLES, BANNERS MUST BE ATTACHED USING REMOVABLE BANDS OR SCREWS THAT DO NOT PENETRATE THE ENTIRE DIAMETER OF THE POLE. FOR NON-WOOD POLES, REMOVABLE BANDS **ONLY** WILL BE ALLOWED. ANY HARDWARE USED TO SECURE BANNERS IS NOT TO CONFLICT WITH THE OPERATION OF ANY COMPANY EQUIPMENT.
9. COMPANY SHALL NOT BE RESPONSIBLE FOR REMOVING AND/OR REBANDING BANNERS WHENEVER THE POLES ARE REPLACED. EXCEPT IN CASES OF EMERGENCY, OUTAGE RESPONSE, OR SIMILAR CIRCUMSTANCE, CONTACT THE JOINT USE DEPARTMENT PRIOR TO THE REMOVAL OF ANY BANNERS.
10. REQUESTS NOT COVERED BY THE ABOVE STANDARD CAN BE REVIEWED ON A CASE BY CASE BASIS. ANY COSTS ASSOCIATED WITH THIS ANALYSIS WILL BE BORNE BY THE REQUESTING PARTY.
11. CUSTOMER AGREES TO INDEMNIFY, DEFEND, AND SAVE HARMLESS COMPANY FROM ALL CLAIMS, LOSSES, INJURIES, DAMAGE 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.

DUKE ENERGY.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

BANNER INSTALLATION ON DISTRIBUTION POLES

DEC	DEM	DEP	DEF
X	X	X	X

10.06-05

GENERAL

1. ANYONE REQUESTING TO INSTALL AND MAINTAIN ATTACHMENTS ON DUKE ENERGY POLES SHALL SUBMIT THE APPROPRIATE AUTHORIZATION 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.
2. ALL PERMITTED ATTACHMENTS SHALL BE ON THE SAME SIDE OF THE POLE, PREFERABLY THE SAME SIDE AS THE NEUTRAL. IF THE NEUTRAL IS ON THE OPPOSITE SIDE OF THE POLE FROM EXISTING JOINT USERS, A NEW JOINT USER SHALL INSTALL CABLE ON THE SAME SIDE AS EXISTING JOINT USERS.
3. NO PERMANENT CLIMBING AIDS ARE ALLOWED ON DUKE 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 WIRE BE CUT.
5. ALL NEW POWER SUPPLIES AND NEW METERING EQUIPMENT SHALL BE MOUNTED ONLY ON CUSTOMER OWNED FACILITIES. ALL POWER SUPPLY INSTALLATIONS MUST HAVE APPROPRIATE DISCONNECT DEVICES. NEW STRAND MOUNTED POWER SUPPLIES WILL BE BILLED ON A METERED ACCOUNT BASIS. EXISTING INSTALLATIONS WHERE POWER SUPPLIES AND METERING EQUIPMENT ARE LOCATED ON COMPANY OWNED FACILITIES CAN REMAIN AS CURRENTLY INSTALLED. ANY UPGRADE, RELOCATION, POLE CHANGEOUT (EXCEPT IN THE CASE OF UNPLANNED EMERGENCY WORK OR OUTAGE RELATED INCIDENT) OR OTHER CHANGE TO THE FACILITIES WILL ADHERE TO THE CURRENT POLICY. IN DENSELY POPULATED DOWNTOWN AREAS OR OTHER INSTANCES WHERE EXISTING AGREEMENTS ARE IN PLACE WITH THE RIGHT-OF-WAY OWNER, POWER SUPPLIES AND METERING EQUIPMENT MAY BE ALLOWED ON COMPANY OWNED FACILITIES. THE CUSTOMER MUST PROVIDE WRITTEN VERIFICATION FROM THE RIGHT-OF-WAY OWNER THAT ADDITIONAL FACILITIES OF ANY KIND (POLE, PEDESTAL, ETC) CANNOT BE ADDED WITHIN THE RIGHT-OF-WAY. THESE REQUESTS WILL BE HANDLED ON A CASE BY CASE BASIS, AND THE COST OF ANY ENGINEERING LABOR AND MAKE-READY WORK WILL BE BORNE IN FULL BY THE CUSTOMER.
6. ONLY DEVICES SUCH AS ANTENNAS AND THEIR RELATED CABLING ARE PERMITTED ON COMPANY FACILITIES AS DESCRIBED ON THE ACCOMPANYING PAGES. CRITERIA SURROUNDING DISCONNECTS, WARNING SIGNS, ETC THAT ADDRESS PROPER WORK PRACTICES AROUND RF EMITTING DEVICES MUST BE FOLLOWED AT ALL TIMES. THESE INSTALLATIONS ARE EVALUATED INDIVIDUALLY, AND REGARDLESS OF OTHER CIRCUMSTANCES CAN BE DENIED AT THE COMPANY'S DISCRETION.
7. WHERE REQUESTS FOR INSTALLATIONS INVOLVE WOODEN STREET LIGHT ONLY POLES AND MEET THE ABOVE CRITERIA FOR INSTALLATION ON THE POLE, THE ENGINEERING ANALYSIS MUST ACCOUNT FOR THE CAPACITY AND VOLTAGE DROP OF EXISTING STREET LIGHTING CABLE AND THE STRENGTH OF THE POLE TO ACCEPT THE PROPOSED EQUIPMENT. FOR DECORATIVE, NON-WOODEN INSTALLATIONS, SPECIALLY DESIGNED POLES MAY BE RECOMMENDED IN THESE INSTANCES THAT PLACE THE CABLING AND OTHER CONDUITS WITHIN THE POLE. LEAD TIMES FOR THESE SPECIAL ORDER ITEMS SHOULD BE ACCOUNTED FOR IN ANY DISCUSSIONS WITH THE CUSTOMER.
8. UNMETERED EQUIPMENT IS NOT PERMITTED EXCEPT IN THOSE JURISDICTIONS WHERE ALLOWED BY EXISTING TARIFFS.
9. NEW AIR DRYERS, NITROGEN BOTTLES, LOAD COILS, ETC. SHALL NOT BE ATTACHED TO DUKE ENERGY POLES.
10. 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 DUKE ENERGY SPECIFICATIONS.
11. ATTACHMENT LOCATIONS MAY BE ASSIGNED BY DUKE ENERGY AT SPECIFIC HEIGHTS. UNDER NO CIRCUMSTANCES WILL PROPER CLEARANCES FROM DUKE ENERGY FACILITIES BE VIOLATED.
12. ALL ATTACHMENTS ON DUKE ENERGY POLES SHALL BE TAGGED IN ACCORDANCE WITH THE LATEST DUKE ENERGY REQUIREMENTS.
13. 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 SYSTEMWIDE BASIS.

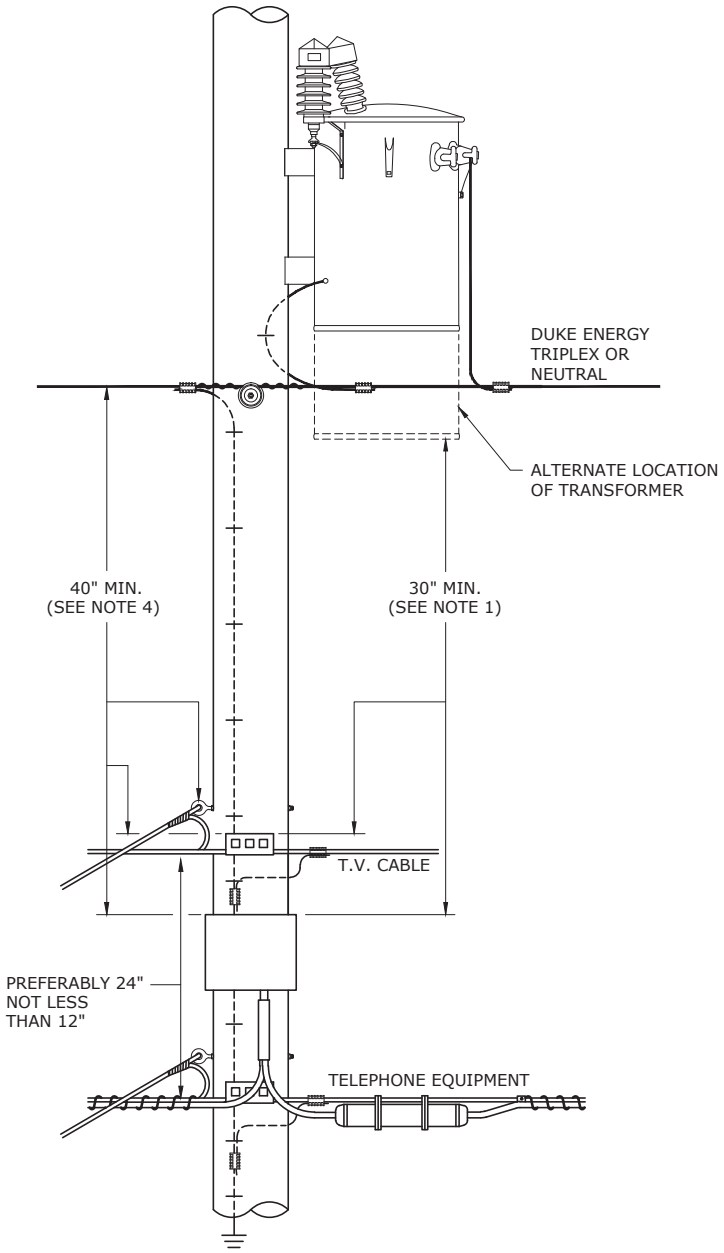
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/10/15	EANES	EANES	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

JOINT USE ATTACHMENT AND CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

10.07-03



NOTES:

1. THIS DIMENSION OF NOT LESS THAN 30" APPLIES BETWEEN COMMUNICATION CABLES IN THE COMMUNICATION SPACE AND NON-CURRENT CARRYING PARTS OF SUPPLY EQUIPMENT THAT ARE EFFECTIVELY GROUNDED (THIS DOES NOT APPLY TO THE SUPPLY NEUTRAL OR SECONDARY WHICH REQUIRES A MINIMUM OF 40 INCHES OF CLEARANCE).

2. MINIMUM DIMENSIONS APPLY TO UPPERMOST ATTACHMENT.

3. CLEARANCES BETWEEN POWER AND COMMUNICATION LINES AT THE POLE MUST BE INCREASED IF THE PROPER MIDSPAN CLEARANCES DESCRIBED ON DWG. 10.07-07 CANNOT BE MAINTAINED.

4. A 40" MINIMUM CLEARANCE IS REQUIRED BETWEEN CLOSEST METAL PARTS OF COMMUNICATION AND UNGROUNDED POWER EQUIPMENT.

5. THE CLEARANCES ON THIS DRAWING APPLY TO BOTH GROUNDED METALLIC COMMUNICATION CABLES AND DIELECTRIC FIBER OPTIC CABLES.

6. JOINT USER SHALL BOND MESSENGER WIRES TO GROUND WIRE PER NESC REQUIREMENTS.

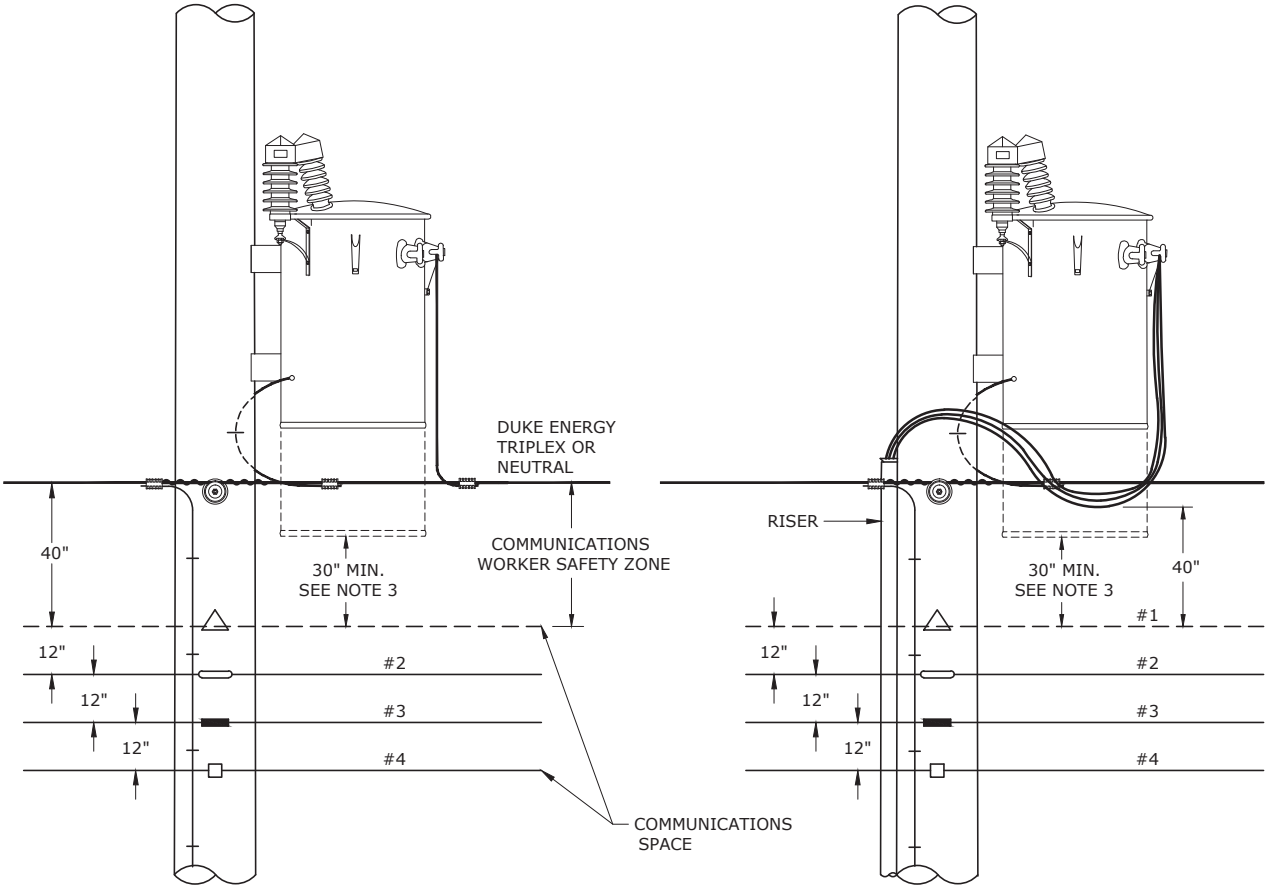
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	12/31/14	ROBESON	GUINN	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

JOINT USE CONSTRUCTION CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

10.07-05



MINIMUM CLEARANCES MIDSPAN (IN.)	
NEUTRAL	30
SECONDARY	30

NOTES:

1. DUKE 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.

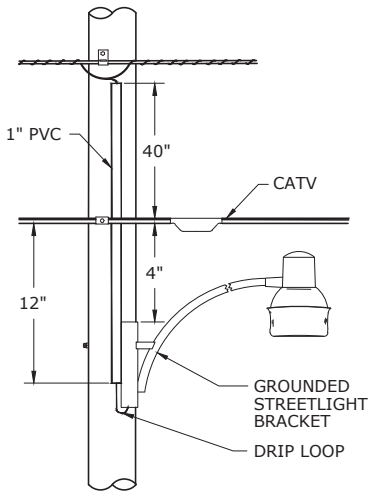
3. THIS DIMENSION OF NOT LESS THAN 30" APPLIES BETWEEN COMMUNICATION CABLES IN THE COMMUNICATION SPACE AND NON-CURRENT CARRYING PARTS OF SUPPLY EQUIPMENT THAT ARE EFFECTIVELY GROUNDED (THIS DOES NOT APPLY TO THE SUPPLY NEUTRAL OR SECONDARY WHICH REQUIRES A MINUMUM OF 40 INCHES OF CLEARANCE).

REVISED		BY	CK'D	APPR.
3				
2	12/31/14	ROBESON	GUINN	ADCOCK
1	8/26/14	EANES	EANES	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

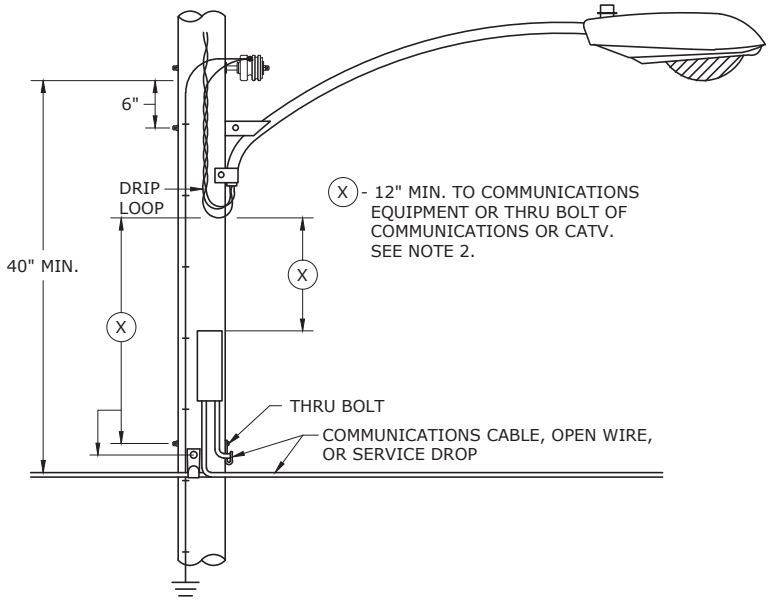
JOINT USE CONSTRUCTION CLEARANCES

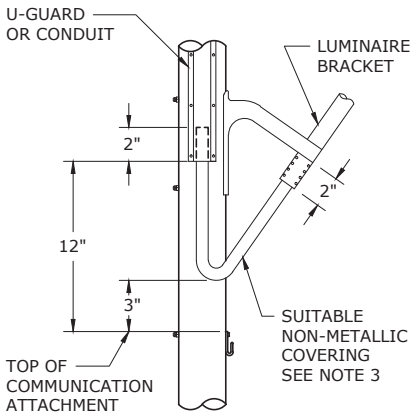
DEC	DEM	DEP	DEF
X	X	X	X

10.07-07



MOUNTED BELOW
COMMUNICATION EQUIPMENT





DETAIL A

MOUNTED WITHIN COMMUNICATION
WORKER SAFETY ZONE

NOTES:

1. CLEARANCES WITHIN THE NESC ESTABLISH A COMMUNICATION WORKER SAFETY ZONE BETWEEN THE FACILITIES LOCATED IN THE SUPPLY SPACE AND FACILITIES LOCATED IN THE COMMUNICATION SPACE, BOTH AT THE STRUCTURE AND IN THE SPAN BETWEEN THE STRUCTURES. WITH FEW EXCEPTIONS, NO SUPPLY OR COMMUNICATION FACILITIES SHALL BE LOCATED IN THE COMMUNICATION WORKER SAFETY ZONE.

2. THE DRIP LOOP OF CONDUCTORS ENTERING A LUMINAIRE OR LUMINAIRE BRACKET SHALL BE AT LEAST 12" ABOVE THE HIGHEST COMMUNICATION CABLE, THROUGH BOLT OR OTHER EXPOSED CONDUCTIVE OBJECTS.

3. THE CLEARANCE STATED IN NOTE 2 MAY BE REDUCED TO 3" IF THE LOOP IS COVERED BY A SUITABLE NON-METALLIC COVERING THAT EXTENDS AT LEAST 2" BEYOND THE LOOP AS SHOWN IN DETAIL A.

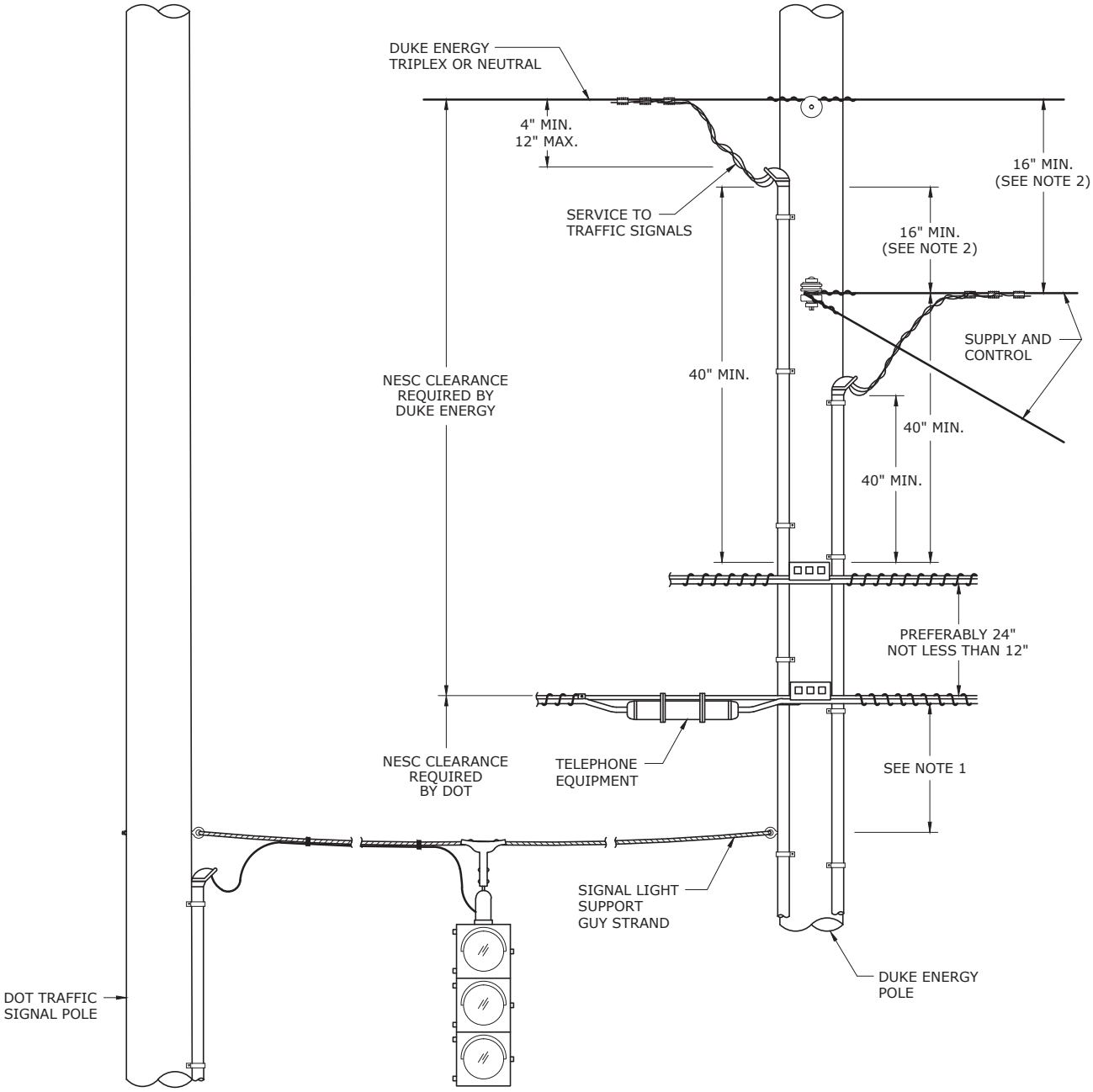
3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

JOINT USE CONSTRUCTION CLEARANCES BETWEEN ELECTRICAL SUPPLY EQUIPMENT AND STREET LIGHTING EQUIPMENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.07-08



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".

2. IN THIS INSTANCE, THE DOT SUPPLY AND CONTROL CABLE IS CONSIDERED A COMMUNICATIONS CONDUCTOR WITHIN THE SUPPLY SPACE, NESC TABLE 235-5.

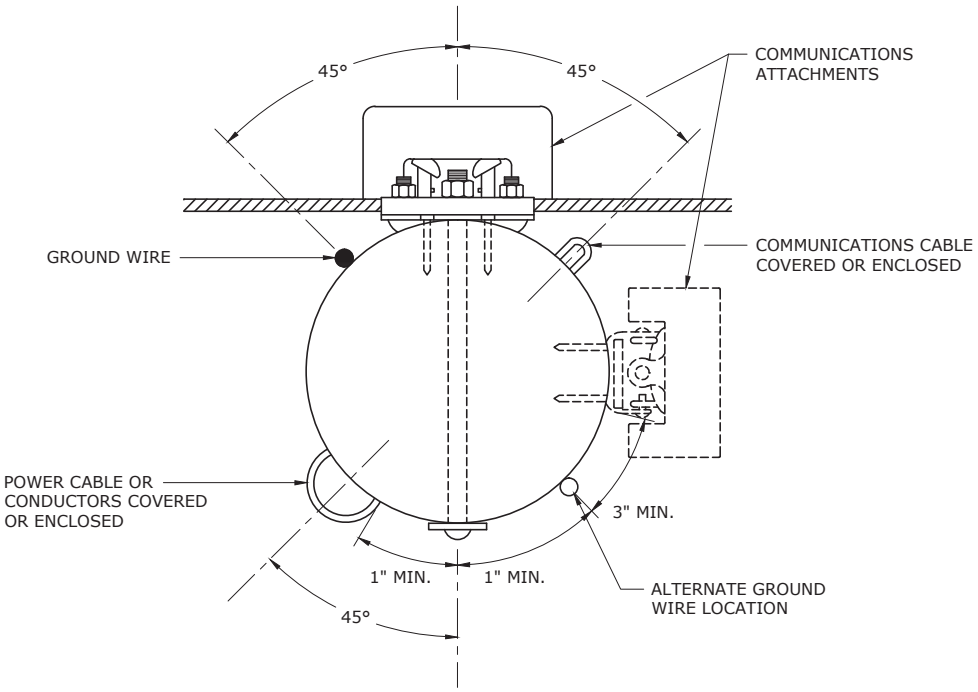
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

JOINT USE CONSTRUCTION
TRAFFIC SIGNAL SUPPORT AND
POWER OPERATING CIRCUIT CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

10.07-09

LOCATION OF VERTICAL RUNS

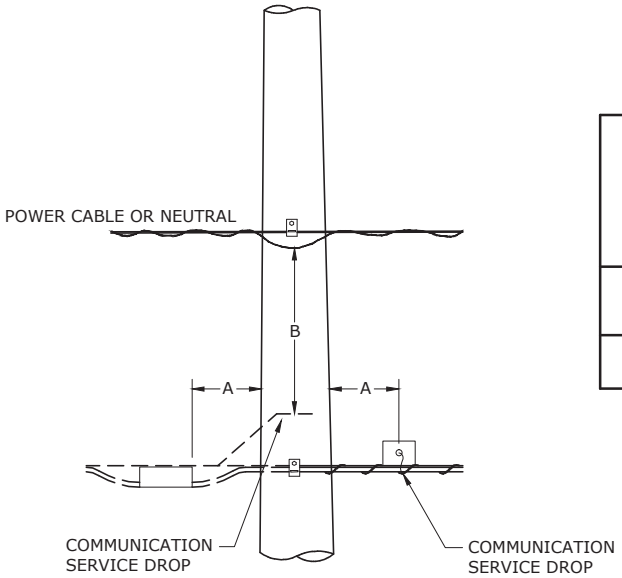


STREET SIDE

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 (IN.)	DUKE ENERGY PREFERRED MINIMUM (IN.)
A	ALLOWED ON POLE	12
B	40	40

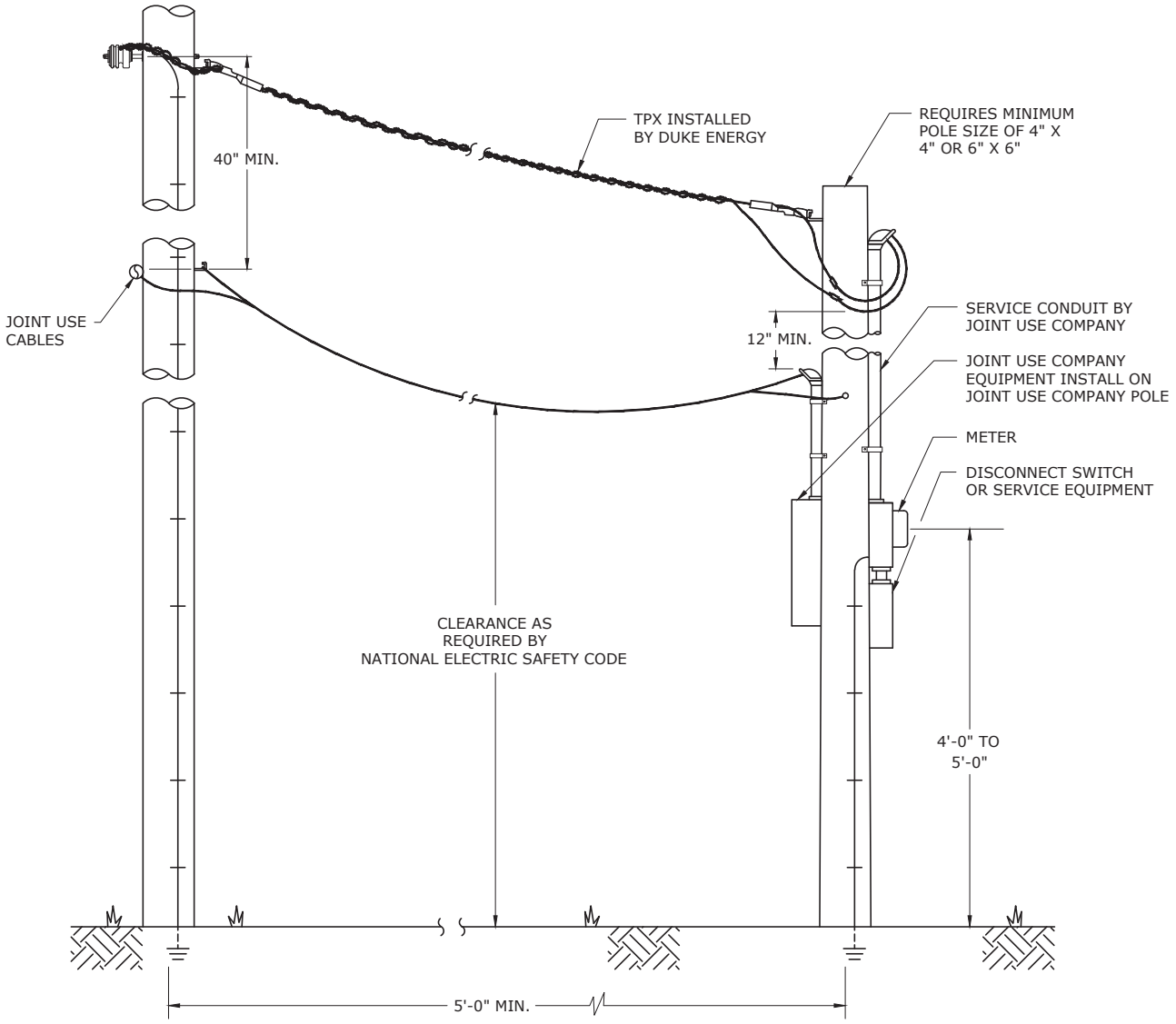
3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

LOCATION OF VERTICAL RUNS AND JOINT USE SERVICE DROPS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.07-11



NOTES:

1. SEE DWG. 10.07-15 FOR PREFERRED INSTALLATION.

2. DUKE ENERGY WILL PROVIDE AND INSTALL:

   A. SERVICE AND CONNECTION AT WEATHERHEAD.
   B. METER

3. JOINT USE COMPANY WILL PROVIDE AND INSTALL:

   A. METER SOCKET.
   B. METER POLE, RISER AND WEATHERHEAD.
   C. SERVICE EQUIPMENT BEYOND METER (AS REQUIRED).
   D. SERVICE EQUIPMENT GROUNDS PER APPLICABLE CODES.

4. ALL JOINT USE COMPANY EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.

5. JOINT USE COMPANY STRUCTURE IS NOT ALLOWED UNDER COMPANY LINES.

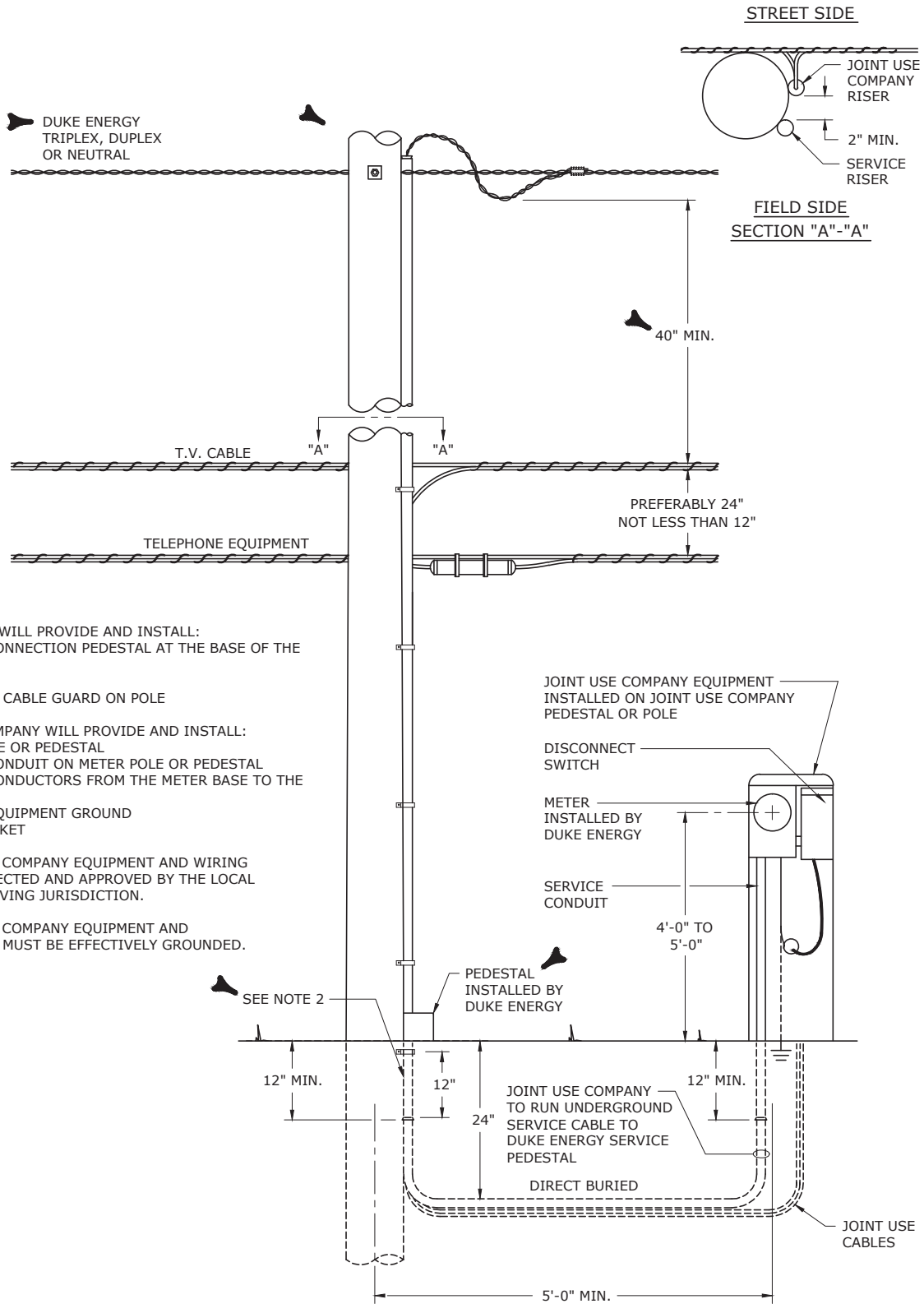
6. ALL JOINT USE COMPANY EQUIPMENT AND WIRING MUST BE INSPECTED AND APPROVED BY THE LOCAL AUTHORITY HAVING JURISDICTION.

3				
2				
1				
0	6/30/14	ROBESON	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

JOINT USE COMPANY INSTALLATION
OVERHEAD SERVICE

DEC	DEM	DEP	DEF
X	X	X	X

10.07-13



NOTES:

1. DUKE ENERGY WILL PROVIDE AND INSTALL:
   A. SERVICE CONNECTION PEDESTAL AT THE BASE OF THE POLE
   B. METER
   C. CABLE AND CABLE GUARD ON POLE

2. JOINT USE COMPANY WILL PROVIDE AND INSTALL:
   A. METER POLE OR PEDESTAL
   B. SERVICE CONDUIT ON METER POLE OR PEDESTAL
   C. SERVICE CONDUCTORS FROM THE METER BASE TO THE PEDESTAL
   D. SERVICE EQUIPMENT GROUND
   E. METER SOCKET

3. ALL JOINT USE COMPANY EQUIPMENT AND WIRING MUST BE INSPECTED AND APPROVED BY THE LOCAL AUTHORITY HAVING JURISDICTION.

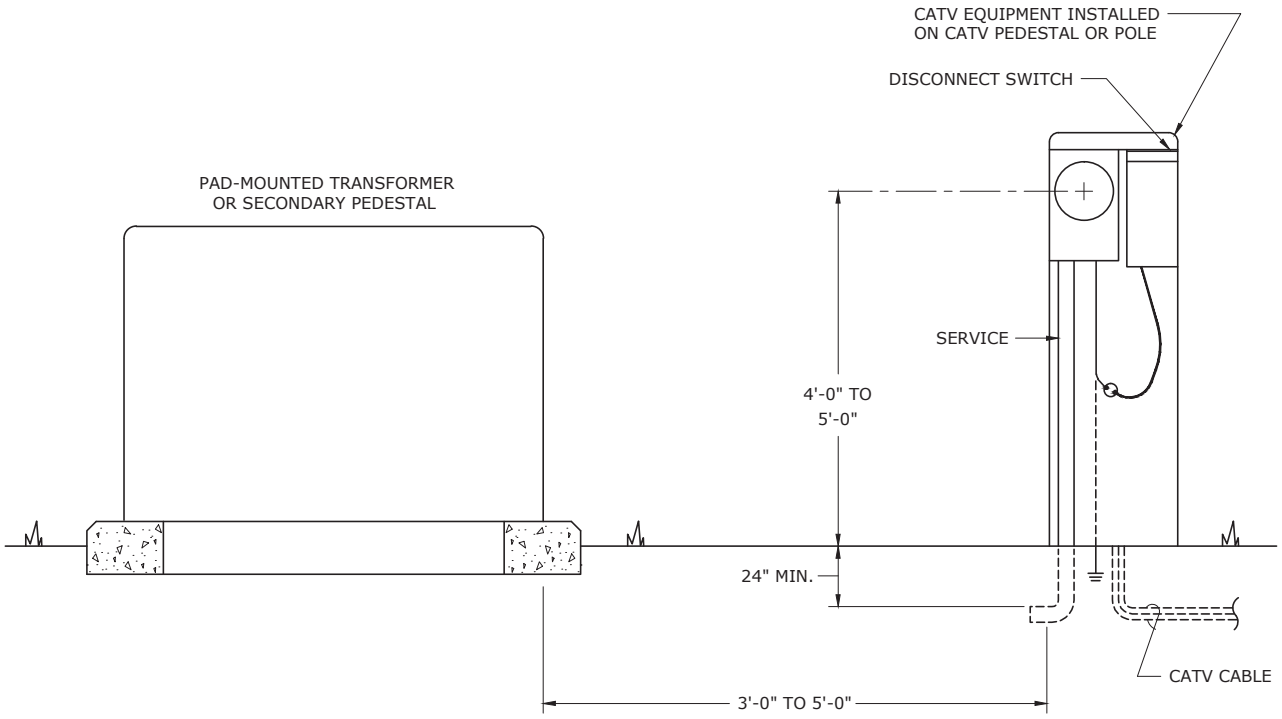
4. ALL JOINT USE COMPANY EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.

REVISED		BY	CK'D	APPR.
3				
2	10/3/14	DANNA	DANNA	ADCOCK
1	8/27/14	GUINN	GUINN	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

JOINT USE COMPANY INSTALLATION UNDERGROUND SERVICE (OVERHEAD SOURCE)

DEC	DEM	DEP	DEF
			X

10.07-15



NOTES:

1. DUKE ENERGY WILL PROVIDE AND INSTALL:

   A. UNDERGROUND SERVICE FROM TRANSFORMER OR PEDESTAL TO METER SOCKET.
   B. METER

   EXCEPTION:

   THE NORMAL POINT OF DELIVERY (POD) IS AT THE SOURCE LUGS OF THE CATV METER SOCKET. FOR THESE INSTALLATIONS, DUKE ENERGY WILL PROVIDE THE SERVICE. HOWEVER, IF A CATV COMPANY DESIRES TO INSTALL A SERVICE TO THE EDGE OF THE PAD-MOUNT OR SECONDARY PEDESTAL AND LEAVE ENOUGH CABLE TO MAKE THE CONNECTION INSIDE THE EQUIPMENT, DUKE ENERGY WILL MAKE THE CONNECTION. CATV CABLES SHALL BE TAGGED IN THE METER BASE AND AT THE SOURCE END AS OWNED BY THE CATV COMPANY. THE TAGS SHALL REMAIN WITH THE CABLE WHEN CONNECTED. PROPER CONNECTIONS WITHIN THE METER SOCKET MUST BE VERIFIED (RUNG OUT OR OHMED) BEFORE CONNECTING WITHIN ANY DUKE ENERGY EQUIPMENT.

2. JOINT USE COMPANY WILL PROVIDE AND INSTALL:

   A. METER POLE OR PEDESTAL
   B. SERVICE EQUIPMENT BEYOND METER (IF REQUIRED)
   C. SERVICE EQUIPMENT GROUND
   D. METER SOCKET

3. ALL EQUIPMENT AND ATTACHMENTS MUST BE EFFECTIVELY GROUNDED.

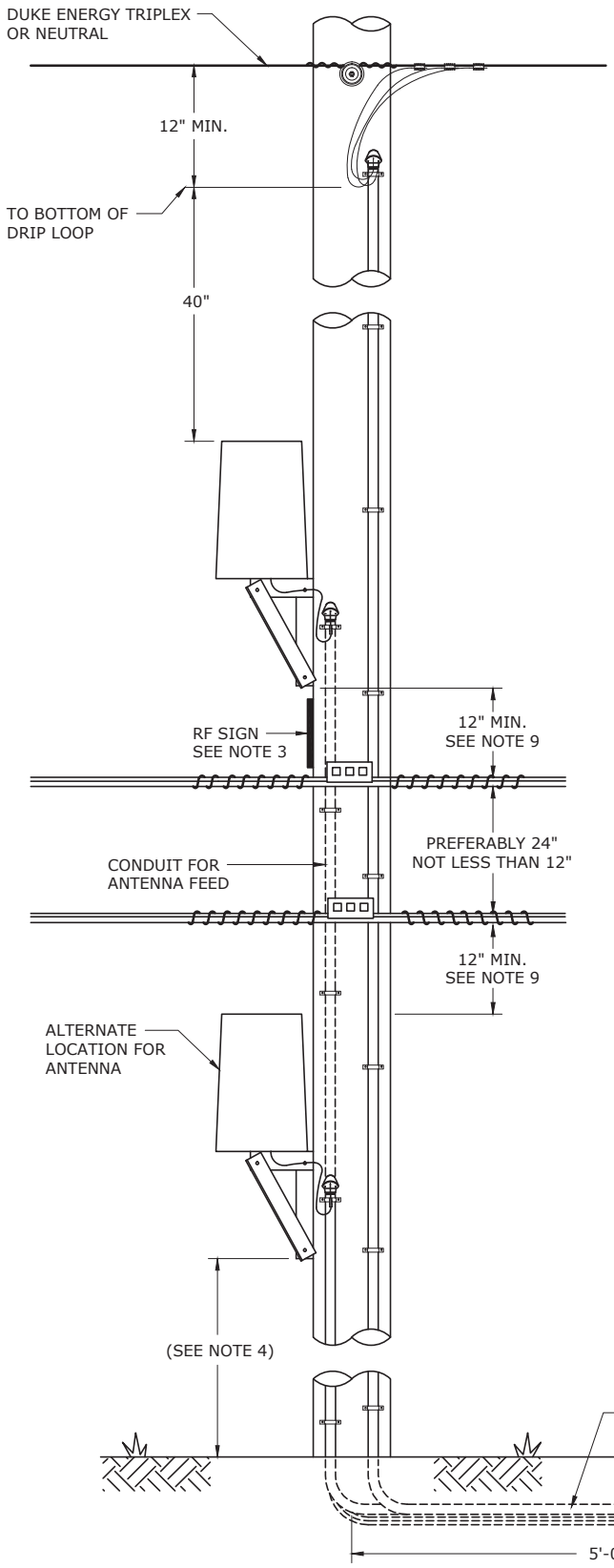
4. BONDING SHOULD BE PROVIDED BETWEEN ALL ABOVE GROUND METALLIC POWER AND COMMUNICATIONS APPARATUS (PEDESTALS, TERMINALS, APPARATUS CASES, TRANSFORMER CASES, ETC.) THAT ARE SEPARATED BY A DISTANCE OF 6' OR LESS.

3				
2				
1				
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

JOINT USE COMPANY INSTALLATION UNDERGROUND SERVICE (PAD-MOUNTED TRANSFORMER OR SECONDARY PEDESTAL)

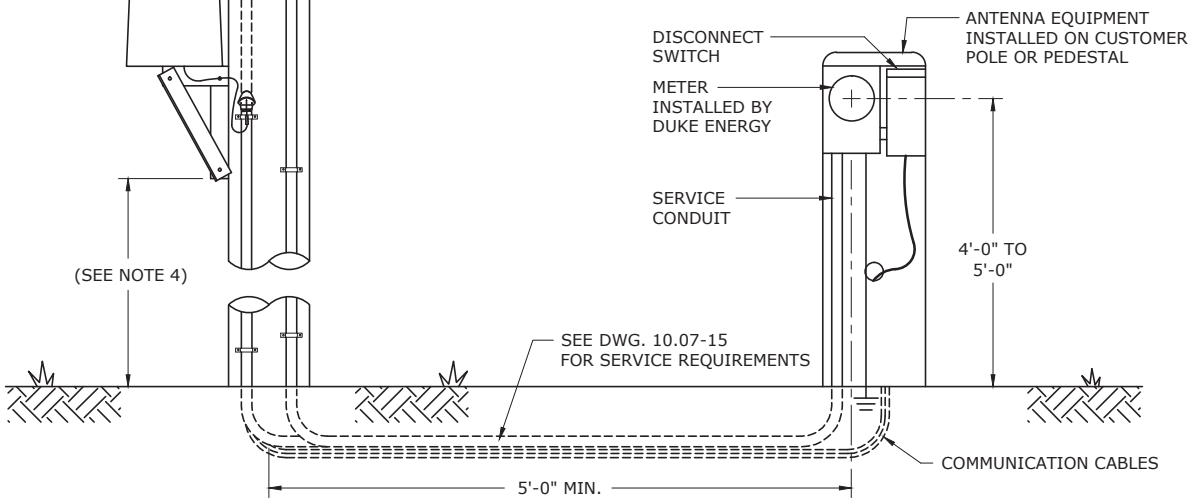
DEC	DEM	DEP	DEF
X	X	X	X

10.07-17



NOTES:

1. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.
2. ONLY ONE ANTENNA PER POLE ALLOWED.
3. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.
4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d. SEE DWG. 10.02-13.
5. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
6. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
7. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA. FOR EXCEPTIONS SEE DWG. 10.07-03, NOTE 5.
8. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
9. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USED PARTIES.



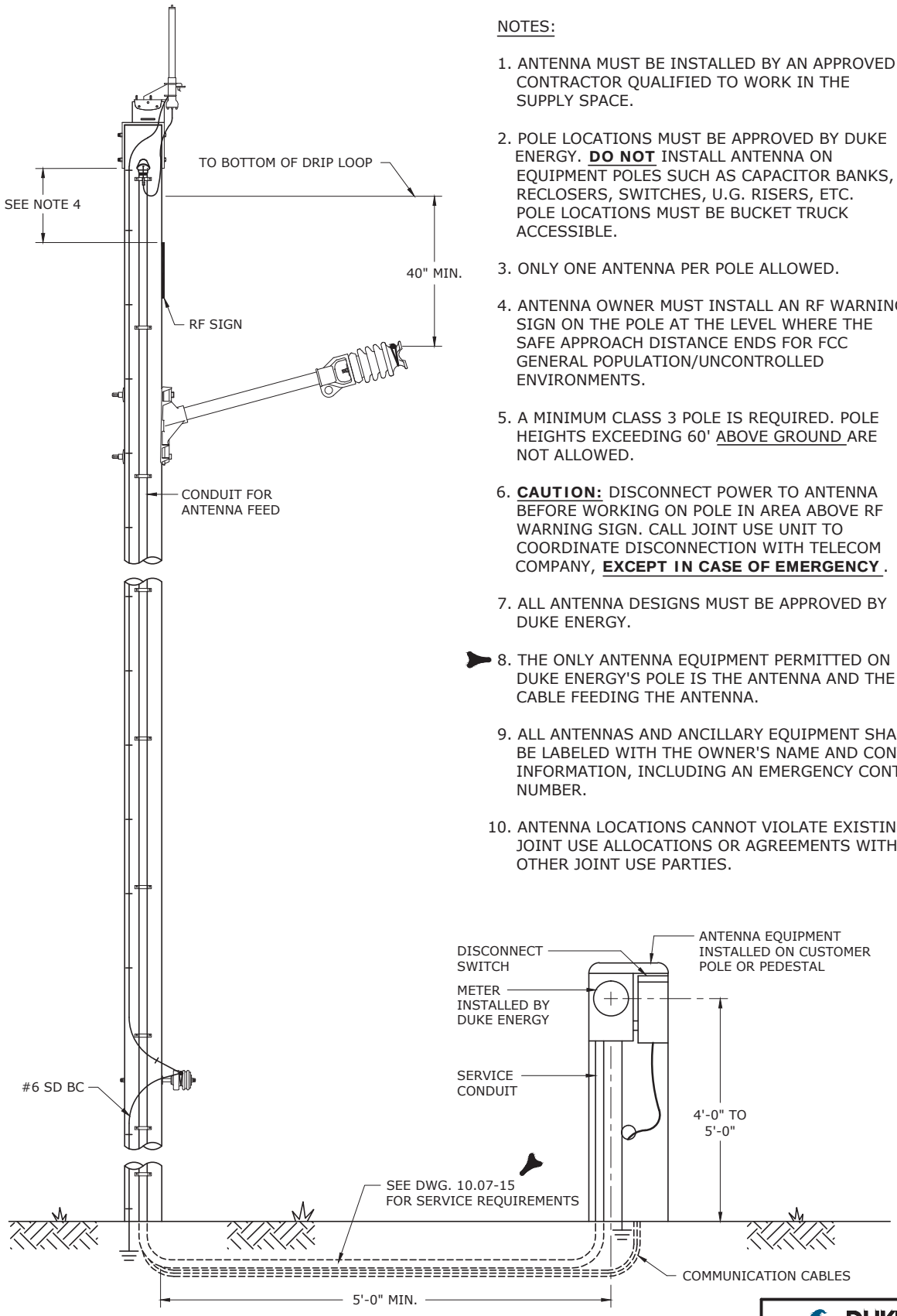
FRONT VIEW

REVISED	BY	CK'D	APPR.
3			
2	2/24/17	EANES	BURLISON	ADCOCK
1	12/19/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

ANTENNA SYSTEMS INSTALLED IN COMMUNICATION SPACE

DEC	DEM	DEP	DEF
X	X	X	X

10.08-01



FRONT VIEW

NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.
5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.
6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.
9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

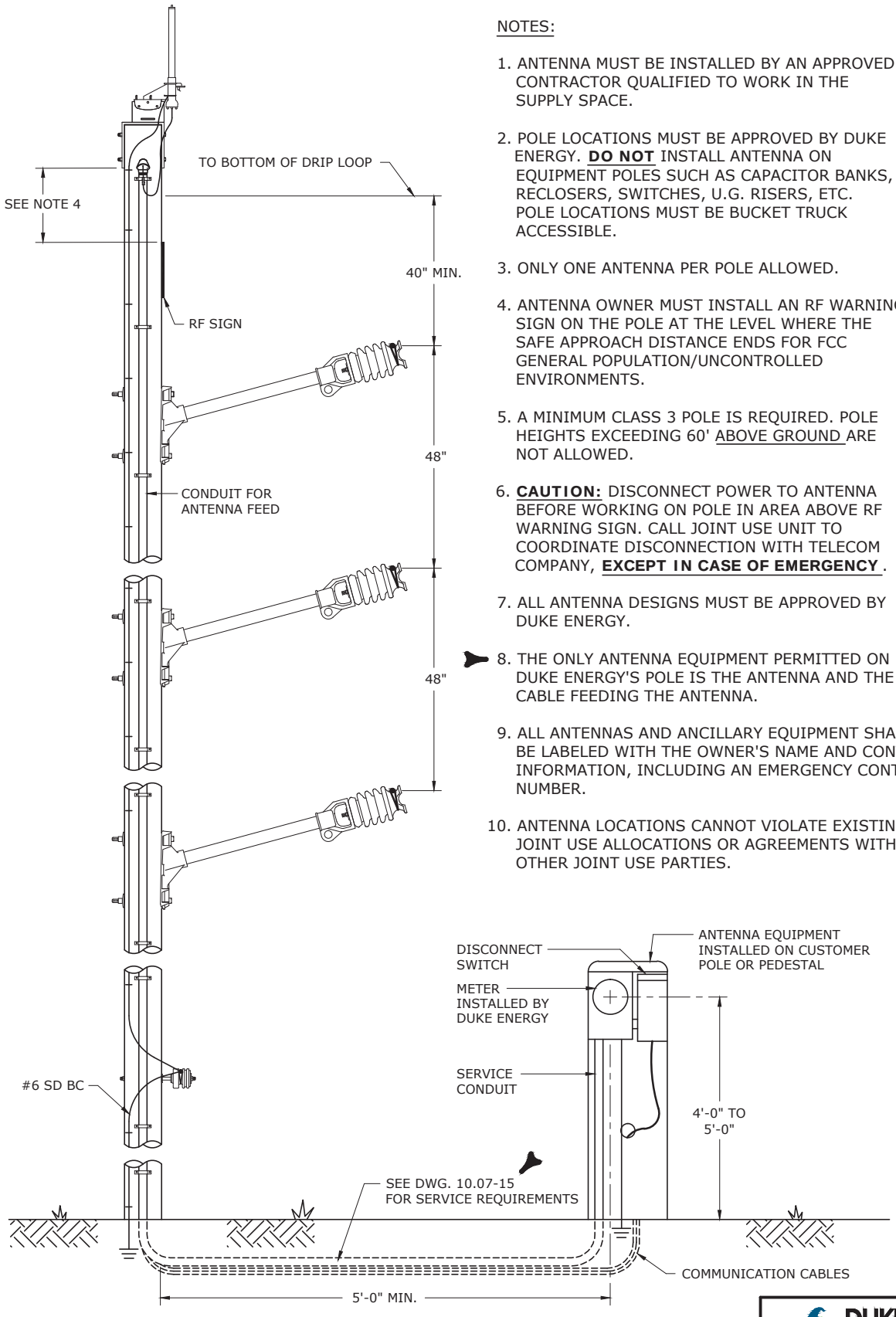
3				
2				
1	12/19/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
VERTICAL PRIMARY CONSTRUCTION
SINGLE-PHASE

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

10.08-02



FRONT VIEW

NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.
5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.
6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA.
9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

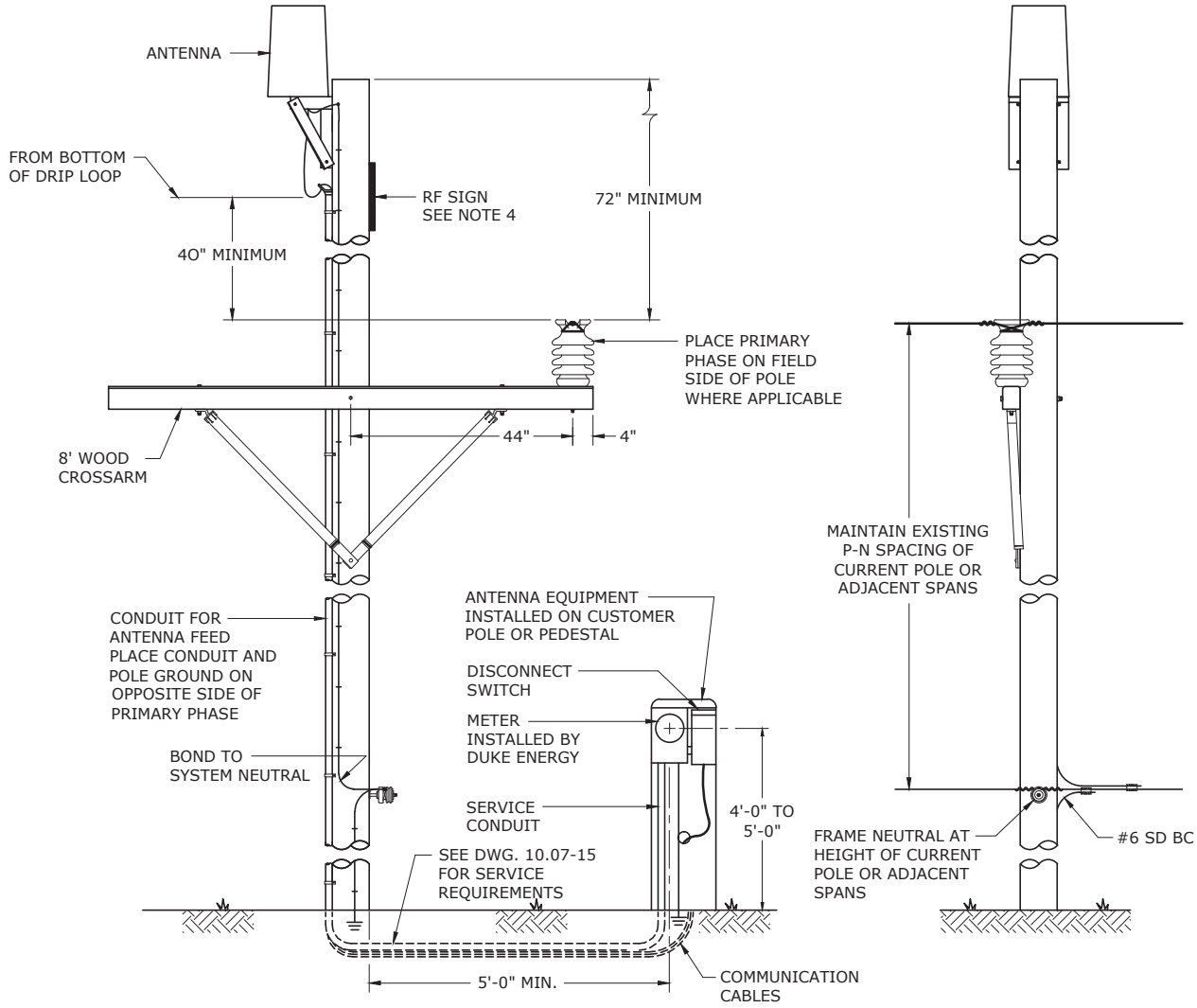
3				
2				
1	12/19/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
VERTICAL PRIMARY CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

10.08-03



FRONT VIEW

SIDE VIEW
(PEDESTAL REMOVED FOR CLARITY)

NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPEMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATION MUST BE BUCKET TRUCK ACCESSIBLE.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/ UNCONTROLLED ENVIRONMENTS.
5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.
6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA. FOR EXCEPTIONS SEE DWG. 10.07-03, NOTE 5.
9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

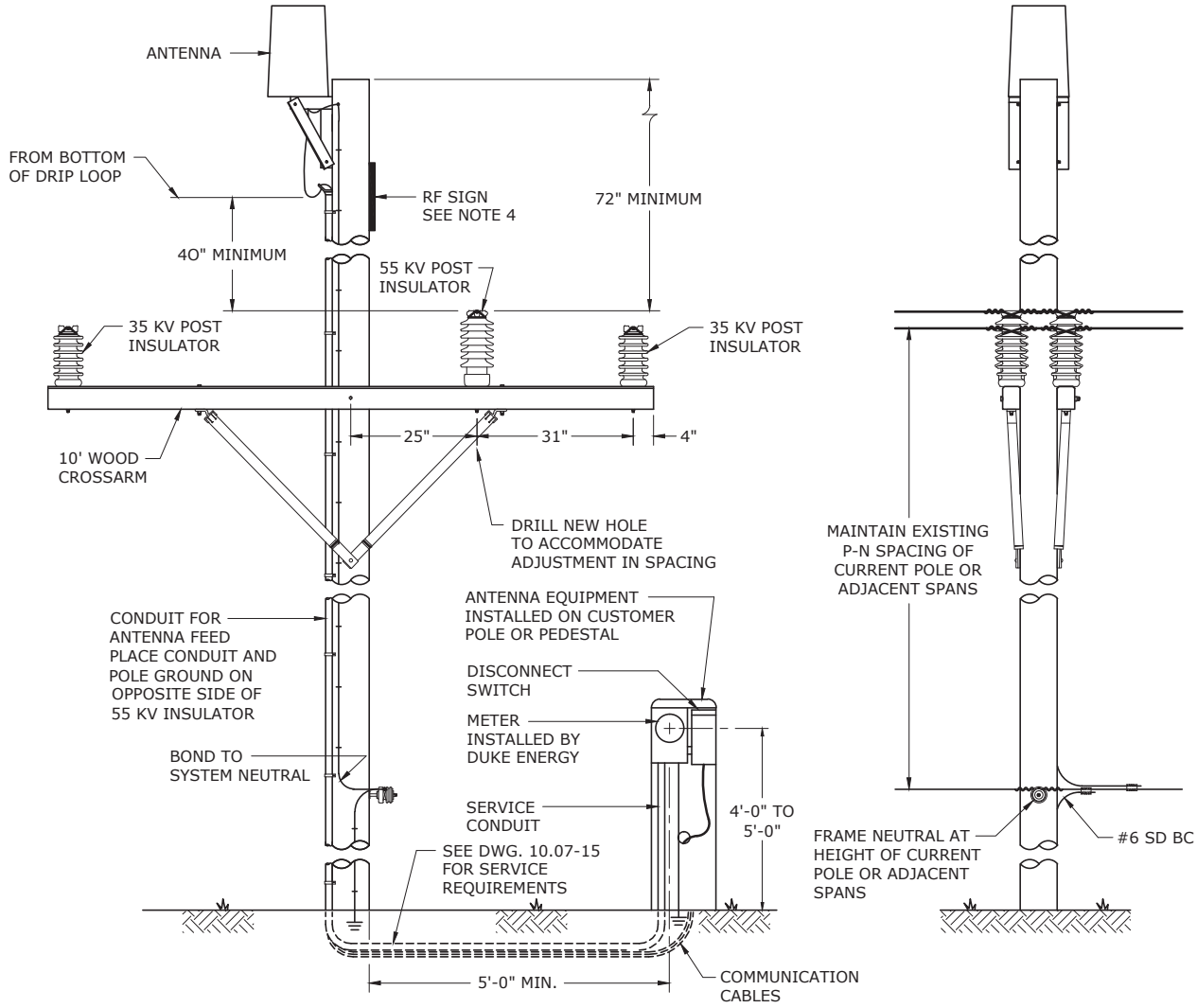
REVISED		BY	CK'D	APPR.
3				
2	2/24/17	EANES	BURLISON	ADCOCK
1	12/22/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
HORIZONTAL PRIMARY CONSTRUCTION
SINGLE-PHASE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.08-04



FRONT VIEW

SIDE VIEW
(PEDESTAL REMOVED FOR CLARITY)

NOTES:

1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPEMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATION MUST BE BUCKET TRUCK ACCESSIBLE.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/ UNCONTROLLED ENVIRONMENTS.
5. A MINIMUM CLASS 3 POLE IS REQUIRED. POLE HEIGHTS EXCEEDING 60' ABOVE GROUND ARE NOT ALLOWED.
6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA. FOR EXCEPTIONS SEE DWG. 10.07-03, NOTE 5.
9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

REVISED		BY	CK'D	APPR.
3				
2	2/24/17	EANES	BURLISON	ADCOCK
1	12/22/14	GUINN	GUINN	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

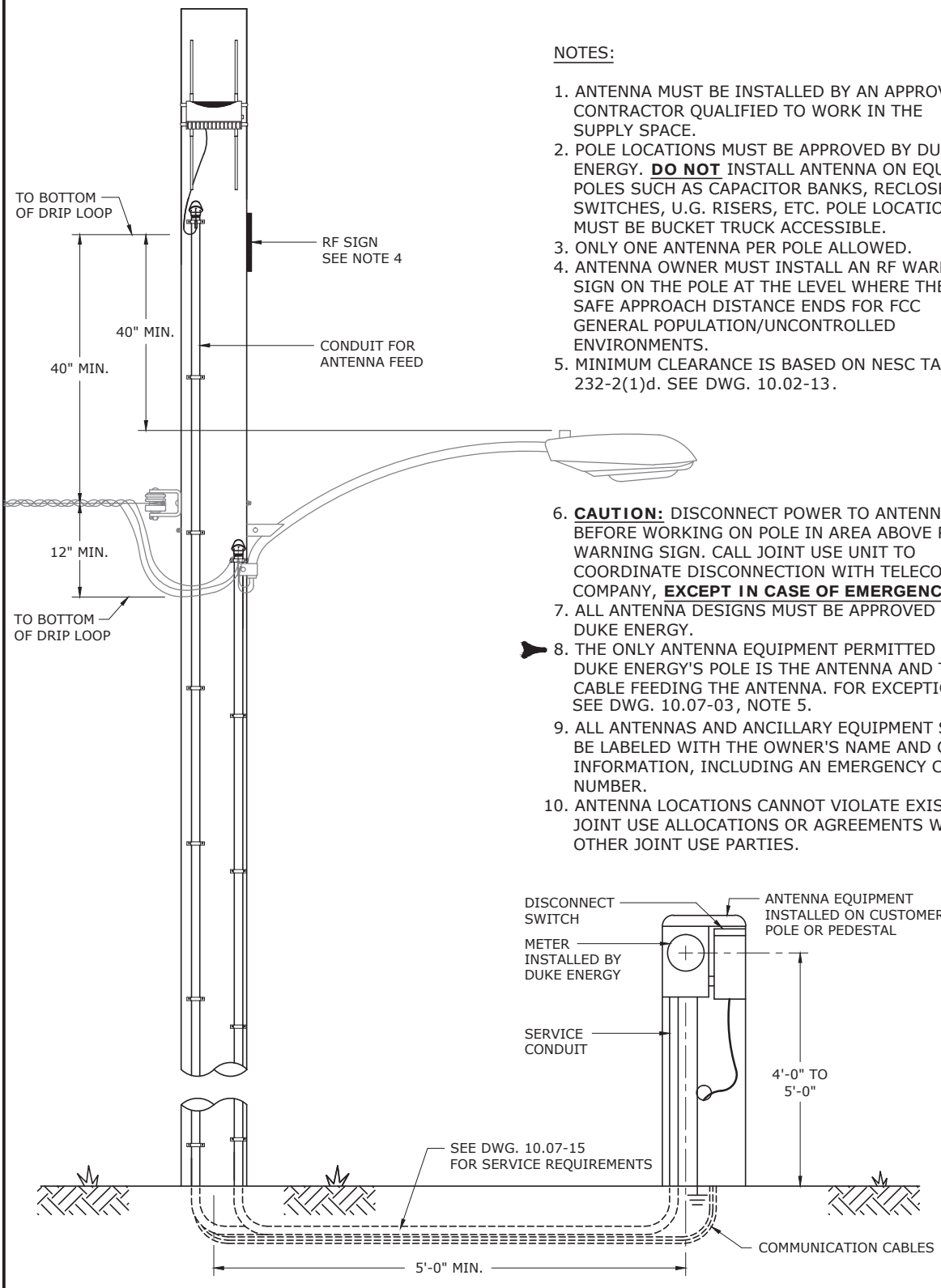
ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE

HORIZONTAL PRIMARY CONSTRUCTION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.08-05



FRONT VIEW

NOTES:

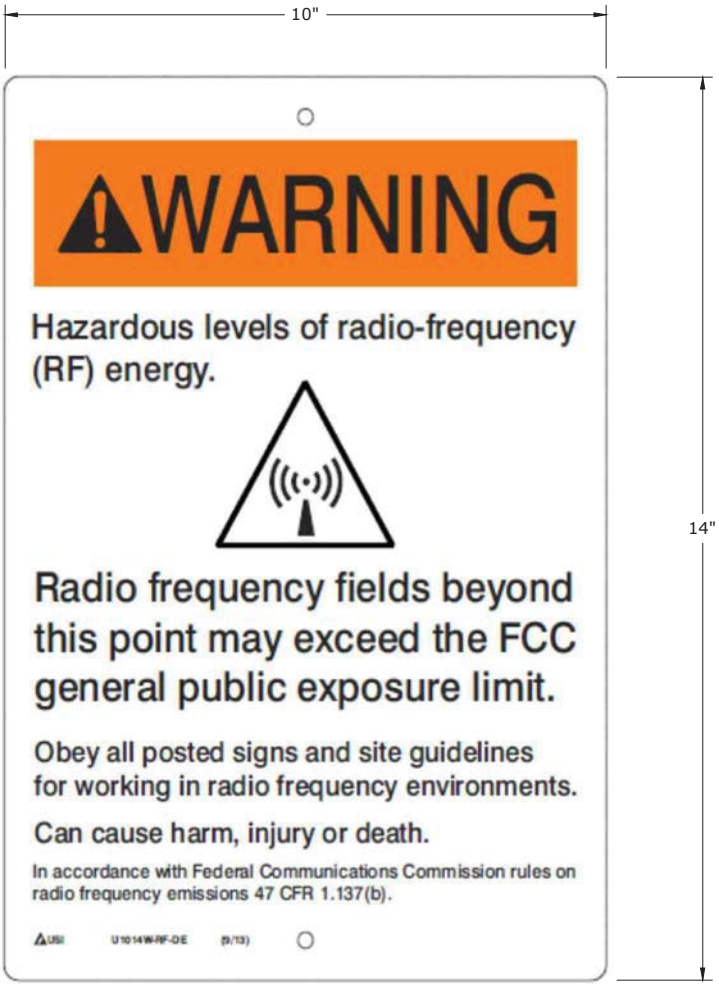
1. ANTENNA MUST BE INSTALLED BY AN APPROVED CONTRACTOR QUALIFIED TO WORK IN THE SUPPLY SPACE.
2. POLE LOCATIONS MUST BE APPROVED BY DUKE ENERGY. **DO NOT** INSTALL ANTENNA ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, SWITCHES, U.G. RISERS, ETC. POLE LOCATIONS MUST BE BUCKET TRUCK ACCESSIBLE.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPROACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS.
5. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d. SEE DWG. 10.02-13.
6. **CAUTION:** DISCONNECT POWER TO ANTENNA BEFORE WORKING ON POLE IN AREA ABOVE RF WARNING SIGN. CALL JOINT USE UNIT TO COORDINATE DISCONNECTION WITH TELECOM COMPANY, **EXCEPT IN CASE OF EMERGENCY**.
7. ALL ANTENNA DESIGNS MUST BE APPROVED BY DUKE ENERGY.
8. THE ONLY ANTENNA EQUIPMENT PERMITTED ON DUKE ENERGY'S POLE IS THE ANTENNA AND THE CABLE FEEDING THE ANTENNA. FOR EXCEPTIONS SEE DWG. 10.07-03, NOTE 5.
9. ALL ANTENNAS AND ANCILLARY EQUIPMENT SHALL BE LABELED WITH THE OWNER'S NAME AND CONTACT INFORMATION, INCLUDING AN EMERGENCY CONTACT NUMBER.
10. ANTENNA LOCATIONS CANNOT VIOLATE EXISTING JOINT USE ALLOCATIONS OR AGREEMENTS WITH OTHER JOINT USE PARTIES.

REVISED	BY	CK'D	APPR.
3			
2 — 2/24/17	EANES	BURLISON	ADCOCK
1 — 12/22/14	GUINN	GUINN	ADCOCK
0 — 6/30/14	EANES	EANES	ADCOCK

ANTENNA SYSTEMS INSTALLED IN SUPPLY SPACE
SERVICE, SECONDARY OR WOOD LIGHT POLE

DEC	DEM	DEP	DEF
X	X	X	X

10.08-07



NOTES:

1. ANTENNA OWNER MUST INSTALL AN RF WARNING SIGN ON THE POLE AT THE LEVEL WHERE THE SAFE APPOACH DISTANCE ENDS FOR FCC GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS. ANTENNAS WITH RADIATION LEVELS BELOW THE EXPOSURE LEVELS FOR GENERAL POPULATION/UNCONTROLLED ENVIRONMENTS DO NOT REQUIRE A WARNING SIGN.

2. RF SIGNAGE MUST BE IEEE C95.2 AND ANSI Z535.2 COMPLIANT (MOST RECENT VERSION AT TIME OF INSTALLATION).

3. RF SIGNAGE MUST INCLUDE THREE FUNCTIONAL PANELS:

   A. SIGNAL WORD PANEL ('WARNING' IN BLACK LETTERS ON ORANGE BACKGROUND).
   B. SYMBOL OR PICTORIAL PANEL (RF ENERGY SYMBOL SHOWN ABOVE).
   C. WORD MESSAGE PANEL (VERBIAGE AS SHOWN ABOVE).

4. SIGNS MUST BE POLYCARBONATE WITH UV RESISTANT MATERIALS AND INKS.

5. SIGNS MUST BE VISIBLE FROM THE ROAD OR FROM THE POINT OF TRUCK ACCESS.

3				
2				
1				
0	7/15/14	EANES	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

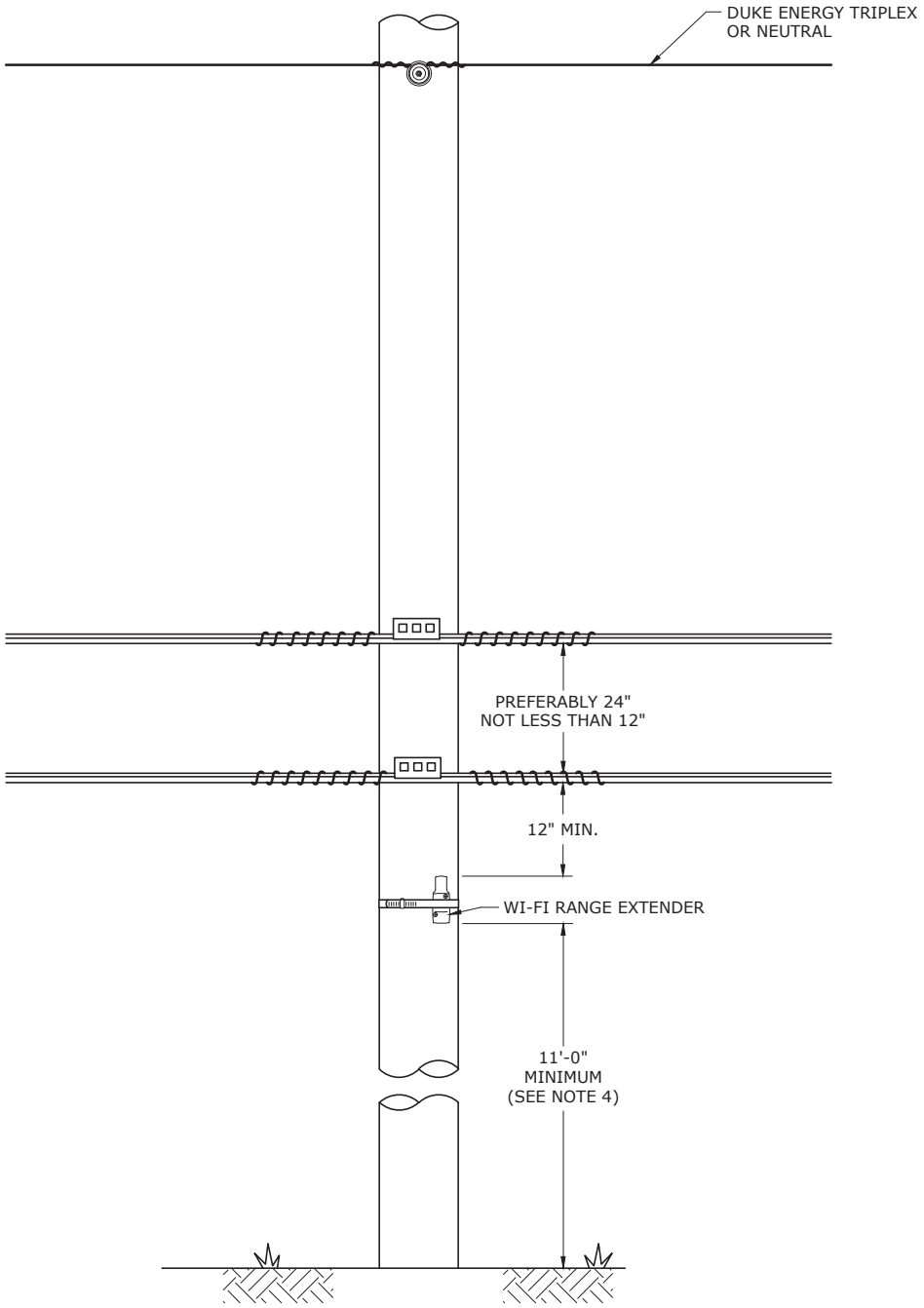
CUSTOMER PROVIDED RF WARNING SIGNS

EXAMPLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

10.08-08



FRONT VIEW

NOTES:

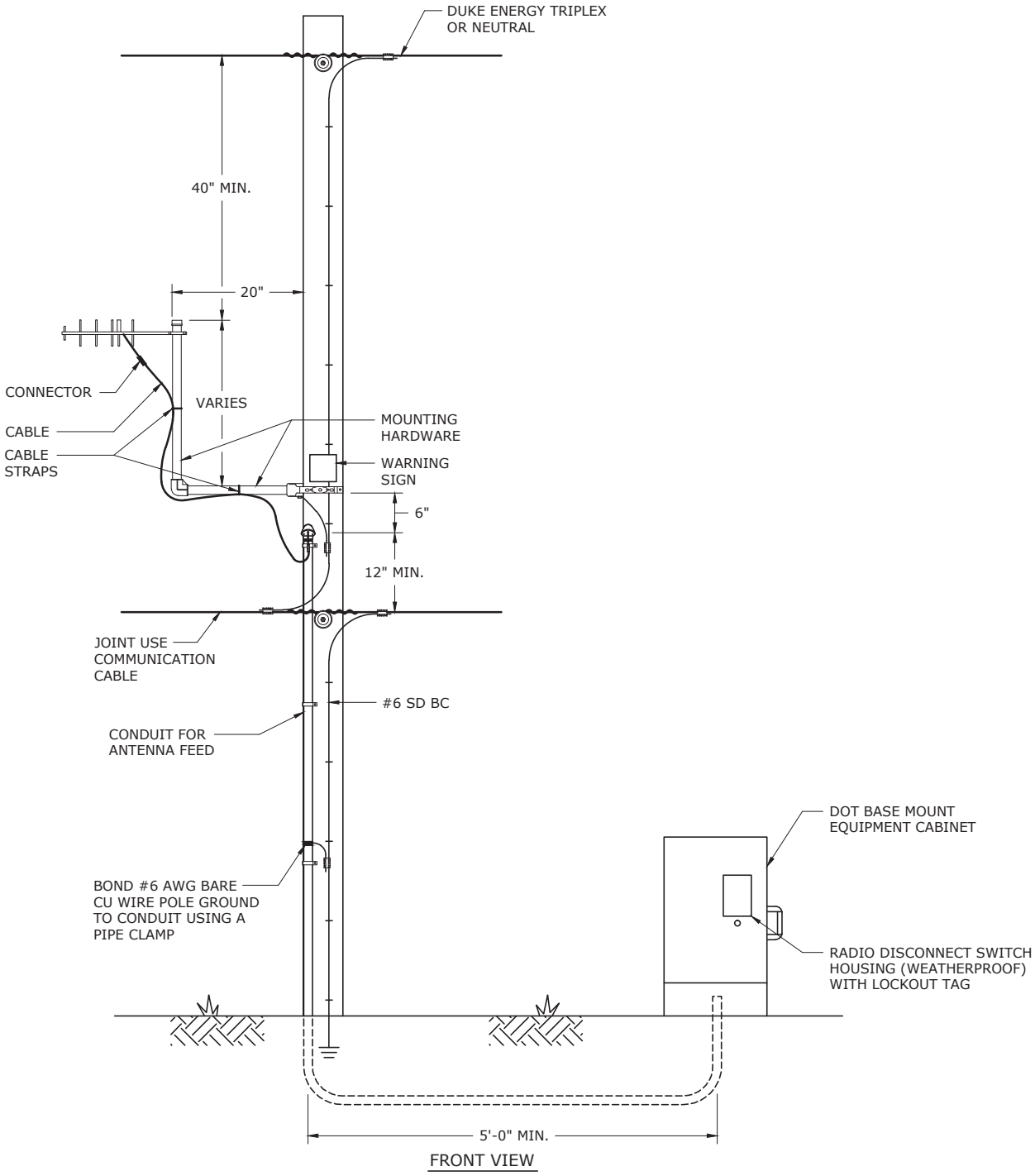
1. **DO NOT** INSTALL ANTENNAS ON EQUIPMENT POLES SUCH AS CAPACITOR BANKS, RECLOSERS, REGULATOR, SWITCHES, U.G. DIP, ETC.
2. ALL ANTENNA LOCATIONS MUST BE APPROVED BY A COMPANY DISTRIBUTION ENGINEER.
3. ONLY ONE ANTENNA PER POLE ALLOWED.
4. MINIMUM CLEARANCE IS BASED ON NESC TABLE 232-2(1)d.

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/13/18	EANES	FLETCHER	ADCOCK
0	6/30/14	EANES	EANES	ADCOCK

JOINT USE CONSTRUCTION
WI-FI RANGE EXTENDER ON SERVICE POLE

DEC	DEM	DEP	DEF
X	X	X	X

10.08-09



FRONT VIEW

NOTES:

1. POLE LOCATIONS APPROVED BY DUKE 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 DUKE ENERGY DISTRIBUTION.
4. THE ONLY JOINT USE EQUIPMENT PERMITTED ON THE POLE IS THE ANTENNA AND CABLE RISER. FOR EXCEPTIONS SEE DWG. 10.07-03, NOTE 5.
5. DOT TO MOUNT WARNING SIGN ON POLE: "WARNING - TURN OFF ANTENNA AT DOT EQUIPMENT CABINET BEFORE WORKING ON POLE".

REVISED		BY	CK'D	APPR.
3				
2				
1	2/24/17	EANES	BURLISON	ADCOCK
0	6/30/14	ROBESON	EANES	ADCOCK

JOINT USE CONSTRUCTION

TRAFFIC SIGNAL ANTENNA

DEC	DEM	DEP	DEF
X	X	X	X

10.08-11

11.00 METERING GENERAL

11.01 SELF-CONTAINED METERING GENERAL

11.02 SELF-CONTAINED METERING, SINGE-PHASE

11.03 SELF-CONTAINED METERING, THREE-PHASE

11.04 SELF-CONTAINED METERING, NETWORK (OPEN WYE)

11.07 TRANSFORMER-RATED METERING, SECONDARY, THREE-PHASE

11.08 TRANSFORMER-RATED METERING, PRIMARY, SINGLE-PHASE

11.09 TRANSFORMER-RATED METERING, PRIMARY, THREE-PHASE

11.11 TRANSFORMER-RATED METERING, PRIMARY, THREE-PHASE - UG

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE

DUKE ENERGY.

REVISED	BY	CK'D	APPR.
5 6/30/15	KATIGBAK	BURLISON	ADCOCK
4 7/25/14	KATIGBAK	DANNA	ADCOCK
3 8/23/13	KATIGBAK	GUINN	ADCOCK
0 11/30/10	CECCONI	GUINN	ELKINS

SECTION 11 - METERING - OH

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

NOTES:

1. ON INSTALLATIONS, REPAIRS, REPLACEMENTS OR UPGRADES OF ENCLOSURES INVOLVING MORE THAN ONE METER ON A SINGLE PREMISE, THE CUSTOMER SHALL CORRECTLY IDENTIFY EACH METER ENCLOSURE ON THE OUTSIDE BY A NONFERROUS METAL OR PLASTIC PLATE ENGRAVED OR STAMPED WITH THE APARTMENT NUMBER, OFFICE SUITE, LOT NUMBER, ETC.

2. THE PLATE SHALL BE PERMANENTLY ATTACHED TO THE METER ENCLOSURE UTILIZING AN INDUSTRIAL-STRENGTH ADHESIVE SUITABLE FOR EXTERIOR USE. TWO-SIDED TAPE IS NOT ACCEPTABLE.

3. THE INSIDE OF EACH METER ENCLOSURE SHALL BE CORRECTLY IDENTIFIED WITH A PLATE DESCRIBED ABOVE OR WITH A PERMANENT MARKER.

4. CONDUCTOR LABELING FOR MULTI-TENANT METERING APPLICATIONS: WHERE ONE SERVICE IS C.T. METERED ON THE PAD-MOUNTED TRANSFORMER **AND** OTHER CUSTOMER OWNED SERVICES ARE RUN TO THE **SAME** TRANSFORMER **BUT** ARE METERED ELSEWHERE (BUILDING WALL OR METER ROOM), BOTH ENDS OF ALL CUSTOMER CABLES MUST BE CLEARLY AND SPECIFICALLY MARKED FOR PHASE AND LABELED WITH A TAG TO IDENTIFY THE LOCATION OF THE SOURCE AND LOAD ENDS OF THE CONDUCTOR. THE LOAD END OF EACH CABLE SHALL BE LABELED TO IDENTIFY THE SOURCE (TRANSFORMER LOCID NUMBER). EACH SOURCE END SHALL BE LABELED TO IDENTIFY THE LOCATION OF THE LOAD END OF THE CABLE (TROUGH NUMBER, SWITCH PANEL NUMBER, ETC.).

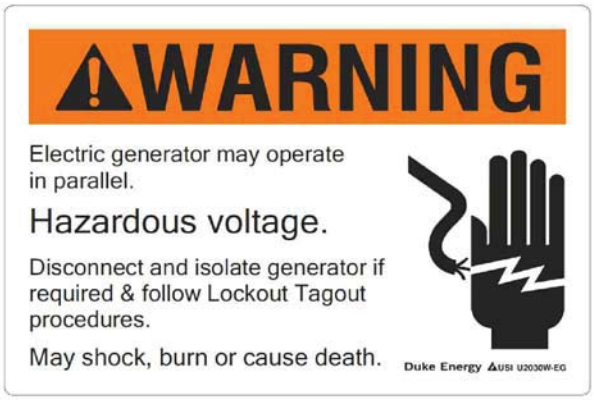
DUKE ENERGY.

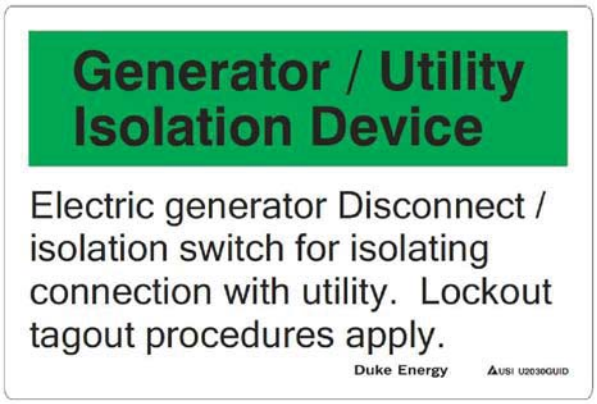
REVISED		BY	CK'D	APPR.
3				
2	9/12/14	SIMPSON	SIMPSON	ADCOCK
1	4/1/11	SIMPSON	SIMPSON	ELKINS
0	7/12/10	SIMPSON	SIMPSON	ELKINS

LABELING MULTIPLE METER ENCLOSURES
ON A SINGLE PREMISE

DEC	DEM	DEP	DEF
		X	X

11.00-04





DISTRIBUTED GENERATION LABELS AND SIGNS				
ITEM NUMBER	TYPE	DESCRIPTION	APPLICATION	WHERE TO INSTALL
9220271204	LABEL	ELECTRIC GENERATOR WARNING (3"X2")	METER BASE/PRIMARY METER	LOWER LEFT
9220271203	LABEL	ELECTRIC GENERATOR WARNING (6"X4")	PAD MOUNTED TRANSFORMER	ABOVE THE LOCK
9220267181	SIGN	ELECTRIC GENERATOR WARNING (9"X6")	OVERHEAD TRANSFORMERS POLE	5' TO 6' ABOVE THE GROUND
9220271196	LABEL	GENERATOR ISOLATION DEVICE (3"X2")	SMALL DISCONNECT SWITCH	NEAR THE OFF POSITION
9220271197	LABEL	GENERATOR ISOLATION DEVICE (6"X4")	LARGE DISCONNECT SWITCH	NEAR THE OFF POSITION
9220271194	SIGN	GENERATOR ISOLATION DEVICE (9"X6")	ER RECLOSER/POLE DISCONNECT SWITCH	5' TO 6' ABOVE THE GROUND

NOTES:

1. SIGNS AND LABELS ARE TO BE INSTALLED BY DUKE ENERGY.
2. INSTALL SIGNS AND LABELS ON ALL KW SIZES OF DISTRIBUTED GENERATION SITES.
3. CLEAN THE SURFACE BEFORE INSTALLING LABELS.

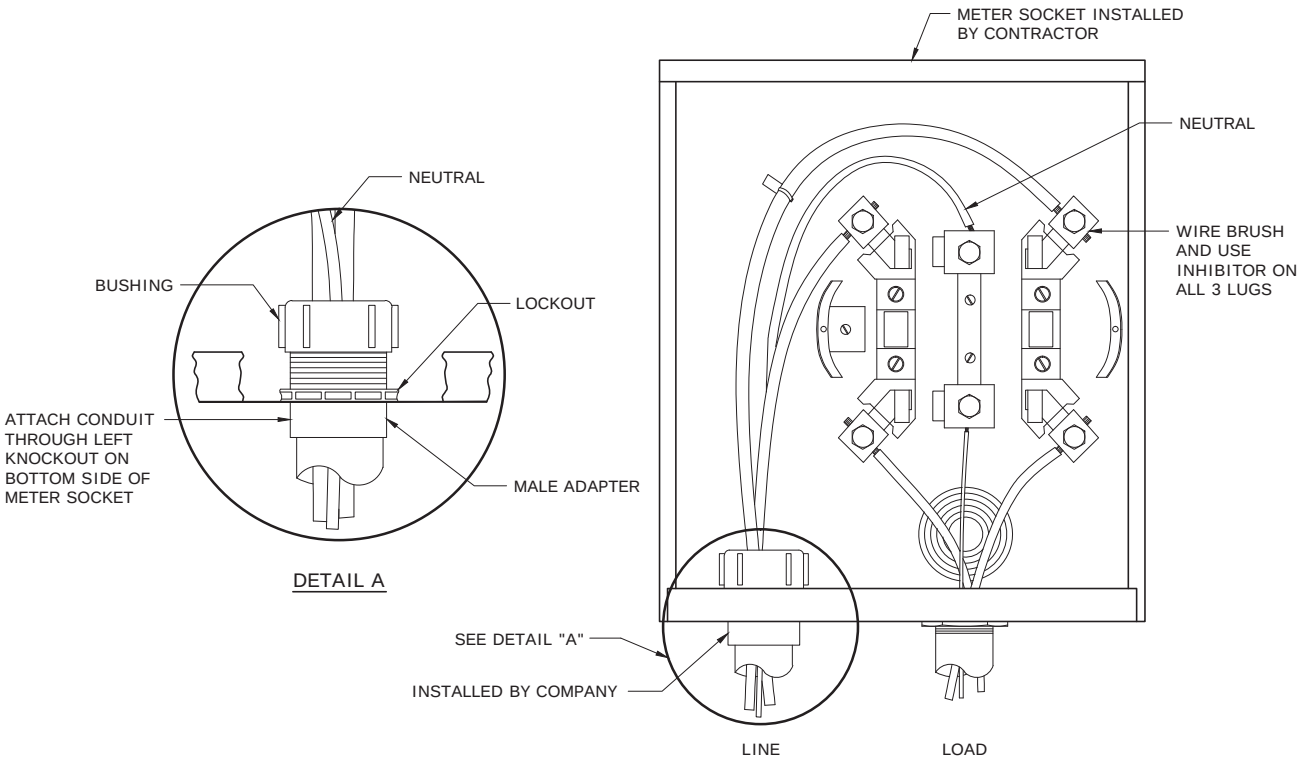
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	6/30/15	BOWDEN	VALENTIN	ADCOCK

DISTRIBUTED GENERATION
LABELS AND SIGNS

DEC	DEM	DEP	DEF
		X	X

11.01-00

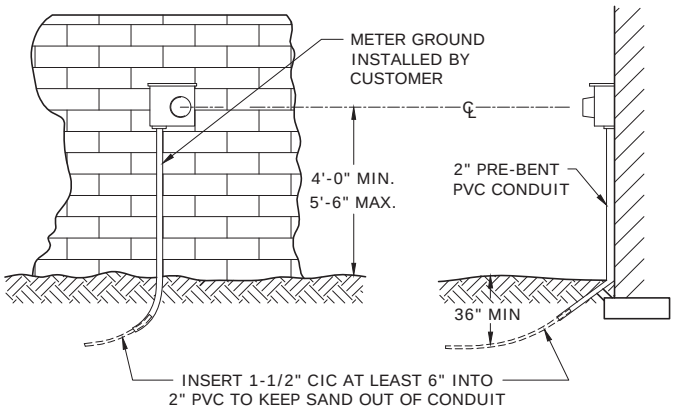
INSTALLATION DETAILS 120/240 VOLT SINGLE-PHASE
UNDERGROUND RESIDENTIAL SERVICE



THIS ILLUSTRATION IS FOR DE-ENERGIZED CONDITIONS. IF METER IS ENERGIZED USE PROPER SAFETY PROCEDURES AS OUTLINED IN THE ACCIDENT AND PREVENTION MANUAL.

METER BASE MAY BE ENERGIZED FROM CUSTOMER LOAD SIDE.

METER SOCKET CONNECTIONS



NOTE: CABLE SHOULD BE FED THROUGH CONDUIT BEFORE IT IS INSTALLED BELOW GRADE AND ATTACHED TO METER SOCKET.

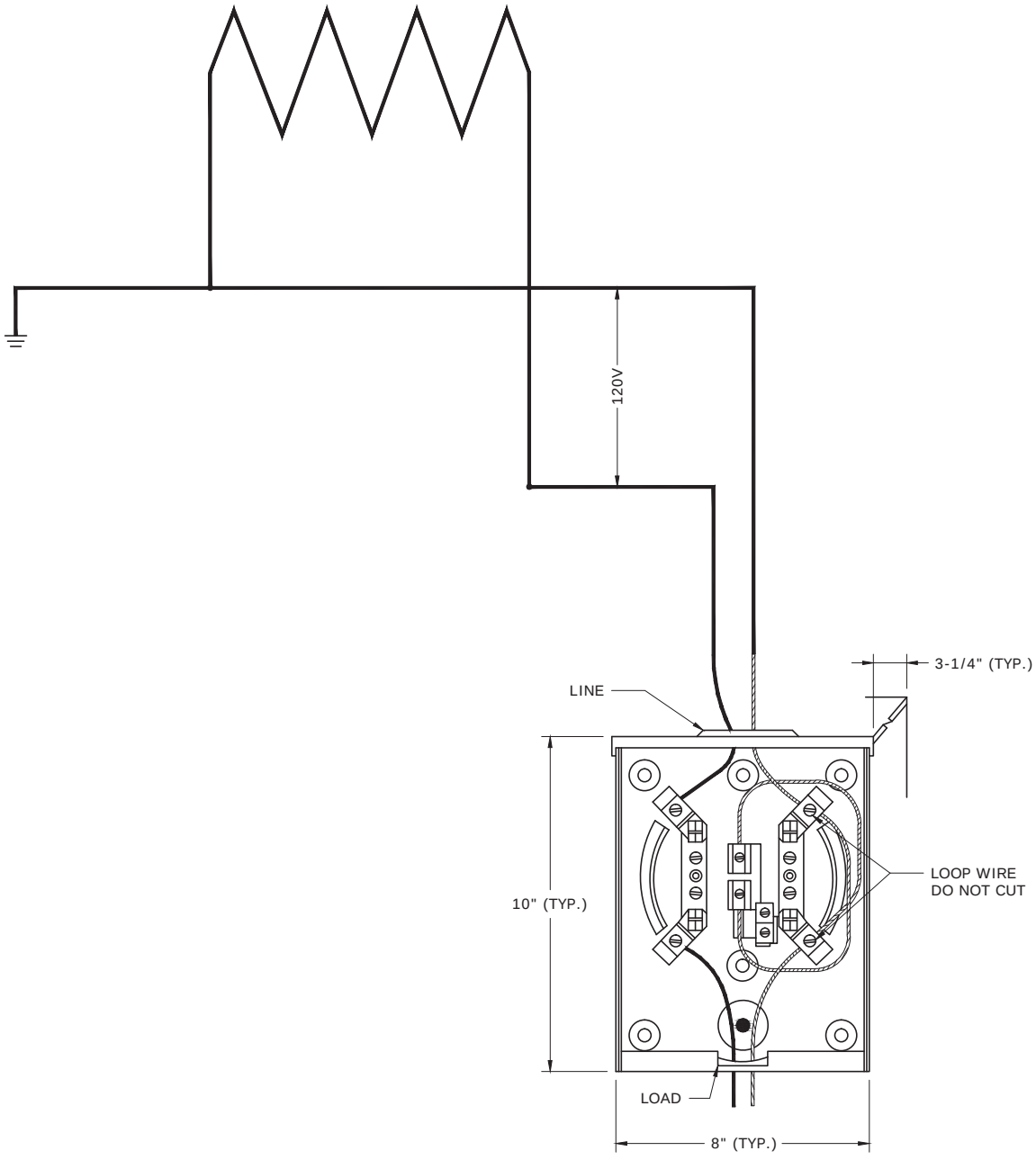
3				
2				
1				
0	11/3/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION DETAILS 120/240 VOLT
SINGLE-PHASE UNDERGROUND RESIDENTIAL SERVICE
AND METER SOCKET CONNECTIONS

Duke Energy®

FLA

DWG. 11.02-08



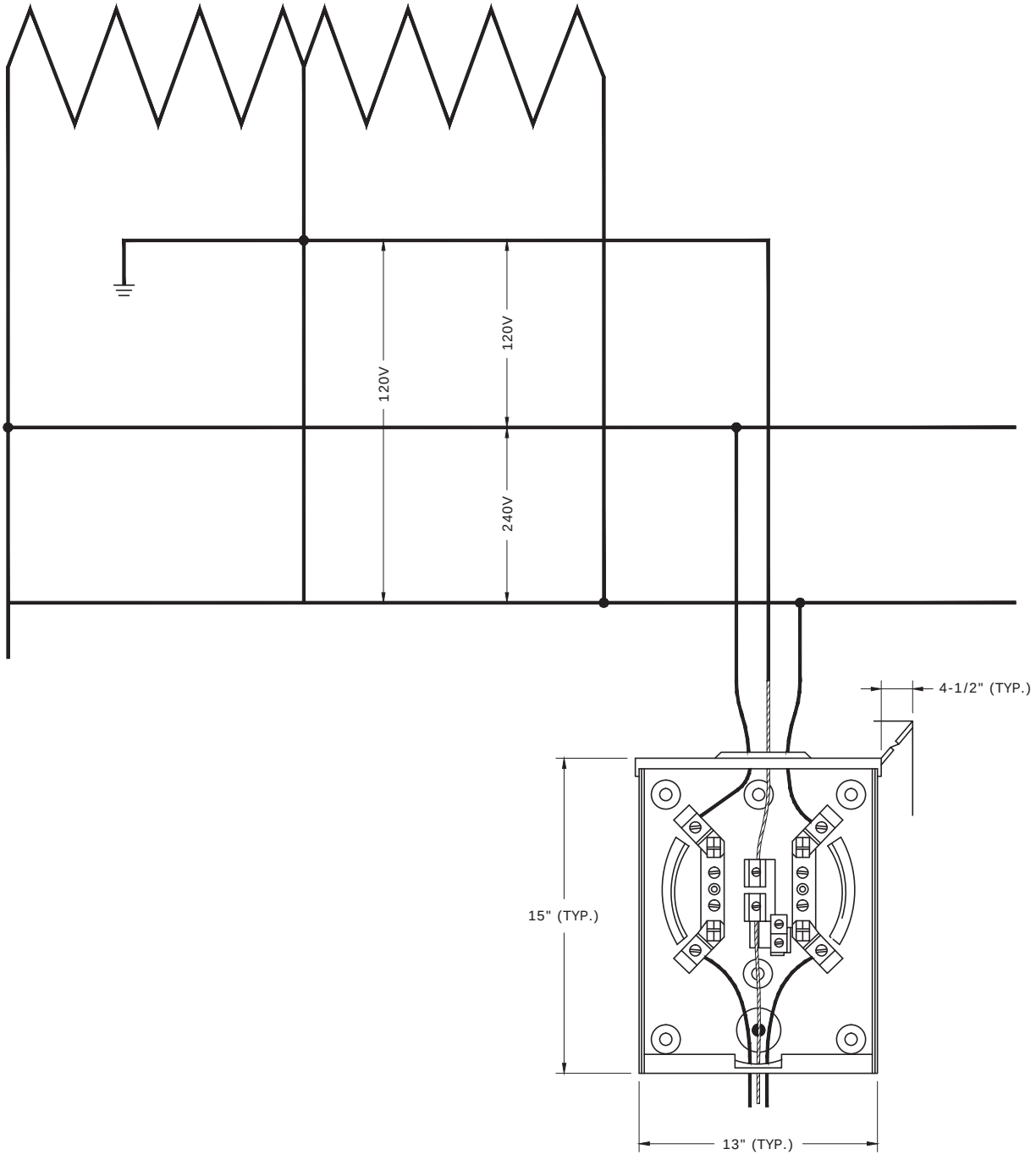
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED METER WIRING DIAGRAM, SINGLE-PHASE, 2-WIRE

Duke Energy®

FLA

DWG. 11.02-12



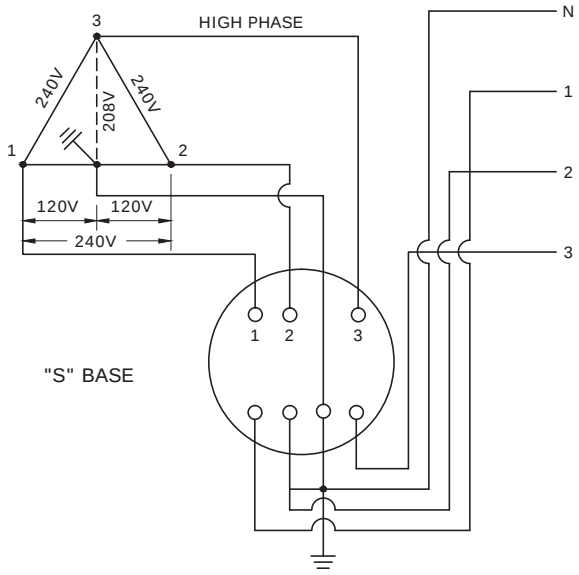
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED
METER WIRING DIAGRAM,
SINGLE-PHASE, 3-WIRE

Duke Energy®

FLA

DWG.
11.02-14



THREE-PHASE, FOUR WIRE, DELTA

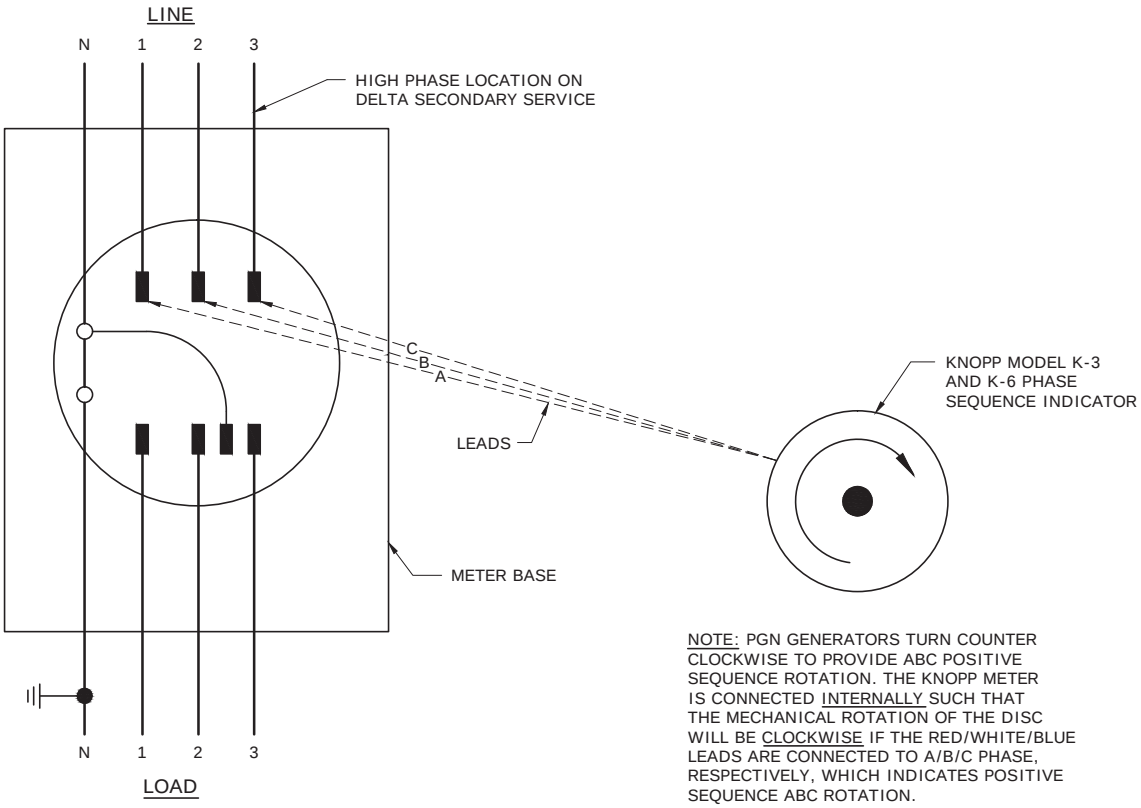
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED 4-WIRE
DELTA WIRING DIAGRAM

Duke Energy®

FLA

DWG.
11.03-06



NOTE: PGN GENERATORS TURN COUNTER CLOCKWISE TO PROVIDE ABC POSITIVE SEQUENCE ROTATION. THE KNOPP METER IS CONNECTED INTERNALLY SUCH THAT THE MECHANICAL ROTATION OF THE DISC WILL BE CLOCKWISE IF THE RED/WHITE/BLUE LEADS ARE CONNECTED TO A/B/C PHASE, RESPECTIVELY, WHICH INDICATES POSITIVE SEQUENCE ABC ROTATION.

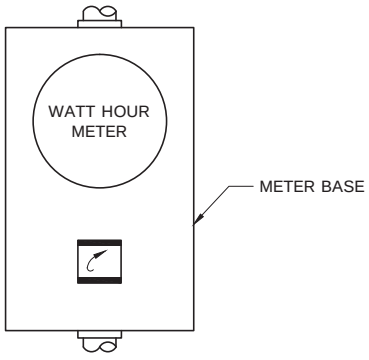
HIGH PHASE LOCATION ON DELTA SECONDARY SERVICE

NOTE: CONNECT ON LINE SIDE OF METER BASE WITH LEADS A, B, C (LEFT TO RIGHT) TO IDENTIFY CLOCKWISE OR COUNTER-CLOCKWISE ROTATION TO THIS SERVICE. THIS WILL IDENTIFY PHASE ROTATION ONLY: IT IS NOT AN INDICATION OF SOURCE PHASE IDENTIFICATION.

SEE DWGS. 23.04-03A, 23.04-03B AND 23.04-03C FOR STANDARD CABLE TAGGING.

INSTALL APPROPRIATE PHASE ROTATION INDICATION STICKER ON THE FACE OF THE METER BASE BELOW METER GLASS AND ALSO INSIDE THE METER BASE:

COUNTERCLOCKWISE: CN 440303
CLOCKWISE: CN 440302



STANDARD PHASE ROTATION IDENTIFICATION PROCEDURE
FOR SELF-CONTAINED METER BASES ONLY

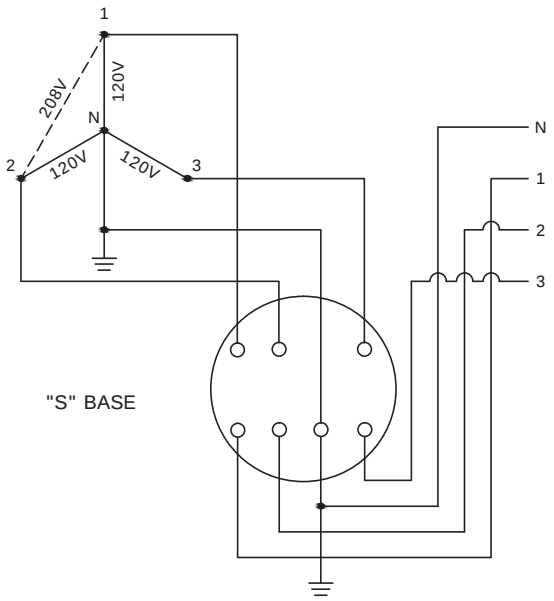
3				
2				
1	11/12/12	DANNA	DANNA	ADCOCK
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

HIGH PHASE LOCATION ON DELTA SERVICE AND STANDARD PHASE ROTATION FOR SELF-CONTAINED METER BASES ONLY

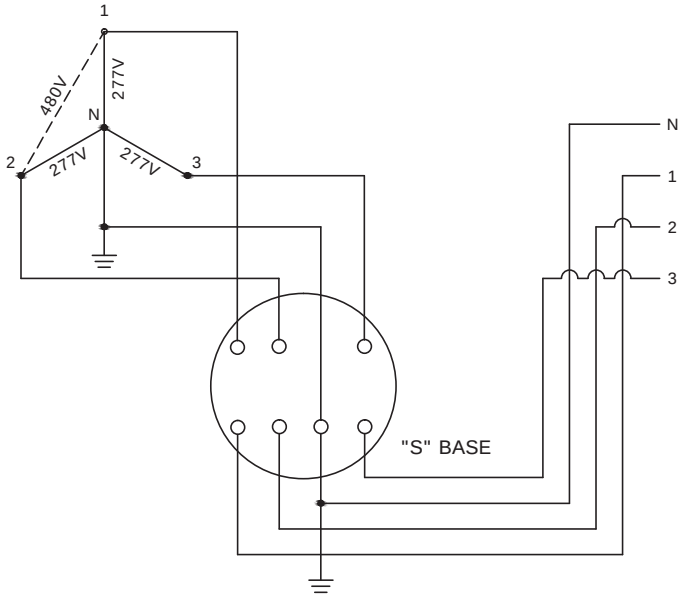
Duke Energy®

FLA

DWG. 11.03-08



THREE-PHASE, FOUR WIRE, WYE 120/208 VOLTS



THREE-PHASE, FOUR WIRE, WYE 277/480 VOLTS

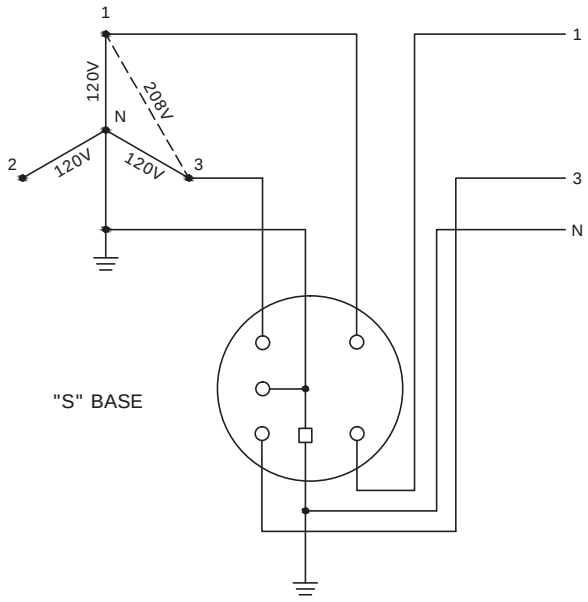
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED 4-WIRE
WYE METER WIRING DIAGRAMS

Duke Energy®

FLA

DWG. 11.03-12



THREE WIRE NETWORK

3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

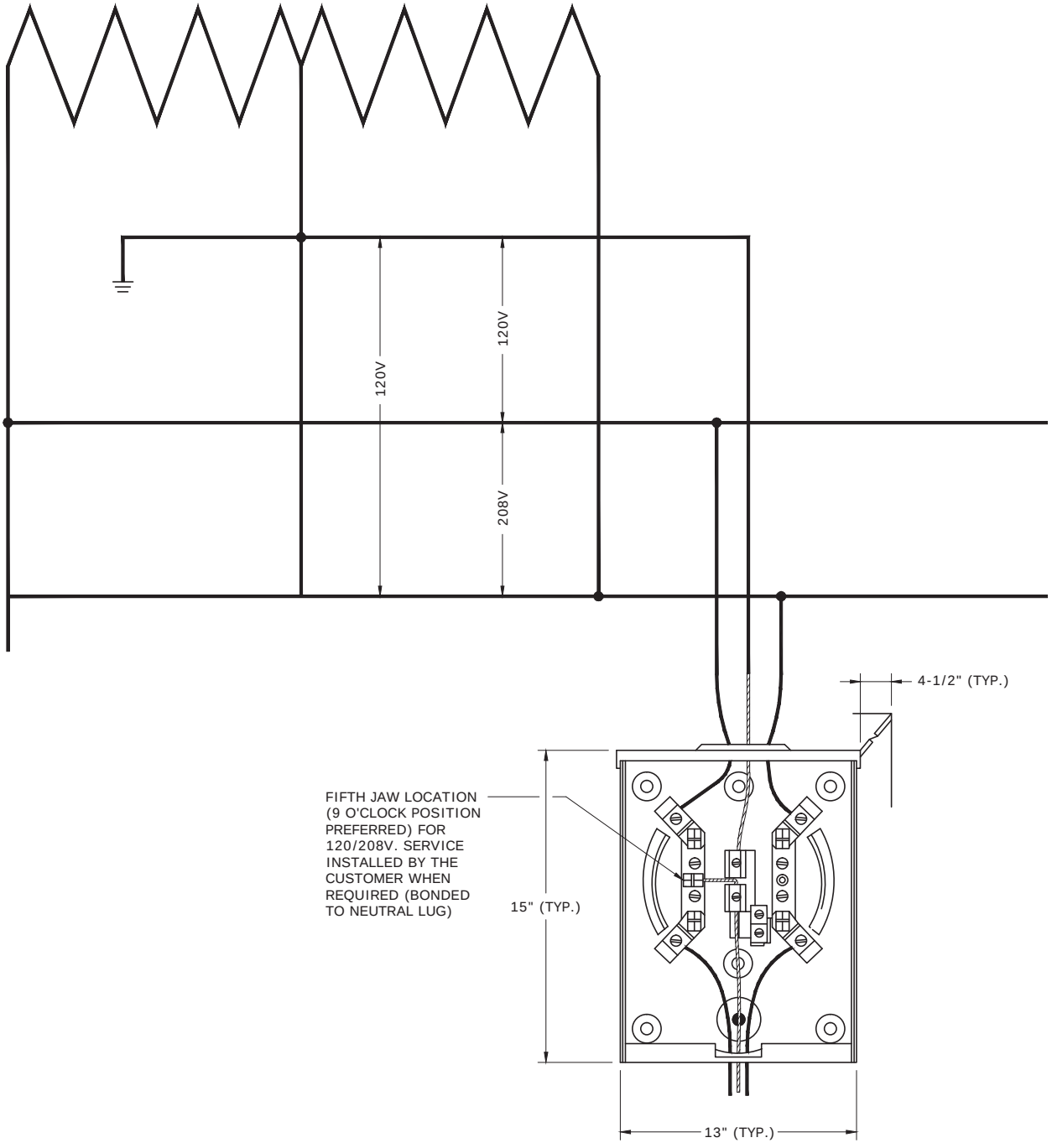
120/208 VOLT 3-WIRE NETWORK

SELF-CONTAINED METERING WIRING DIAGRAM

Duke Energy®

FLA

DWG. 11.04-02



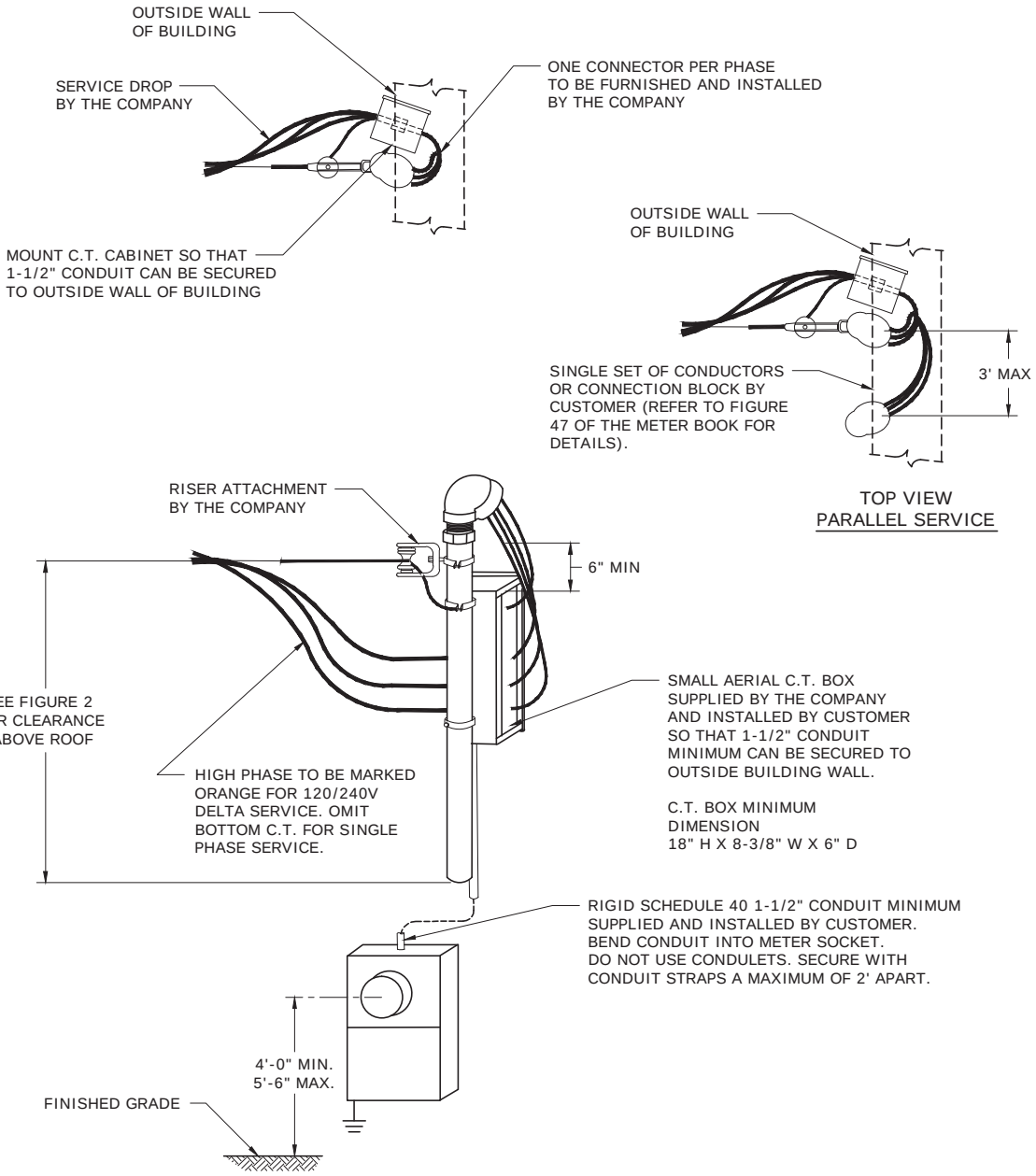
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED METER WIRING CONNECTIONS, 120/208 VOLT, 3-WIRE - NETWORK

Duke Energy®

FLA

DWG. 11.04-03



NOTE: ALL METER CONTROL WIRE CONNECTIONS TO BE MADE INSIDE CURRENT TRANSFORMER ENCLOSURE.

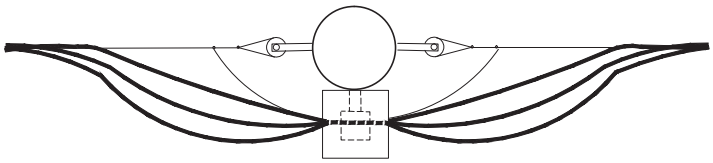
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

CT CABINET INSTALLATION ON SERVICE RISER, THREE-PHASE, 4-WIRE OR SINGLE-PHASE, 3-WIRE SERVICE

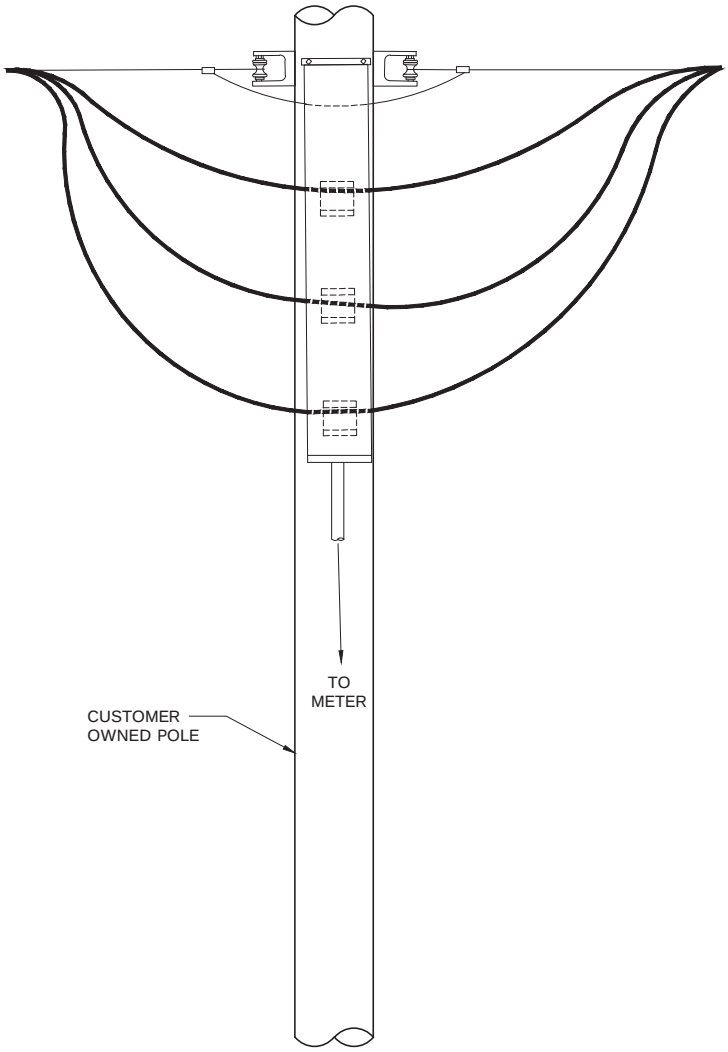
Duke Energy®

FLA

DWG. 11.07-08



PLAN VIEW



FRONT VIEW

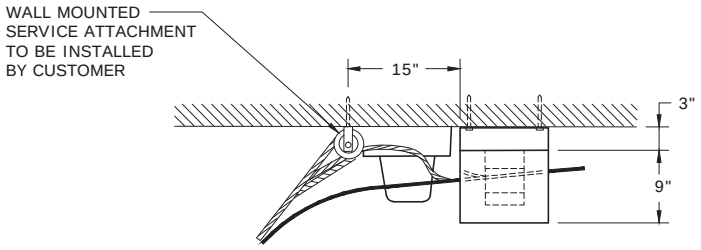
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

CURRENT TRANSFORMER INSTALLATION FOR SECONDARY METERING

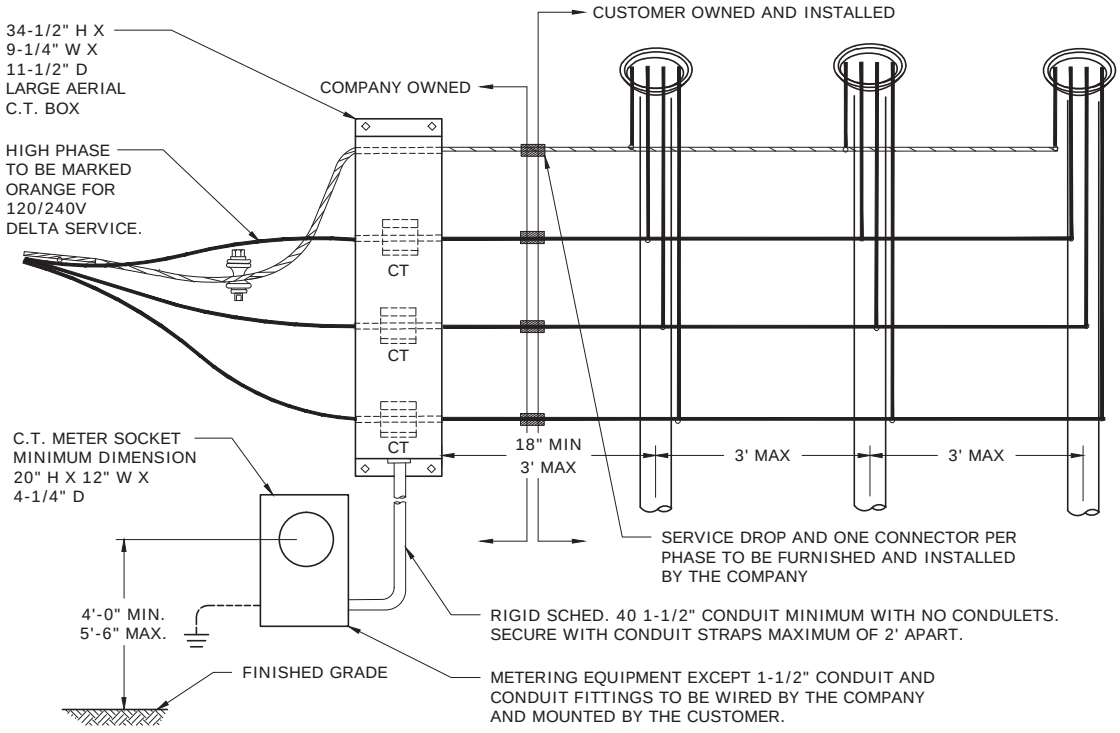
Duke Energy®

FLA

DWG. 11.07-10



CUSTOMER SHALL CONNECT MULTIPLE RISERS BEHIND THE C.T.'S TO A SINGLE SET OF CONDUCTORS OR CONNECTION BLOCK FOR CONNECTION TO THE SERVICE DROP BY THE COMPANY. (REFER TO FIG. 47 OF THE METER BOOK FOR CONNECTION BLOCK DETAILS)



NOTES:

1. CUSTOMER MUST PROVIDE ADEQUATE GROUNDING OF FACILITIES IN ACCORDANCE WITH THE N.E.C. AND AUTHORITY HAVING JURISDICTION, AND THE COMPANY.

2. ALL METER CONTROL WIRE CONNECTIONS TO BE MADE INSIDE CURRENT TRANSFORMER ENCLOSURE.

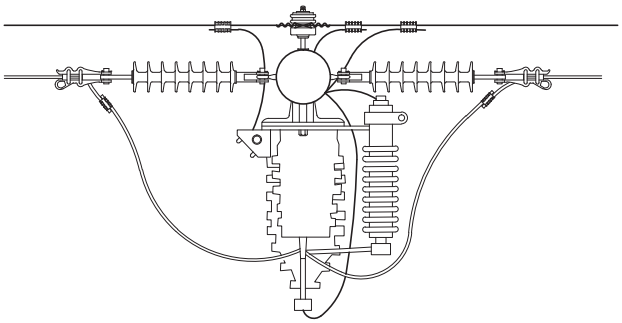
3				
2				
1				
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

CT CABINET INSTALLATION ON THREE-PHASE, 4-WIRE WALL MOUNTED

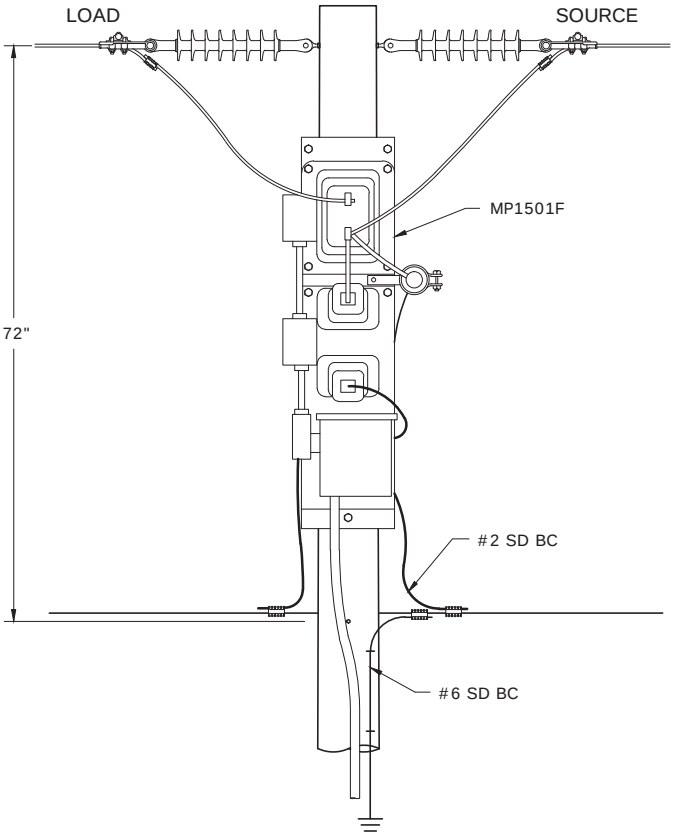
Duke Energy®

FLA

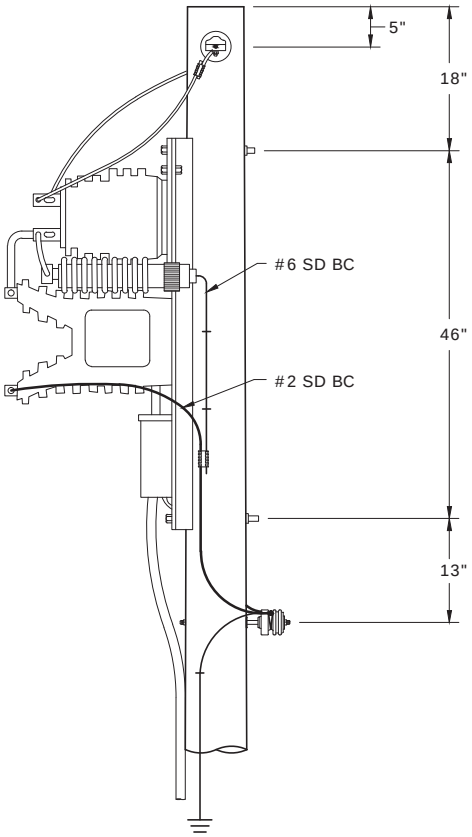
DWG. 11.07-12



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

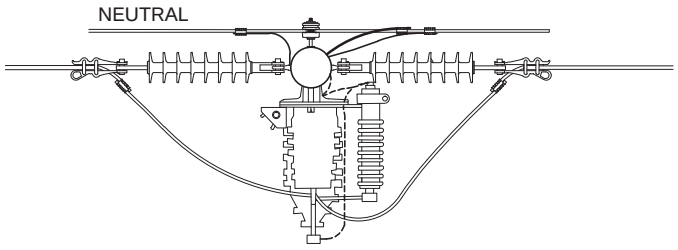
3				
2				
1				
0	11/30/10	STARNES	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

SINGLE-PHASE PRIMARY METERING INSTALLATION - 15 KV OVERHEAD CLUSTER

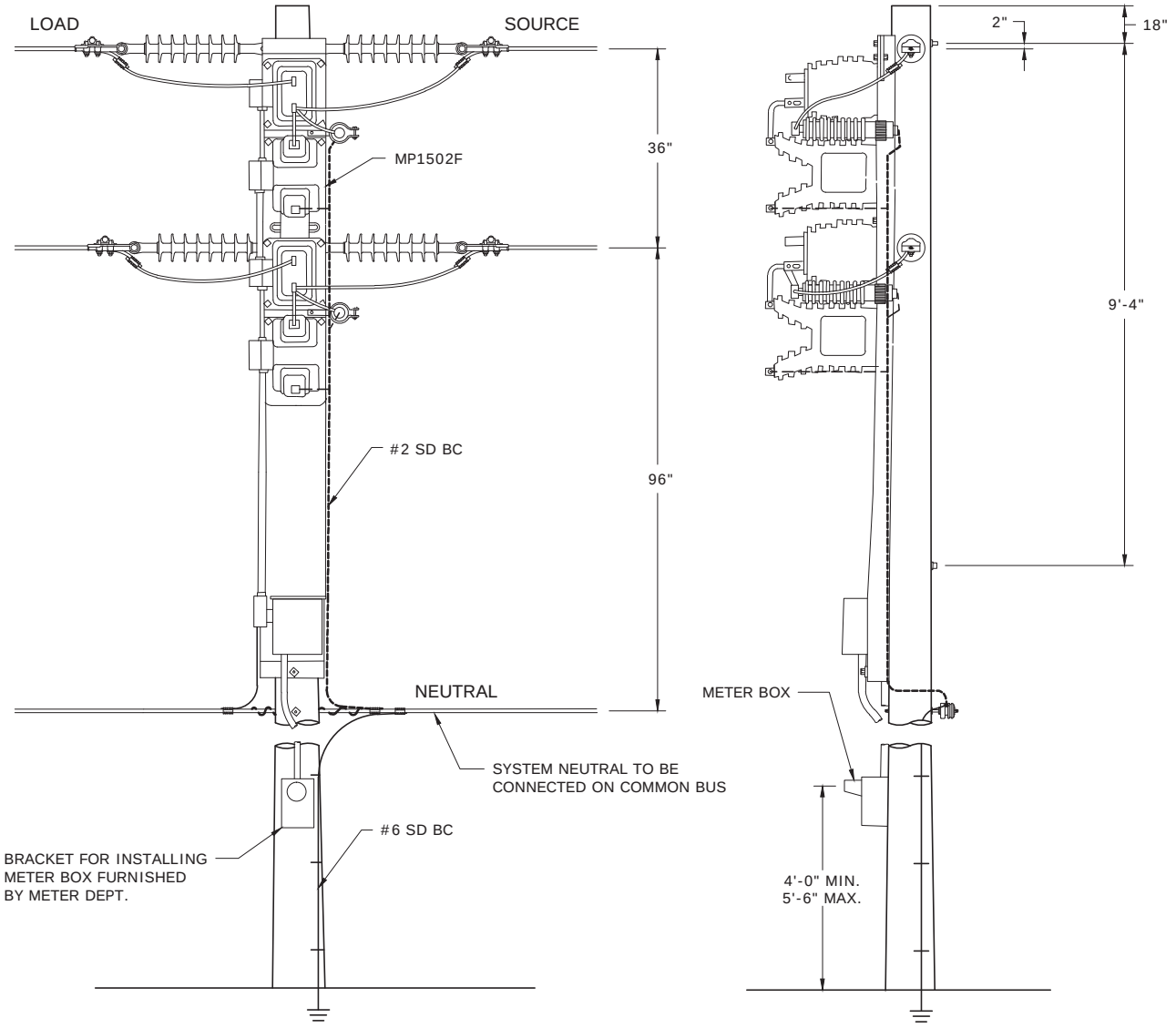
Duke Energy®

FLA

DWG. 11.08-04



PLAN VIEW



FRONT VIEW

SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

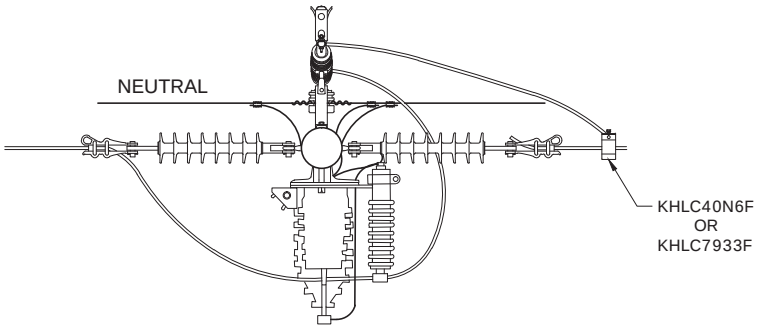
3				
2				
1				
0	11/30/10	STARNES	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

POLYPHASE PRIMARY METERING INSTALLATION - 15 KV, 2 ELEMENT, OVERHEAD VERTICAL CLUSTER

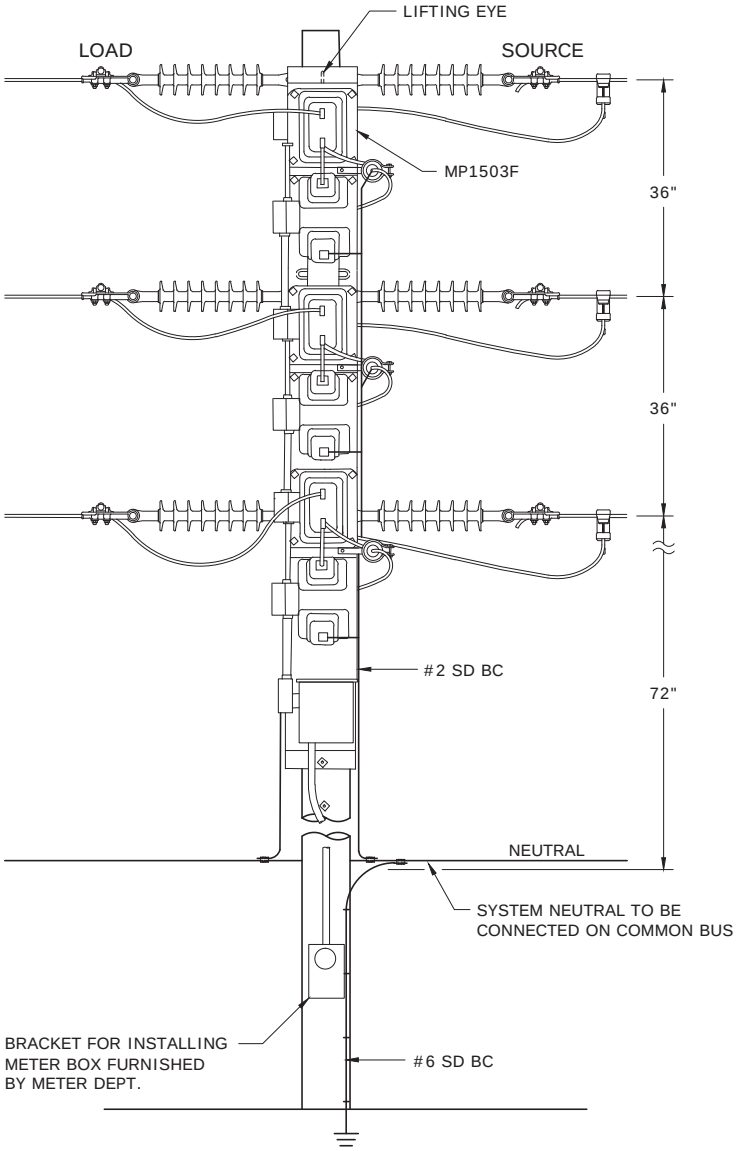
Duke Energy®

FLA

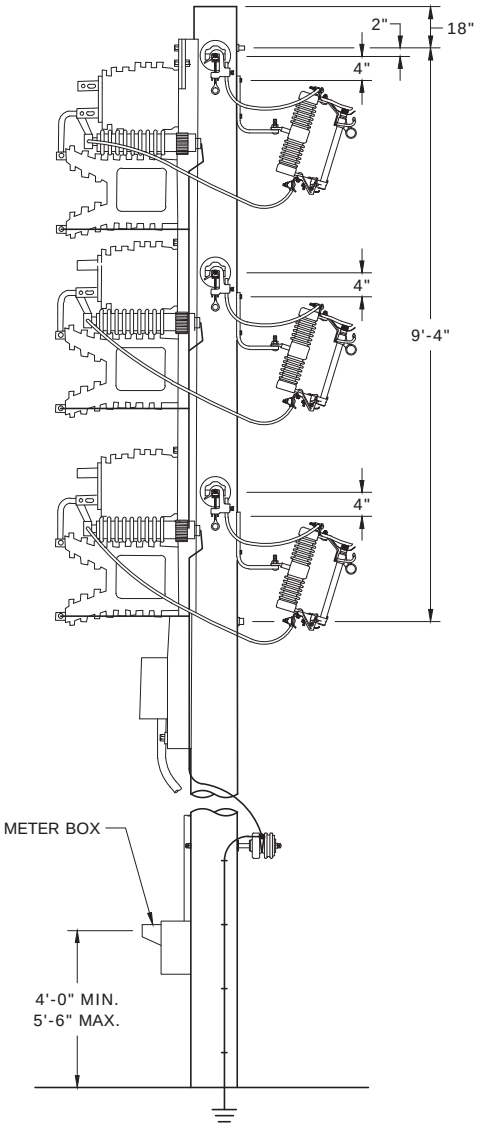
DWG. 11.09-06



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.
2. LINE FUSES MAY BE PLACED ON POLE UPSTREAM OF METER CLUSTER IF CIRCUIT CONFIGURATION PERMITS AND APPROVED BY PLANNER.

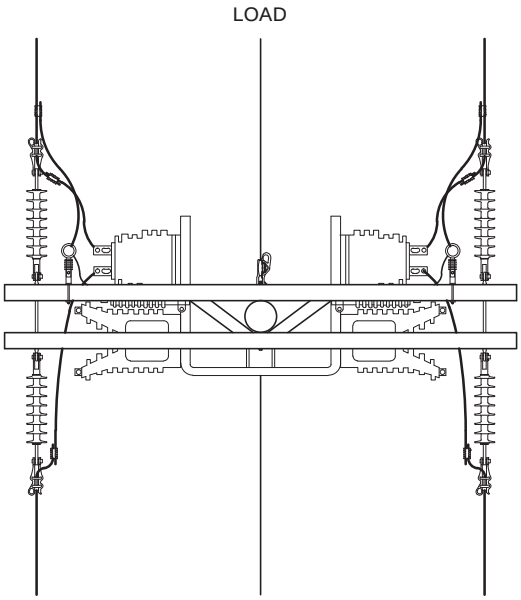
REVISED	BY	CK'D	APPR.
3 5/24/12	BURLISON	BURLISON	ELKINS
2 8/31/11	BURLISON	BURLISON	ELKINS
1 2/4/11	SIMPSON	BURLISON	ELKINS
0 11/30/10	STARNES	SIMPSON	ELKINS

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 3 ELEMENT, OVERHEAD VERTICAL CLUSTER

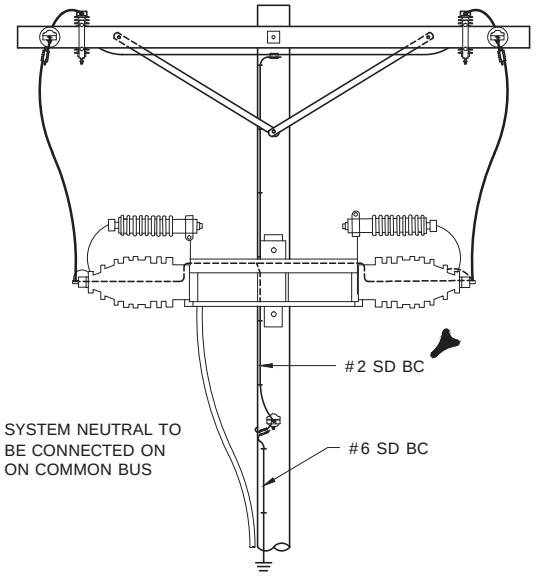
Progress Energy

FLA

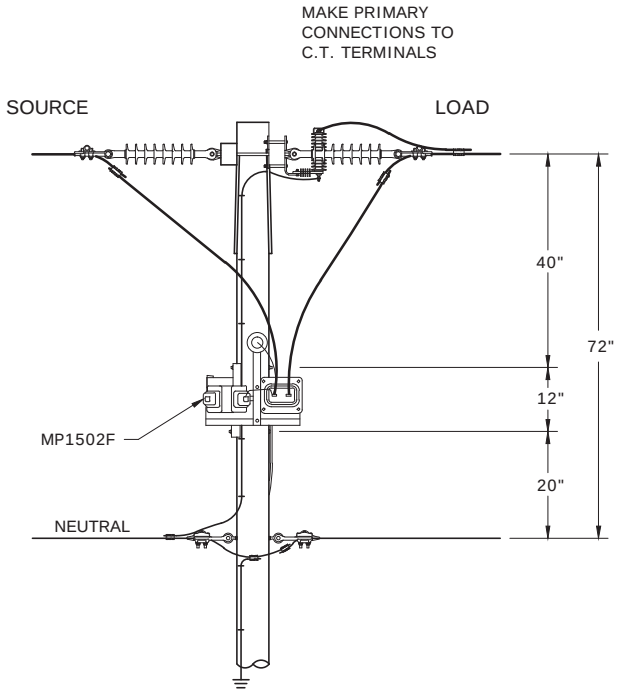
DWG. 11.09-10



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. METER DEPARTMENT TO SPECIFY LOCATION FOR USE OF THIRD POTENTIAL TRANSFORMER.

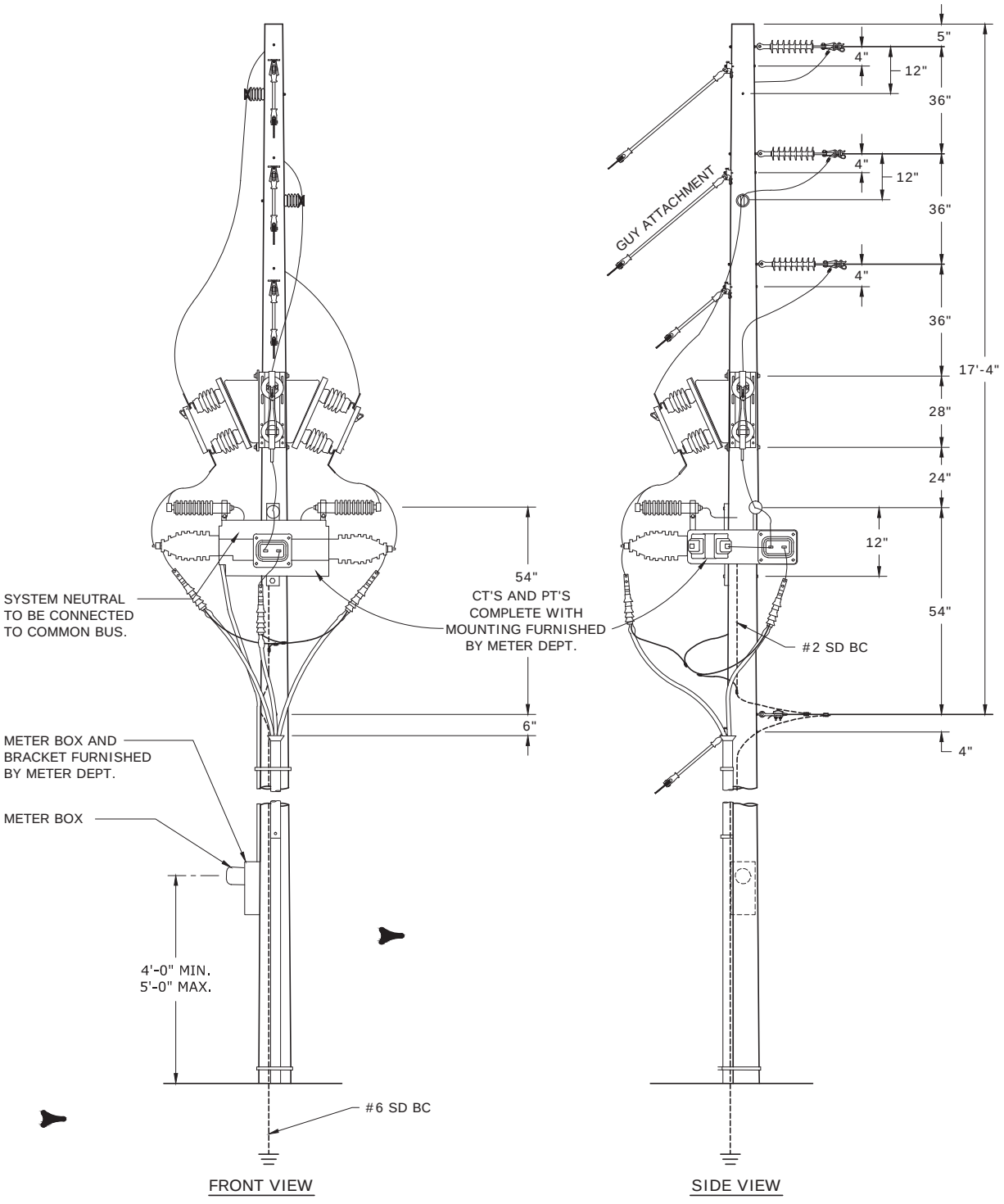
3				
2				
1	12/20/13	McCONNELL	GUINN	ADCOCK
0	11/30/10	STARNES	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

DUKE ENERGY.

FLA

DWG. 11.09-12



NOTES:

1. GUYS MUST BE BONDED TO POLE GROUND, NOT SHOWN HERE FOR CLARITY. REFER TO DWG. 02.04-04.

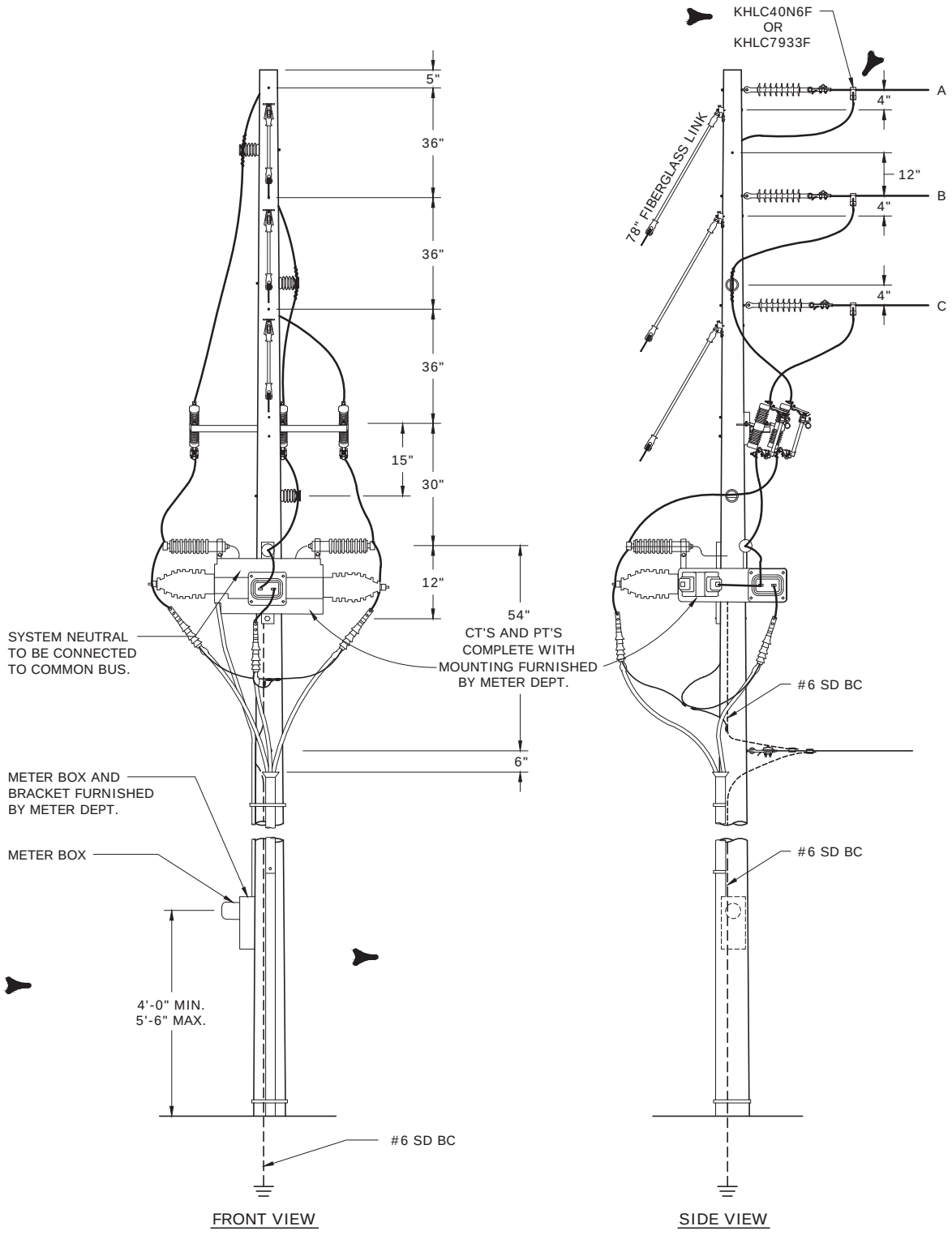
3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 600 AMP, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

Progress Energy

FLA

DWG. 11.09-16



NOTES:

1. GUYS MUST BE BONDED TO POLE GROUND, NOT SHOWN HERE FOR CLARITY. REFER TO DWG. 02.04-04.

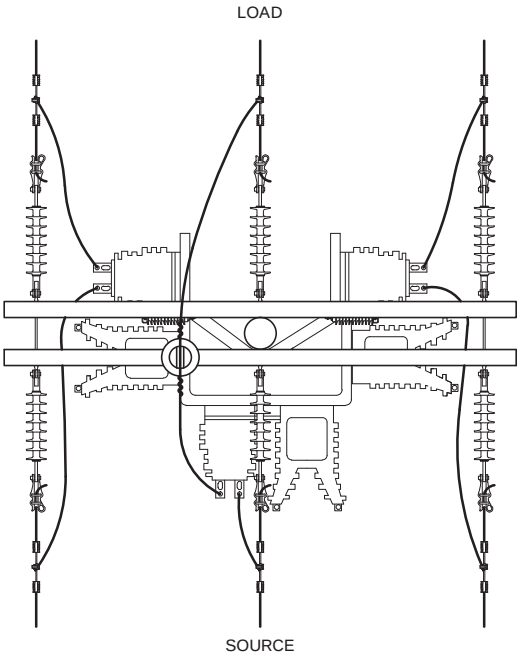
REVISED		BY	CK'D	APPR.
3				
2				
1	8/31/11	DANNA	BURLISON	ELKINS
0	11/30/10	SIMPSON	SIMPSON	ELKINS

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 200 AMP, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

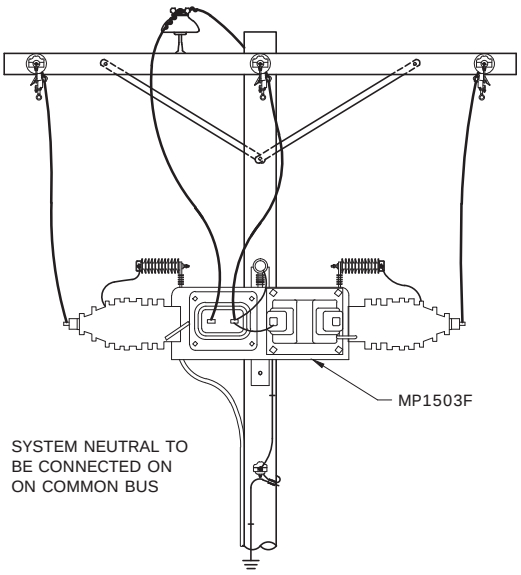
Duke Energy®

FLA

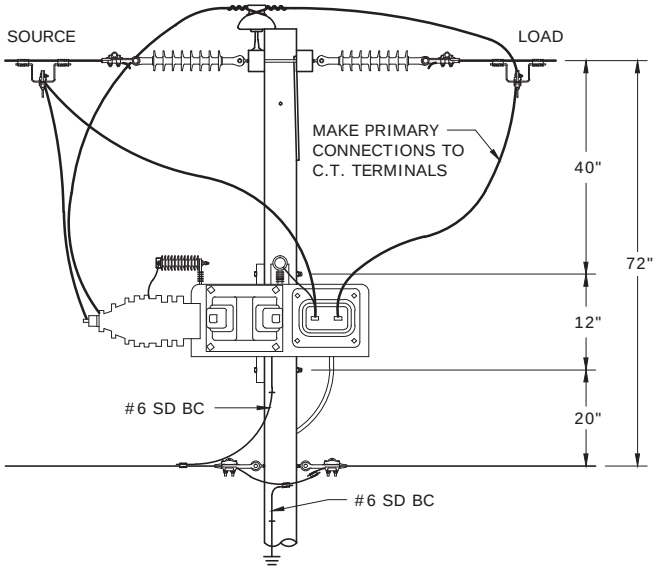
DWG. 11.09-18



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. METER DEPARTMENT TO SPECIFY LOCATION FOR USE OF THIRD POTENTIAL TRANSFORMER.
2. CUTOUTS MAY BE INSTALLED ON ADJACENT SERVICE POLE IF SPECIFIED BY ENGINEER.
3. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

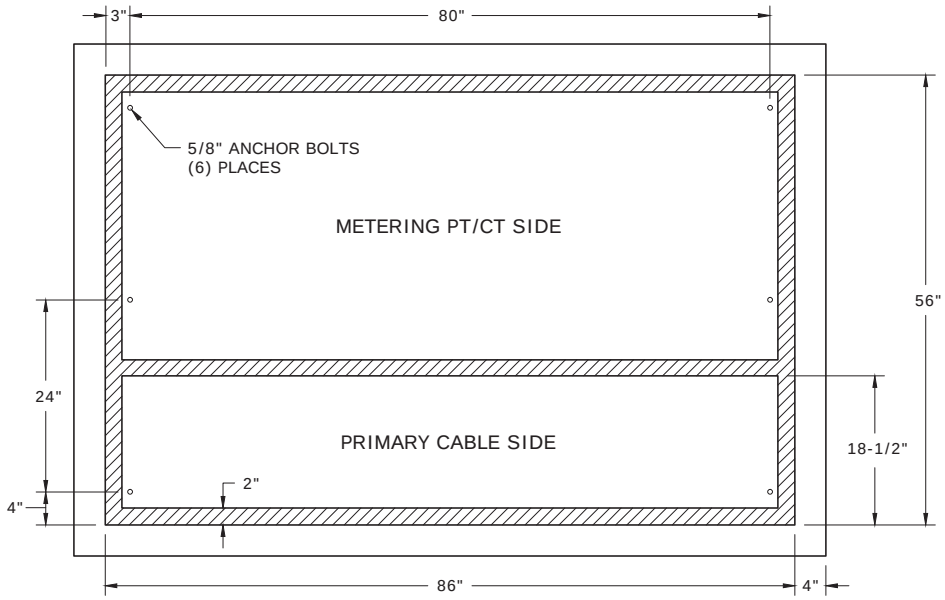
3				
2				
1				
0	11/30/10	STARNES	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 3 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

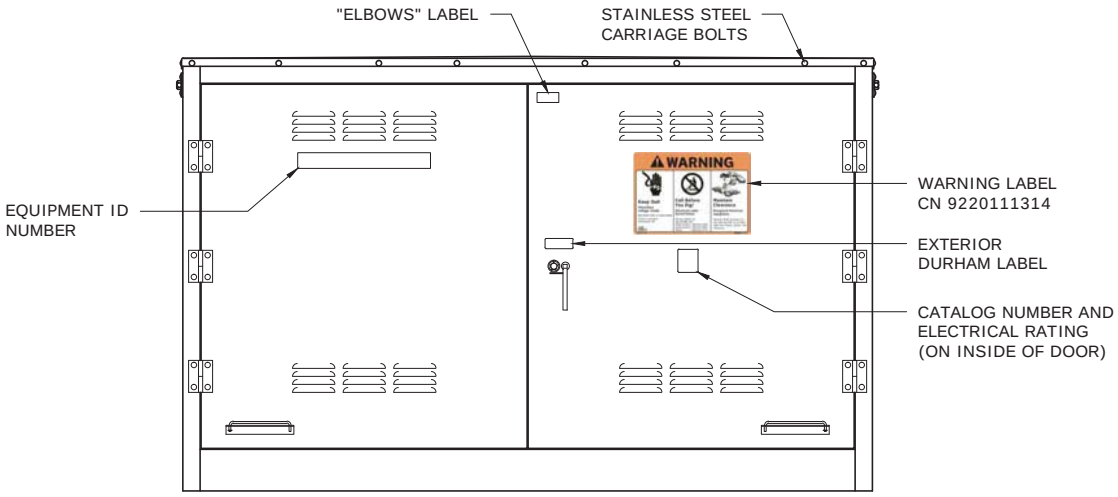
Duke Energy®

FLA

DWG. 11.09-20



ENCLOSURE FOOTPRINT



FRONT VIEW

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCMTRCTPTSF	1	001466	1	PAD-MOUNTED METER ENCLOSURE
	2	PAD3P82X87CF	1	327712	1	82" X 87" CONCRETE PAD
	3	-	1	9220111314	1	WARNING LABEL
	4	-	4	211298041	1	DANGER LABEL (SEE NOTE 2)

NOTES:

1. ISSUE GROUNDS SEPARATELY.
2. INSTALL DANGER LABEL ON INSIDE OF EACH DOOR: TOTAL (4) LABELS.
3. INSTALL 1 WARNING LABEL ON EACH SET OF DOORS (ONE PER SIDE).

REVISED		BY	CK'D	APPR.
3				
2	7/23/14	DANNA	DANNA	ADCOCK
1	10/7/13	DANNA	DANNA	ADCOCK
0	8/23/13	GUINN	GUINN	ADCOCK

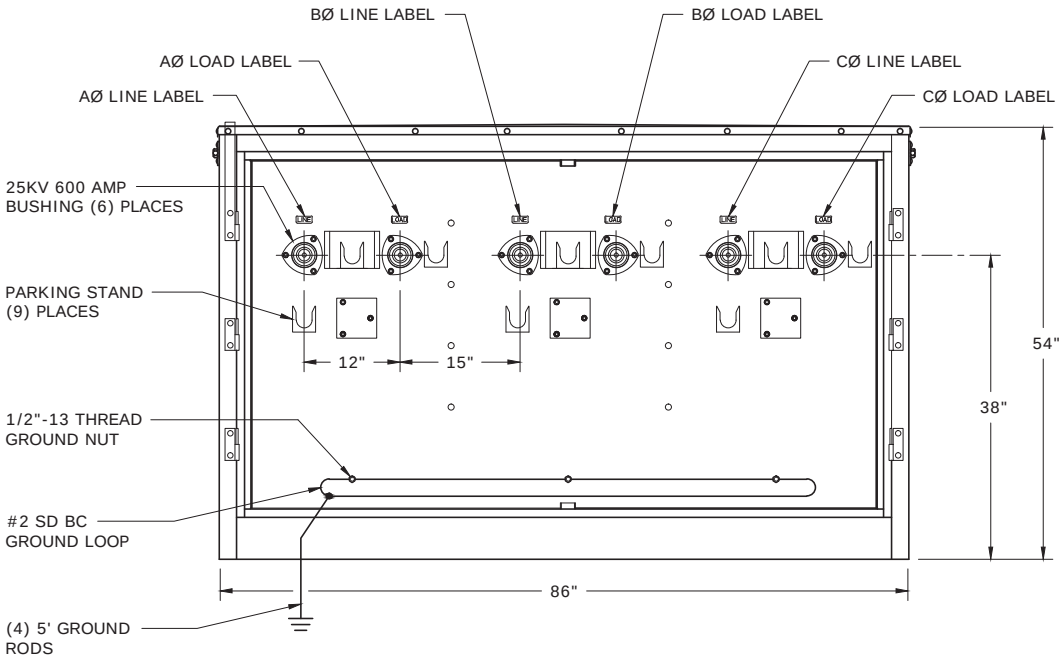
THREE-PHASE PRIMARY METERING ENCLOSURE

FRONT VIEW AND FOOTPRINT

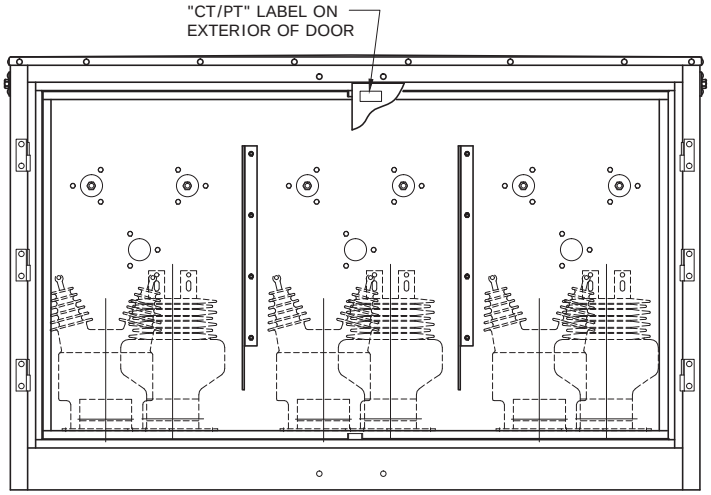
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

11.11-01



FRONT VIEW (DOORS REMOVED)



BACK VIEW (DOORS REMOVED)

NOTES:

1. REAR SIDE ACCESS FOR METER DEPARTMENT ONLY.
2. CONTACT METERING WHEN THERE IS AN APPLICATION FOR THIS ENCLOSURE.
3. INSTALL ELBOW ARRESTERS ON BACK OF T-BODY.

3				
2				
1				
0	8/23/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING ENCLOSURE
BUSHING AND CT/PT LAYOUT

DUKE ENERGY.

FLA

DWG. 11.11-03

NOTES:

1. DEADFRONT CONSTRUCTION 600 AMP BOLTED ELBOW (T-BODY).

2. T-BODY IS NON-LOADBREAK (NO VOLTAGE AND CURRENT).

3. IT IS ACCEPTABLE TO CONNECT BOTH GROUND DRAIN LEADS TO THE GROUNDING BUSS USING SEPARATE CONNECTORS AS A METHOD OF CROSS BONDING.

4. CONNECT DRAIN WIRE FROM INSULATED CAP TO GROUND LOOP.

5. VERIFY LINE AND LOAD SIDE CABLES ARE CONNECTED PROPERLY (I.E. LINE TO LINE, LOAD TO LOAD, CORRECT PHASE).

   IMPROPER CONNECTION WILL RESULT IN INCORRECT METER READINGS!

6. SEE DWG. 22.06-10 FOR CABLE AND CONDUIT PLACEMENT.

7. MARK ALL CABLES USING WHITE PLASTIC CABLE IDENTIFICATION TAG. TAG MUST INCLUDE LINE OR LOAD DESIGNATION. SEE DWG. 27.00-03 FOR ADDITIONAL DETAIL.

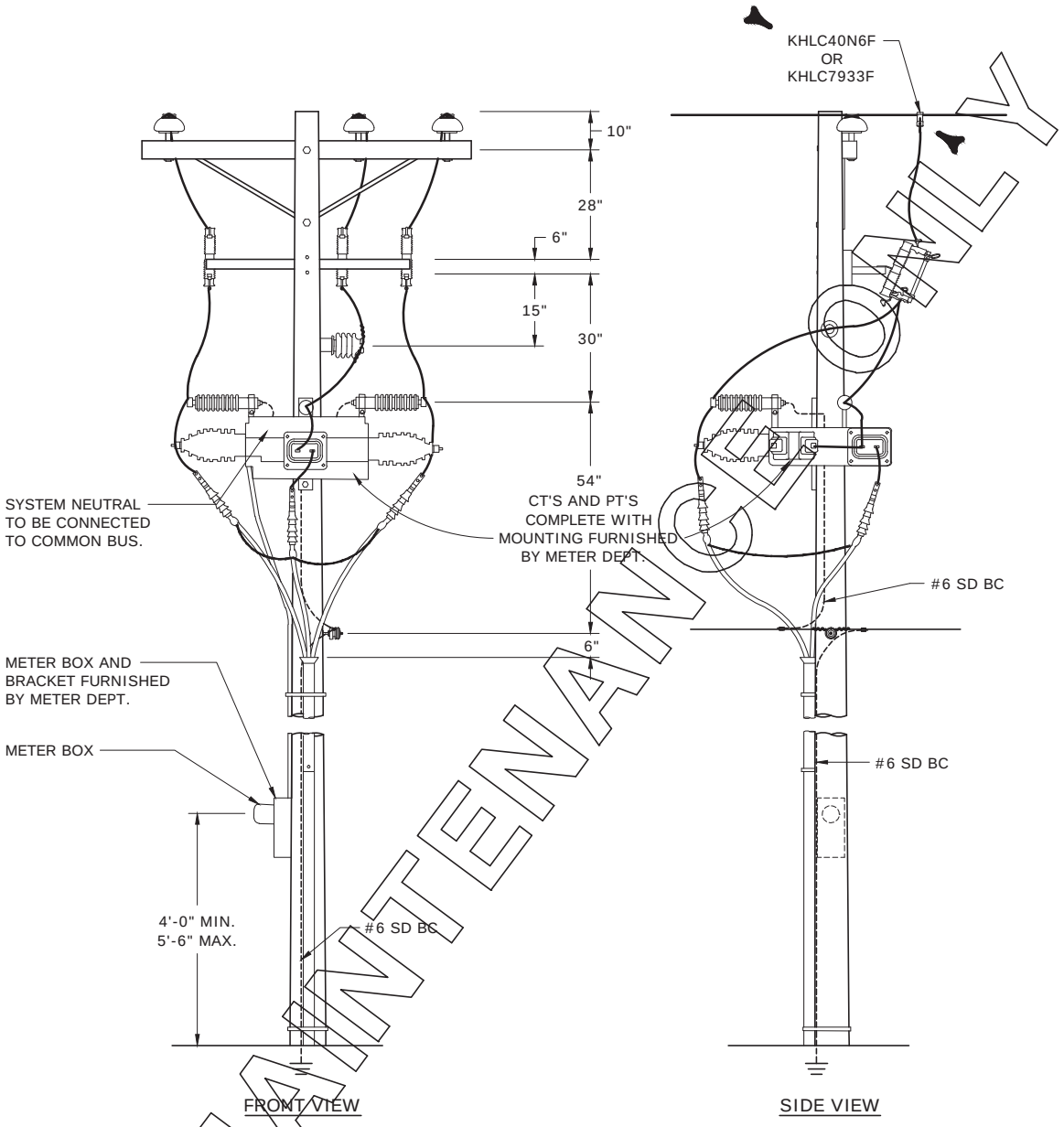
3				
2				
1				
0	8/23/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING ENCLOSURE

DUKE ENERGY.

FLA

DWG. 11.11-05



NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3				
2				
1	8/31/11	BURLISON	BURLISON	ELKINS
0	11/30/10	SIMPSON	SIMPSON	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER (FMO)

Duke Energy®

FLA

DWG. 11.09-14

DUKE ENERGY.

3				
2				
1	12/31/17	KATIGBAK	BURLISON	ADCOCK
0	9/30/16	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SECTION 12 - COASTAL AND CONTAMINATED AREAS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

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 SECTION 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 AS DEFINED IN SECTION 3 PRIMARY OVERHEAD CONSTRUCTION.

TWO TYPES OF AREAS ARE SPECIFIED WITH REGARDS TO COASTAL AND CONTAMINATED CONSTRUCTION.

I. COASTLINE AND SALTWATER MARSH AREAS

AREAS ALONG THE COAST AND NEAR MARSHLAND THAT ARE 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, AREAS SURROUNDING MANUFACTURING FACILITIES KNOWN TO RELEASE AIRBORNE PARTICULATE AND AREAS IN THE VICINITY OF CHEMICALLY ACTIVE SOILS. THESE SHOULD BE IDENTIFIED BY LOCAL ENGINEERING.

II. OVER INSULATED AREAS

AREAS WHERE SALT FOG OR EXCESSIVE MINERAL OR PARTICULATE COLLECTING ON INSULATION HAS BEEN THE CAUSE OF POLE FIRES. OVER INSULATED AREAS ARE EXCLUSIVE OF AREAS ALREADY IDENTIFIED IN THE 1000' ZONE DETAILED IN THE COASTAL AND CONTAMINATED AREAS.

THE SIGNIFICANT DIFFERENCE IN THE TWO AREAS IS THAT THE OVER INSULATED AREA DOES NOT USE STAINLESS EQUIPMENT AND DOES NOT INCORPORATE THE COASTAL GUYING BONDING METHOD OUTLINED IN SECTION 12.02. **ALL OTHER MATERIALS AND GUIDELINES REFERENCED IN THIS SECTION ARE COMMON TO BOTH AREAS.** PLEASE CONTACT YOUR LOCAL DISTRIBUTION STANDARDS REPRESENTATIVE WITH ANY CLARIFYING MATERIAL QUESTIONS.

NOTES:

1. FOR AREAS OF DEC AND DEM, CONTACT DISTRIBUTION STANDARDS IF YOU HAVE AN APPLICATION THAT MAY REQUIRE ANTI-CORROSIVE MATERIALS.

3				
2				
1	7/11/17	LOOSIER	BURLISON	ADCOCK
0	9/30/16	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

COASTAL AND CONTAMINATED AREAS

GENERAL INFORMATION

DEC	DEM	DEP	DEF
X	X	X	X

12.00-100

AS PREVIOUSLY MENTIONED, AREAS WITHIN 1000' OF ANY SALTWATER OR SALTWATER MARSH ARE IDENTIFIED AS COASTAL AND CONTAMINATED AREAS. AREAS WITHIN DEF IDENTIFIED AS OVER INSULATED AREAS ARE DEFINED BELOW:

- ST. PETERSBURG OPERATION CENTER GEOGRAPHIC SERVICE BOUNDARY
- WALSINGHAM OPERATIONS CENTER GEOGRAPHIC SERVICE BOUNDARY
- ODENA OPERATIONS CENTER GEOGRAPHIC SERVICE BOUNDARY
- CRAWFORDVILLE OPERATIONS CENTER GEOGRAPHIC SERVICE BOUNDARY WEST OF THE OCHLOCKONEE RIVER.

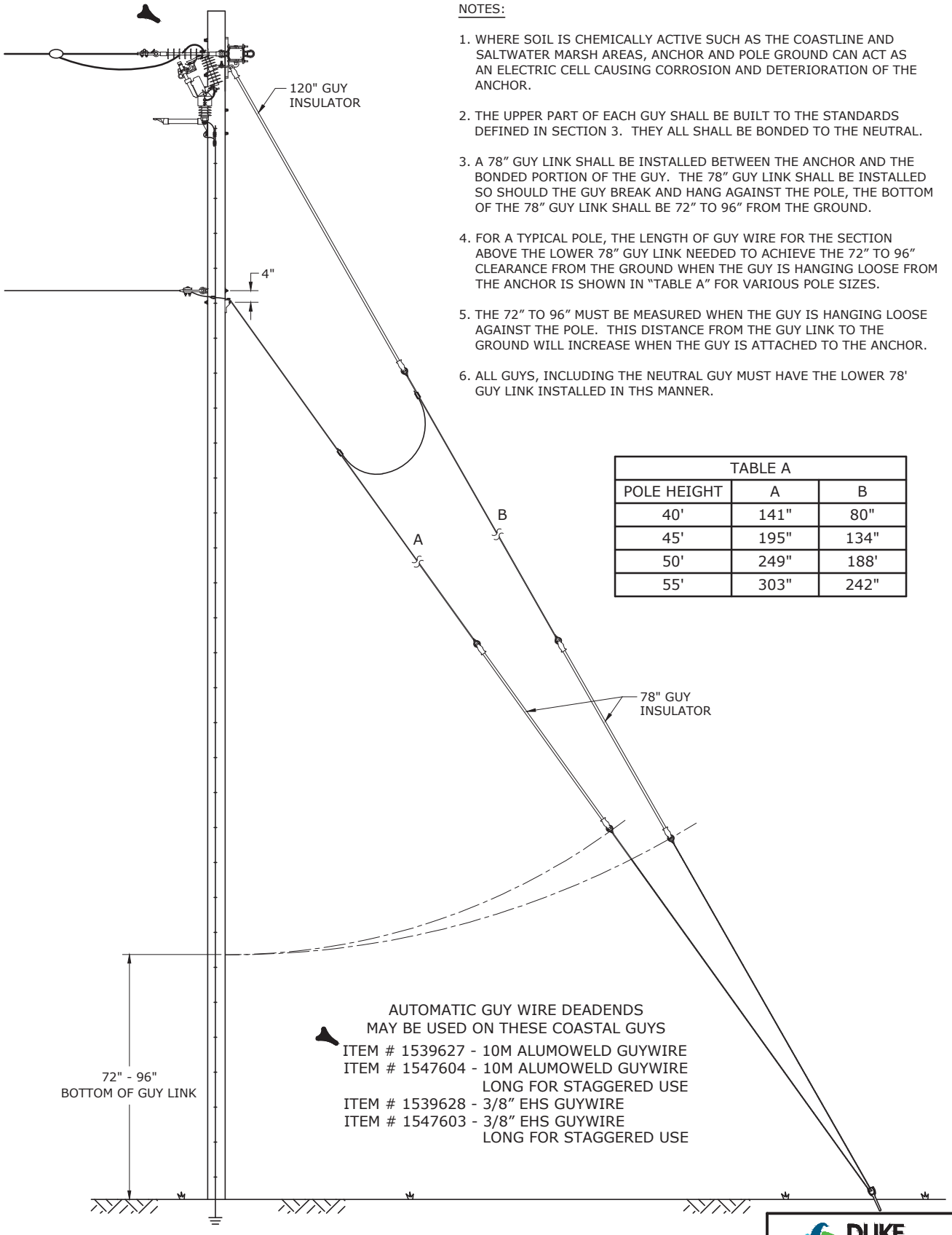
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/11/17	LOOSIER	BURLISON	ADCOCK
0	9/30/16	LOOSIER	BURLISON	ADCOCK

COASTAL AND CONTAMINATED AREAS
GENERAL INFORMATION

DEC	DEM	DEP	DEF
			X

12.00-105



NOTES:

1. WHERE SOIL IS CHEMICALLY ACTIVE SUCH AS THE COASTLINE AND SALTWATER MARSH AREAS, ANCHOR AND POLE GROUND CAN ACT AS AN ELECTRIC CELL CAUSING CORROSION AND DETERIORATION OF THE ANCHOR.
2. THE UPPER PART OF EACH GUY SHALL BE BUILT TO THE STANDARDS DEFINED IN SECTION 3. THEY ALL SHALL BE BONDED TO THE NEUTRAL.
3. A 78" GUY LINK SHALL BE INSTALLED BETWEEN THE ANCHOR AND THE BONDED PORTION OF THE GUY. THE 78" GUY LINK SHALL BE INSTALLED SO SHOULD THE GUY BREAK AND HANG AGAINST THE POLE, THE BOTTOM OF THE 78" GUY LINK SHALL BE 72" TO 96" FROM THE GROUND.
4. FOR A TYPICAL POLE, THE LENGTH OF GUY WIRE FOR THE SECTION ABOVE THE LOWER 78" GUY LINK NEEDED TO ACHIEVE THE 72" TO 96" CLEARANCE FROM THE GROUND WHEN THE GUY IS HANGING LOOSE FROM THE ANCHOR IS SHOWN IN "TABLE A" FOR VARIOUS POLE SIZES.
5. THE 72" TO 96" MUST BE MEASURED WHEN THE GUY IS HANGING LOOSE AGAINST THE POLE. THIS DISTANCE FROM THE GUY LINK TO THE GROUND WILL INCREASE WHEN THE GUY IS ATTACHED TO THE ANCHOR.
6. ALL GUYS, INCLUDING THE NEUTRAL GUY MUST HAVE THE LOWER 78' GUY LINK INSTALLED IN THS MANNER.

TABLE A		
POLE HEIGHT	A	B
40'	141"	80"
45'	195"	134"
50'	249"	188'
55'	303"	242"

AUTOMATIC GUY WIRE DEADENDS
MAY BE USED ON THESE COASTAL GUYS
ITEM # 1539627 - 10M ALUMOWELD GUYWIRE
ITEM # 1547604 - 10M ALUMOWELD GUYWIRE
LONG FOR STAGGERED USE
ITEM # 1539628 - 3/8" EHS GUYWIRE
ITEM # 1547603 - 3/8" EHS GUYWIRE
LONG FOR STAGGERED USE

REVISED		BY	CHK'D	APPR.
3				
2	11/13/17	BURLISON	BENDER	ADCOCK
1	7/11/17	LOOSIER	BURLISON	ADCOCK
0	9/30/16	BURLISON	WHITE	ADCOCK

COASTAL AND CONTAMINATED AREAS GUY BONDING AND ANCHOR ISOLATION - HORIZONTAL CONSTRUCTION

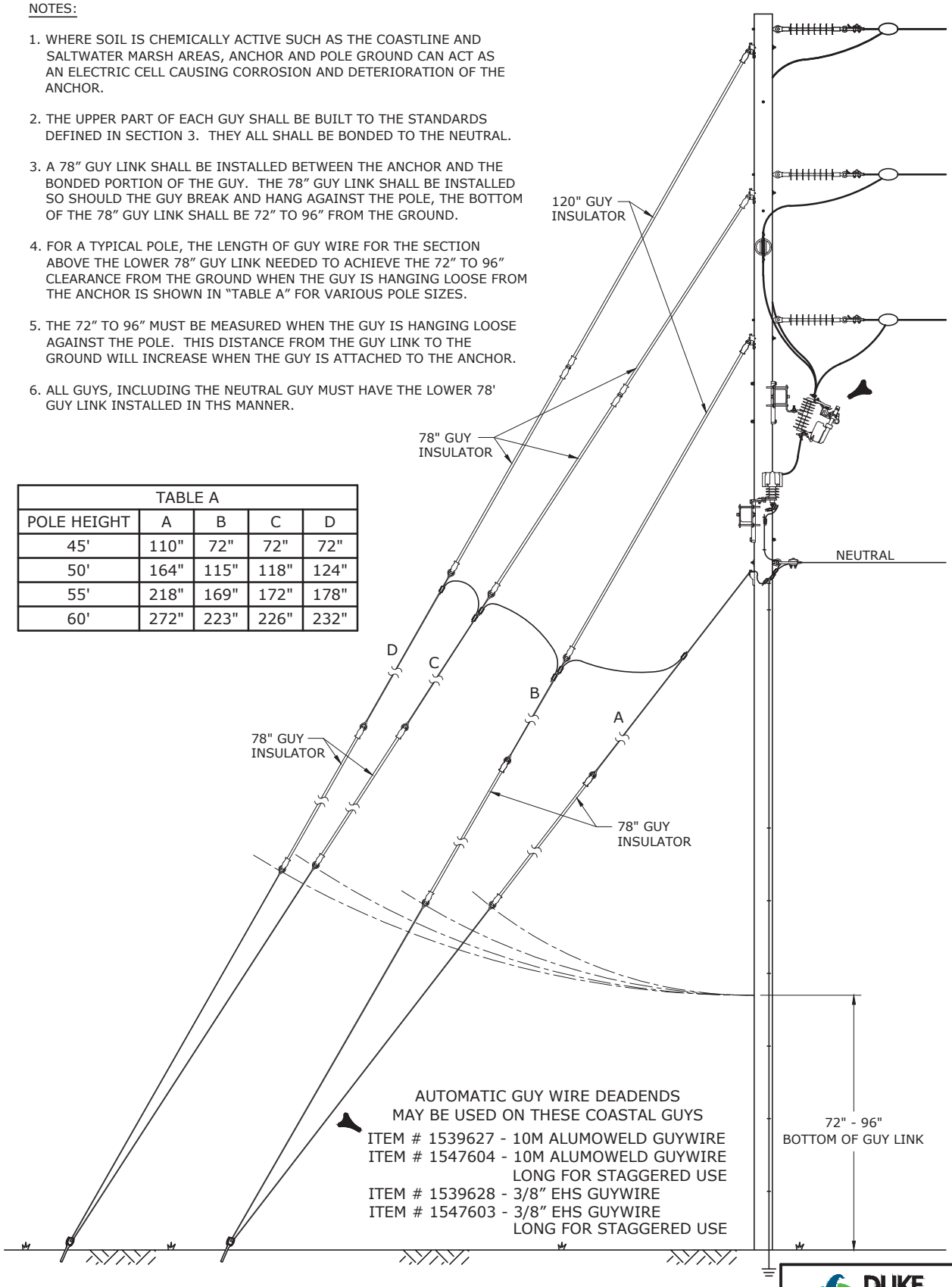
DEC	DEM	DEP	DEF
		X	X

12.02-100

NOTES:

1. WHERE SOIL IS CHEMICALLY ACTIVE SUCH AS THE COASTLINE AND SALTWATER MARSH AREAS, ANCHOR AND POLE GROUND CAN ACT AS AN ELECTRIC CELL CAUSING CORROSION AND DETERIORATION OF THE ANCHOR.
2. THE UPPER PART OF EACH GUY SHALL BE BUILT TO THE STANDARDS DEFINED IN SECTION 3. THEY ALL SHALL BE BONDED TO THE NEUTRAL.
3. A 78" GUY LINK SHALL BE INSTALLED BETWEEN THE ANCHOR AND THE BONDED PORTION OF THE GUY. THE 78" GUY LINK SHALL BE INSTALLED SO SHOULD THE GUY BREAK AND HANG AGAINST THE POLE, THE BOTTOM OF THE 78" GUY LINK SHALL BE 72" TO 96" FROM THE GROUND.
4. FOR A TYPICAL POLE, THE LENGTH OF GUY WIRE FOR THE SECTION ABOVE THE LOWER 78" GUY LINK NEEDED TO ACHIEVE THE 72" TO 96" CLEARANCE FROM THE GROUND WHEN THE GUY IS HANGING LOOSE FROM THE ANCHOR IS SHOWN IN "TABLE A" FOR VARIOUS POLE SIZES.
5. THE 72" TO 96" MUST BE MEASURED WHEN THE GUY IS HANGING LOOSE AGAINST THE POLE. THIS DISTANCE FROM THE GUY LINK TO THE GROUND WILL INCREASE WHEN THE GUY IS ATTACHED TO THE ANCHOR.
6. ALL GUYS, INCLUDING THE NEUTRAL GUY MUST HAVE THE LOWER 78' GUY LINK INSTALLED IN THS MANNER.

TABLE A				
POLE HEIGHT	A	B	C	D
45'	110"	72"	72"	72"
50'	164"	115"	118"	124"
55'	218"	169"	172"	178"
60'	272"	223"	226"	232"

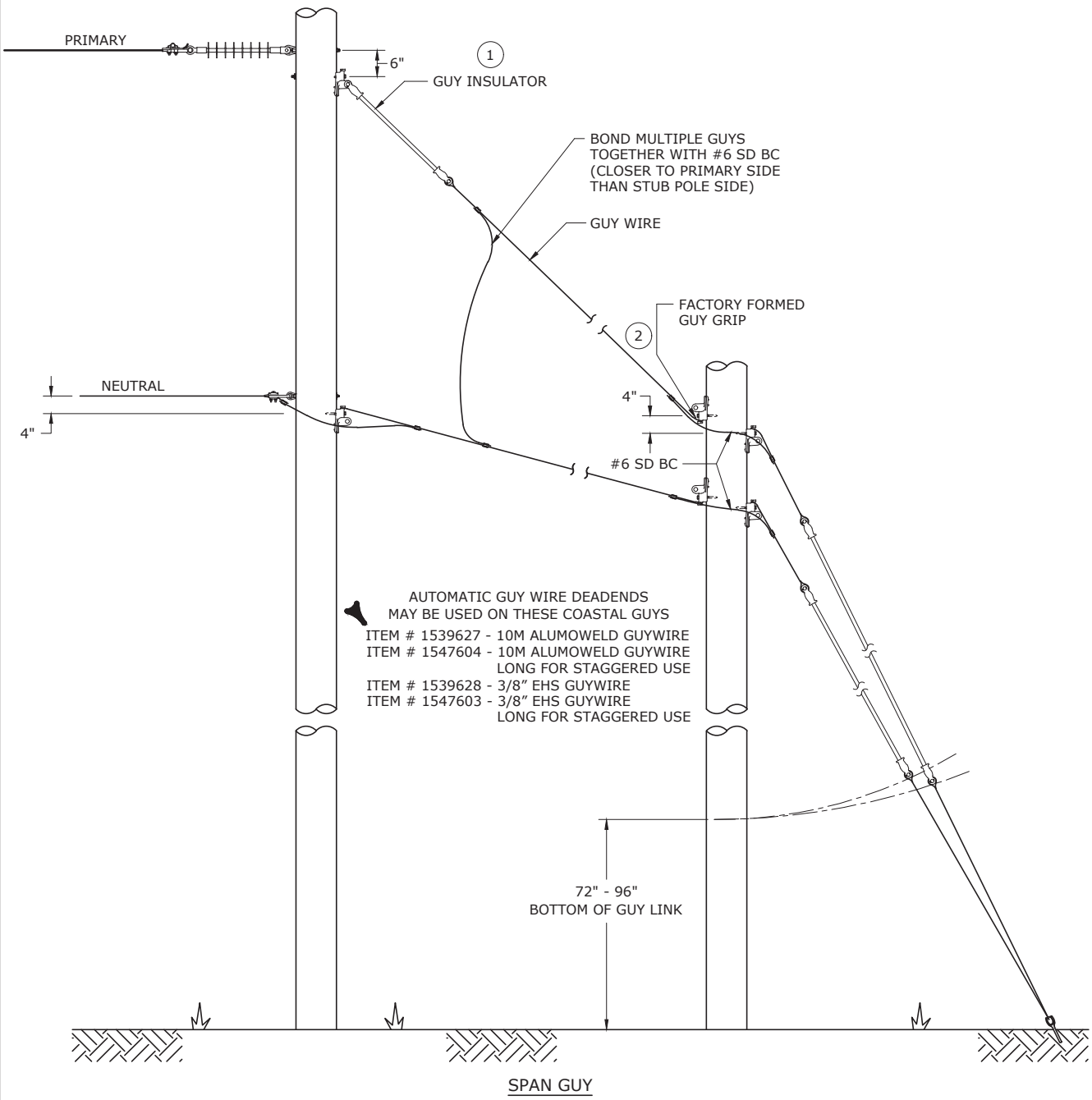


REVISED	BY	CHK'D	APPR.
3			
2	11/13/17	BURLISON	BENDER	ADCOCK
1	7/11/17	LOOSIER	BURLISON	ADCOCK
0	9/30/16	BURLISON	WHITE	ADCOCK

COASTAL AND CONTAMINATED AREAS GUY BONDING AND ANCHOR ISOLATION - VERTICAL CONSTRUCTION

DEC	DEM	DEP	DEF
		X	X

12.02-105



SPAN GUY

NOTES:

1. THE PRIMARY POLE NEUTRAL POSITION SHOULD BE BONDED TO THE SYSTEM NEUTRAL.

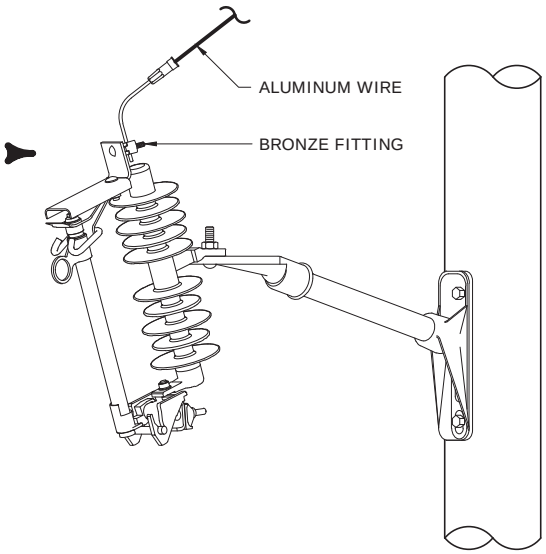
REVISED	BY	CHK'D	APPR.
3			
2	11/13/17	BURLISON	BENDER	ADCOCK
1	7/12/17	LOOSIER	BURLISON	ADCOCK
0	3/31/17	LOOSIER	BURLISON	ADCOCK

COASTAL AND CONTAMINATED AREAS
SPAN GUYING ATTACHMENTS

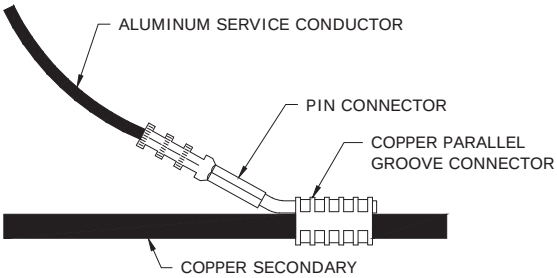
DEC	DEM	DEP	DEF
		X	X

12.02-107

PIN CONNECTOR
(FOR CONNECTING ALUMINUM WIRE TO COPPER)



PARALLEL GROOVE
(FOR ALUMINUM TO ALUMINUM CONNECTIONS)



(FOR CONNECTING PIN CONNECTOR TO COPPER WIRE)

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.

FOR ALUMINUM TO ALUMINUM CONNECTIONS, USE ALUMINUM PARALLEL GROOVE CONNECTORS WITH A LIBERAL AMOUNT OF INHIBITOR APPLIED.

USE PIN CONNECTORS WHEN TERMINATING ALUMINUM CONDUCTORS TO COPPER OR BRONZE FITTINGS.

NOTES:

1. BRUSH CONDUCTOR AND APPLY INHIBITOR TO CONNECTOR BEFORE ATTACHING TO PRIMARY.

DUKE ENERGY.

3				
2				
1	11/13/17	BURLISON	BENDER	ADCOCK
0	9/30/16	BENDER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

COASTAL AND CONTAMINATED AREA CONNECTIONS

DEC	DEM	DEP	DEF
		X	X

12.03-100A

STEM CONNECTORS				DIES REQUIRED	
ITEM NUMBER	CONDUCTOR SIZE	COLOR CODE	STEM SIZE	BURNDY	KEARNEY
4186396	#6 STR AL	BLUE	#4	W-BG	5/8
4159756	#4 STR AL	ORANGE	#4 SOLID	W-BG	5/8
4022877	#2 STR AL	RED	#4 SOLID	W-BG	5/8
4003003	#1/0 STR AL	YELLOW	#2 SOLID	W-BG	840
-	#2/0 STR AL	GRAY	#1/0 SOLID	W-K840	840
4003004	#4/0 STR AL	PINK	#1/0 SOLID	W-K840	840
4003005	336.4 ACSR AL & 350 MCM AL	GREEN	1/2" DIA	W-K840	-
4003006	500 MCM	PINK	1/2" DIA	U34ART	1-1/8 - 1

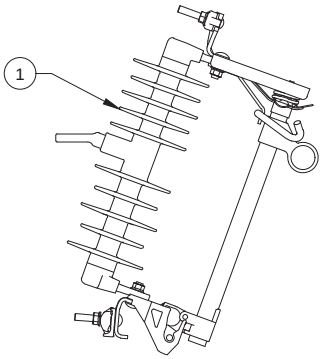
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

COASTAL AND CONTAMINATED
AREA CONNECTIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

12.03-100B



COASTAL CUTOUT WITH 100A BARREL
27KV

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	FUSE-CUTOUT-100-27KV-COAST-EQUIP-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
	FUSE-CUTOUT-100-27KV-COAST-TF-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
	FUSE-CUTOUT-100-27KV-COAST-LINE-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
	FUSE-CUTOUT-100-27KV-COAST-RETRO-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
ADDITIONAL CU'S (CUTOUT WITH 200A BARREL OR 300A BLADE)					
2	FUSE-CUTOUT-200-27KV-COAST-EQUIP-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
			1549385	1	HOLDER, FUSE, 200A, 27KV, CUTOUT, 12KA ASYM,150KV BIL
	FUSE-CUTOUT-200-27KV-COAST-LINE-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
			1549385	1	HOLDER, FUSE, 200A, 27KV, CUTOUT, 12KA ASYM,150KV BIL
3	SW-CUTOUT-300-27KV-1P-COAST-EQUIP-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLYMER INSULATOR, W/O NEMA BRACKET, 150KV BIL
			30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL
	SW-CUTOUT-300-27KV-1P-COAST-LINE-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLYMER INSULATOR, W/O NEMA BRACKET, 150KV BIL
			30172	1	BLADE, ELECTRICAL, DISCONNECT, 27KV, 300A, CU, SOL, 150 KV BIL
15KV FAULT TAMER IN A 27KV COASTAL CUTOUT (FOR USE ON 12 KV SYSTEM)					
4	FUSE-CUTOUT-15/FLIMITER-27KV-COAST-EQUIP-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE IN 25KV CUTOUT HOLDER, F/ 15KV FAULT TAMER FUSE
4	FUSE-CUTOUT-15/FLIMITER-27KV-COAST-TF-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE IN 25KV CUTOUT HOLDER, F/ 15KV FAULT TAMER FUSE
4	FUSE-CUTOUT-15/FLIMITER-27KV-COAST-RETRO-F	1	4156143	1	CUTOUT, FUSE, NON LOADBREAK, 100A, 12KAIC, 27KV, CORROSIVE AREA USE, POLY INSULATOR, W/ INTERCHANGEABLE DOOR, 150KV BIL
			406679	1	FUSE, CURRENT LIMITING,15KV, FAULT TAMER
			1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE IN 25KV CUTOUT HOLDER, F/ 15KV FAULT TAMER FUSE
15KV FAULT TAMER (PARTS) (FOR USE ON 12 KV SYSTEM IN A 27KV CUTOUT)					
5	FUSE-BACKUP-20-CL-15KV-FLIMITER-F	1	406679	1	FUSE, CURRENT LIMITING, 15KV, FAULT TAMER
6	FUSE-BARREL-15KV-FLIMITER-EXT-F	1	1534820	1	TUBE, EXPULSION FUSE, W/ EXTENSION ADAPTER, USE IN 25KV

NOTES:

1. COASTAL CUTOUTS HAVE A POLYMER INSULATOR AND STAINLESS STEEL HARDWARE.
2. SEE DWG. 08.01-110A AND 08.01-110B FOR GENERAL CUTOUT NOTES, BARRELS AND SOLID BLADES.
3. LINE-F CU'S ARE USED FOR PROTECTING A LINE; TF-F CU'S ARE USED FOR PROTECTING A TRANSFORMER/ CAPACITOR (NON TRANSFORMER RETROFIT WORK); EQUIP-F CU'S ARE USED FOR PROTECTING EQUIPMENT (EXCEPT TRANSFORMERS AND CAPACITORS); RETRO-F CU'S ARE USED FOR TRANSFORMER RETROFIT PROGRAM.

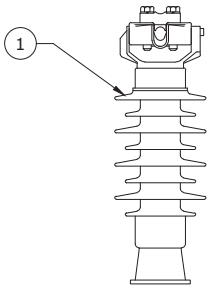
DUKE ENERGY.

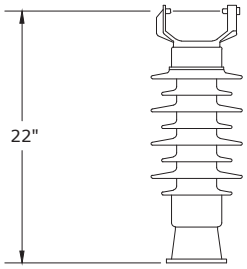
REVISED		BY	CHK'D	APPR.
3				
2	3/31/18	BRAVO	BURLISON	ADCOCK
1	12/31/17	BENDER	BURLISON	ADCOCK
0	11/13/17	BURLISON	BENDER	ADCOCK

COASTAL POLYMER NON LOAD-BREAK CUTOUTS WITH STAINLESS STEEL HARDWARE AND LOADBUSTER HOOKS

DEC	DEM	DEP	DEF
			X

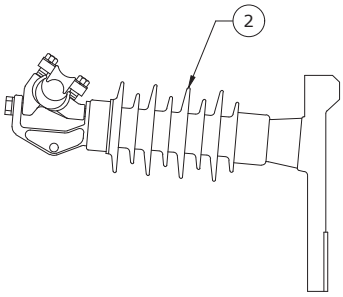
12.04-100

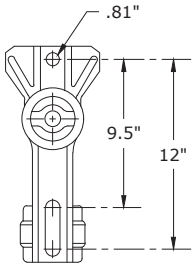


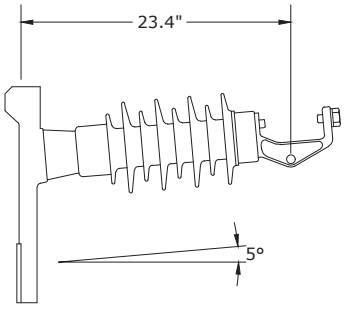


STUD MOUNTED

COASTAL
ALL VOLTAGES







COASTAL
ALL VOLTAGES

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	INSL-POST-45KV-POLY-VC-F	1	4022910	1	INSULATOR, VERT LINE POST, 45KV, SILICONE, VRT-MT, RND BASE
2	INSL-POST-45KV-POLY-HC-GB-F	1	4022898	1	INSULATOR, HORZ LINE POST, 45KV, 10" BOLT HOLE SPACING, SILICONE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
2	HDWR-MACH-SM-12IN-GALV-F	2	931563	2	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV STL

DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

COASTAL INSULATORS

DEC	DEM	DEP	DEF
			X

12.05-100

COASTAL FRAMING	
SINGLE CIRCUIT	
POLE TYPE	FRAMING
TANGENT - HORIZONTAL	SINGLE-PHASE - USE DWGS. 03.08-100A AND 03.08-100B WITH 45KV SILICONE VERTICAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.11-100A AND 03.11-100B WITH 45KV SILICONE VERTICAL LINE POST.
SMALL ANGLE - HORIZONTAL	SINGLE-PHASE - USE DWGS. 03.08-105A AND 03.08-105B WITH 45KV SILICONE VERTICAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.11-107A AND 03.11-107B WITH 45KV SILICONE VERTICAL LINE POST.
MEDIUM ANGLE - HORIZONTAL	SINGLE-PHASE - USE DWGS. 03.08-110A AND 03.08-110B WITH 45KV SILICONE VERTICAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.11-112A AND 03.11-112B WITH 45KV SILICONE VERTICAL LINE POST.
LARGE ANGLE - HORIZONTAL	SINGLE-PHASE - USE DWGS. 03.08-114A AND 03.08-114B WITH 45KV SILICONE VERTICAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.11-119A AND 03.11-119B WITH 45KV SILICONE VERTICAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.
RIGHT ANGLE - HORIZONTAL	SINGLE-PHASE - USE DWGS. 03.08-104A AND 03.08-104B WITH 45KV SILICONE VERTICAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.11-119A AND 03.11-119B WITH 45KV SILICONE VERTICAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.
OTHER HORIZONTAL	FOR TAPS AND OTHER FRAMINGS, USE THE SPACINGS DEFINED IN SECTION 03 WITH 45KV VERTICAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.
TANGENT - VERTICAL	SINGLE-PHASE - USE DWGS. 03.08-100A AND 03.08-100B WITH 45KV SILICONE HORIZONTAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.12-102A AND 03.12-102B WITH 45KV SILICONE HORIZONTAL LINE POST.
SMALL ANGLE - VERTICAL	SINGLE-PHASE - USE DWGS. 03.08-105A AND 03.08-105B WITH 45KV SILICONE HORIZONTAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.12-107A AND 03.12-107B WITH 45KV SILICONE HORIZONTAL LINE POST.
MEDIUM ANGLE - VERTICAL	SINGLE-PHASE - USE DWGS. 03.08-110A AND 03.08-110B WITH 45KV SILICONE HORIZONTAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.12-112A AND 03.12-112B WITH 45KV SILICONE HORIZONTAL LINE POST.
LARGE AND RIGHT ANGLE - VERTICAL	SINGLE-PHASE - USE DWGS. 03.08-104A AND 03.08-104B WITH 45KV SILICONE HORIZONTAL LINE POST. FOR THREE-PHASE, USE DWGS. 03.12-119A AND 03.12-119B WITH 45KV SILICONE HORIZONTAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.
OTHER VERTICAL	FOR TAPS AND OTHER FRAMINGS, USE THE SPACINGS DEFINED IN SECTION 03 WITH 45KV HORIZONTAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.
SLACK SPANS	SEE DWG. 12.06-115.
MID SPAN TAPS	NO EXTRA INSULATION REQUIRED. SEE DWG. 03.18-101.

DOUBLE CIRCUIT	
POLE TYPE	FRAMING
ALL	FOR TAPS AND OTHER FRAMINGS, USE THE SPACINGS DEFINED IN SECTION 03 WITH 45KV HORIZONTAL AND VERTICAL LINE POST. USE 2-35KV POLYMER INSULATORS FOR DEADEND APPLICATIONS.

NOTES:

1. SPANS LIMITED TO 250 FT.
2. THIS DRAWING SPECIFIES THE STANDARD POLE FRAMING TO BE USED FOR 12KV, 23KV AND 35KV SYSTEM LINES.
3. MAINTAIN DIMENSIONS SHOWN ON THE REFERENCED DRAWINGS.

DUKE ENERGY.

3				
2				
1				
0	7/11/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

CONSTRUCTION -

COASTAL AND CONTAMINATED AREAS

DEC	DEM	DEP	DEF
		X	X

12.06-100

HARDWARE

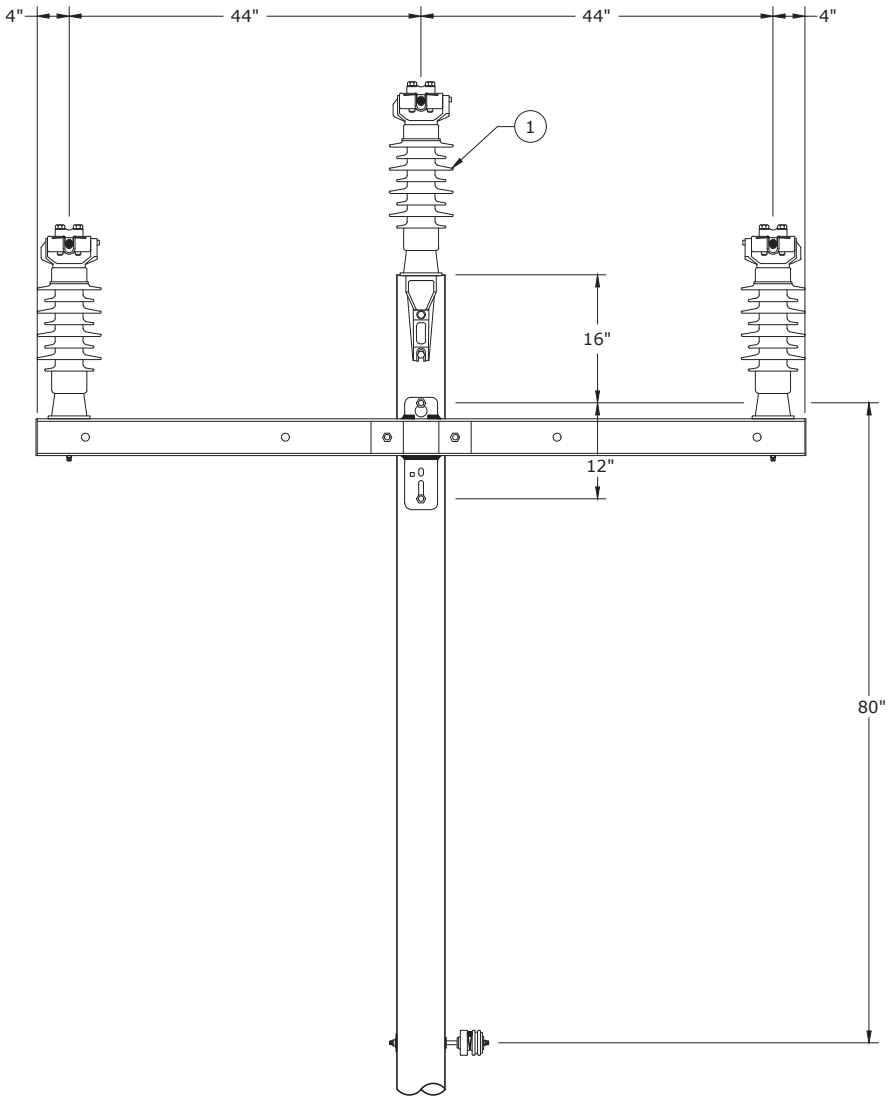
SUBSTITUTE TDG (THERMO DIFFUSED GALVANIZED) MACHINE BOLTS (ITEM #1528481 5/8" X 10" AND ITEM # 1528482 5/8" X 12") FOR GALVANIZED STEEL BOLTS.

ALL OTHER HARDWARE CURRENTLY STAYS SAME AS ALL OTHER AREAS OF DEF TERRITORY.

3					COASTAL AND CONTAMINATED AREA CONSTRUCTION - HARDWARE
2					
1					
0	11/13/17	BURLISON	BENDER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

DEC	DEM	DEP	DEF
			X

12.06-103



BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	INSL-POST-45KV-POLY-VC-F	1	4022910	1	INSULATOR, POST, LINE, 45KV, RB, VRT-MT, SI

NOTES:

1. USE 45KV SILICONE INSULATORS FOR 12, 23 AND 35KV FEEDERS.
2. SEE DWG. 03.03-134 FOR CUSHION GRIPS.
3. SEE SECTION 03 FOR REMAINING BILL OF MATERIALS ITEMS.
4. ALL COASTAL CROSSARMS SHALL BE FIBERGLASS WITH CENTERMOUNT BRACKETS.
5. SEE SECTION 03.07 FOR FIBERGLASS CROSSARM DETAILS.

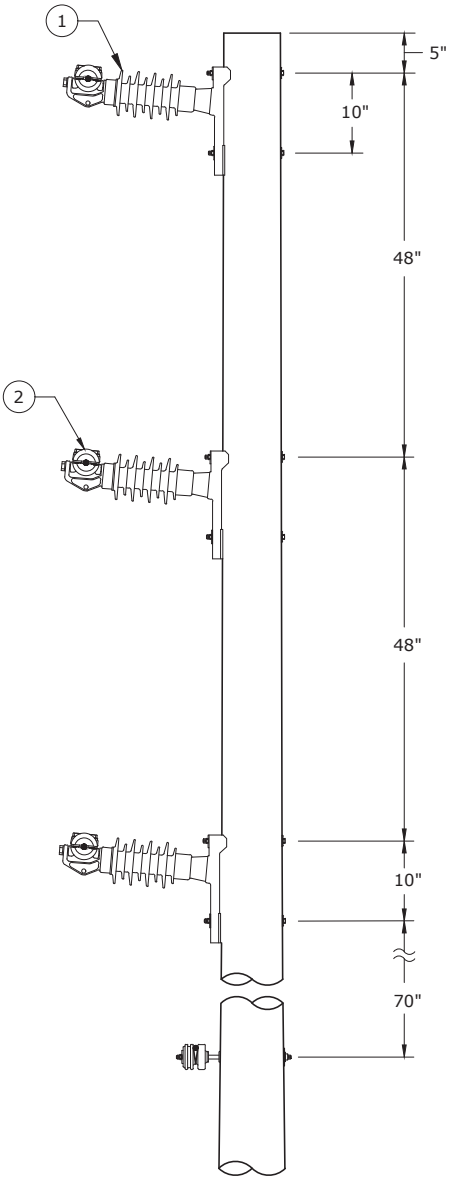
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

HORIZONTAL PRIMARY - TANGENT - COASTAL AND CONTAMINATED AREAS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

12.06-105



BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	INSL-POST-45KV-POLY-HC-GB-F	3	4022898	1	INSULATOR, HORZ LINE POST, 45KV, 10" BOLT HOLE SPACING, SILICONE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
1	HDWR-MACH-SM-12IN-GALV-F	6	931563	2	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV STL
2	-	3	-	1	SEE SECTION 03.03 FOR CLAMP DETAILS (VARIES)

NOTES:

1. USE 45KV SILICONE INSULATORS FOR ALL VOLTAGES.
2. SEE DWG. 03.03-134 FOR CUSHION GRIPS.
3. SEE SECTION 03 FOR REMAINING BILL OF MATERIALS ITEMS.

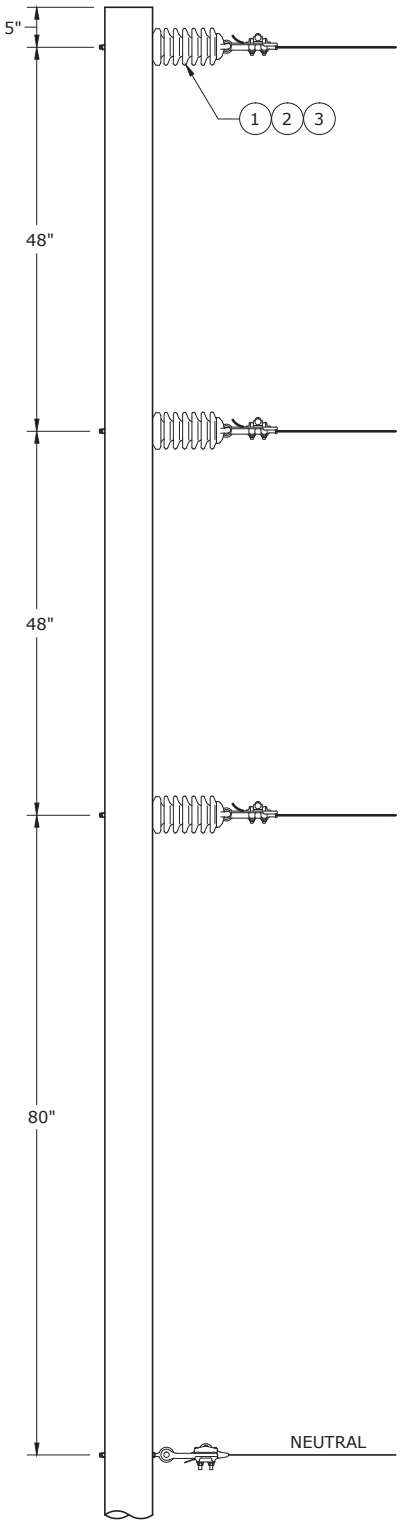
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

VERTICAL PRIMARY - TANGENT - COASTAL AND CONTAMINATED AREAS

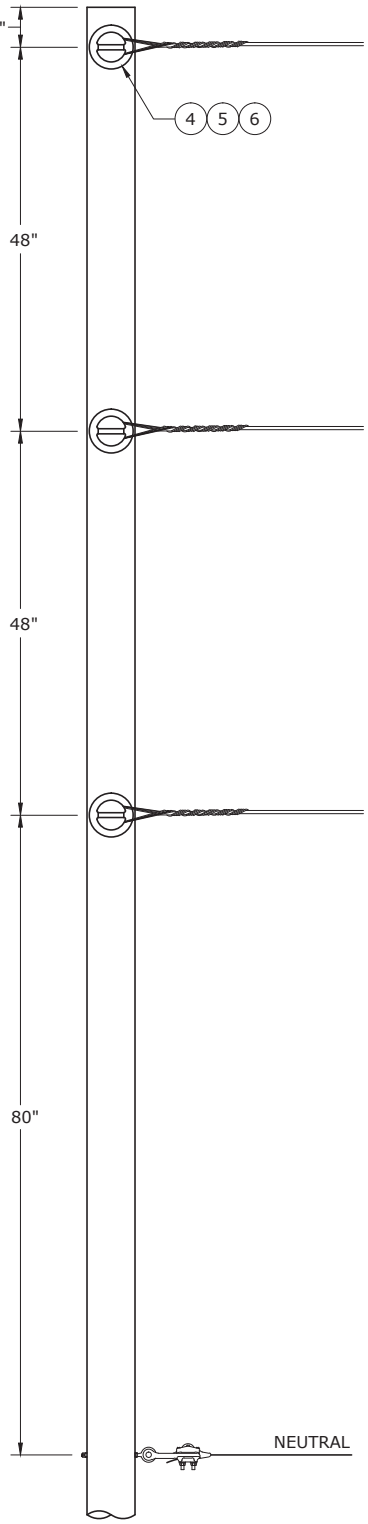
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

12.06-110



FOR #4/0 THROUGH 795



FOR #2 AND #1/0 CONDUCTORS

3				
2				
1				
0	7/11/17	LOOSIER	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE VERTICAL CONSTRUCTION - SLACK SPAN

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

12.06-115A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	INSL-POST-45KV-POLY-VC-F	3	4022910	1	INSULATOR, LINEPOST, 45KV, RB, VRT-MT
2	INSL-STUD-STL-12IN-THD-F	3	134398	1	STUD, INSULATOR, 5/8"DIA, 12" LG, 11 UNC, 6"THD LG, GALV STL
2	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSUL TO POLES
3	CLAMP-TR-SLACK-SM-F	3	4002481	1	CLAMP, TRUNNION, SLACK SPAN, 2-4/0 AL
	CLAMP-TR-SLACK-LG-F	3	81233	1	CLAMP, TRUNNION, SLACK SPAN, 336-795 AL
4	INSL-POST-45KV-POLY-TT-F	3	1545900	1	INSULATOR, LINE POST, 46KV, 19.5" LG, SILICONE, TIE TOP, F-NECK
5	INSL-STUD-STL-12IN-THD-F	3	134398	1	STUD, INSULATOR, 5/8"DIA, 12" LG, 11 UNC, 6"THD LG, GALV STL
5	INSL-GAIN-LG-F	3	4002383	1	GAIN, GRID, 5-1/2", GALV DI, 5 DEG, F/ MOUNTING INSUL TO POLES
6	TIE-SLACKGRIP-2-AL-F	3	4161624	1	TIE, SLACK SPAN, GRIP 2AL
	TIE-SLACKGRIP-10-AL-F	3	930024	1	TIE, SLACK SPAN, GRIP 10AL

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	5/17/18	ROBBINS	BURLISON	ADCOCK
0	11/13/17	BURLISON	BENDER	ADCOCK

THREE-PHASE VERTICAL CONSTRUCTION - SLACK SPAN

DEC	DEM	DEP	DEF
			X

12.06-115B

OVERHEAD 12 KV SYSTEMS			
TYPE TRANSFORMER	SIZE (KVA)	COMPATIBLE UNIT	ITEM NUMBER
CONVENTIONAL: 7200/12470Y, 120/240, 304L STAINLESS STEEL 2-BUSHING	25	TF-OH-25-12KV-120/240V-1P-2B-3S-F	4154095
CONVENTIONAL: 7200/12470Y, 120/240, 304L STAINLESS STEEL 2-BUSHING, ±2 @ 2.5% TAPS	50	TF-OH-50-12KV-120/240V-1P-2BT-3S-F	4154096
	100	TF-OH-100-12KV-120/240V-1P-2BT-3S-F	4154097
CONVENTIONAL: 12470YGRDY/7200, 120/240, 304L STAINLESS STEEL 1-BUSHING, NO TAPS	3	TF-OH-3-12KV-120/240V-1P-3S-F	4191601

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 (ITEM # 4025533). SOME NEWER UNITS WILL ALSO HAVE A SPRING AT THE TOP OF THE BUSHING THAT IS NOT GROUNDED.

3. SEE DWG 12.04-100 FOR SILICONE CUTOUT INSTALLATION DETAILS. ALL OVERHEAD TRANSFORMER INSTALLATIONS (INCLUDING CSP) SHALL INCLUDE A FUSED CUTOUT.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

STAINLESS STEEL POLE-TYPE TRANSFORMERS
(12KV SYSTEM)
FOR COASTAL AREAS

DEC	DEM	DEP	DEF
			X

12.08-100

UNDERGROUND 12 KV SYSTEMS			
TYPE TRANSFORMER	SIZE (KVA)	COMPATIBLE UNIT	ITEM NUMBER
SINGLE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 240/120 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	25	TF-UG-25-12KV-240/120V-1P-3S-F	4164073
	50	TF-UG-50-12KV-240/120V-1P-3S-F	4164074
	75	TF-UG-75-12KV-240/120V-1P-3S-F	4164075
	100	TF-UG-100-12KV-240/120V-1P-3S-F	4164076
	167	TF-UG-167-12KV-240/120V-1P-3S-F	4164077
SINGLE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 480/240 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	50	TF-UG-50-12KV-480/240V-1P-3S-F	4164078
	167	TF-UG-167-12KV-480/240V-1P-3S-F	4164079
THREE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 208Y/120 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	75	TF-UG-75-12KV-208Y/120V-3P-3S-F	4164048
	150	TF-UG-150-12KV-208Y/120V-3P-3S-F	4164049
	300	TF-UG-300-12KV-208Y/120V-3P-3S-F	4164050
	500	TF-UG-500-12KV-208Y/120V-3P-3S-F	4164051
	750	TF-UG-750-12KV-208Y/120V-3P-3S-F	4164052
	1000	TF-UG-1000-12KV-208Y/120V-3P-3S-F	4181215
	1500	TF-UG-1500-12KV-208Y/120V-3P-3S-F	4181216
THREE-PHASE: PAD-MOUNTED 12470GRDY/7200 TO 480Y/277 VOLT WITH 304L STAINLESS STEEL CONSTRUCTION	75	TF-UG-75-12KV-480Y/277V-3P-3S-F	4164053
	150	TF-UG-150-12KV-480Y/277V-3P-3S-F	4164054
	300	TF-UG-300-12KV-480Y/277V-3P-3S-F	4164056
	500	TF-UG-500-12KV-480Y/277V-3P-3S-F	4164057
	750	TF-UG-750-12KV-480Y/277V-3P-3S-F	4164059
	1000	TF-UG-1000-12KV-480Y/277V-3P-3S-F	4164060
	1500	TF-UG-1500-12KV-480Y/277V-3P-3S-F	4181217
	2500	TF-UG-2500-12KV-480Y/277V-3P-3S-F	4181214

NOTES:

1. 304L STAINLESS STEEL TRANSFORMERS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS.

DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

304L STAINLESS STEEL
PAD-MOUNTED TRANSFORMERS
FOR COASTAL AREAS

DEC	DEM	DEP	DEF
			X

12.08-110

COMPATIBLE UNIT	ITEM NUMBER	RATED VOLTS	VOLTS (KV) SET	KVA RATED	AMPS ±10%	AMPS ±5%	A-65°C ±5%**	MOUNTING	BASE MOUNTING DIMENSIONS*	WEIGHT (LBS)	MAX HEIGHT
REG-LINE-100-7KV-1P-3S-F	4192223	7.62	7.2	76	100	160	179	POLE/ PLATFORM	22" X 22"	1620	75"
REG-LINE-219-7KV-1P-3S-F	4192224	7.62	7.2	167	219	350	392	POLE/ PLATFORM	24.5" X 24.5"	2330	85"
REG-LINE-328-7KV-1P-3S-F	4192222	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 ITEM 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 (ITEM # 4025533).

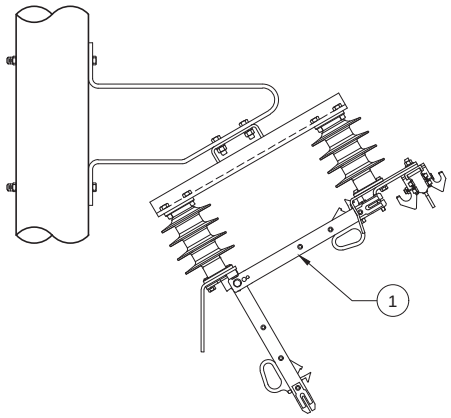
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

STAINLESS STEEL REGULATORS
FOR COASTAL AREAS

DEC	DEM	DEP	DEF
			X

12.09-100



25 KV SWITCH, BYPASS, SINGLE-PHASE
BRACKET IS INCLUDED WITH SWITCH

BILL OF MATERIALS

BUBBLE NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	SW-BYPASS-600-25KV-1P-NLB-REG-F	1	4003946	1	SWITCH, BYPASS, 600A, 25KV, W/ BRACKET
			94540	8	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			1421012	24	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			90121	8	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS, FLAT LOADING 1500LB TO 3000LB
			930030	2	WASHER, SPRING, COIL, STEEL, FOR 5/8" BOLT, GALV.
			939033	2	WASHER, SQUARE, 2-1/4", SQUARE, FLAT
			93787	8	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
1	HDWR-MACH-SM-10IN-GALV-F	2	931555	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 10" LG, SQ HEAD, HOT DIP

NOTES:

1. THE FACE OF POLE SHOULD BE LEFT CLEAR FOR OPERATION OF VERTICAL MOUNTED SOLID BLADE SWITCHES. AVOID MOUNTING STREET LIGHT BRACKETS AND OTHER SIMILAR EQUIPMENT ON THESE POLES.

2. SEE SECTIONS 07 AND 08 FOR DESIGN SPECIFICATIONS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	12/31/18	BRUINS	BURLISON	ADCOCK
1	2/26/18	BURLISON	BENDER	ADCOCK
0	11/13/17	BURLISON	BENDER	ADCOCK

RECLOSER AND REGULATOR BYPASS SWITCHES, 25KV
FOR 12KV CIRCUITS
IN COASTAL AND CONTAMINATED AREAS

DEC	DEM	DEP	DEF
			X

12.10-100

13.02 FIBER OPTICS

13.05 ANTENNAS IN POWER SPACE

13.06 NGDR AMI

13.12 CISCO GRID ROUTER-ITRON RELAY

GENERAL

DUKE ENERGY OWNS AND ELECTRIC DISTRIBUTION MAINTAINS ALL OVERHEAD FIBER OPTIC CABLE LOCATED IN THE UTILITY POWER ZONE AND ALL UNDERGROUND FIBER OPTIC CABLE LOCATED IN DUKE ENERGY'S UNDERGROUND DUCT FACILITIES. THE OVERHEAD FIBER IS TYPICALLY LOCATED IN THE UTILITY POWER ZONE JUST ABOVE THE PRIMARY NEUTRAL. DUKE ENERGY'S FIBER OPTIC CABLE WILL BE ALLOWED TO BE INSTALLED IN THE POWER ZONE ON POLES AND SHOULD BE A MINIMUM OF 6 INCHES ABOVE THE NEUTRAL CONDUCTOR. ALL DUKE ENERGY OWNED AND MAINTAINED FIBER OPTIC INSTALLATIONS SHALL ADHERE TO THE SPECIFICATIONS IN THIS SECTION.

SAFETY

FIBER OPTIC CABLE MUST BE TREATED AS ANY OTHER CONDUCTOR WHEN INSTALLED IN THE ELECTRIC SUPPLY SPACE ON OVERHEAD INSTALLATIONS.

PROTECTIVE EQUIPMENT WILL BE UTILIZED ON THE STRUCTURE AT THE ATTACHMENT POINT THE SAME AS ON ANY OTHER CONDUCTOR OR EQUIPMENT. MID SPAN COVER UP IS NOT REQUIRED DUE TO THE FACT THE FIBER OPTIC CABLE IS NOT DESIGNED TO SUPPORT THE WEIGHT OF MULTIPLE LINE HOSES. 20KV INSULATED GLOVES ARE REQUIRED WHEN HANDLING FIBER OPTIC CABLE.

INSTALL ROLLER BLOCKS ON POLE WHERE THE PULLING GRIP WILL NOT COME IN CONTACT WITH ENERGIZED SECONDARY. THIS MAY REQUIRE STANDING OFF THE ROLLER AND UTILIZING A LONGER BOLT OR SHORT CROSS ARM TO ATTACH ROLLER.

FIBER OPTIC CABLE CONTAINS OPTICAL FIBERS (GLASS) THAT ARE ENCLOSED IN BUFFER TUBES. EACH BUFFER TUBE HAS UP TO 12 OPTICAL FIBERS IN EACH TUBE. ONE CABLE HAS SEVERAL BUFFER TUBES. THESE BUFFER TUBES ARE COVERED WITH A POLYETHYLENE INNER JACKET, AND THEN COVERED WITH ARAMID (KEVLAR) COVER. THE OUTER JACKET IS POLYETHYLENE. WHEN CUTTING/INSTALLING OR WORKING WITH ANY EXPOSED FIBERS, GLOVES AND GLASSES SHALL BE WORN. BECAUSE THE FIBERS ARE GLASS THEY CAN PENETRATE THE SKIN WITHOUT YOU REALIZING IT. DO NOT WIPE YOUR EYES OR ANY SKIN WITH GLOVES THAT HAVE BEEN USED HANDLING EXPOSED FIBERS. COLLECT ALL FIBER SCRAPS AND PROPERLY DISPOSE. TAPE/SEAL ALL CABLE ENDS AT ALL TIMES.

BENDING RADIUS

CARE MUST BE TAKEN NOT TO MISHANDLE OR IMPROPERLY INSTALL FIBER OPTIC CABLE THAT WILL CAUSE SUBSEQUENT DAMAGE. ENSURE THAT THE CABLE IS NOT KINKED OR THAT THE MINIMUM BEND RADIUS (20 TIMES THE CABLE DIAMETER PLUS 2 INCHES) AND 10 TIMES THE CABLE DIAMETER FOR STATIC CONDITIONS (SUCH AS STORED CONDITIONS IN VAULT OR CABINET).

DAMAGE CONTROL

FIBER OPTIC ADSS CABLE IS LIGHTWEIGHT, DURABLE AND RELIABLE, BUT CARE MUST BE TAKEN WITH FIBER OPTIC CABLE TO ENSURE ITS INTEGRITY.

TAKE CARE WHEN HANDLING REELS OF FIBER WITH A FORKLIFT, NEVER SQUEEZE THE REEL WITH THE FORKS OF THE LIFT. ALWAYS LIFT THE REEL WITH THE FORKS THROUGH THE CENTER OF THE REEL.

CARE MUST BE TAKEN THAT THE CABLE IS NOT CRUSHED, TWISTED, AND THAT THE BENDING RADIUS IS NOT EXCEEDED. DURING INSTALLATION CARE MUST BE TAKEN TO ROUTE THE CABLE PULLING PATH SO THAT THE CABLE IS FREE OF OBSTRUCTIONS AND THAT THE CABLE WILL NOT BE DAMAGED FROM ABRASION OR RUBBING AGAINST ANY OBJECT WHEN PULLING. DO NOT DRAG THE CABLE OVER OBSTRUCTIONS IN THE SPAN OR ON THE GROUND.

WORKING ON POLES WHERE EXISTING FIBER IS INSTALLED, AVOID PULLING CONDUCTORS OR ROPE (HAND LINES, BLOCK LINES, WINCH LINES, TAG LINES ETC.) AGAINST THE FIBER OPTICS. THIS WILL DAMAGE THE FIBER CABLE AND MAY REQUIRE REPLACEMENT OF THE SPAN.

WHEN INSTALLING NEW POLES IN-LINE, CHANGING-OUT EXISTING POLES, POLE TRANSFERS, TRANSFORMERS OR OTHER EQUIPMENT IT IS IMPORTANT THAT THE FIBER OPTIC CABLE IS RELOCATED TO THE PROPER POSITION ON THE NEW STRUCTURE. STANDARD INSTALLATION OF FIBER OPTIC CABLE IS 6 INCHES ABOVE THE COMMON NEUTRAL.

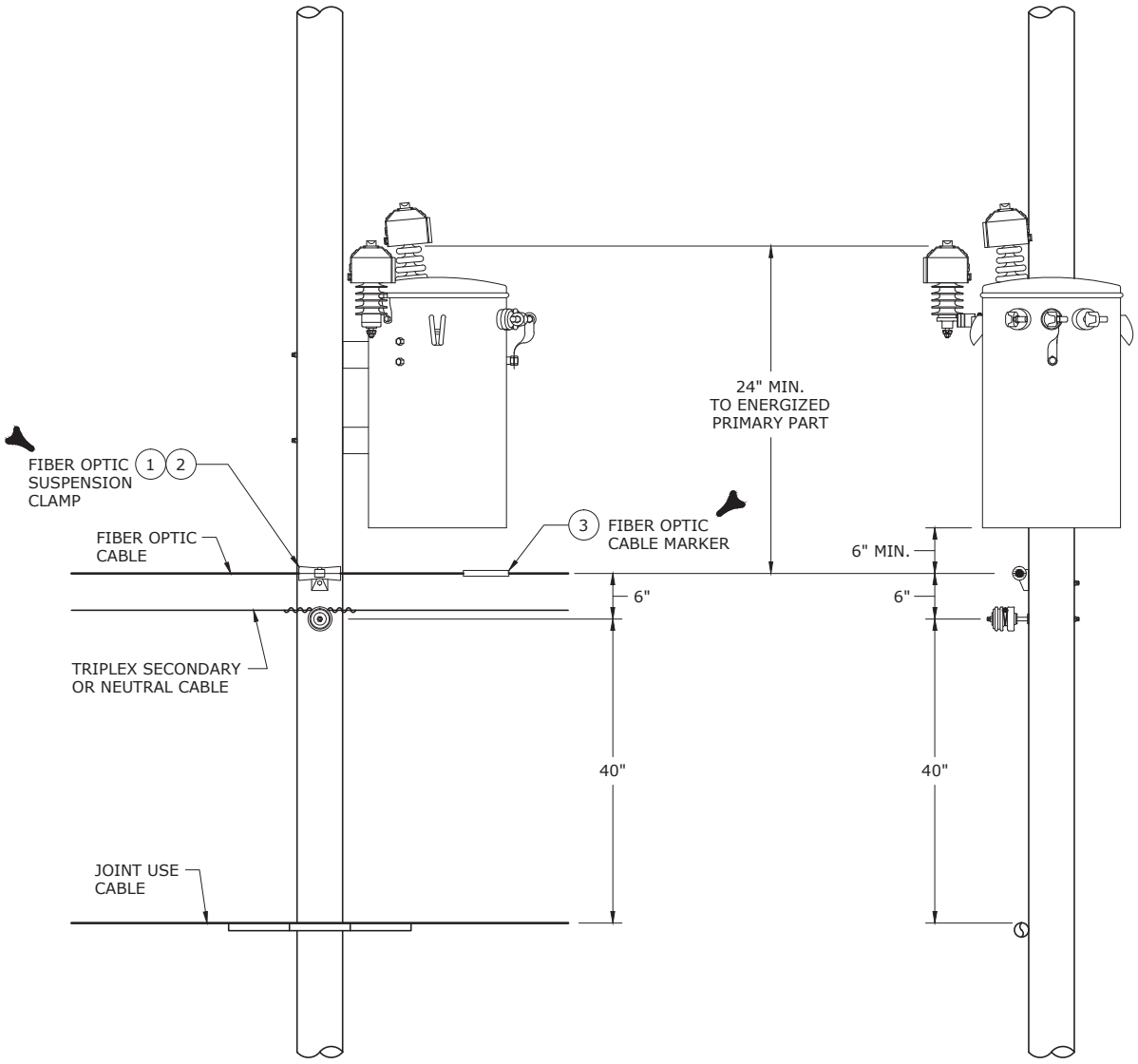
DUKE ENERGY.

3				
2				
1				
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

FIBER OPTICS CARE

DEC	DEM	DEP	DEF
X	X	X	X

13.02-100B



FRONT VIEW

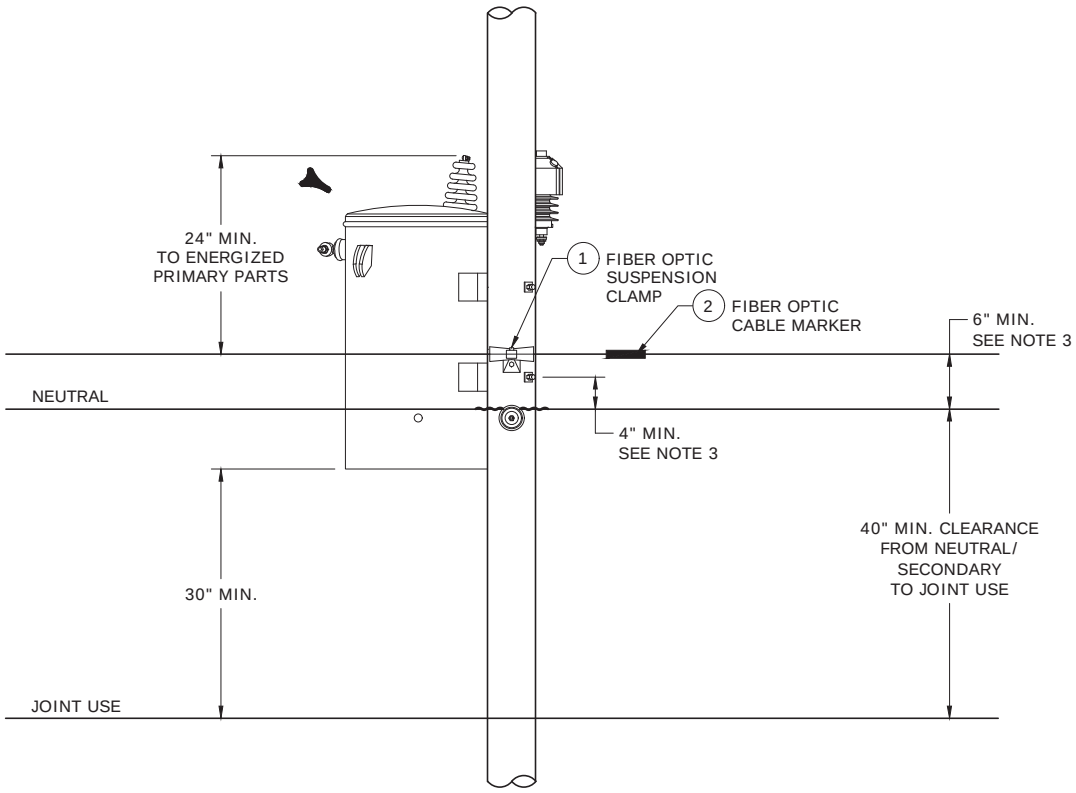
SIDE VIEW

REVISED	BY	CHK'D	APPR.
3				
2				
1	11/13/17	BURLISON	BENDER	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

STRAIGHT LINE INSTALLATION

DEC	DEM	DEP	DEF
X	X	X	X

13.02-104A



FRONT VIEW

NOTES:

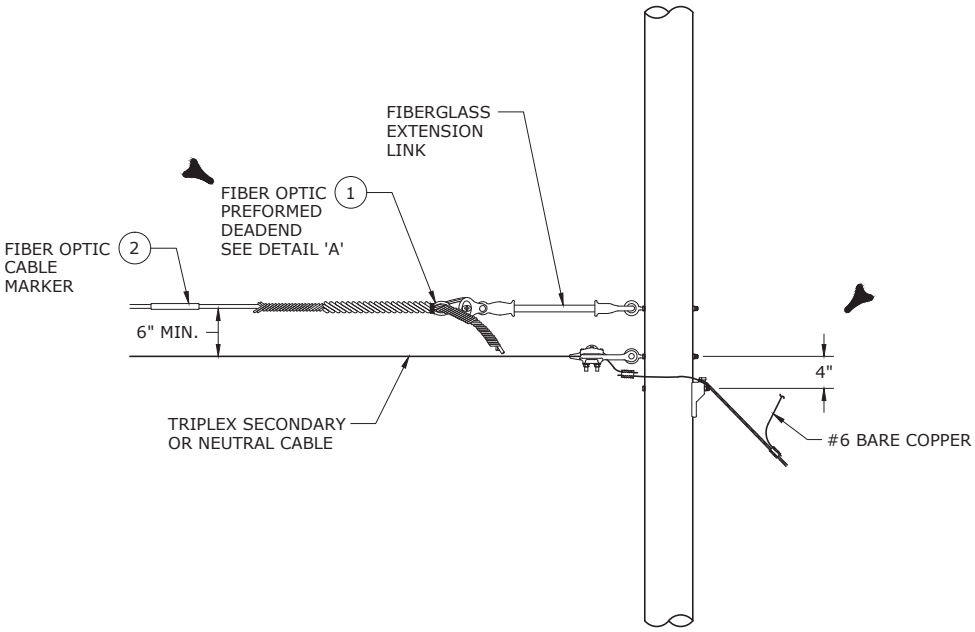
1. MINIMUM BOLT HOLE SPACING IS 4"; NO HOLES SHOULD BE DRILLED CLOSER THAN 4".
2. THIS CONFIGURATION IS FOR EXISTING LEGACY LINES ONLY WHERE POLE CHANGE OUT IS NOT REQUIRED. FOR NEW CONSTRUCTION, USE DWG. 13.02-104A.
3. SEE DWG. 13.02-104B FOR BILL OF MATERIALS.
4. TRANSFORMER LOCATION RELATIVE TO THE NEUTRAL MAY VARY FROM LOCATION TO LOCATION. THEY MAY VARY AS LONG AS ALL HOLES ARE A MINIMUM OF 4" APART, THE FIBER IS A MINIMUM OF 6" ABOVE THE NEUTRAL AND THERE IS A MINIMUM OF 24" FROM THE FIBER TO ENERGIZED PRIMARY PARTS.
5. SECONDARY AND PRIMARY RISERS AND ALL OTHER EQUIPMENT MUST BE ON THE OPPOSITE SIDE OF THE POLE FROM THE NEUTRAL AND THE FIBER OPTIC CABLE. THE FIBER OPTIC CABLE MAY NOT PASS BETWEEN ANY OTHER CABLE AND THE POLE.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	BURLISON	BENDER	ADCOCK
0	11/13/17	BURLISON	BENDER	ADCOCK

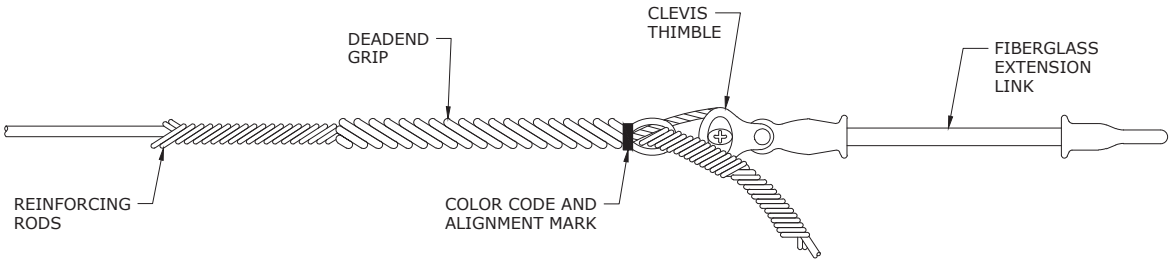
DUKE OWNED AND SOLELY OPERATED FIBER INSTALLATION ON LEGACY LINES ONLY

DEC	DEM	DEP	DEF
X	X	X	X

13.02-105



FRONT VIEW



DETAIL 'A'

3				
2				
1	8/7/17	WHITE	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE DEADEND WRAPPED

DEC	DEM	DEP	DEF
X	X	X	X

13.02-106A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-DE-WRAP-24-F	1	4002466	1	DEADEND, DIELECTRIC, 0.55"-0.599" DIA CONDUCTOR
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
	FIBER-DE-WRAP-96-F	1	4002465	1	DEADEND, DIELECTRIC, 0.68"-0.7" PLP CONDUCTOR, 0.65"-0.699"
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
1	HDWR-DA-SM-12IN-GALV-F	1	930825	1	BOLT, DOUBLE ARMING, 5/8" DIA, 12" LG, GALV STL
	HDWR-DA-SM-14IN-GALV-F	1	930833	1	BOLT, DOUBLE ARMING, 5/8" DIA, 14" LG, 12400 LB, GALV STL
	HDWR-DA-SM-16IN-GALV-F	1	930849	1	BOLT, DOUBLE ARMING, 5/8" DIA, 16" LG, GALV STL, FULL THD
	HDWR-DA-SM-18IN-GALV-F	1	930857	1	BOLT, DOUBLE ARMING, 5/8" DIA, 18" LG, 12400 LB, GALV STL
	HDWR-DA-SM-20IN-GALV-F	1	930865	1	BOLT, DOUBLE ARMING, 5/8" DIA, 20" LG, 12400 LB, GALV STL
	HDWR-DA-SM-22IN-GALV-F	1	930873	1	BOLT, DOUBLE ARMING, 5/8" DIA, 22" LG, 13550 LB, GALV STL
	HDWR-DA-SM-24IN-GALV-F	1	930881	1	BOLT, DOUBLE ARMING, 5/8" DIA, 24" LG, 12400 LB, GALV STL
2	FIBER-CABLE-MARKER-F	1	4167896	1	MARKER, WIRE, 4" X 7", ORANGE BACKGROUND W/ BLACK LETTER

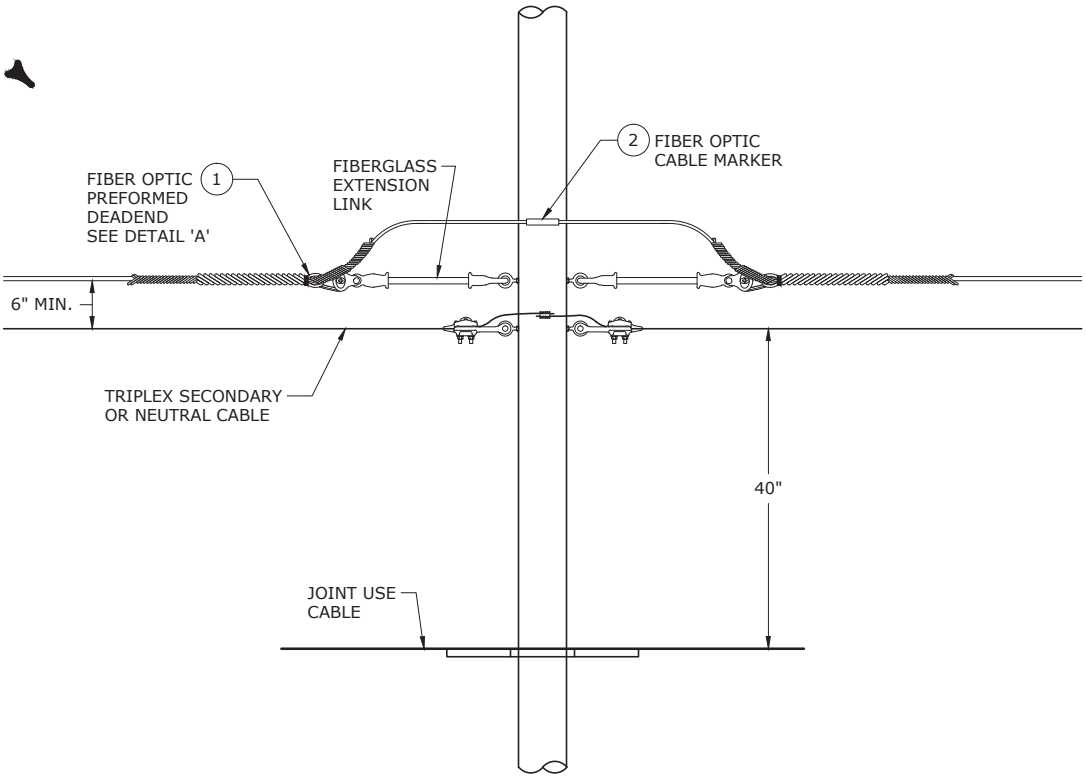
DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

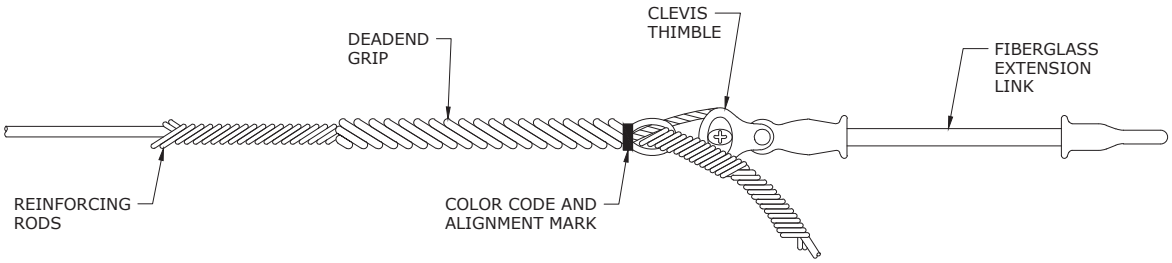
SINGLE DEADEND WRAPPED

DEC	DEM	DEP	DEF
			X

13.02-106B



FRONT VIEW



DETAIL 'A'

3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

DOUBLE DEADEND WRAPPED

DEC	DEM	DEP	DEF
X	X	X	X

13.02-108A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-DE-WRAP-24-F	2	4002466	1	DEADEND, DIELECTRIC, 0.55"-0.599" DIA CONDUCTOR
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
	FIBER-DE-WRAP-96-F	2	4002465	1	DEADEND, DIELECTRIC, 0.68"-0.7" PLP CONDUCTOR, 0.65"-0.699"
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
1	HDWR-DA-SM-12IN-GALV-F	1	930825	1	BOLT, DOUBLE ARMING, 5/8" DIA, 12" LG, GALV STL
	HDWR-DA-SM-14IN-GALV-F	1	930833	1	BOLT, DOUBLE ARMING, 5/8" DIA, 14" LG, 12400 LB, GALV STL
	HDWR-DA-SM-16IN-GALV-F	1	930849	1	BOLT, DOUBLE ARMING, 5/8" DIA, 16" LG, GALV STL, FULL THD
	HDWR-DA-SM-18IN-GALV-F	1	930857	1	BOLT, DOUBLE ARMING, 5/8" DIA, 18" LG, 12400 LB, GALV STL
	HDWR-DA-SM-20IN-GALV-F	1	930865	1	BOLT, DOUBLE ARMING, 5/8" DIA, 20" LG, 12400 LB, GALV STL
	HDWR-DA-SM-22IN-GALV-F	1	930873	1	BOLT, DOUBLE ARMING, 5/8" DIA, 22" LG, 13550 LB, GALV STL
	HDWR-DA-SM-24IN-GALV-F	1	930881	1	BOLT, DOUBLE ARMING, 5/8" DIA, 24" LG, 12400 LB, GALV STL
2	FIBER-CABLE-MARKER-F	1	4167896	1	MARKER, WIRE, 4" X 7", ORANGE BACKGROUND W/ BLACK LETTER

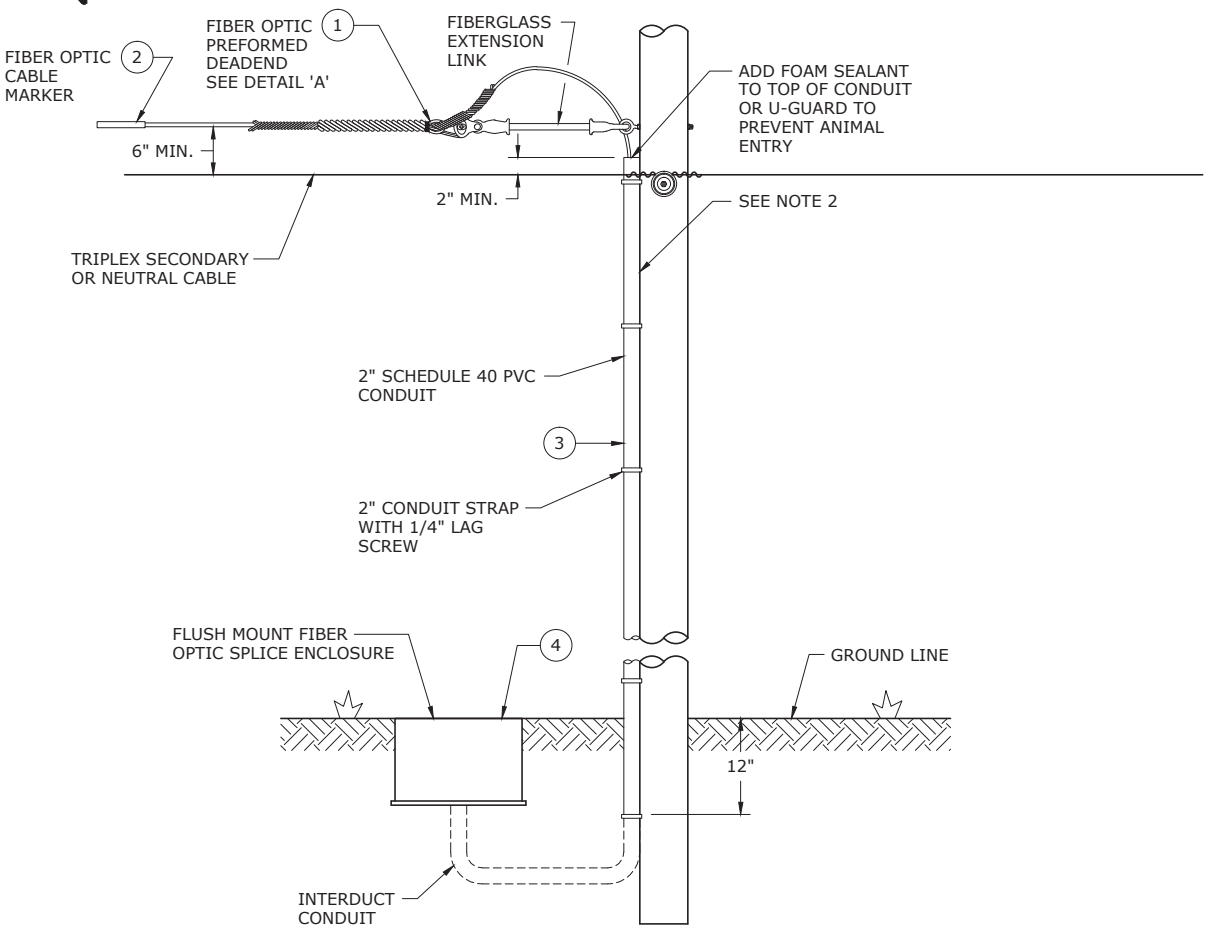
DUKE ENERGY.

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

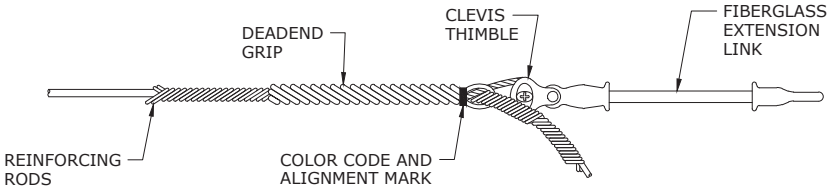
DOUBLE DEADEND WRAPPED

DEC	DEM	DEP	DEF
			X

13.02-108B



FRONT VIEW



DETAIL 'A'

NOTES:

1. DO NOT INSTALL ENERGIZED CONDUCTORS IN FIBER OPTIC ENCLOSURE.

2. STANDOFF BRACKET MAY BE REQUIRED.

3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

POLE MOUNTED SINGLE RISER

DEC	DEM	DEP	DEF
X	X	X	X

13.02-110A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-DE-WRAP-24-F	1	4002466	1	DEADEND, DIELECTRIC, 0.55"-0.599" DIA CONDUCTOR
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
	FIBER-DE-WRAP-96-F	1	4002465	1	DEADEND, DIELECTRIC, 0.68"-0.7" PLP CONDUCTOR, 0.65"-0.699"
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-EYENUT-SM-GALV-F	1	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
1	HDWR-DA-SM-12IN-GALV-F	1	930825	1	BOLT, DOUBLE ARMING, 5/8" DIA, 12" LG, GALV STL
	HDWR-DA-SM-14IN-GALV-F	1	930833	1	BOLT, DOUBLE ARMING, 5/8" DIA, 14" LG, 12400 LB, GALV STL
	HDWR-DA-SM-16IN-GALV-F	1	930849	1	BOLT, DOUBLE ARMING, 5/8" DIA, 16" LG, GALV STL, FULL THD
	HDWR-DA-SM-18IN-GALV-F	1	930857	1	BOLT, DOUBLE ARMING, 5/8" DIA, 18" LG, 12400 LB, GALV STL
	HDWR-DA-SM-20IN-GALV-F	1	930865	1	BOLT, DOUBLE ARMING, 5/8" DIA, 20" LG, 12400 LB, GALV STL
	HDWR-DA-SM-22IN-GALV-F	1	930873	1	BOLT, DOUBLE ARMING, 5/8" DIA, 22" LG, 13550 LB, GALV STL
	HDWR-DA-SM-24IN-GALV-F	1	930881	1	BOLT, DOUBLE ARMING, 5/8" DIA, 24" LG, 12400 LB, GALV STL
1	FIBER-CLAMP-DOWN-24-F	1	4002659	1	CUSHION, DOWNLEAD, 0.563"-0.656" DIA, F/ FIBER OPTICS
			4165218	1	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			938750	1	WASHER, FLAT, 1/2", 9/16" ID, 1-3/8" OD, 0.08100" THK, GALV STL
			4001701	1	SCREW, LAG, 1/2" DIA, 4" LG, GALV STL
	FIBER-CLAMP-DOWN-96-F	1	4002660	1	CUSHION, DOWNLEAD, 0.657"-0.75" DIA, F/ FIBER OPTICS
			4165218	1	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			938750	1	WASHER, FLAT, 1/2", 9/16" ID, 1-3/8" OD, 0.08100" THK, GALV STL
			4001701	1	SCREW, LAG, 1/2" DIA, 4" LG, GALV STL
2	FIBER-CABLE-MARKER-F	1	4167896	1	MARKER, WIRE, 4" X 7", ORANGE BACKGROUND W/ BLACK LETTER
3	FIBER-RISER-UGUARD-F	4	4169126	1	GUARD, U, 8' LG X 1-1/4" WD X 1-1/4" DP, HOT DIP GALV STL
			4001700	16	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
4	STRUCT-HH-RECT-CTE-MD-PEDS-FIBER-F	1	4005439	1	ENCLOSURE, CABLE, 36" (3') WD X 36" (3') LG X 24" (2') DP

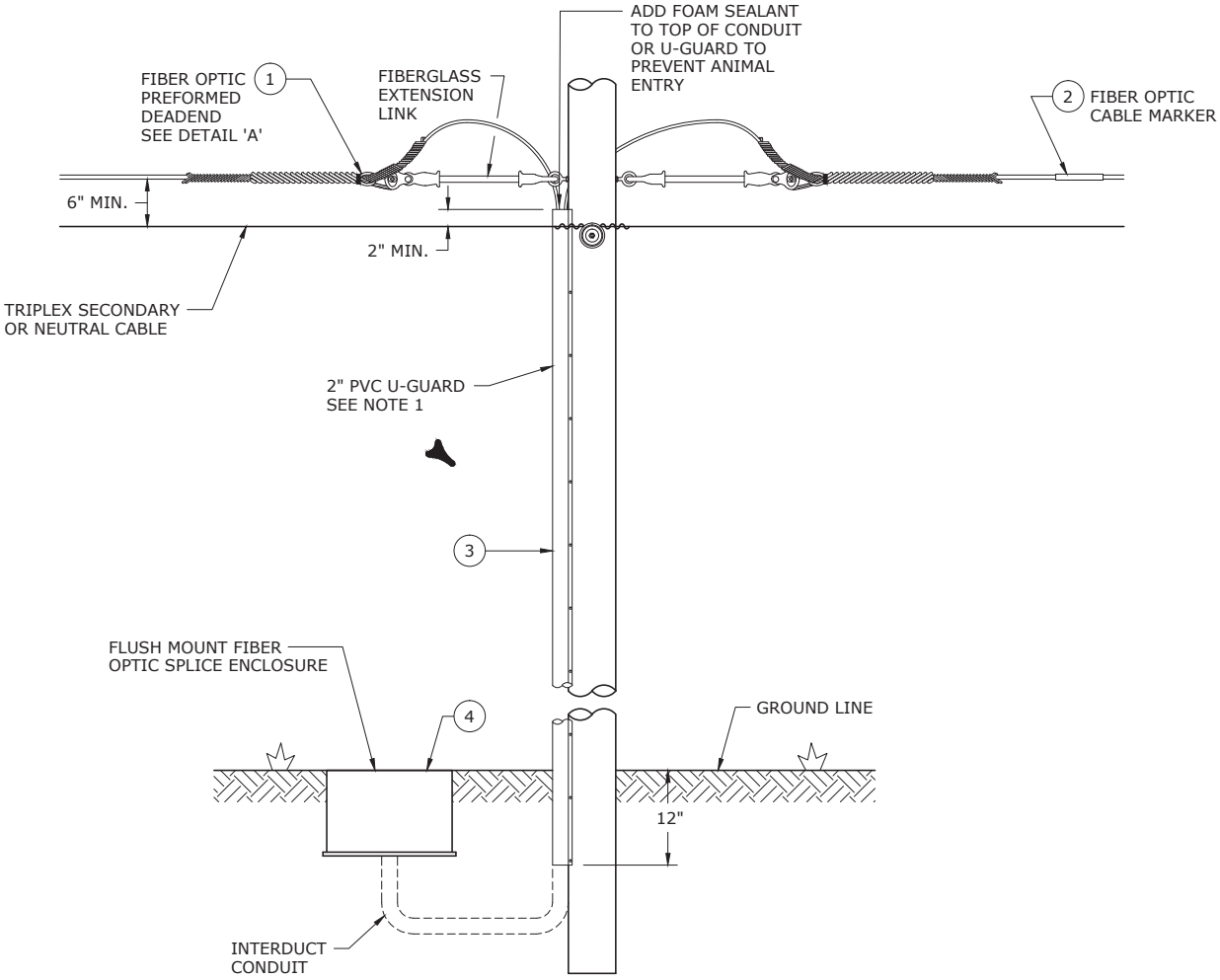
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

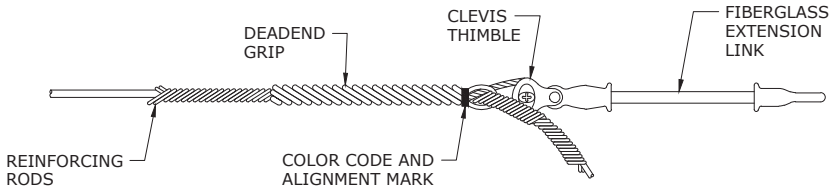
POLE MOUNTED SINGLE RISER

DEC	DEM	DEP	DEF
			X

13.02-110B



FRONT VIEW



DETAIL 'A'

NOTES:

1. STANDARD 2" CONDUIT SHOULD BE USED IN PLACE OF U-GUARD IF THE FIBER OPTIC CABLE IS TO BE SPLICED IN THE ENCLOSURE.

2. DO NOT INSTALL ENERGIZED CONDUCTORS IN FIBER OPTIC ENCLOSURE.

REVISED		BY	CHK'D	APPR.
3				
2	11/13/17	BURLISON	BENDER	ADCOCK
1	8/7/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

POLE MOUNTED DOUBLE RISER

DEC	DEM	DEP	DEF
X	X	X	X

13.02-112A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-DE-WRAP-24-F	2	4002466	1	DEADEND, DIELECTRIC, 0.55"-0.599" DIA CONDUCTOR
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
	FIBER-DE-WRAP-96-F	2	4002465	1	DEADEND, DIELECTRIC, 0.68"-0.7" PLP CONDUCTOR, 0.65"-0.699"
			4002594	1	CLEVIS, THIMBLE, 7/8" DIA, 36000 LB LOAD, 3/4" PIN
			4002598	1	TURNBUCKLE, JAW & EYE ENDS, 5/8" SHANK DIA, 6" TAKE-UP
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4165218	2	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
1	HDWR-EYENUT-SM-GALV-F	2	935421	1	NUT, EYE, OVAL, 5/8" DIA, 11 UNC, GALV STL
1	HDWR-DA-SM-12IN-GALV-F	1	930825	1	BOLT, DOUBLE ARMING, 5/8" DIA, 12" LG, GALV STL
	HDWR-DA-SM-14IN-GALV-F	1	930833	1	BOLT, DOUBLE ARMING, 5/8" DIA, 14" LG, 12400 LB, GALV STL
	HDWR-DA-SM-16IN-GALV-F	1	930849	1	BOLT, DOUBLE ARMING, 5/8" DIA, 16" LG, GALV STL, FULL THD
	HDWR-DA-SM-18IN-GALV-F	1	930857	1	BOLT, DOUBLE ARMING, 5/8" DIA, 18" LG, 12400 LB, GALV STL
	HDWR-DA-SM-20IN-GALV-F	1	930865	1	BOLT, DOUBLE ARMING, 5/8" DIA, 20" LG, 12400 LB, GALV STL
	HDWR-DA-SM-22IN-GALV-F	1	930873	1	BOLT, DOUBLE ARMING, 5/8" DIA, 22" LG, 13550 LB, GALV STL
	HDWR-DA-SM-24IN-GALV-F	1	930881	1	BOLT, DOUBLE ARMING, 5/8" DIA, 24" LG, 12400 LB, GALV STL
1	FIBER-CLAMP-DOWN-24-F	2	4002659	1	CUSHION, DOWNLEAD, 0.563"-0.656" DIA, F/ FIBER OPTICS
			4165218	1	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			938750	1	WASHER, FLAT, 1/2", 9/16" ID, 1-3/8" OD, 0.08100" THK, GALV STL
			4001701	1	SCREW, LAG, 1/2" DIA, 4" LG, GALV STL
	FIBER-CLAMP-DOWN-96-F	2	4002660	1	CUSHION, DOWNLEAD, 0.657"-0.75" DIA, F/ FIBER OPTICS
			4165218	1	WASHER, 5/8" NOM, 11/16" ID, 2-1/4" SQ OD, 3/16" THK, 316 SS
			938750	1	WASHER, FLAT, 1/2", 9/16" ID, 1-3/8" OD, 0.08100" THK, GALV STL
			4001701	1	SCREW, LAG, 1/2" DIA, 4" LG, GALV STL
2	FIBER-CABLE-MARKER-F	2	4167896	1	MARKER, WIRE, 4" X 7", ORANGE BACKGROUND W/ BLACK LETTER
3	FIBER-RISER-UGUARD-F	4	4169126	1	GUARD, U, 8' LG X 1-1/4" WD X 1-1/4" DP, HOT DIP GALV STL
			4001700	16	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
4	STRUCT-HH-RECT-CTE-MD-PEDS-FIBER-F	1	4005439	1	ENCLOSURE, CABLE, 36" (3') WD X 36" (3') LG X 24" (2') DP

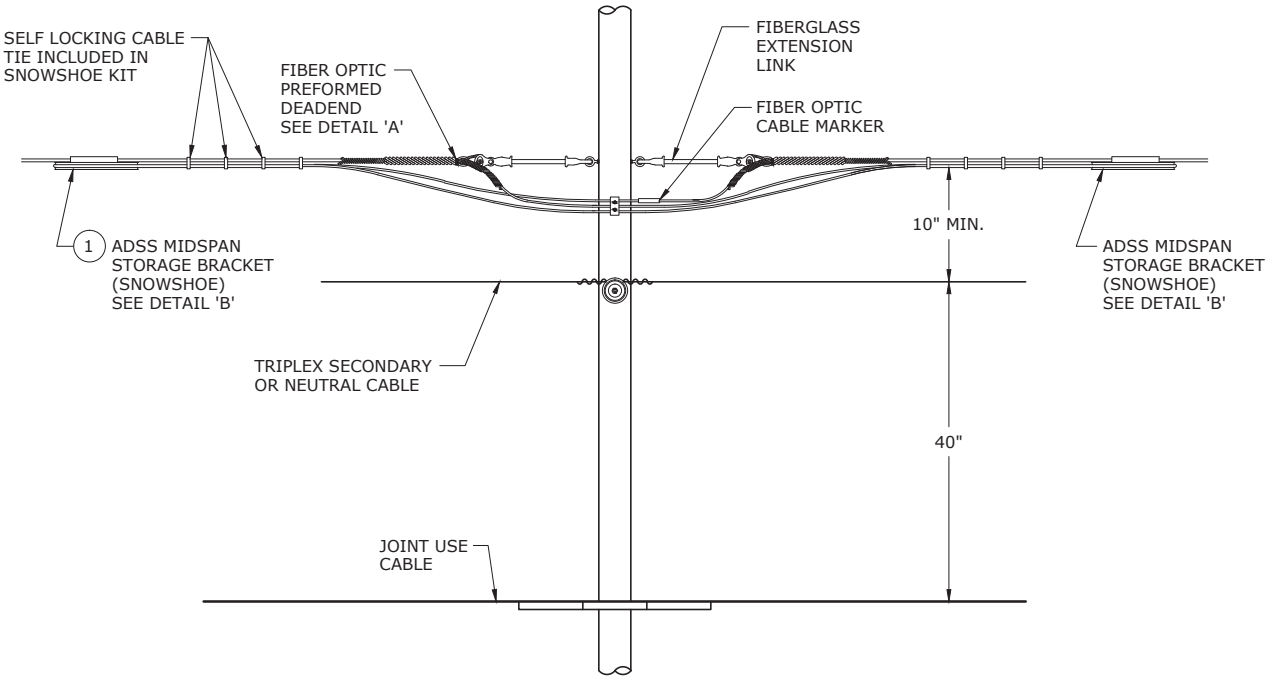
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

POLE MOUNTED DOUBLE RISER

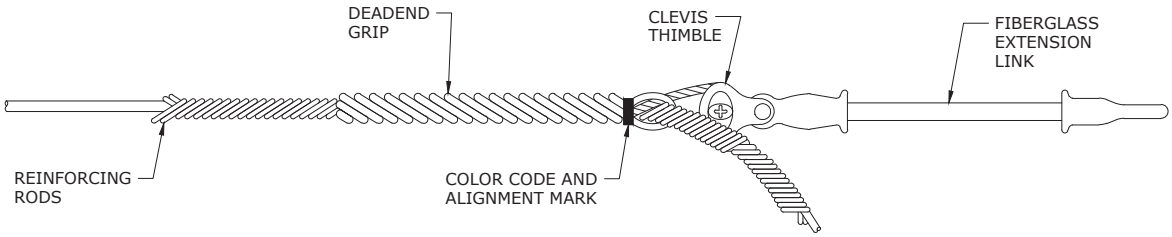
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

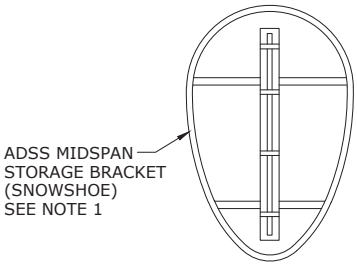
13.02-112B



FRONT VIEW



DETAIL 'A'



DETAIL 'B'

NOTES:

1. REFER TO INSTALLATION INSTRUCTIONS INCLUDED IN SNOWSHOE KIT.

3				
2				
1				
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

MID-SPAN SLACK STORAGE (SNOW SHOE)

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

13.02-116A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-CABLE-SNS-F	1	1500080	1	KIT, AERIAL CLOSURE BRACKET, CABLE STORAGE SYSTEM (2) FIBERLIGN CENTER-LOCK AERIAL SLACK BRACKETS

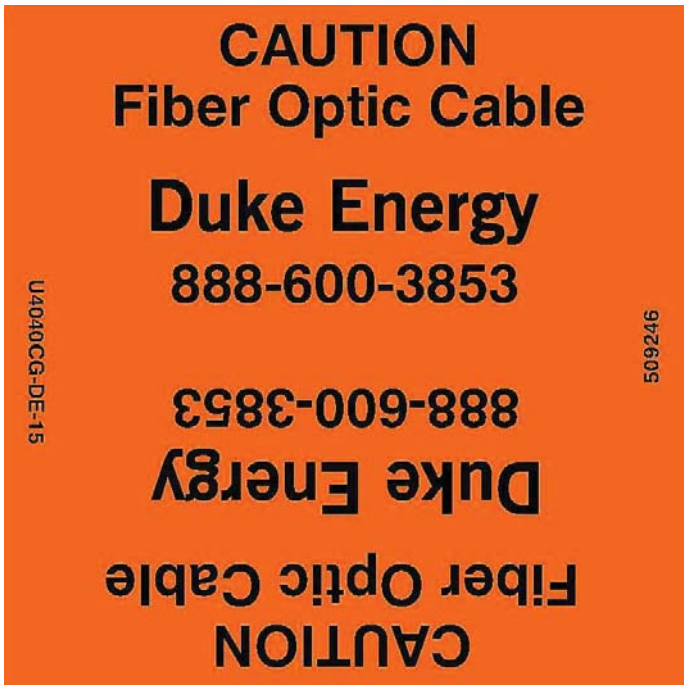
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

MID-SPAN SLACK STORAGE (SNOW SHOE)

DEC	DEM	DEP	DEF
			X

13.02-116B



NOTES:

1. FIBER OPTIC CABLE MARKERS SHALL BE INSTALLED AT EACH POLE. THEY ARE PLACED ON THE FIBER OPTIC CABLE BESIDE EACH ATTACHMENT POINT.

3				
2				
1				
0	3/31/17	WHITE	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

FIBER OPTIC CABLE MARKER

DEC	DEM	DEP	DEF
X	X	X	X

13.02-118A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FIBER-CABLE-MARKER-F	1	4167896	1	MARKER, WIRE, 4" X 7", ORANGE BACKGROUND W/ BLACK LETTER PRINT, CABLE WRAP AROUND

3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

FIBER OPTIC CABLE MARKER

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

13.02-118B

THE ABOVE DEPICTS THE USE OF A 3/4" DOUBLE ARMING BOLT IN COMBINATION WITH AN EYE NUT, ANCHOR SHACKLE AND SUSPENSION CLAMP. THE 3/4" DA BOLT WILL BE REQUIRED TO STAND-OFF ANY FIBER OPTIC CABLE WHERE THE SUSPENSION CLAMP (DOG BONE) IS NOT MOUNTED ON THE FACE OF A POLE. THE LENGTH OF THE BOLT IS DETERMINED BY THE HORIZONTAL/DIAGONAL CLEARANCE REQUIRED TO THE FIBER OPTIC CABLE AS IT PASSES BESIDE THE EQUIPMENT ON THE POLE. THE SHACKLE CAUSES THE SUSPENSION CLAMP TO "FLOAT" AFTER IT IS ATTACHED.

THE SUSPENSION CLAMP CAN TAKE UP TO MAXIMUM 30° OF LINE ANGLE. FOR ANGLES GREATER THAN 30°, DEAD-ENDING WILL BE REQUIRED. THE MAXIMUM SPAN LENGTH IS 600' WITH THIS CLAMP. CONSULT DUKE STANDARDS ENGINEERING FOR APPLICATIONS EXCEEDING THESE PARAMETERS. THE RUBBER INSERT IS REMOVABLE FOR STRINGING OPERATIONS, ETC. IF THE CLAMP IS USED DURING A STRINGING OPERATION IN IN LIEU OF A PULLEY, CARE MUST BE EXERCISED TO INSURE THE SWIVEL (BECKET) AND WIRE MESH PULLING GRIP WILL NOT HANG UP. EXPERIENCE HAS SHOWN THIS CLAMP CAN BE USED AS A PULLEY FOR SMALL ANGLES. FOR LARGER ANGLES, A PULLEY IS RECOMMENDED, WHICH CAN BE SUPPORTED BY THE 3/4" DA BOLT.

REVISED		BY	CHK'D	APPR.
3				
2				
1	8/7/17	BENDER	BURLISON	ADCOCK
0	3/31/17	WHITE	BURLISON	ADCOCK

FIBER OPTIC STANDOFF

STRAIGHT AND ANGLED INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

13.02-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	HDWR-DA-LG-30IN-GALV-F	1	930953	1	BOLT, DOUBLE ARMING, 3/4" DIA, 24" LG, 18350 LB, GALV STL
1	FIBER-CLAMP-SUS-30DEG-F	1	4001687	2	WASHER, FLAT, 13/16", 13/16" ID, 3" SQ OD, 1/4" THK
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
			935437	1	NUT, EYE, OVAL,3/4" DIA, 10 UNC, GALV STL
			4002563	1	SHACKLE, ANCHOR, 1-1/16" INSIDE WD, 2-3/4" INSIDE LG, 3/4" PIN
			4002655	1	CLAMP, CABLE SUPPORT, 0.576"-0.625", F/ .589" DIA RND

DUKE ENERGY.

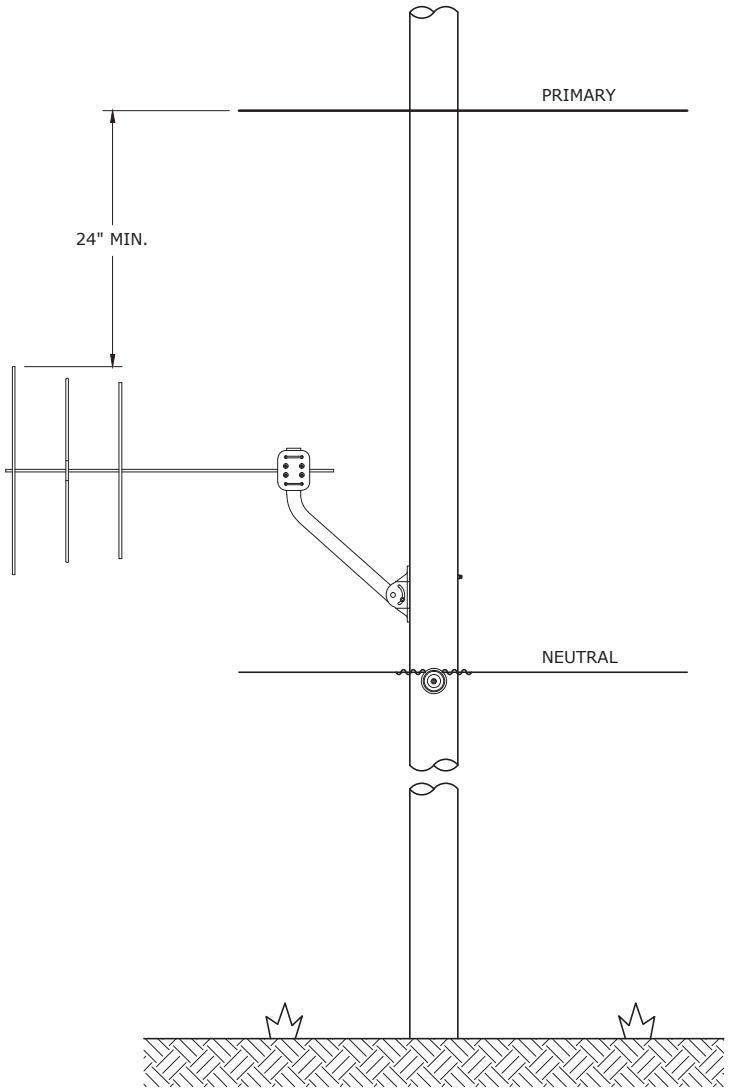
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

FIBER OPTIC STANDOFF

STRAIGHT AND ANGLED INSTALLATION

DEC	DEM	DEP	DEF
			X

13.02-120B



FRONT VIEW

NOTES:

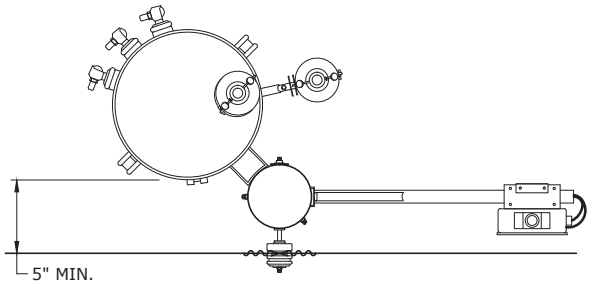
1. THE LOCATION OF THE ANTENNA SHOWN IS FOR ILLUSTRATION PURPOSES. SINCE THE ANTENNA IS A DIRECTIONAL ANTENNA, THE MOUNTING POSITION AROUND THE POLE MAY VARY. CLEARANCES TO THE PRIMARY CONDUCTORS MUST BE MAINTAINED.

3				
2				
1				
0	7/31/17	BENDER	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

PRIVATE RADIO AND CELLULAR COMMUNICATIONS - UTILITY OWNED FOR THE OPERATION OF THE SUPPLY SYSTEM

DEC	DEM	DEP	DEF
X	X	X	X

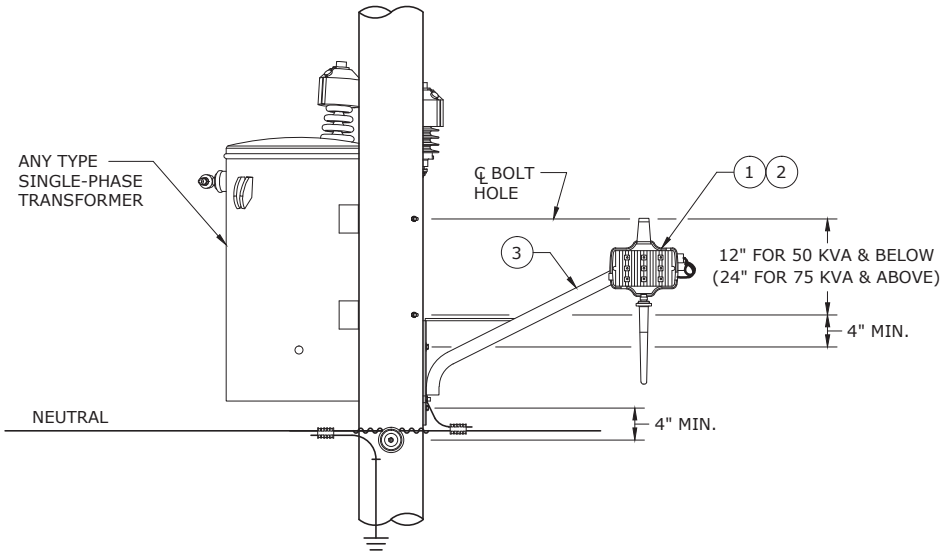
13.05-104



PLAN VIEW

WHAT SHOULD LINE RESOURCES DO IF THEY ENCOUNTER ONE OF THESE DEVICES DURING A RESTORATION EFFORT?

- RECOGNIZE THAT THE DEVICE IS COMPANY 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.



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 06 OF THE DISTRIBUTION CONSTRUCTION SPECIFICATIONS. SECTION 06 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. WEATHERPROOF THE EXPOSED NAN ANTENNA CONNECTION ON THE BOTTOM OF THE ACCESS POINT AND RELAY UNITS TO DECREASE RISK OF NETWORK COMMUNICATIONS DEGRADATION AND FAILURE. THE SEQUENTIAL ORDER FOR PROPER WEATHERPROOFING OF EACH CONNECTION IS TO:
    1. PLACE THE FIRST LAYER OF ELECTRICAL TAPE ON THE CONNECTION.
    2. PLACE AQUASEAL OVER THE ELECTRICAL TAPE.
    3. PLACE THE LAST LAYER OF ELECTRICAL TAPE OVER THE AQUASEAL. THIS PROCEDURE ALLOWS FOR EASY REMOVAL OF THE WEATHERPROOFING OVER THE CONNECTION IN THE FUTURE, IF NEEDED.

   SEAL BOTH ENDS OF THE BRACKET WITH AQUASEAL TO PREVENT ANIMALS FROM USING AS HOME AND TO KEEP THE POWER CABLE ENTERING AND EXITING THE PIPE FROM DAMAGE.

   ENSURE ALL POWER AND BATTERY CABLE CONNECTORS ARE PROPERLY TIGHTENED/LOCKED. THE CABLE CONNECTORS ARE LISTED BELOW:
    1. PRIMARY POWER CABLE CONNECTOR ON ACCESS POINT AND RELAY UNITS, NOT THE CONNECTIONS AT THE DISTRIBUTION SOURCE.
    2. BATTERY POWER CABLE CONNECTOR ON THE ACCESS POWER UNITS.
    3. POWER CABLE CONNECTOR ON BACKUP BATTERY UNIT.
8. SEE DWG. 13.06-102B FOR DEVICE COMPATIBLE UNITS, ITEM NUMBERS AND DESCRIPTIONS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

TYPICAL NGDR AMI TELECOM NAN ATTACHMENT

DEC	DEM	DEP	DEF
		X	X

13.06-102A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
GENERATION 3.0 DEVICES					
1	COMM-OH-AP-SSN-ATT-NAN-GEN3-F	1	4200707	1	MODEM, NETWORK ACCESS PT, 900MHZ, SSN, GENERATION 3.0
			4200701	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
1	COMM-OH-AP-SSN-VZ-NAN-GEN3-F	1	4200706	1	MODEM, NETWORK ACCESS PT, 900MHZ, SSN, GENERATION 3.0
			4200701	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
1	COMM-OH-RELAY-SSN-NAN-GEN3-F	1	4200704	1	RELAY, NO MODIFIER, NETWORK, 900MHZ, SSN, GENERATION 3.0
			4200701	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
2	COMM-OH-BATTERY-SSN-NAN-GEN3-F	1	4200694	1	BATTERY, BACK-UP, F/ SSN NETWORK ACCESS PT GENERATION 3.0
			4200700	1	CABLE, BATTERY, BATTERY BACKUP F/ SSN NETWORK ACCESS PT
GENERATION 4.5 DEVICES					
1	COMM-OH-AP-SSN-ATT-NAN-GEN4-F	1	4200708	1	MODEM, NETWORK ACCESS PT, 900MHZ, SSN, GENERATION 4.5
			4200703	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
1	COMM-OH-AP-SSN-VZ-NAN-GEN4-F	1	4200710	1	MODEM, NETWORK ACCESS PT, 900MHZ, SSN, GENERATION 4.5
			4200703	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
1	COMM-OH-RELAY-SSN-NAN-GEN4-F	1	4200705	1	RELAY, NO MODIFIER, NETWORK, 900MHZ, SSN, GENERATION 4.5
			4200703	1	CORD, COMMUNICATION, 3 PIN, CABLE, POWER, SSN RELAY & ACCESS PT
			4200696	1	KIT, MOUNTING, SSN RELAY & ACCESS POINTS, F/ HRZTL BRACKET CATID & PACKAGE QUANTITY IS REQUIRED ON EACH
2	COMM-OH-BATTERY-SSN-NAN-GEN4-F	1	4200698	1	BATTERY, BACK-UP, F/ SSN NETWORK ACCESS PT GENERATION 4.5
			4200702	1	CABLE, BATTERY, BATTERY BACKUP F/ SSN NETWORK ACCESS PT
BRACKETS FOR BOTH GENERATION 3.0 AND 4.5 DEVICES					
3	BKT-ANT-NEU-SM-NAN-F	1	4003725	1	BRACKET, STREET LIGHT, 20" X 12" RISE, GALV STL, 1-1/4" DIA
3	BKT-ANT-NEU-LG-NAN-F	1	4003727	1	BRACKET, BULLHORN, GALV STL/ALUM, W/ 3" OR 2-3/8" DIA TENON

NOTES:

1. SEE DWG. 13.06-102A FOR DEVICE INSTALLATION SPECIFICATIONS.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	BURLISON	BENDER	ADCOCK

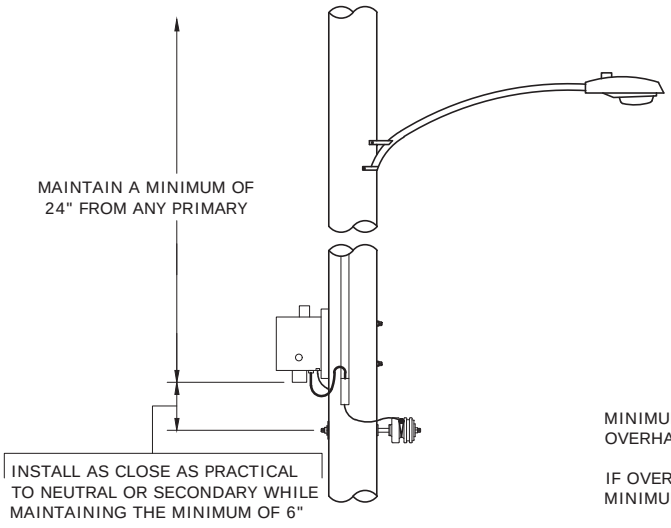
TYPICAL NGDR AMI TELECOM NAN ATTACHMENT MATERIALS LIST

DUKE ENERGY.

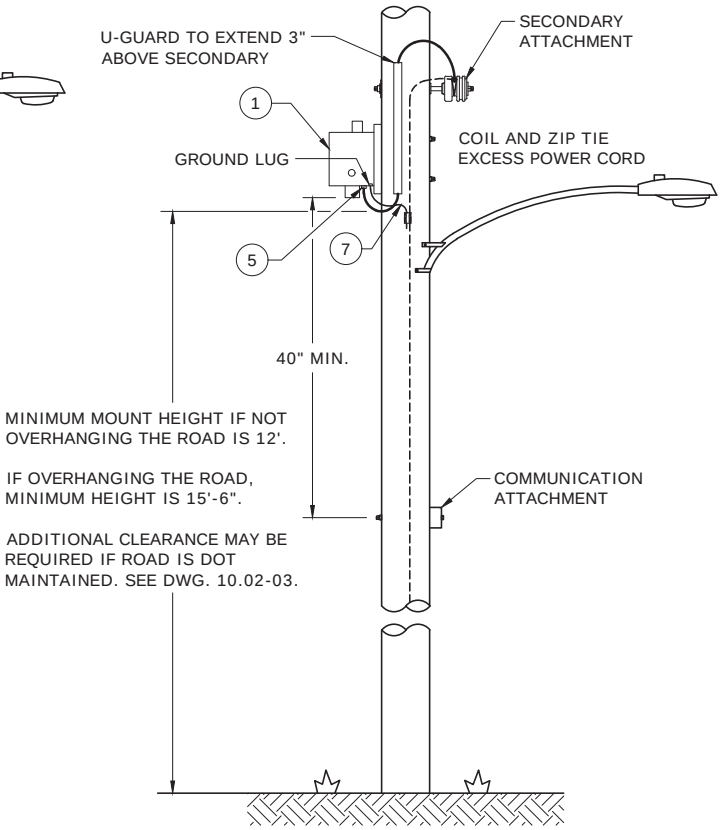
DEC	DEM	DEP	DEF
			X

13.06-102B

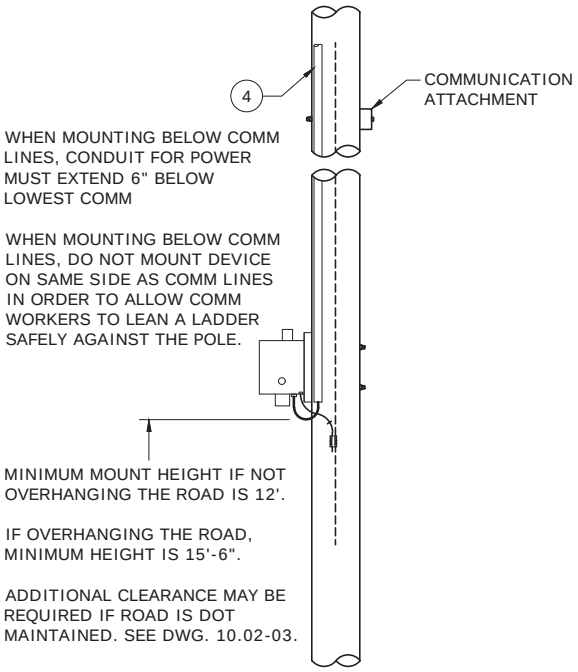
PREFERRED INSTALLATION IS ABOVE TELECOM



ABOVE SECONDARY DETAIL
CONNECTED GRID ROUTER
OR RF RANGE EXTENDER



BELOW SECONDARY DETAIL
CONNECTED GRID ROUTER
OR RF RANGE EXTENDER



BELOW TELECOM DETAILS
CONNECTED GRID ROUTER
OR RF RANGE EXTENDER

CONNECTED GRID ROUTER OR RF RANGE EXTENDER NOTES:

1. SEE DWG. 13.12-101B FOR ZIGBEE DETAILS. SEE DWG. 13.12-101C FOR BILL OF MATERIALS.
2. LOCATE WITHIN 1500' OF METERS.
3. **CONNECT EQUIPMENT TO 120V.**
   CONNECT BLACK LEAD TO 120V; WHITE AND GREEN LEAD TO NEUTRAL
4. RF RANGE EXTENDER BOX DOES NOT NEED TO BE GROUNDED.
5. CONNECTED GRID ROUTER MAY BE GROUNDED ONLY TO THE NEUTRAL IF POLE GROUND IS NOT AVAILABLE.
6. RF RANGE EXTENDER (ITEM #1498380) WITHOUT ANTENNA REQUIRES 240V.
   CONNECT BLACK AND WHITE LEADS TO 120V LEGS AND GREEN TO NEUTRAL.
7. DO NOT MOUNT EQUIPMENT WITHIN 18" OF TRANSFORMER.
8. DO NOT MOUNT EQUIPMENT ABOVE THE NEUTRAL IF THERE IS PRIMARY EQUIPMENT
   ON POLE.

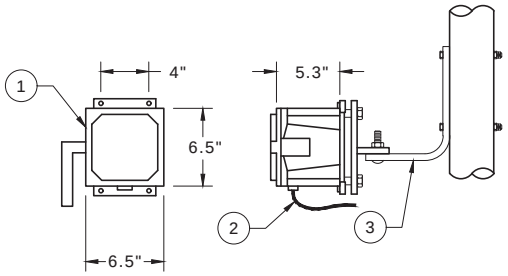
DUKE ENERGY.

3				
2				
1				
0	6/30/18	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

CONNECTED GRID ROUTER AND RF RANGE EXTENDER EQUIPMENT DETAIL

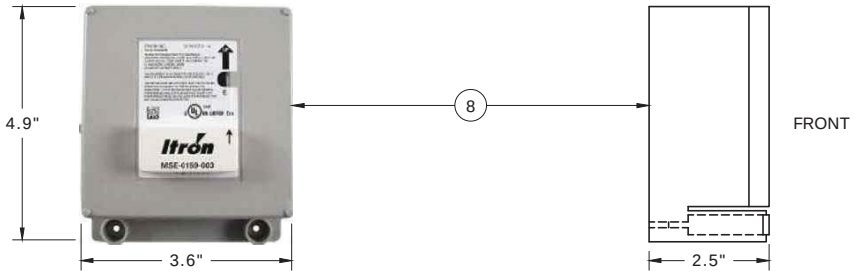
DEC	DEM	DEP	DEF
X	X	X	X

13.12-101A



RF RANGE EXTENDER DETAIL

ZIGBEE RANGE EXTENDER

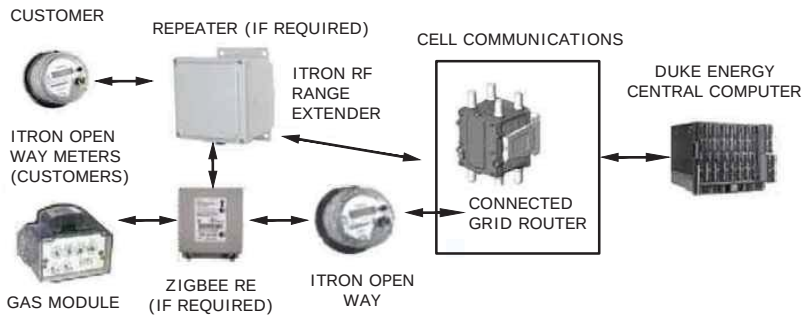


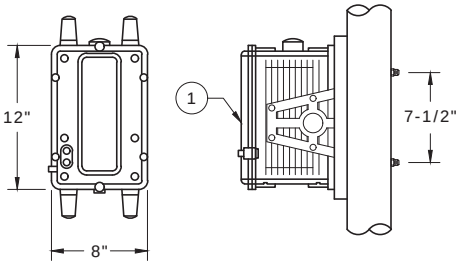
FRONT VIEW SIDE VIEW

ZIGBEE EXTENDER NOTES:

- LOCATE THE ZIGBEE RANGE EXTENDER WHERE OBSTRUCTIONS BETWEEN ELECTRIC METER AND GAS MODULE ARE MINIMAL.
- MOUNT ONTO EXISTING PIPE OR RISER WITH A MINIMUM DIAMETER OF 2 INCHES IF POSSIBLE.
- CUSTOMER ACCEPTANCE IS REQUIRED IF NOT MOUNTED ON UTILITY OWNED EQUIPMENT.
- **ALWAYS MOUNT THE ZIGBEE RANGE EXTENDER IN A VERTICAL POSITION WITH THE LABEL ARROW POINTING UPWARD.**

ITRON OPENWAY ARCHITECTURE OVERVIEW





CONNECTED GRID ROUTER DETAIL

NOTES:

1. SEE DWG. 13.12-101C FOR BILL OF MATERIALS.

3				
2				
1				
0	6/30/18	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

CONNECTED GRID ROUTER, RF RANGE EXTENDER AND ZIGBEE EXTENDER EQUIPMENT DETAIL

DEC	DEM	DEP	DEF
X	X	X	X

13.12-101B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	COMM-RF-E/G-F	1	1486309	1	MODULE, COMMUNICATION, 120VAC INPUT, RFLAN RANGE EXT
	COMM-ROUTER-GRID-E/G-F	1	1536368	1	MODULE, ROUTER, 120/240VAC INPUT, 900MHZ RF OUTPUT, AC
2	COMM-CORD-RF-F	1	1497879	1	CABLE, POWER, 12' LG, F/ ITRON 120V RF RANGE EXTENDER
3	BKT-COMM-RF-F	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			1491267	1	BRACKET, STANDOFF, 5" WD X 5" LG X 1/4" THK, FIBERGLASS
			1500997	1	ADAPTER, COMMUNICATIONS, COAXIAL RIGHT ANGLE
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
			1490676	0.05	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA, BEZINAL COATED
			837872	3	TIE, CABLE, SELF-LOCKING, LASHING, 0.06" TO 1.88 DIA RANGE, 0.19" WD, 7.4" LG, 50 LB TENSILE, BLACK NYLON
	BKT-COMM-ROUTER-GRID-F	1	939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PKG
			1490676	0.05	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA, BEZINAL COATED
			837872	3	TIE, CABLE, SELF-LOCKING, LASHING, 0.06" TO 1.88 DIA RANGE, 0.19" WD, 7.4" LG, 50 LB TENSILE, BLACK NYLON
3	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, GALV STL
4	RISER-1IN-UGUARD-1PC-F	1	4004659	1	GUARD, CABLE, 1" X 10', PVC, W/ ONE BELLED END
			4001700	15	SCREW,LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
5	-	2	900030	1	CONDUIT, FLEXIBLE, 3/4", SCH 40, PVC
6	-	3	-	-	SEE SECTION 04 FOR CONNECTOR DETAILS
7	GND-EQUIP-6-BOND-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			933366	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 6 X 1 STR ACSR, 2 AWG 7 STR AA CONDUCTOR

DUKE ENERGY.

3				
2				
1				
0	6/30/18	BURLISON	BENDER	ADCOCK
REVISED		BY	CHK'D	APPR.

BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

13.12-101C

15.01 DER COMMUNICATIONS

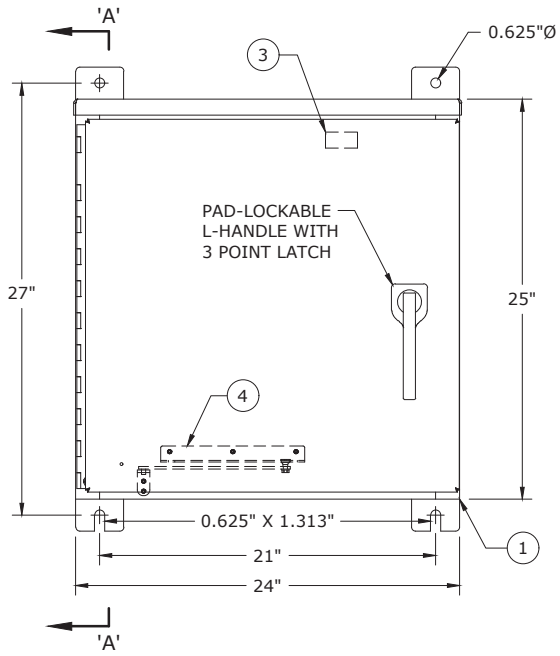
3				
2				
1				
0	1/31/19	KATIGBAK	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

SECTION 15 - DISTRIBUTED ENERGY RECOURSES

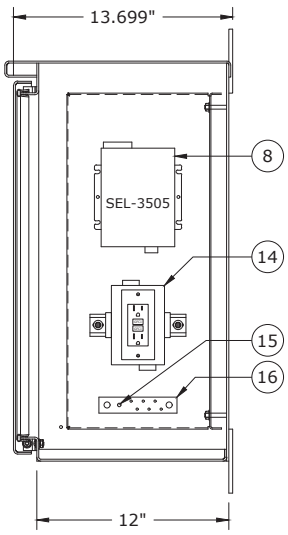
TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

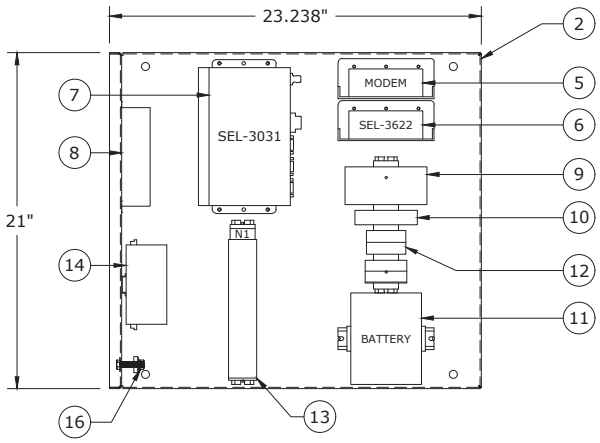
15.00-00A



FRONT VIEW



SECTION 'A'-'A'



SUB-PANEL DETAIL

ITEM	DESCRIPTION
1	ENCLOSURE
2	SUBPANEL
3	DOOR SWITCH
4	DOOR STOP
5	MODEM GX-450
6	SECURITY GATEWAY SEL-3622
7	RADIO SEL-3031
8	RTAC SEL 3505-3
9	POWER SUPPLY
10	CONVERTER, MINI PS 12-24VDC
11	BATTERY
12	FUSE BLOCK
13	TERMINAL BLOCK
14	DUPLEX RECEPTACLE
15	GROUNDING CONNECTOR
16	GROUND BUS

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-DER-COMM-S3505-S3031-F	1	1566165	1	ENCLOSURE, COMMUNICATION CONTROLLER, 24" WD X 24" HT X 12" DP, W/ SEL 3031 RADIO, F/DISTRIBUTED GENERATORS

NOTES:

1. CONTACT DPAC ENGINEER FOR USE AND PROCESS OF THIS DEVICE.

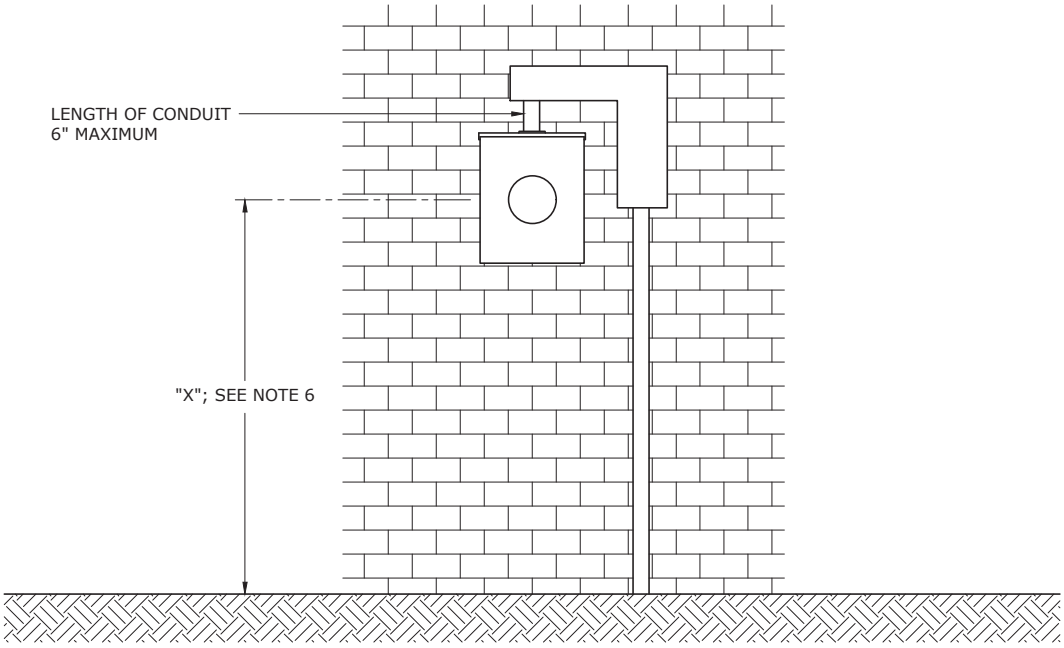
3				
2				
1				
0	1/31/19	BRAVO	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

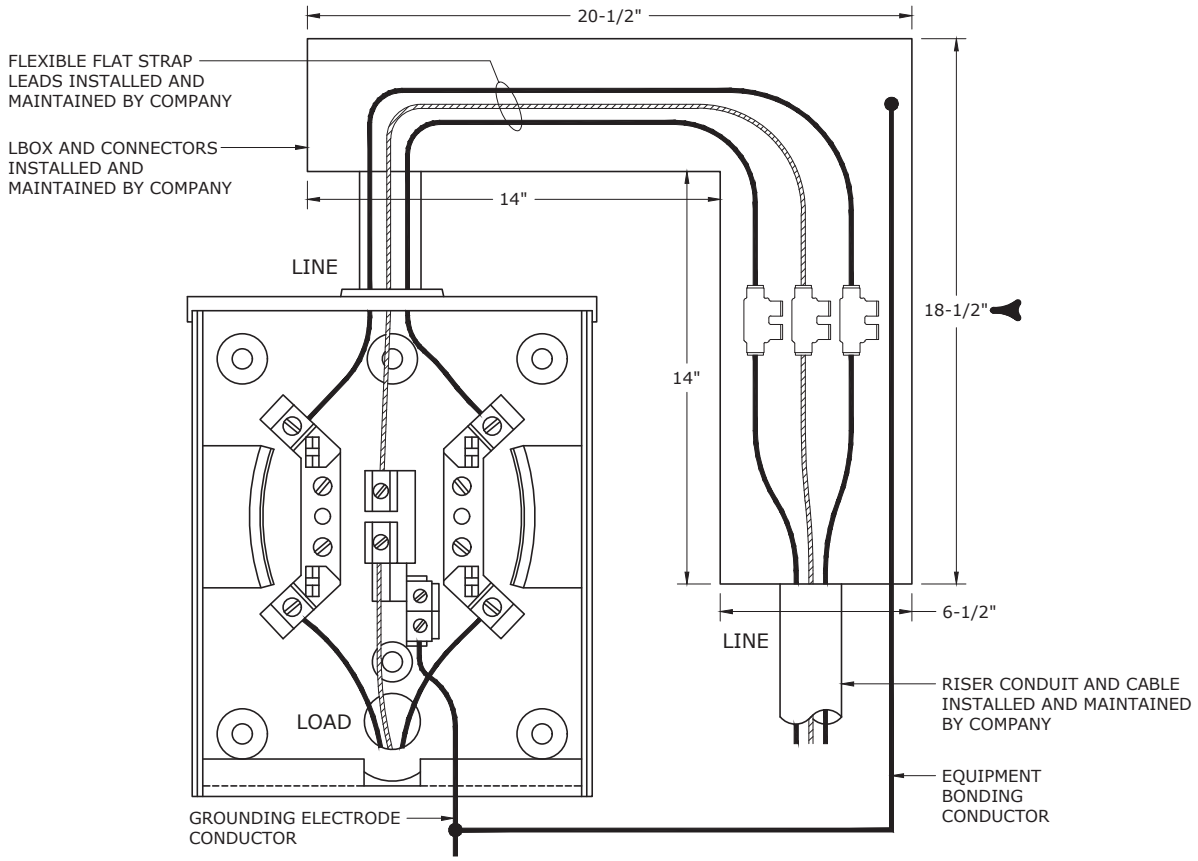
DG COMMUNICATIONS BOX

DEC	DEM	DEP	DEF
			X

15.01-100

16.01 RESIDENTIAL OH TO UG CONVERSIONS





NOTES:

1. THIS DESIGN IS FOR OVERHEAD TO UNDERGROUND CONVERSIONS ONLY AND NOT FOR NEW CONSTRUCTION.
2. METER ENCLOSURE SHALL BE BONDED TO GROUND AS REQUIRED BY THE N.E.C. OR AUTHORITY HAVING JURISDICTION.
3. METER ENCLOSURE PROVIDED AND INSTALLED BY CUSTOMER PER COMPANY APPROVED METER ENCLOSURE LIST.
4. MINIMUM WIRE SIZE #6.
5. LBOX SHALL BE BONDED TO GROUND AS REQUIRED BY N.E.S.C.
6. SEE LOCAL REQUIREMENTS FOR RULES GOVERNING METER MOUNTING HEIGHT.

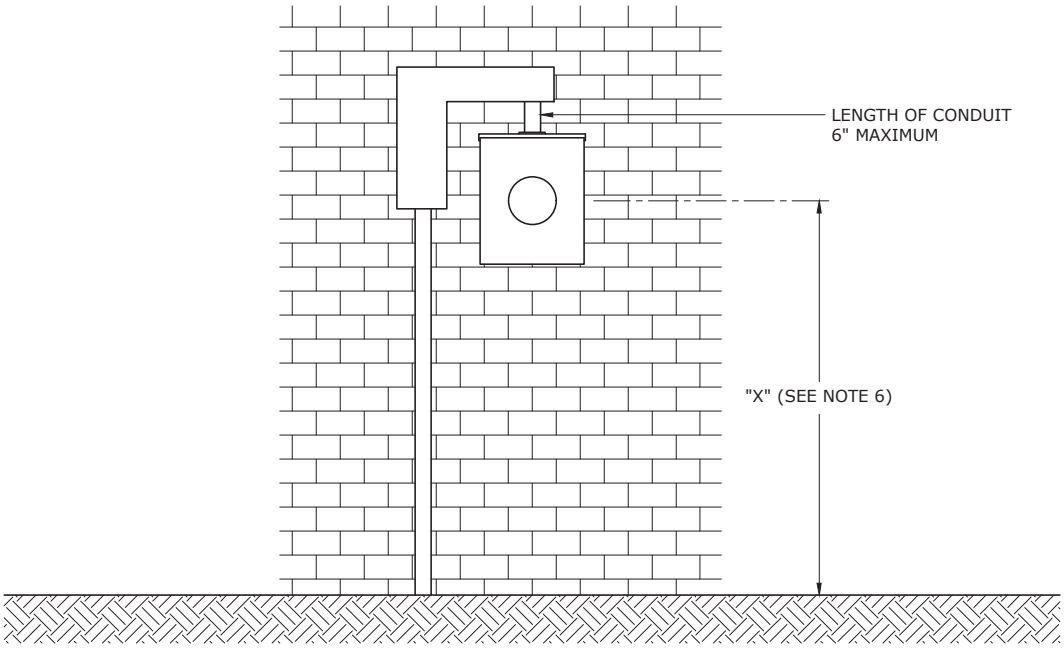
REVISED		BY	CHK'D	APPR.
3				
2				
1	9/30/18	DANNA	EANES	ADCOCK
0	3/31/18	DANNA	EANES	ADCOCK

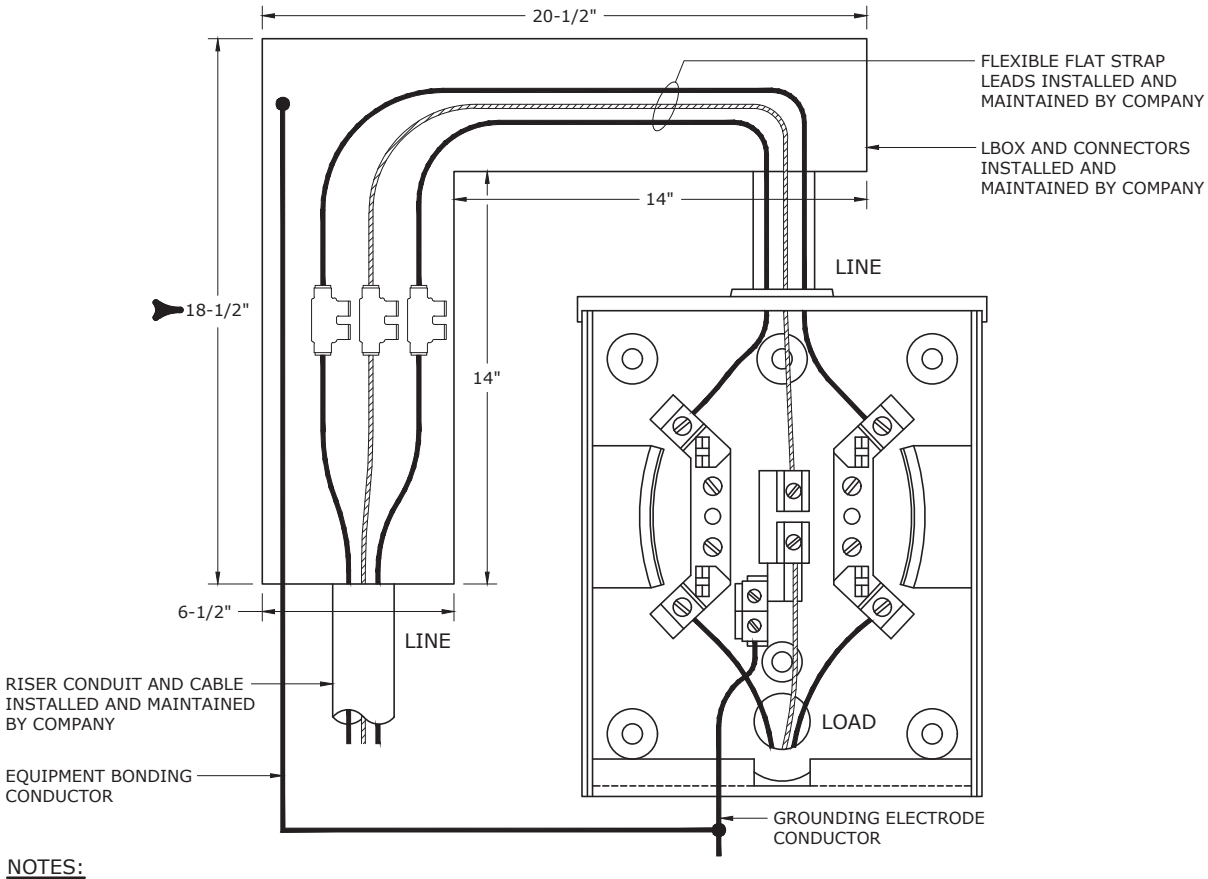
UNDERGROUND CONFIGURATION - LBOX RIGHT DESIGN - ➤ 200 AMP METER BASE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

16.01-102





NOTES:

1. THIS DESIGN IS FOR OVERHEAD TO UNDERGROUND CONVERSIONS ONLY AND NOT FOR NEW CONSTRUCTION.
2. METER ENCLOSURE SHALL BE BONDED TO GROUND AS REQUIRED BY THE N.E.C. OR AUTHORITY HAVING JURISDICTION.
3. METER ENCLOSURE PROVIDED AND INSTALLED BY CUSTOMER PER COMPANY APPROVED METER ENCLOSURE LIST.
4. MINIMUM WIRE SIZE #6.
5. LBOX SHALL BE BONDED TO GROUND AS REQUIRED BY N.E.S.C.
6. SEE LOCAL REQUIREMENTS FOR RULES GOVERNING METER MOUNTING HEIGHT.

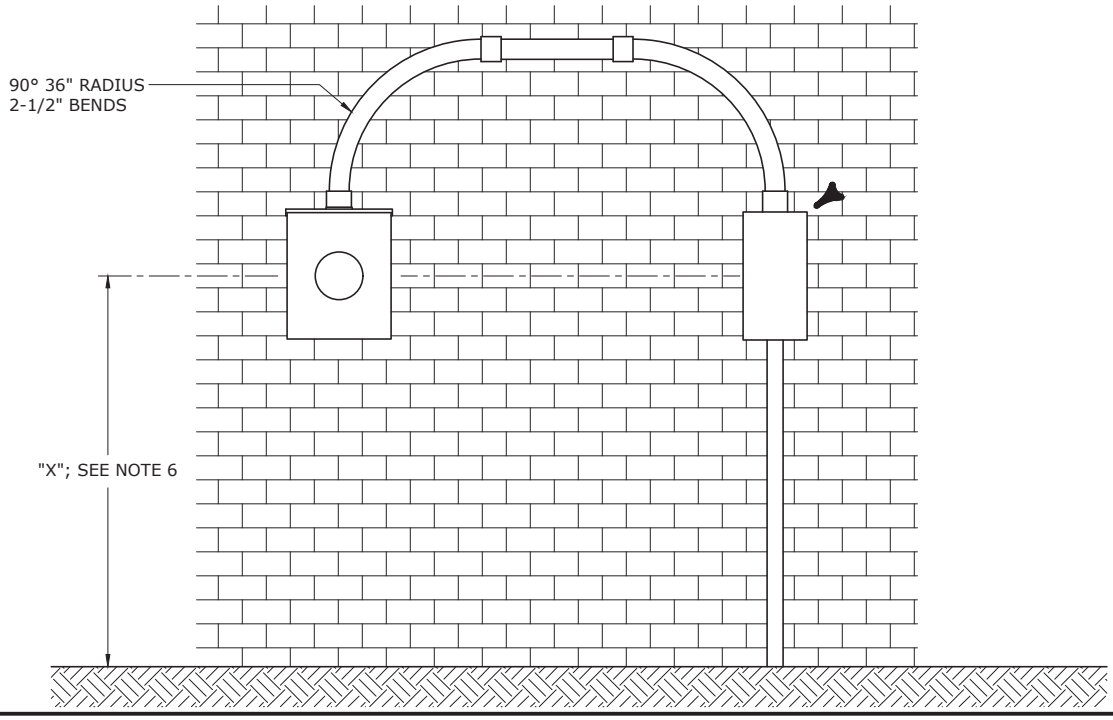
REVISED		BY	CHK'D	APPR.
3				
2				
1	9/30/18	DANNA	EANES	ADCOCK
0	3/31/18	DANNA	EANES	ADCOCK

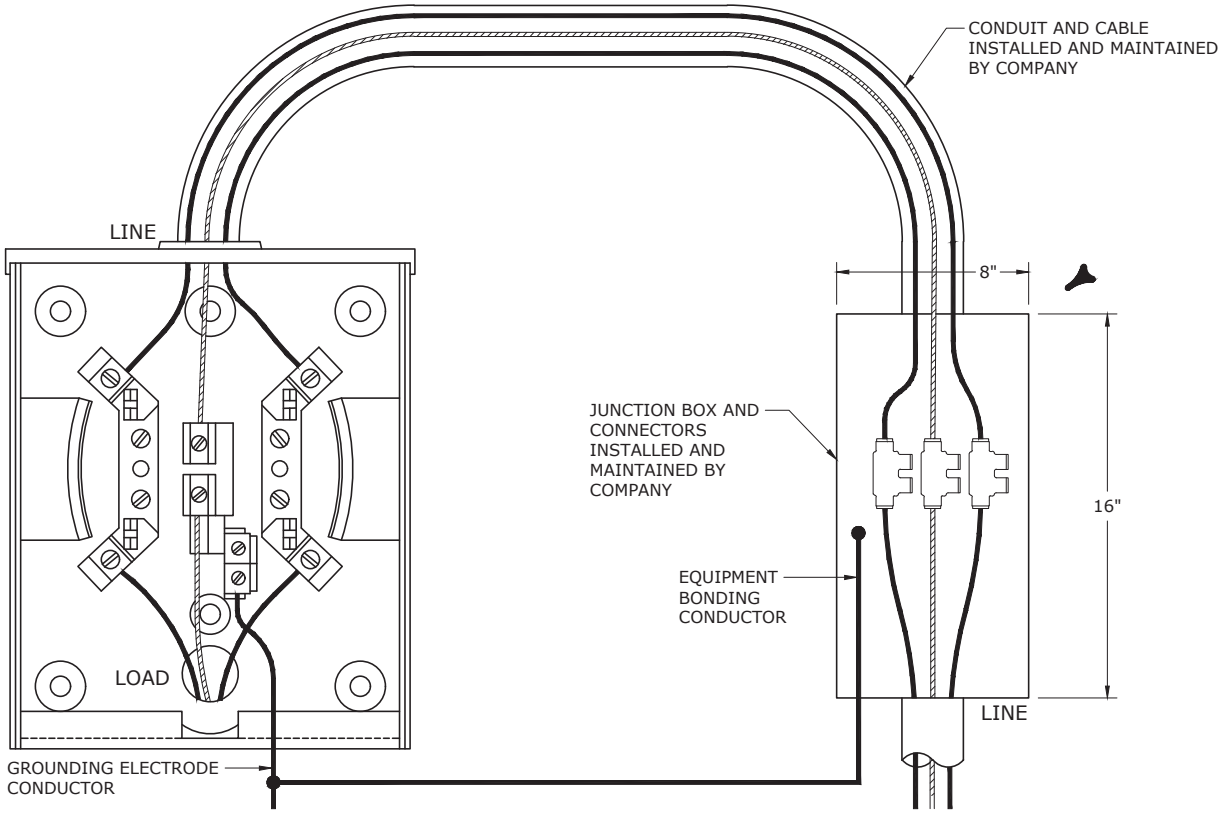
UNDERGROUND CONFIGURATION - LBOX LEFT DESIGN - 200 AMP METER BASE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

16.01-104





NOTES:

1. THIS DESIGN IS FOR OVERHEAD TO UNDERGROUND CONVERSIONS ONLY AND NOT FOR NEW CONSTRUCTION.
2. METER ENCLOSURE SHALL BE BONDED TO GROUND AS REQUIRED BY THE N.E.C. OR AUTHORITY HAVING JURISDICTION.
3. METER ENCLOSURE PROVIDED AND INSTALLED BY CUSTOMER PER COMPANY APPROVED METER ENCLOSURE LIST.
4. MINIMUM WIRE SIZE #6.
5. JUNCTION BOX SHALL BE BONDED TO GROUND AS REQUIRED BY N.E.S.C.
6. SEE LOCAL REQUIREMENTS FOR RULES GOVERNING METER MOUNTING HEIGHT.

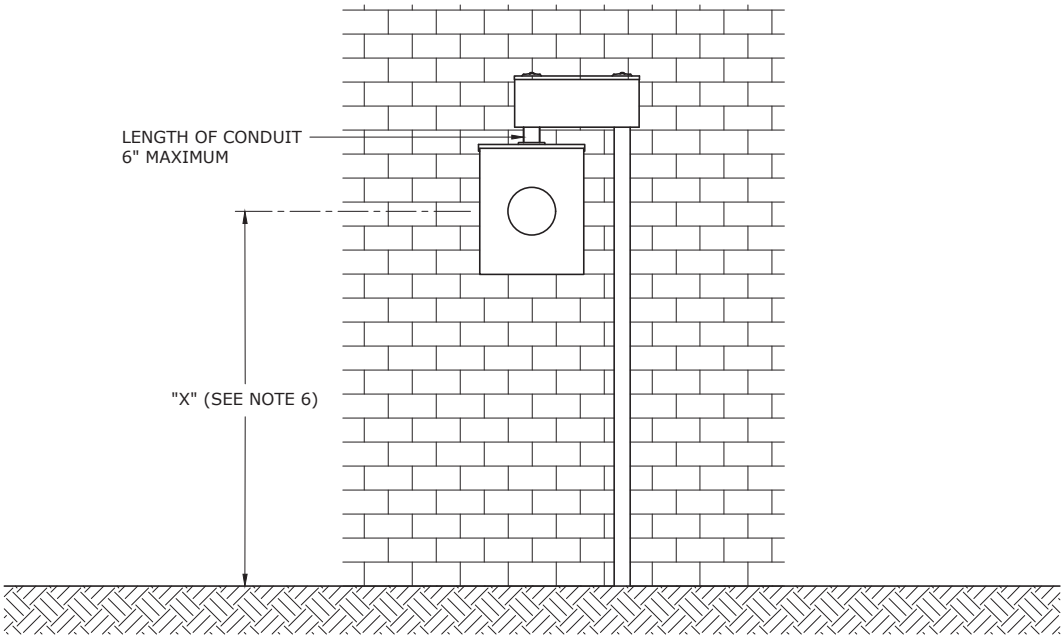
REVISED		BY	CHK'D	APPR.
3				
2	10/26/18	DANNA	EANES	ADCOCK
1	9/30/18	DANNA	EANES	ADCOCK
0	3/31/18	DANNA	EANES	ADCOCK

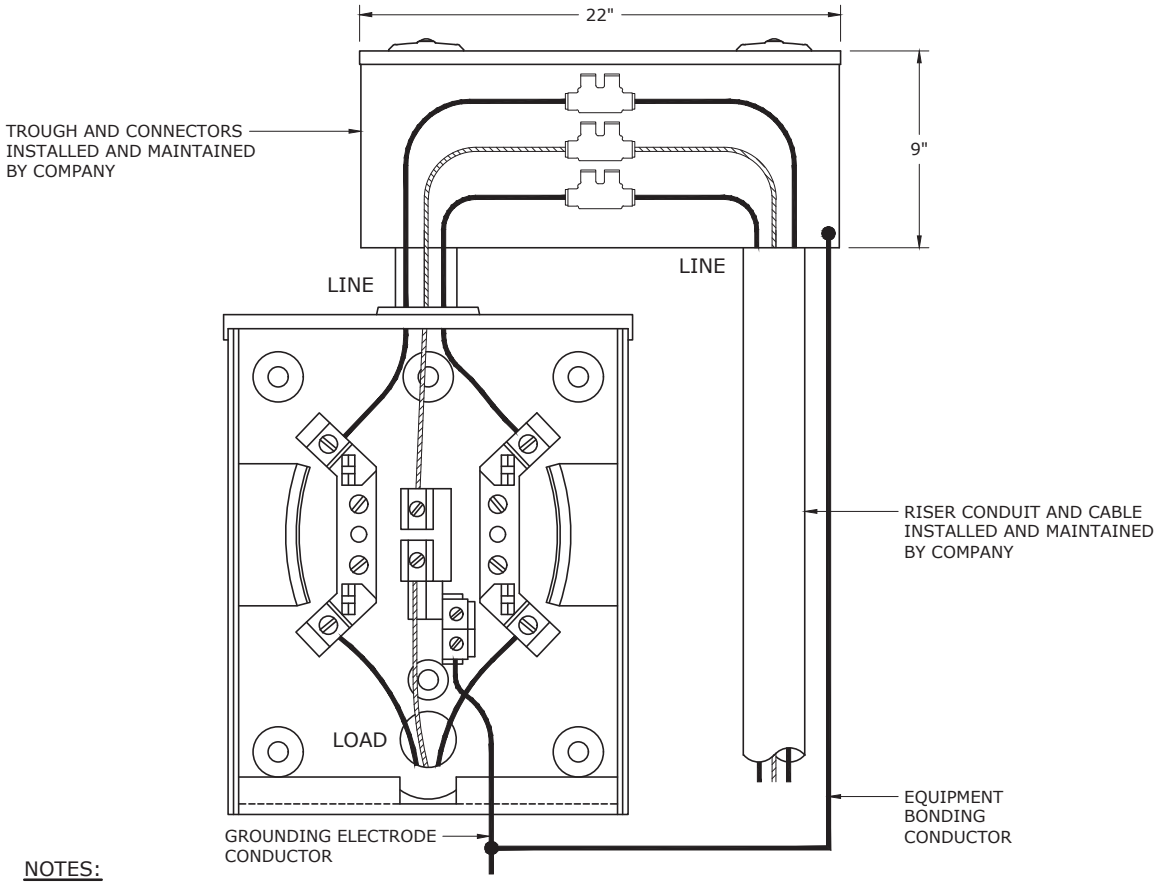
UNDERGROUND CONFIGURATION - JUNCTION BOX - 200 AMP METER BASE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

16.01-106





NOTES:

1. THIS DESIGN IS FOR OVERHEAD TO UNDERGROUND CONVERSIONS ONLY AND NOT FOR NEW CONSTRUCTION.
2. METER ENCLOSURE SHALL BE BONDED TO GROUND AS REQUIRED BY THE N.E.C. OR AUTHORITY HAVING JURISDICTION.
3. METER ENCLOSURE PROVIDED AND INSTALLED BY CUSTOMER PER COMPANY APPROVED METER ENCLOSURE LIST.
4. MINIMUM WIRE SIZE #6.
5. TROUGH SHALL BE BONDED TO GROUND AS REQUIRED BY N.E.S.C.
6. SEE LOCAL REQUIREMENTS FOR RULES GOVERNING METER MOUNTING HEIGHT.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	9/30/18	DANNA	EANES	ADCOCK

UNDERGROUND CONFIGURATION - TROUGH ABOVE METER DESIGN 200 AMP METER BASE

DEC	DEM	DEP	DEF
X	X	X	X

16.01-107

REVISED	BY	CHK'D	APPR.
3			
2 10/26/18	DANNA	EANES	ADCOCK
1 9/30/18	DANNA	EANES	ADCOCK
0 3/31/18	DANNA	EANES	ADCOCK

PARTS LIST

ITEM DESCRIPTION	CU RISER-2IN-SVC-CONV-LEFT-* KIT MAXIMO ITEM #1548295 DWG. 16.01-104 LEFT (2" ONLY)	CU RISER-2IN-SVC-CONV-RIGHT-* KIT MAXIMO ITEM #1548296 DWG. 16.01-102 RIGHT (2" ONLY)	CU RISER-2 1/2IN-SVC-CONV-STRT-* KIT MAXIMO ITEM #1548297 DWG. 16.01-106 (2.5" ONLY)	CU RISER-2IN-SVC-CONV-TROUGH-* KIT MAXIMO ITEM #1570258 DWG. 16.01-107 (2" ONLY)
RIGHT L BOX		1		
LEFT L BOX	1			
STRAIGHT BOX			1	
36" FLEXIBLE LEADS/ STUD ON BOTH ENDS (3/ PACKAGE)	1	1		
CONNECTOR - 600V INSULATED - SETSCREW SHEAR BOLT 2WAY, 1/ 0- 350, AL/ CU	3	3	3	3
2" METER BASE HUB	1	1		1
2.5" METER BASE HUB			2	
**2" (RIGID) PVC SCH. 40 (NOT INCLUDED IN KIT)	10	10		10
**2.5" (RIGID) PVC SCH. 40 (NOT INCLUDED IN KIT)			10	
2" PVC OFFSET	1	1		
2" PVC MALE TERMINAL ADAPTER	2	2		3
2.5" PVC MALE TERMINAL ADAPTER			3	
2" PVC SLIP COUPLING - WITH CENTER STOP	1	1		
2.5" PVC SLIP COUPLING - WITH CENTER STOP			1	
2" LOCKNUT	2	2		2
2.5" LOCKNUT			1	
2.5" PVC SCH. 40 90 DEG BEND - 36" RADIUS			2	
**SERVICE RISER 2" SCH. 40 (NOT INCLUDED IN KIT)	1	1		1
**SERVICE RISER 2.5" SCH. 40 (NOT INCLUDED IN KIT)			1	
2" SUPPORT STRAPS	2	2		
2.5" SUPPORT STRAPS			4	
2" PLASTIC BUSHING	2	2		2
2.5" PLASTIC BUSHING			1	
TROUGH (JUNCTION BOX ABOVE METER)				1

* THE LAST DIGIT OF THE COMPATIBLE UNIT NAME HAS BEEN OMITTED. PLEASE ADD THE FOLLOWING LETTER TO THE CU NAME DEPENDING ON YOUR LOCATION: DEC - C, DEM - M, DEP - P, DEF - F

** ITEMS NOT INCLUDED IN KIT AND MUST BE ISSUED SEPARATELY. SEE DWGS. 22.04-100 AND 22.01-124.

NOTES:

1. JOBS WILL BE KITTED USING THE CU RELATED TO EACH SPECIFICATION PER DWGS. 16.01-102, 16.01-104, 16.01-106 AND 16.01-107.

DEC	DEM	DEP	DEF
X	X	X	X

DUKE ENERGY®

16.01-108

SECTIONS 20 THROUGH 36 OF THIS ENTERPRISE CONSTRUCTION MANUAL COVER SPECIFICATIONS FOR THE PLACEMENT AND INSTALLATION OF UNDERGROUND DISTRIBUTION CABLES, EQUIPMENT, AND SUPPORTING FACILITIES.

PURPOSE OF SPECIFICATIONS

THE PURPOSE OF THESE MANUAL SECTIONS IS TO PROMOTE ECONOMICAL AND UNIFORM CONSTRUCTION OF UNDERGROUND DISTRIBUTION SYSTEMS IN SUCH A MANNER TO ACHIEVE THE BEST OVERALL SAFETY, OPERATION, MAINTENANCE, AND RELIABILITY.

SCOPE

THESE SPECIFICATIONS ARE THE STANDARDS FOR CONSTRUCTION OF ALL UNDERGROUND DISTRIBUTION SYSTEMS FOR DUKE ENERGY. THESE SPECIFICATIONS SHALL BE FOLLOWED FOR ALL NEW CONSTRUCTION, RELOCATION PROJECTS, AND OTHER TARGETED IMPROVEMENT PROJECTS UNLESS OTHERWISE INSTRUCTED BY ENGINEERING. WHERE FEASIBLE AND PRACTICAL, THESE STANDARDS SHOULD ALSO BE USED ON EXISTING FACILITIES WHEN INSTALLING NEW EQUIPMENT OR REPLACING EXISTING EQUIPMENT.

EXCEPTIONS

IT IS RECOGNIZED THAT, IN SOME CASES, POLICIES, PROCEDURES, AND PRACTICES MAY DIFFER BETWEEN REGIONS. THOSE DIFFERENCES ARE ADDRESSED IN EACH SECTION AS THEY MAY APPLY. FOR STANDARDS RELATED NEEDS NOT YET COVERED IN THE ENTERPRISE STANDARDS MANUAL, INDIVIDUALS SHOULD DEFAULT TO THEIR LEGACY CONSTRUCTION STANDARDS.

EASEMENTS AND LOCATION OF UNDERGROUND FACILITIES

WHERE POSSIBLE AND PRACTICAL, THE PREFERRED DUKE ENERGY PRACTICE IS TO SECURE EASEMENTS OR RIGHTS OF WAY TO INSTALL UNDERGROUND CABLES, FACILITIES, AND EQUIPMENT ON PRIVATE PROPERTY. DUKE ENERGY FACILITIES INSTALLED IN PUBLIC RIGHTS OF WAY ARE SUBJECT TO RELOCATION AT DUKE ENERGY'S COST IN THE EVENT THEY CONFLICT WITH PUBLIC INFRASTRUCTURE PROJECTS, I.E., STATE HIGHWAY PROJECTS.

CABLE LABELING

EACH SERVICE AREA HAS ITS OWN UNIQUE MEANS OF LABELING UNDERGROUND CABLE. WHILE THE MEANS OF IDENTIFICATION VARY ACROSS THE COMPANY, THE OBJECTIVE IS BASICALLY THE SAME. IT IS ALWAYS IMPORTANT TO KNOW WHERE EACH END OF A CABLE IS LOCATED. IT IS ALSO IMPORTANT IN MANY CASES TO KNOW THE CIRCUIT NUMBER OF PRIMARY CABLES.

IT WOULD NOT BE PRACTICAL FROM A LABOR OR EXPENSE STANDPOINT TO ADOPT A SINGLE CABLING METHODOLOGY AND TO UNDERTAKE THE MASSIVE RE-LABELING EFFORT THAT WOULD BE REQUIRED TO HAVE A SINGLE METHODOLOGY ACROSS THE COMPANY. FOR DETAILS REGARDING ANY SPECIFIC AREA, REVIEW THE PRACTICE FOR THAT SERVICE AREA. DEF PRACTICES MAY BE FOUND IN SECTION 23 OF THIS MANUAL.

EQUIPMENT LABELING

SOME ASPECTS OF EQUIPMENT LABELING, SUCH AS WARNING AND DANGER LABELS, WILL BE CONSISTENT ACROSS THE COMPANY. HOWEVER, OTHER LABELING PRACTICES, SUCH AS NUMBERING/NAMING CONVENTIONS, WILL VARY GREATLY. FOR DETAILS REGARDING ANY SPECIFIC AREA, REVIEW THE PRACTICE FOR THAT SERVICE AREA. THESE PRACTICES MAY BE FOUND IN THE CORRESPONDING EQUIPMENT SECTIONS WITHIN THIS MANUAL.

ENVIRONMENTAL REQUIREMENTS

ENVIRONMENTAL SERVICES HAS DEFINED A "CRITICAL FACILITY" AS ANY OIL-FILLED PIECE OF EQUIPMENT WITH GREATER THAN 210 GALLONS OF OIL CAPACITY THAT IS LOCATED WITHIN 100 FEET OF AN ENVIRONMENTALLY SENSITIVE AREA. ENVIRONMENTALLY SENSITIVE AREAS ARE DEFINED AS BODIES OF WATER AND THEIR ASSOCIATED VEGETATED BORDERS. THIS INCLUDES SURFACE WATERS SUCH AS WETLANDS, STREAMS, RIVERS, PONDS, LAKES, OCEANS, AND INTRACOASTAL WATERWAYS. CRITICAL FACILITIES INCLUDE THREE-PHASE PAD-MOUNTED TRANSFORMERS, BUT CAN ALSO INCLUDE BANKS OF TRANSFORMERS OR REGULATORS IF THE TOTAL OIL CAPACITY EXCEEDS 210 GALLONS. MOST POLE-MOUNTED SINGLE-PHASE TRANSFORMERS AND SINGLE-PHASE PAD-MOUNTED TRANSFORMERS ARE EXCLUDED BECAUSE THEY CONTAIN LESS THAN 210 GALLONS OF OIL.

CONTACT THE ENVIRONMENTAL HEALTH & SAFETY GROUP FOR GUIDANCE CONCERNING THE INSTALLATION, UPGRADE, REPAIR, OR REMOVAL OF CRITICAL FACILITIES LOCATED WITHIN 125 FEET OF A BODY OF WATER OR DRAINS THAT COULD DISCHARGE OIL DIRECTLY INTO A BODY OF WATER.

COMPLETE A DEFECTIVE/FAILED MATERIAL TAG, ITEM NUMBER 4032754 (SEE FIGURE BELOW), AND ATTACH IT TO THE FAILED MATERIAL WHEN REPORTING DEFECTIVE/FAILED MATERIAL. IF THE MATERIAL IS SMALL ENOUGH, SEND IT THROUGH THE INTER-OFFICE MAIL TO THE APPROPRIATE DISTRIBUTION STANDARDS ENGINEER. IF THE MATERIAL IS TOO LARGE TO MAIL, SEND AN EMAIL TO THE APPROPRIATE STANDARDS ENGINEER THAT INCLUDES A VERY BRIEF EXPLANATION OF THE PROBLEM AND IDENTIFIES WHERE THE MATERIAL IS LOCATED.

TAG#

DEFECTIVE/FAILED MATERIAL TAG

REGION: _____

LOCATION: _____

PREPARED BY _____
(NAME)

DIS/GIS # _____

PHONE # _____

ITEM # _____

DATE _____

REASON FOR RETURN

☐ FAILED IN SERVICE

☐ BROKEN/DEFECTIVE WHEN RECEIVED

☐ OTHER-EXPLAIN _____

CLAIM INVOLVED ?

☐ YES NO ☐

DO YOU WANT A RESPONSE REPORT ON THIS ITEM

☐ YES NO ☐

DO NOT REMOVE THIS TAG

DUKE ENERGY.

ATTENTION

Fill out tag completely

Attach to material

Notify appropriate standards personnel if urgent

Send material to Material Recovery or Distribution Standards for review

If tagging a transformer, write the pole/pad ID number and "CLAIM" on the unit with a black waterproof marker

TF Serial #

COMMENTS: _____

_____

_____

_____

_____

_____

_____

_____

_____

DUKE ENERGY.

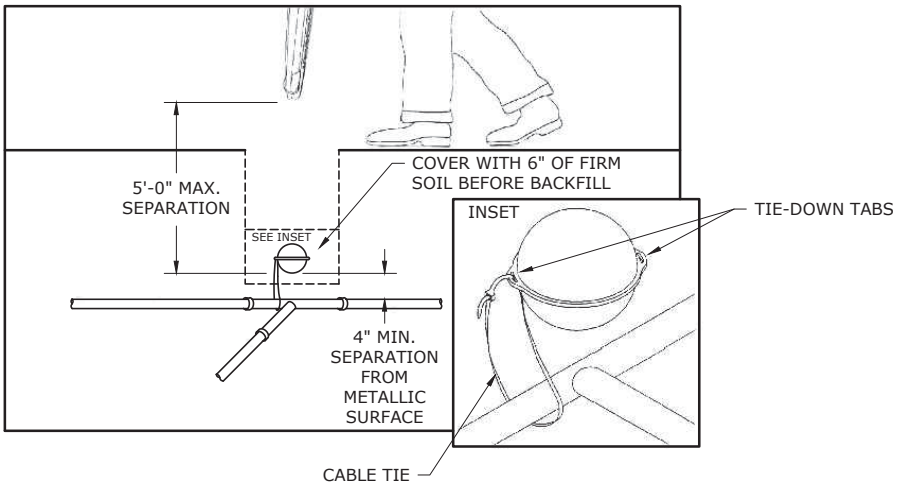
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DEFECTIVE / FAILED MATERIAL REPORTING PROCESS

DEC	DEM	DEP	DEF
		X	X

20.00-105

REGION	ITEM NUMBER	COMPATIBLE UNIT
DEC	4027782	MISC-MARKER-UG-C
DEM	4027782	MISC-MARKER-UG-M
DEP	4004797	MISC-MARKER-UG-P
DEF	4004797	MISC-MARKER-UG-F



NOTES:

1. MARKER BALLS PROVIDE AN ACCURATE, LONG LASTING METHOD OF MARKING BURIED UNDERGROUND FACILITIES (SPLICES, PULL BOXES, ETC.). THE SOLID RED COLORED MARKER BALLS ARE FOR GENERAL APPLICATIONS, AND THEY ARE TUNED TO 169.8 KHZ. MUST BE USED WITH LOCATING DEVICES SUCH AS 3M DYNATEL 2200M-ID SERIES, 3M DYNATEL 2500-ID SERIES, OR OTHER LOCATING DEVICES THAT ARE DESIGNED TO FIND ELECTRONIC MARKERS.
2. BEFORE PLACING A MARKER BALL OVER THE FACILITY DECIDE IF A TIE DOWN IS REQUIRED TO KEEP IT IN PLACE. IF SO, SECURE THE MARKER BY INSERTING A CABLE TIE THROUGH ONE OR BOTH SIDES OF THE MARKER BALL.
3. THE MARKER BALL DOES NOT NEED TO BE LEVEL, ANY ORIENTATION IS GOOD.
4. HAND FILL AT LEAST 6 INCHES OF SOIL OVER THE MARKER BALL TO PREVENT MOVEMENT, OR DAMAGE DURING BACKFILL.
5. MARKER BALL CAN BE INSTALLED AT ANY DEPTH, BUT MAXIMUM DEPTH FOR ACCURATE LOCATION IS 5 FEET.
6. A GIS NUMBER MAY BE ASSIGNED FOR EACH MARKER BALL INSTALLATION AND LOCATED ON A GIS MAP.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	FLETCHER	EANES	ADCOCK

ELECTRONIC MARKER BALL

DEC	DEM	DEP	DEF
X	X	X	X

20.00-107

DIRECT BURIED VS CABLE IN CONDUIT INSTALLATION

INSTALLATION POLICIES AND PROCEDURES VARY BY STATE AND LOCAL JURISDICTION ACROSS THE ENTERPRISE. SOME AREAS MAY HAVE A DIRECT BURIAL POLICY FOR ALL CABLE, OTHERS MAY REQUIRE CABLE TO BE PLACED IN CONDUIT, AND SOME AREAS MAY HAVE A MIXED POLICY. FOR DETAILS REGARDING ANY SPECIFIC AREA, REVIEW THE POLICIES AND PROCEDURES FOR THAT SERVICE AREA.

USE OF 25KV CABLE IN DEC AND DEP

25KV CABLE WILL BE USED FOR ALL 25KV AND 12KV APPLICATIONS IN DEC AND DEP. THE LIST BELOW PROVIDES SOME OF THE REASONS FOR THIS POLICY.

- FEWER CABLE TYPES AND CABLE ACCESSORIES HAVE TO BE PURCHASED AND STOCKED
- OVERALL INVENTORIES CAN BE MINIMIZED
- CREWS DO NOT HAVE TO SWAP CABLES WHEN MOVING FROM ONE JOB TO ANOTHER
- THE RISK OF INSTALLING 15KV CABLE ON A 25KV CIRCUIT IS ELIMINATED
- LOWER ELECTRICAL STRESS APPLIED ACROSS THE CABLE INSULATION
- BETTER UTILIZATION OF SHORT CABLE LENGTHS IS POSSIBLE

15KV CABLE CAN BE OBTAINED FOR SPECIAL APPLICATIONS IN DEC AND DEP, SUCH AS WHEN CABLES HAVE TO BE INSTALLED IN EXISTING, SMALL DUCTS AND THERE ARE NO 25KV CABLES THAT CAN BE USED. CONTACT DISTRIBUTION STANDARDS WHEN SUCH A NEED ARISES.

MAXIMUM NUMBER OF TRANSFORMERS ON A RADIAL

FLORIDA:

FOR NEW INSTALLATIONS, SINGLE TRANSFORMERS SHALL BE RADIALLY FED AND MULTIPLE TRANSFORMERS (TWO OR MORE) SHALL BE LOOP FED. THIS APPLIES TO BOTH SINGLE AND THREE-PHASE TRANSFORMERS.

IT WILL BE LEFT TO LOCAL GUIDANCE WHETHER CRITICAL OR HIGHLY SENSITIVE LOADS THAT MIGHT OTHERWISE BE LEFT ON A RADIAL SHOULD BE LOOP FED. IN THESE CASES LOCAL CHARGING POLICIES SHOULD BE APPLIED (SUCH AS EXTRA OR ADDITIONAL FACILITIES, OH VERSUS UG COST DIFFERENTIALS, ETC).

CAROLINAS/MIDWEST:

FOR NEW INSTALLATIONS, SINGLE TRANSFORMERS SHALL BE RADIALLY FED AND MULTIPLE TRANSFORMERS (TWO OR MORE) SHALL BE LOOP FED. THIS APPLIES TO BOTH SINGLE PHASE AND THREE PHASE TRANSFORMERS.

CAROLINAS/MIDWEST EXCEPTIONS:

1. IT WILL BE LEFT TO LOCAL GUIDANCE WHETHER CRITICAL OR HIGHLY SENSITIVE LOADS THAT MIGHT OTHERWISE BE LEFT ON A RADIAL SHOULD BE LOOP FED. IN THESE CASES LOCAL CHARGING POLICIES SHOULD BE APPLIED (SUCH AS EXTRA OR ADDITIONAL FACILITIES, OH VERSUS UG COST DIFFERENTIALS, ETC).
2. IN AREAS WHERE A LOOP FEED IS NOT FEASIBLE OR PRACTICAL DUE TO FACTORS SUCH AS TERRAIN, DISTANCE, CHARGING POLICIES, ETC, MULTIPLE TRANSFORMERS MAY BE PLACED ON A RADIAL SYSTEM UNDER THE FOLLOWING CRITERIA:
   - TRANSFORMERS MUST BE EQUIPPED WITH FAULTED CIRCUIT INDICATORS (WITH THE EXCEPTION OF THE LAST TRANSFORMER ON THE RADIAL).
   - NO MORE THAN 20 SINGLE PHASE CUSTOMERS CAN BE LEFT ON A RADIAL SYSTEM. A CUSTOMER IS DEFINED AS AN ELECTRICAL ACCOUNT, EXCLUDING ACCOUNTS THAT ARE SOLELY FOR LIGHTING.
   - NO MORE THAN 3 SINGLE-PHASE TRANSFORMERS CAN BE LEFT ON A RADIAL SYSTEM.

NOTE: TRANSFORMERS (SINGLE-PHASE OR THREE-PHASE) INSTALLED SOLELY FOR DUKE ENERGY LIGHTING DO NOT COUNT TOWARDS THE NUMBER OF TRANSFORMERS PERMITTED TO REMAIN ON A RADIAL.

RADIAL TAPS OFF A SINGLE-PHASE LOOP

RADIAL TAPS OFF A SINGLE-PHASE LOOP SHOULD BE AVOIDED AND THE LOOP EXTENDED FOR MOST APPLICATIONS. HOWEVER, THERE MAY BE SITUATIONS WHERE THE DISTANCE TO THE TRANSFORMER IS EXTREMELY LONG AND IT WOULD BE IMPRACTICAL TO EXTEND THE LOOP. FOR THESE APPLICATIONS, A PROTECTIVE DEVICE (FUSE CABINET, VFI, ETC.) IS RECOMMENDED TO MAINTAIN SERVICE RELIABILITY FOR THE CUSTOMERS SERVED BY THE LOOP WHEN A FAULT OCCURS ON THE RADIAL. THIS ALSO FACILITATES FASTER SERVICE RESTORATION WHEN A FAULT OCCURS ON THE RADIAL.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK

BASIC DESIGN REQUIREMENTS

DEC	DEM	DEP	DEF
X	X	X	X

20.02-121A

SINGLE-PHASE TRANSFORMERS ON NON-RESIDENTIAL THREE-PHASE LOOPS

SINGLE-PHASE PAD-MOUNTED TRANSFORMERS USED TO SERVE CUSTOMER LOADS ARE NOT ALLOWED TO BE INSTALLED ON NON-RESIDENTIAL THREE-PHASE UNDERGROUND LOOPS. THE ONLY EXCEPTIONS TO THIS POLICY ARE AS FOLLOWS:

- THE INSTALLATION OF SINGLE-PHASE TRANSFORMERS TO SERVE DUKE ENERGY LIGHTING.
- THE INSTALLATION OF A SINGLE-PHASE RADIAL, SERVING ONLY ONE TRANSFORMER, FROM A THREE-PHASE TRANSFORMER. IF THE SINGLE-PHASE TRANSFORMER CAN BE LOCATED IMMEDIATELY ADJACENT TO THE TAPPED THREE-PHASE TRANSFORMER, THEN THE TAP DOES NOT NEED TO BE FUSED. OTHERWISE, THE SINGLE-PHASE TRANSFORMER MUST BE FED FROM A PROTECTIVE DEVICE, WHICH MUST BE LOCATED IMMEDIATELY ADJACENT TO THE TAPPED THREE-PHASE TRANSFORMER.
- THE INSTALLATION OF A SINGLE-PHASE RADIAL, SERVING ONLY ONE TRANSFORMER, FROM THE LINE-SIDE OF PAD-MOUNTED DEAD-FRONT SWITCHGEAR USING A FUSABLE ELBOW.

SERVICE RELIABILITY IS THE MAJOR REASON FOR THIS POLICY. ANY SINGLE-PHASE TRANSFORMER CONNECTED TO A THREE-PHASE SECTION OF UNDERGROUND CABLE WOULD HAVE TO BE DE-ENERGIZED WHENEVER WORK HAS TO BE PERFORMED ON ANY OF THE CABLES. THIS WOULD CREATE AN OUTAGE FOR THE CUSTOMERS SERVED BY THE SINGLE-PHASE TRANSFORMER.

ALLOWING THE INSTALLATION OF SINGLE-PHASE TRANSFORMERS WOULD ALSO FORCE THE IMMEDIATE LOCATION AND REPAIR OF ANY CABLE FAILURE ON THE SECTION OF THREE-PHASE CABLE WHERE THE SINGLE-PHASE TRANSFORMER IS INSTALLED REGARDLESS OF THE TIME OF DAY WHEN THE FAULT OCCURRED. WITHOUT THE SINGLE-PHASE TRANSFORMER, THE LOOP COULD HAVE BEEN SWITCHED, SERVICE RESTORED, AND THE FAULT REPAIRED DURING NORMAL WORKING HOURS THE NEXT DAY.

SPLICING EXISTING CABLE ALSO CREATES A POINT FOR A POTENTIAL FUTURE FAILURE. SPLICES SHOULD PERFORM AS WELL AS UNDERGROUND CABLE, BUT INSTALLING THEM IN A HOLE CREATES A SITUATION WHERE IT IS DIFFICULT TO PROPERLY TERMINATE UNDERGROUND PRIMARY CABLE, AVOID CONTAMINATION AND INSTALL THE SPLICE CONNECTOR AND HOUSING.

LOOP REQUIREMENTS

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 OR SWITCHGEAR.

WHEN DIPPING INTO AN UNDERGROUND SUBDIVISION, THE DEVELOPER SHALL PROVIDE LOCATIONS FOR TWO POLES SO THE DIPS WILL NOT HAVE TO BE ON THE SAME POLE.

BOTH ENDS OF A SINGLE-PHASE LOOP SHALL BE ON THE SAME PHASE. THIS IS NECESSARY TO MINIMIZE SWITCHING ISSUES AND TO ALLOW SWITCHING TO BE PERFORMED WITHOUT INTERRUPTING SERVICE TO CUSTOMERS.

BOTH ENDS OF AN UNDERGROUND LOOP SHOULD TERMINATE ON THE SAME FEEDER. THIS MAY NOT BE POSSIBLE, BUT IS DESIRABLE. IF NOT POSSIBLE, INSTALL LABEL, ITEM # 4006060, IN THE OPEN POINT TRANSFORMER TO NOTIFY FIELD PERFORMERS THAT TWO FEEDERS ARE PRESENT.

IT IS NOT DESIRABLE FOR AN OVERHEAD SWITCH TO BE LOCATED BETWEEN RISER POLES SERVING A LOOP. THIS REDUCES THE POTENTIAL FOR LOOPS BETWEEN FEEDERS.

IT IS DESIRABLE FOR BOTH RISER POLES FOR AN UNDERGROUND LOOP TO BE IN THE SAME GENERAL AREA, BUT NOT SO CLOSE THAT A VEHICLE ACCIDENT COULD DAMAGE BOTH POLES.

AVOID ROUTING PRIMARY SO THAT IT DOUBLES BACK IN THE SAME TRENCH. IT IS BEST FOR THE TWO TRENCHES TO BE INSTALLED ON OPPOSITE SIDES OF THE ROAD. SEE DWG. 22.01-101 FOR TRENCH CONFIGURATIONS AND REQUIRED CABLE SEPARATION.

OVERVOLTAGE PROTECTION

PROPER OVERVOLTAGE PROTECTION IS CRITICAL FOR THE LONG-TERM RELIABILITY OF UNDERGROUND SYSTEMS. THIS IS A RESULT OF FACTORS SUCH AS VERY THIN INSULATION WALL THICKNESSES IN UNDERGROUND CABLES AND VOLTAGE REFLECTIONS AT THE END OF CABLES WHERE VOLTAGES CAN DOUBLE. SO PROPER ARRESTERS MUST BE INSTALLED AT ALL PRIMARY RISERS AND THE OPEN POINTS OF ALL UNDERGROUND SYSTEMS.

DUKE ENERGY.

3					DEC	DEM	DEP	DEF
2								
1					X	X	X	X
0	3/31/18	FLETCHER	EANES	ADCOCK				
REVISED		BY	CHK'D	APPR.				

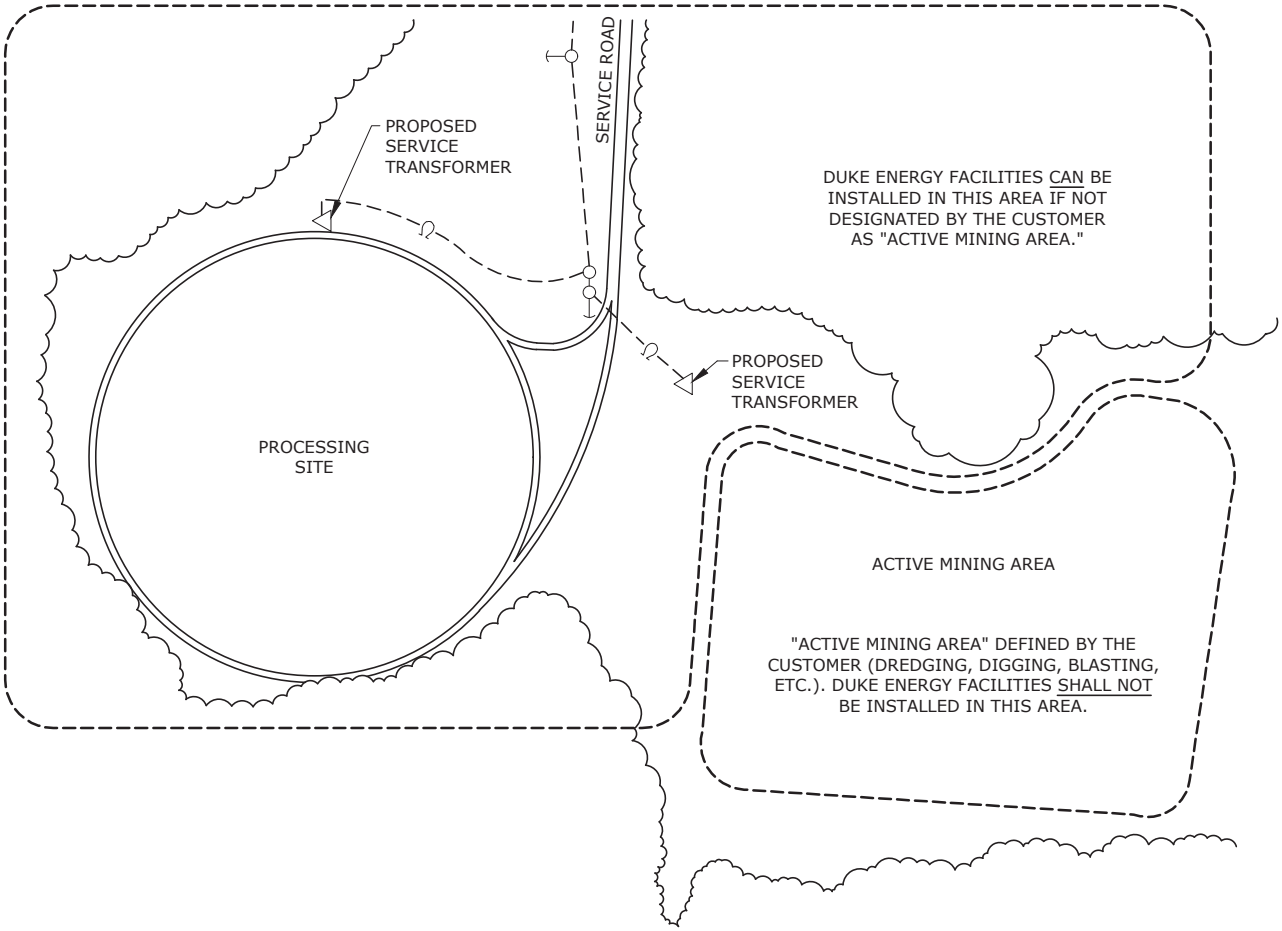
BASIC DESIGN REQUIREMENTS

20.02-121B

OVERVIEW: SERVICE INSTALLATIONS TO CUSTOMERS WHERE STRIP-MINING ACTIVITIES OCCUR (PHOSPHATE MINES, SAND PITS, ROCK QUARRIES, ETC.) REQUIRE CONFORMITY WITH FEDERAL AND STATE MINE HEALTH AND SAFETY ADMINISTRATION (MSHA) REGULATIONS RATHER THAN NESC REGULATIONS. OVERHEAD AND UNDERGROUND DISTRIBUTION FACILITIES LOCATED IN ACTIVE MINING AREAS MUST CONFORM TO THE NATIONAL ELECTRIC CODE (NEC) AND MUST MEET CERTAIN INSPECTION CRITERIA. PERSONS OPERATING AND MAINTAINING FACILITIES IN ACTIVE MINING AREAS MUST ALSO BE CERTIFIED.

POLICY: DUKE ENERGY DISTRIBUTION CONSTRUCTION SPECIFICATIONS ARE DESIGNED TO CONFORM TO THE NATIONAL ELECTRICAL SAFETY CODE (NESC), NOT THE NEC. THEREFORE, ALL SERVICE EXTENSIONS TO SERVE NEW CUSTOMERS OR EXTENSIONS TO EXISTING CUSTOMERS MUST REMAIN OUTSIDE ACTIVE MINING AREAS. INDIVIDUAL MINE OWNERS DETERMINE THE BOUNDARIES OF AN "ACTIVE MINE", BUT GENERALLY INCLUDE AREAS WHERE BLASTING, DREDGING, AND/OR DIGGING OCCUR. MINE OWNERS SHALL PROVIDE A PLAN SIGNED BY THE MINE OWNER DEPICTING "ACTIVE MINING AREAS" AND DESIGNATING THOSE AREAS NOT COVERED BY MSHA WHERE DUKE ENERGY FACILITIES CAN BE PLACED. EXISTING CUSTOMER INSTALLATIONS WILL BE ADDRESSED WHEN THE CUSTOMER REQUESTS MODIFICATIONS TO EXISTING FACILITIES.

THE LOCAL MINE OWNER MAY REQUIRE SITE SPECIFIC HAZARD AWARENESS TRAINING PRIOR TO ANY DUKE ENERGY CONSTRUCTION OR MAINTENANCE ACTIVITY BEING PERFORMED ON MINE PROPERTY. THIS TRAINING, IF REQUIRED BY THE LOCAL MINE OWNER, SHOULD BE INCLUDED IN THE PRE-JOB BRIEFING.



3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SERVICE TO MINES

DEC	DEM	DEP	DEF
X	X	X	X

20.02-123

GROUNDING ELECTRODES FOR DISTRIBUTION LINES

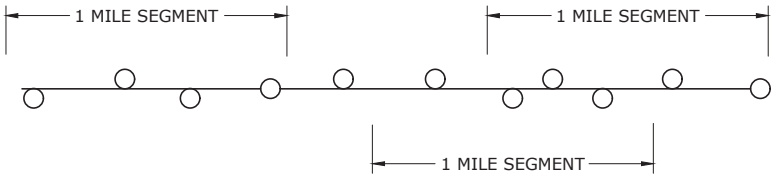
THE UNDERGROUND DISTRIBUTION LINE DESIGN STANDARD IN DUKE ENERGY IS CONSIDERED TO BE A MULTI-GROUNDED SYSTEM PER THE NESC. THE PRIMARY UNDERGROUND SYSTEM NEUTRAL MUST HAVE A MINIMUM OF 4 GROUNDS WITHIN EACH MILE OF CABLE UNDER NORMAL CONDITIONS. THIS IS NOT AN AVERAGE OF 4 GROUNDS PER MILE, BUT INSTEAD MEANS THAT ANY ONE MILE SEGMENT OF LINE, WHEREVER IT IS SELECTED, MUST CONTAIN A MINIMUM OF 4 GROUNDS. THE INTENT OF THIS RULE IS TO ENSURE THE GROUNDING ELECTRODES ARE EVENLY DISTRIBUTED AT APPROXIMATELY 1/4 MILE INTERVALS OR SMALLER.

IN RESIDENTIAL AND COMMERCIAL DEVELOPMENTS, DUE TO THE NUMBER OF TRANSFORMERS AND SWITCHGEAR PRESENT, THE NUMBER OF GROUNDS INSTALLED WILL MOST LIKELY EXCEED THE MINIMUM OF 4 WITHIN EACH MILE. THIS MAY NOT BE THE CASE, HOWEVER, WHERE LONG RUNS OF UNBROKEN, UNDERGROUND CABLE ARE INSTALLED (SOME FEEDER EXITS, EXPRESS FEEDERS TO LARGE LOAD CENTERS, ETC.). THE NESC MAKES THE FOLLOWING EXCEPTIONS FOR UNDERGROUND CABLES:

1. WHERE CABLE OR CABLE IN DUCT IS INSTALLED UNDER WATER, THE REQUIREMENT DOES NOT APPLY FOR THE UNDERWATER PORTION.

2. FOR CABLE OR CABLE IN DUCT WHERE ADHERENCE TO THE RULE WOULD REQUIRE REMOVING THE PROTECTIVE JACKET SOLELY FOR THE PURPOSE OF INSTALLING A GROUND.

FOR BOTH OF THESE EXCEPTIONS, THE CABLE SHOULD BE GROUNDED WHEREVER IT IS AVAILABLE TO PERSONNEL (INCLUDING END-OF-REEL SPLICING IF 4 GROUNDS WITHIN A MILE CANNOT BE OBTAINED THROUGH OTHER MEANS).



○ GROUND ROD LOCATION

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

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK

GROUNDING ELECTRODES FOR UNDERGROUND DISTRIBUTION LINES

DEC	DEM	DEP	DEF
X	X	X	X

20.04-141

EQUIPMENT AND RISER GROUNDING

THE GROUND RESISTANCE AT RISERS AND EQUIPMENT INSTALLATIONS NEEDS TO BE LOW ENOUGH TO MINIMIZE HAZARDS TO PERSONNEL AND TO PERMIT PROMPT OPERATION OF CIRCUIT PROTECTIVE DEVICES IN THE EVENT OF A FAULT. ON A MULTIGROUNDED SYSTEM, THE PERFORMANCE OF THE SYSTEM NEUTRAL IS AFFECTED BY THE RESISTANCE OF THE EQUIPMENT GROUNDS AND ALSO BY THE NUMBER OF GROUNDS INSTALLED ALONG THE LINE. MULTIPLE GROUNDS AT DIFFERENT LOCATIONS ALONG THE SYSTEM ARE MORE IMPORTANT THAN THE RESISTANCE OF ANY 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 RODS WILL MINIMIZE THE VARIATIONS IN RESISTANCE DUE TO WEATHER CONDITIONS AND INCREASE THE PROBABILITY OF PENETRATING A LOW RESISTANCE SOIL LAYER.

THE STANDARD GROUNDING ELECTRODE WILL CONSIST OF MULTIPLE, FIVE (5) FOOT RODS INSTALLED ONE ON TOP OF THE OTHER TO PROVIDE ONE VERTICAL DEEP-DRIVEN ELECTRODE. THE NUMBER OF REQUIRED RODS WILL BE AS FOLLOWS:

- RISERS, PAD-MOUNTED TRANSFORMERS, SWITCHGEAR, AND ANY EQUIPMENT WITH ARRESTERS: FOUR (4); HOWEVER, IF IT BECOMES IMPRACTICAL TO INSTALL FOUR DEEP-DRIVEN RODS DUE TO ADVERSE SOIL CONDITIONS (i.e. ROCK), THEN THE INSTALLATION WILL BE CONSIDERED COMPLETE WITH THE MAXIMUM NUMBER OF RODS THE CONDITIONS WILL PERMIT.
- STREET LIGHT INSTALLATIONS THAT REQUIRE A DRIVEN GROUND: TWO (2)
- EQUIPMENT WITH NO ARRESTERS: TWO (2)

EQUIPMENT BONDING

WHERE EQUIPMENT GROUNDING IS REQUIRED, ALL EQUIPMENT TANKS AND OTHER NON-CURRENT-CARRYING METAL PARTS OF THE EQUIPMENT MUST BE SOLIDLY BONDED TO THE SYSTEM NEUTRAL AND THE GROUNDING ELECTRODE VIA THE GROUND RING BUS. THE GROUND RING MUST BE BONDED TO THE FOLLOWING:

- GROUNDING ELECTRODE
- ALL GROUND LUGS PROVIDED IN THE EQUIPMENT COMPARTMENT(S) OR ON THE HOUSING OF VAULT STYLE GEAR
- SECONDARY NEUTRAL BUSHING GROUND STRAP CONNECTOR OF ALL TRANSFORMERS (EXCEPT THOSE PROVIDING THREE-PHASE THREE-WIRE SERVICES)
- THE METALLIC SHIELD OF ALL UG PRIMARY CABLES (LC SHIELD, CONCENTRIC NEUTRAL, OR FLAT STRAP)

REFER TO THE APPROPRIATE SECTION OF THIS MANUAL FOR THE PROPER CONNECTORS TO BE USED TO BOND THE ABOVE ITEMS TO THE GROUND RING BUS.

A MINIMUM OF SIX (6) FEET OF SEPARATION IS REQUIRED BETWEEN ANY TWO PIECES OF METALLIC EQUIPMENT THAT ARE NOT BONDED.

AN EXTERNAL GROUND PROVISION IS NOW PROVIDED ON ALL PAD-MOUNTED TRANSFORMERS TO ALLOW OTHER UTILITIES TO BOND TO THE DUKE ENERGY SYSTEM NEUTRAL AND GROUND WHEN THEY INSTALL METALLIC EQUIPMENT CLOSER THAN SIX (6) FEET TO A DUKE ENERGY TRANSFORMER.

UNLESS OTHERWISE SPECIFIED, THE FOLLOWING TYPES OF EQUIPMENT THAT ARE SERVED BY #4/0 OR SMALLER UG PRIMARY CABLE REQUIRE A #4 SD BARE CU LOOPED GROUND RING.

- PAD-MOUNTED TRANSFORMERS
- FUSE CABINETS
- JUNCTION CABINETS
- OTHER PRIMARY CABINETS (SINGLE-PHASE OR THREE-PHASE)

ALL UNDERGROUND EQUIPMENT, PAD-MOUNTED OR VAULT STYLE, SERVED BY CABLES LARGER THAN #4/0, SUCH AS SWITCHGEAR, PRIMARY METERING CABINETS, CAPACITORS, RECLOSERS, ETC., REQUIRE A 2/0 AWG SD BARE LOOPED GROUND RING.

RISERS REQUIRE THE METALLIC SHIELD (LC SHIELD, CONCENTRIC NEUTRAL, OR FLAT STRAP) OF ALL UG CABLES TO BE BONDED TO THE OVERHEAD SYSTEM NEUTRAL AND A DRIVEN GROUND ROD AT THE BOTTOM OF THE POLE. THE BOND TO THE SYSTEM NEUTRAL IS ACCOMPLISHED BY CONNECTING EACH TERMINATION GROUND BRAID, CONCENTRIC NEUTRAL STRANDS OR FLAT STRAPS TO A BARE COPPER BUS WHICH IS THEN BONDED TO THE SYSTEM NEUTRAL. FOR 200A RISERS, THE BARE COPPER BUS SHALL BE #2 AWG AND FOR 600A RISERS THE BUS SHALL BE 2/0 AWG. THE BOND TO THE GROUND ROD FOR ALL RISERS IS ACCOMPLISHED BY EXTENDING #6 AWG BARE COPPER FROM THE GROUND ROD UP THE POLE TO THE BARE COPPER BUS BELOW THE TERMINATIONS AND BY BONDING IT TO THE OVERHEAD SYSTEM NEUTRAL. REFER SECTION 21 FOR DETAILS OF THESE CONNECTIONS.

GROUNDING COMPATIBLE UNITS	DESCRIPTION/APPLICATION
(1) GND-ROD-UG-F AND (1) GND-ROD-ADD-VRT-UG-F	GROUND RISERS & EQUIPMENT WITHOUT ARRESTERS: 2 – 5’ RODS UNDERGROUND ONLY
(1) GND-ROD-UG-F AND (3) GND-ROD-ADD-VRT-UG-F	GROUND RISERS & EQUIPMENT WITH ARRESTERS: 4 – 5’ RODS UNDERGROUND ONLY
GND-PED-6-F	BONDING GROUND FOR JOINT USE / PEDESTAL
GND-BOND-TELC-F	BONDING GROUND FOR JOINT USE PMT
GND-EQUIP-4-RING-1P-F	GROUND SINGLE-PHASE PMT – WIRE ONLY
GND-EQUIP-4-RING-3P-F	GROUND THREE-PHASE PMT – WIRE ONLY
GND-SG-4/0-RING-F	GROUND PAD-MOUNTED SWITCHGEAR – WIRE ONLY

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	12/31/18	EANES	FLETCHER	ADCOCK
0	3/31/18	FLETCHER	EANES	ADCOCK

EQUIPMENT AND RISER GROUNDING AND BONDING

DEC	DEM	DEP	DEF
			X

20.04-143

SECONDARY ELECTRICAL DESIGN SOFTWARE (SEDS)

THE DSTAR SECONDARY ELECTRICAL DESIGN SOFTWARE (SEDS) IS A CONVENIENT TOOL FOR PERFORMING THE ELECTRICAL CALCULATIONS NEEDED TO DESIGN SINGLE-PHASE AND THREE-PHASE SECONDARY SYSTEMS. SEDS CALCULATES THE FOLLOWING:

SINGLE-PHASE SYSTEMS:

- DISTRIBUTION TRANSFORMER COINCIDENT LOADING
- SECONDARY CABLE LOADING COINCIDENT CURRENT
- SECONDARY SERVICE VOLTAGES
- VOLTAGE FLICKER
- SERVICE-ENTRANCE SHORT CIRCUIT CIRCUITS
- COLD LOAD PICKUP GUIDELINES

TO DOWNLOAD

GO TO THE DAE SITE. CLICK ON "INSTALLATIONS". IN THE SEARCH BOX, ENTER "DSTAR". WHEN IT APPEARS, CLICK ON "SECONDARY ELECTRICAL DESIGN", THEN CLICK ON "INSTALL".

INSTRUCTIONS ON HOW TO USE SEDS

GO TO THE DISTRIBUTION STANDARDS SHAREPOINT SITE. THIS CAN BE ACCESSED FROM THE PORTAL. ON THE PORTAL, SELECT "OUR COMPANY", THEN SELECT "DISTRIBUTION OPERATIONS". ON THE DELIVERY OPERATIONS PAGE, GO DOWN TO THE BOTTOM RIGHT. UNDER "DISTRIBUTION STANDARDS LINKS", SELECT "ACTIVE MANUAL". IN THE SHAREPOINT SITE, SELECT "REFERENCE. UNDER REFERENCE, SELECT THE CATEGORY "ENGINEERING TOOLS". THEN SELECT THE SEDS TRAINING GUIDE.

QUESTIONS

CONTACT DISTRIBUTION STANDARDS TO ANSWER ANY QUESTIONS.

CYMCAP

CYMCAP IS A WINDOWS-BASED SOFTWARE DESIGNED TO PERFORM THERMAL ANALYSES. IT ADDRESSES BOTH STEADY STATE AND TRANSIENT THERMAL CABLE RATING. THESE THERMAL ANALYSES PERTAIN TO TEMPERATURE RISE AND/OR AMPACITY CALCULATIONS USING THE ANALYTICAL TECHNIQUES DESCRIBED BY NEHER-MCGRATH AND THE IEC 60287 AND IEC 60853 INTERNATIONAL STANDARDS.

TO DOWNLOAD

GO TO THE DAE SITE. CLICK ON "INSTALLATIONS". IN THE SEARCH BOX, ENTER "CYMCAP". WHEN IT APPEARS, CLICK ON "INSTALL"

INSTRUCTIONS

AFTER DOWNLOADING CYMCAP, OPEN IT AND CLICK ON "HELP", THEN "QUICK REFERENCE". FOR BEGINNERS, THE QUICK REFERENCE GUIDE PROVIDES A STEP BY STEP PROCESS TO DETERMINE THE AMPACITY OF A SELECTED CABLE UNDER VARIOUS CONDITIONS SUCH AS DIRECT BURIAL, IN CONDUCT OR DUCT BANKS.

QUESTIONS

CONTACT DISTRIBUTION STANDARDS TO ANSWER ANY QUESTIONS.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CYMCAP SOFTWARE

DEC	DEM	DEP	DEF
X	X	X	X

20.08-183

CABLE PULLING ASSISTANT

THE CABLE PULLING ASSISTANT (CPA) SOFTWARE IS USED TO QUICKLY CALCULATE CABLE PULLING TENSIONS AND SIDEWALL PRESSURES FOR A GIVEN LAYOUT. IT ALLOWS EASY COMPARISON OF PULLS IN EITHER DIRECTION. CPA ALSO CALCULATES PROBABILITY OF CABLE JAM, CONDUIT FILL, AND CONDUIT CLEARANCES.

TO DOWNLOAD

GO TO THE DAE SITE. CLICK ON “INSTALLATIONS”. IN THE SEARCH BOX, ENTER “DSTAR”. WHEN IT APPEARS, CLICK ON “DSTAR CABLE PULLING ASSISTANT”, THEN CLICK ON “INSTALL”

INSTRUCTIONS ON HOW TO USE THE CABLE PULLING ASSISTANT

GO TO THE DISTRIBUTION STANDARDS SHAREPOINT SITE. THIS CAN BE ACCESSED FROM THE PORTAL. ON THE PORTAL, SELECT “OUR COMPANY”, THEN SELECT “DISTRIBUTION OPERATIONS”. ON THE DELIVERY OPERATIONS PAGE, GO DOWN TO THE BOTTOM RIGHT. UNDER “DISTRIBUTION STANDARDS LINKS”, SELECT "ACTIVE MANUAL". IN THE SHAREPOINT SITE, SELECT “REFERENCE”. UNDER REFERENCE, SELECT THE CATEGORY "ENGINEERING TOOLS". THEN SELECT THE “CABLE PULLING ASSISTANT AND INSTRUCTIONS”.

QUESTIONS

CONTACT DISTRIBUTION STANDARDS TO ANSWER ANY QUESTIONS.

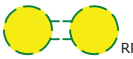
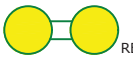
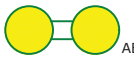
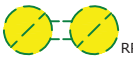
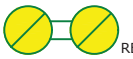
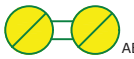
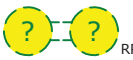
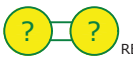
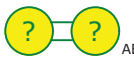
DUKE ENERGY.

3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CABLE PULLING ASSISTANT SOFTWARE

DEC	DEM	DEP	DEF
X	X	X	X

20.08-185

SUPPORT STRUCTURES						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
POLE COMPANY OWNED						
POLE FOREIGN/CUSTOMER OWNED						
POLE UNKNOWN OWNER						
POLE STRUCTURE COMPANY OWNED						
POLE STRUCTURE FOREIGN/CUSTOMER OWNED						
POLE STRUCTURE UNKNOWN OWNER						
PUSH POLE						

SUPPORT STRUCTURES						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
MANHOLE						
VAULT						
PULLBOX						
PAD						
PIT						
CABINET						

3					
2					
1					
0	3/31/18	FLETCHER	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201A

PRIMARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
ARRESTOR			 RPL	 REM	 ABAN	
CAPACITOR			 RPL	 REM	 ABAN	
ELBOW (LOADBREAK)						
ELBOW (NON-LOADBREAK)						
FAULT INDICATOR			 RPL	 REM	 ABAN	
GUY (EXCEPT SPAN)			 RPL	 REM	 ABAN	
GUY (SPAN)			 RPL	 REM	 ABAN	

PRIMARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
OVERHEAD TRANSFORMER (SINGLE-PHASE)			 RPL	 REM	 ABAN	
OVERHEAD TRANSFORMER (TWO-PHASE)			 RPL	 REM	 ABAN	
OVERHEAD TRANSFORMER (THREE-PHASE)			 RPL	 REM	 ABAN	
UNDERGROUND TRANSFORMER (SINGLE-PHASE)			 RPL	 REM	 ABAN	
UNDERGROUND TRANSFORMER (THREE-PHASE)			 RPL	 REM	 ABAN	
UNDERGROUND TRANSFORMER BANK (TWO TRANSFORMERS ON DIFFERENT PADS WIRED TOGETHER)	 BANK	 BANK	 BANK RPL	 BANK REM	 BANK ABAN	 BANK

3					
2					
1					
0	3/31/18	FLETCHER	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

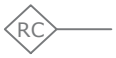
GIS SYMBOLS

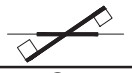
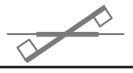
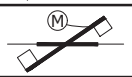
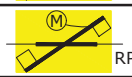
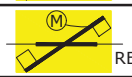
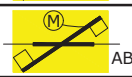
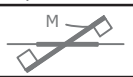
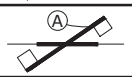
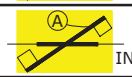
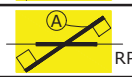
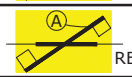
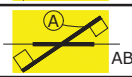
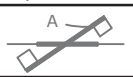
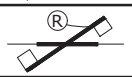
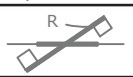
OVERHEAD AND UNDERGROUND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201B

PRIMARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
SECTIONALIZER						
SWITCHGEAR						
UNDERGROUND SPLICE						
RECLOSER						
RESERVE CAPACITY						
PRIMARY OPEN						
REGULATOR						

PRIMARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
SWITCH (NON-LOADBREAK)						
SWITCH (LOADBREAK)						
AIRBREAK (NON-LOADBREAK)						
AIRBREAK (LOADBREAK)						
AIRBREAK (LOADBREAK, MOTORIZED)						
AIRBREAK (LOADBREAK, AUTOMATIC)						
AIRBREAK (LOADBREAK, REMOTE CONTROL)						

3					
2					
1					
0	3/31/18	FLETCHER	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201C

PRIMARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
PRIMARY METER						
FUSE (ALL FUSES EXCEPT SOLID BAR)						
FUSE SOLID BAR						
DISTRIBUTED GENERATION						
STEP-DOWN TRANSFORMER (SINGLE-PHASE)						
STEP-DOWN TRANSFORMER (TWO-PHASE)						
STEP-DOWN TRANSFORMER (THREE-PHASE)						
NOTES: THE SINGLE-PHASE TRANSFORMERS ABOVE DO NOT SHOW THE ANNOTATED PHASING VALUE (A, B, C) WHICH WOULD BE INCLUDED WITH THE SYMBOL. SEE SYMBOLOGY SHEETS.						

SECONDARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
DEMAND POINT (BASE SYMBOL)						
DEMAND POINT (MEDICAL)						
DEMAND POINT (MAC)						
DEMAND POINT (TRAFFIC)						
DEMAND POINT (KEY)						

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201D

SECONDARY EQUIPMENT						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
HANDHOLE			 RPL	 REM	 ABAN	
SECONDARY OPEN			 RPL	 REM	 ABAN	
SECONDARY PEDESTAL			 RPL	 REM	 ABAN	
METER PEDESTAL			 RPL	 REM	 ABAN	
SECONDARY BUS ENCLOSURE			 RPL	 REM	 ABAN	

PRIMARY CONDUCTORS - COMPANY OWNED						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
SINGLE-PHASE UNDERGROUND			RPL	REM	ABAN	
TWO-PHASE UNDERGROUND			RPL	REM	ABAN	
THREE-PHASE UNDERGROUND			RPL	REM	ABAN	
SINGLE-PHASE OVERHEAD			RPL	REM	DUKE WILL NOT BE USING PROPOSED ABANDON FOR OVERHEAD	
TWO-PHASE OVERHEAD			RPL	REM		
THREE-PHASE OVERHEAD			RPL	REM		

NOTES: ON UNDERGROUND, STATUS TEXT WILL NOT BE USED ON 1:200 SCALE AND ABOVE.
ON OVERHEAD, STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201E

PRIMARY CONDUCTORS - CUSTOMER OWNED / FOREIGN OWNED						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
SINGLE-PHASE UNDERGROUND	OTHER	OTHER	OTHER RPL	OTHER REM	OTHER ABAN	OTHER
TWO-PHASE UNDERGROUND	OTHER	OTHER	OTHER RPL	OTHER REM	OTHER ABAN	OTHER
THREE-PHASE UNDERGROUND	OTHER	OTHER	OTHER RPL	OTHER REM	OTHER ABAN	OTHER
SINGLE-PHASE OVERHEAD	OTHER	OTHER	OTHER RPL	OTHER REM	DUKE WILL NOT BE USING PROPOSED ABANDON FOR OVERHEAD	OTHER
TWO-PHASE OVERHEAD	OTHER	OTHER	OTHER RPL	OTHER REM		OTHER
THREE-PHASE OVERHEAD	OTHER	OTHER	OTHER RPL	OTHER REM		OTHER
NOTES: ON UNDERGROUND, STATUS TEXT WILL NOT BE USED ON 1:200 SCALE AND ABOVE. ON OVERHEAD, STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE. EACH PIECE OF CONDUCTOR WILL HAVE THE OWNER AND STATUS TEXT. FOR LONG SPANS, THE TEXT SHOULD APPEAR ONCE EVERY TWO INCHES.						

PRIMARY CONDUCTORS - UNKNOWN						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
SINGLE-PHASE UNDERGROUND	UNK	UNK	UNK RPL	UNK REM	UNK ABAN	UNK
TWO-PHASE UNDERGROUND	UNK	UNK	UNK RPL	UNK REM	UNK ABAN	UNK
THREE-PHASE UNDERGROUND	UNK	UNK	UNK RPL	UNK REM	UNK ABAN	UNK
SINGLE-PHASE OVERHEAD	UNK	UNK	UNK RPL	UNK REM	DUKE WILL NOT BE USING PROPOSED ABANDON FOR OVERHEAD	UNK
TWO-PHASE OVERHEAD	OTHER	OTHER	OTHER RPL	OTHER REM		OTHER
THREE-PHASE OVERHEAD	UNK	UNK	UNK RPL	UNK REM		UNK
NOTES: ON UNDERGROUND, STATUS TEXT WILL NOT BE USED ON 1:200 SCALE AND ABOVE. ON OVERHEAD, STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE. EACH PIECE OF CONDUCTOR WILL HAVE THE OWNER AND STATUS TEXT. FOR LONG SPANS, THE TEXT SHOULD APPEAR ONCE EVERY TWO INCHES.						

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK

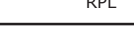
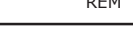
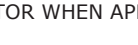
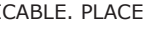
GIS SYMBOLS

OVERHEAD AND UNDERGROUND

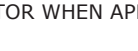
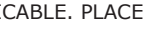
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201F

SECONDARY CONDUCTORS OVERHEAD						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
OVERHEAD TWO WIRE COMPANY OWNED					DUKE WILL NOT BE USING PROPOSED ABANDON FOR OVERHEAD	
OVERHEAD THREE WIRE COMPANY OWNED						
OVERHEAD THREE-PHASE THREE WIRE COMPANY OWNED						
OVERHEAD THREE-PHASE FOUR WIRE COMPANY OWNED						
ALL CUSTOMER OWNED/ FOREIGN OWNED						
ALL UNKNOWN						

NOTES: SHOW OWNER AND STATUS TEXT ONCE PER CONDUCTOR WHEN APPLICABLE. PLACE TEXT AT MIDPOINT OF CONDUCTOR.
OWNER AND STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE.

SECONDARY CONDUCTORS UNDERGROUND						
OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
UNDERGROUND TWO WIRE COMPANY OWNED						
UNDERGROUND THREE WIRE COMPANY OWNED						
UNDERGROUND THREE-PHASE THREE WIRE COMPANY OWNED						
UNDERGROUND THREE-PHASE FOUR WIRE COMPANY OWNED						
ALL CUSTOMER OWNED/ FOREIGN OWNED						
ALL UNKNOWN						

NOTES: SHOW OWNER AND STATUS TEXT ONCE PER CONDUCTOR WHEN APPLICABLE. PLACE TEXT AT MIDPOINT OF CONDUCTOR.
OWNER AND STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201G

SERVICE CONDUCTORS OVERHEAD

OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
OVERHEAD TWO WIRE COMPANY OWNED	2	2	2 RPL	2 REM		2
OVERHEAD THREE WIRE COMPANY OWNED	3	3	3 RPL	3 REM	DUKE WILL NOT BE USING PROPOSED ABANDON FOR OVERHEAD	3
OVERHEAD THREE-PHASE THREE WIRE COMPANY OWNED	3	3	3 RPL	3 REM		3
OVERHEAD THREE-PHASE FOUR WIRE COMPANY OWNED	4	4	4 RPL	4 REM		4
ALL CUSTOMER OWNED	CUST	CUST	CUST RPL	CUST REM		CUST
ALL UNKNOWN	UNK	UNK	UNK RPL	UNK REM		UNK
ALL FOREIGN OWNED	FOREIGN	FOREIGN	FOREIGN RPL	FOREIGN REM		FOREIGN

NOTES: SHOW OWNER, PHASE AND STATUS TEXT ONCE PER CONDUCTOR WHEN APPLICABLE. PLACE TEXT AT MIDPOINT OF CONDUCTOR.
OWNER AND STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE.

SERVICE CONDUCTORS UNDERGROUND

OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
UNDERGROUND TWO WIRE COMPANY OWNED	2U	2U	2U RPL	2U REM	2U ABAN	2U
UNDERGROUND THREE WIRE COMPANY OWNED	3U	3U	3U RPL	3U REM	3U ABAN	3U
UNDERGROUND THREE-PHASE THREE WIRE COMPANY OWNED	3U	3U	3U RPL	3U REM	3U ABAN	3U
UNDERGROUND THREE-PHASE FOUR WIRE COMPANY OWNED	4U	4U	4U RPL	4U REM	4U ABAN	4U
ALL CUSTOMER OWNED	CUST UG	CUST UG	CUST UG RPL	CUST UG REM	CUST UG ABAN	CUST UG
ALL UNKNOWN	UNK UG	UNK UG	UNK UG RPL	UNK UG REM	UNK UG ABAN	UNK UG
ALL FOREIGN OWNED	FOR UG	FOR UG	FOR UG RPL	FOR UG REM	FOR UG ABAN	FOR UG

NOTES: SHOW OWNER, PHASE AND STATUS TEXT ONCE PER CONDUCTOR WHEN APPLICABLE. PLACE TEXT AT MIDPOINT OF

OWNER AND STATUS TEXT WILL NOT BE USED ON 1:400 SCALE AND ABOVE.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

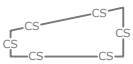
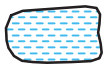
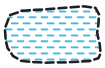
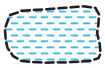
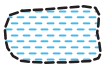
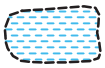
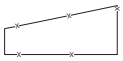
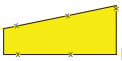
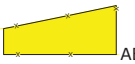
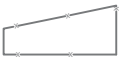
DEC	DEM	DEP	DEF
X	X	X	X

20.10-201H

LIGHTING EQUIPMENT

OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
LIGHT (AREA)			 RPL	 REM	 ABAN	
LIGHT (OL)			 RPL	 REM	 ABAN	
LIGHT (OLE)			 RPL	 REM	 ABAN	
LIGHT (STREET)			 RPL	 REM	 ABAN	
DECORATIVE POLE			 RPL	 REM	 ABAN	

MISCELLANEOUS OBJECTS

OBJECT	EXISTING/ TEMPORARY	PROPOSED (INSTALL NEW)	PROPOSED REPLACE	PROPOSED REMOVE	PROPOSED ABANDON	ABANDONED/ INACTIVE
CUSTOMER STATION			 RPL	 REM	 ABAN	
CUSTOMER STATION (EXTENT)			 RPL	 REM	 ABAN	
CONTRACT AREA						
SUBSTATION (LOCATION)			 RPL	 REM	 ABAN	
SUBSTATION (EXTENT)			 RPL	 REM	 ABAN	
MID SPAN TAP			 RPL	 REM	 ABAN	
CIRCUIT			 RPL	 REM	 ABAN	
CONDUIT			 RPL	 REM	 ABAN	
DUCT			 RPL	 REM	 ABAN	
HYPERNODE						
WIRE CHANGE						
FIBER OPTIC LINE						
STRUCTURE NODE						

DUKE ENERGY.

3				
2				
1				
0	3/31/18	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

GIS SYMBOLS

OVERHEAD AND UNDERGROUND

DEC	DEM	DEP	DEF
X	X	X	X

20.10-201I

21.00 GENERAL RISER CONSTRUCTION INFORMATION

21.01 CONDUIT AND U-GUARD RISERS ON WOOD, STEEL AND CONCRETE POLES

21.02 SINGLE-PHASE PRIMARY RISER CONSTRUCTION

21.03 THREE-PHASE 200A PRIMARY RISERS ON HORIZONTAL CONSTRUCTION

21.04 THREE-PHASE 200A PRIMARY RISERS ON VERTICAL CONSTRUCTION

DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	KATIGBAK	BURLISON	ADCOCK

SECTION 21 - OH-UG TRANSITION

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

21.05 THREE-PHASE 600A PRIMARY RISERS ON HORIZONTAL CONSTRUCTION

21.06 THREE-PHASE 600A PRIMARY RISERS ON VERTICAL CONSTRUCTION

THE SPECIFICATIONS CONTAINED IN SECTION 21 ARE INTENDED TO SERVE AS THE PREFERRED CONSTRUCTION METHODS FOR OVERHEAD TO UNDERGROUND RISER CONFIGURATIONS ON STANDARD DUKE ENERGY DISTRIBUTION PRIMARY LINES. THE LOCATION AND SPACING OF EQUIPMENT, HARDWARE, AND CONDUCTORS HAS BEEN CHOSEN TO PROVIDE THE BEST DESIGN IN TERMS OF SAFETY, OPERATION, MAINTENANCE, AND RELIABILITY. THESE SPECIFICATIONS SHALL BE FOLLOWED FOR CONSTRUCTION OF RISERS ON ALL NEW LINES, AND ON ALL EXISTING LINES UNLESS EXTENUATING CIRCUMSTANCES REQUIRE THE USE OF ALTERNATE METHODS. ALTERATIONS TO THESE SPECIFICATIONS REQUIRE APPROVAL BY THE LOCAL ENGINEERING MANAGEMENT.

INFORMATION CONTAINED IN OTHER SECTIONS OF THE ENTERPRISE-WIDE MANUAL HAS NOT BEEN DUPLICATED HERE, AND THE USER WILL BE DIRECTED TO THOSE SECTIONS FOR SPECIFIC DETAILS. EACH RISER SPECIFICATION WILL SHOW A CIRCLE AT THE PRIMARY CONNECTION TO THE OVERHEAD LINE, AND THE BILL OF MATERIALS WILL DIRECT THE DESIGNER TO SECTION 04 OF THIS MANUAL FOR SELECTION OF THE PROPER CONNECTOR. THE USER WILL ALSO BE REFERRED TO SECTION 26 CABLE ACCESSORIES FOR DETAILS AND PROPER SPECIFICATION OF UNDERGROUND PRIMARY CABLE TERMINATIONS.

SPECIFICATIONS ARE PROVIDED FOR THE INSTALLATION OF CONDUIT AND RISER SHIELDS ON WOOD, AND ON CONCRETE AND STEEL POLES. PREFERRED PRACTICES CONCERNING USE OF CONDUIT VERSUS RISER SHIELDS IS DETERMINED BY C&M AND LOCAL ENGINEERING MANAGEMENT. IN ALL CASES WHERE RISER SHIELDS ARE USED, A BACKING PLATE MUST BE INSTALLED FOR AT LEAST THE FIRST EIGHT (8) FEET ABOVE GROUND LEVEL TO PREVENT ANY GAPS BETWEEN THE RISER SHIELD AND THE POLE.

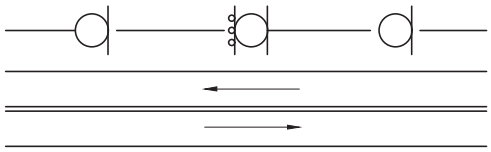
NOTES:

1. FOR NEW INSTALLATIONS, A MAXIMUM OF 2 CONDUITS OR RISER SHIELDS SHOULD BE DIRECTLY ATTACHED TO A POLE. IF IT IS KNOWN AT THE TIME OF INSTALLATION THAT AN ADDITIONAL SERVICE WILL BE REQUIRED FROM THE SAME POLE, INSTALL A PEDESTAL AT THE BASE OF THE POLE AND AN APPROPRIATELY SIZED CONDUCTOR THAT CAN ACCOMMODATE BOTH SERVICES.

2. THE USE OF STANDOFF BRACKETS FOR MULTIPLE RISERS IS NO LONGER ALLOWED. REFER TO LEGACY STANDARDS FOR NECESSARY MAINTENANCE OF EXISTING STANDOFF BRACKETS.

3. DO NOT INSTALL MULTIPLE SERVICES IN THE SAME CONDUIT OR RISER SHIELD.

4. RISERS SHOULD BE LOCATED ON THE POLE IN THE SAFEST AVAILABLE POSITION WITH RESPECT TO CLIMBING AND POSSIBLE EXPOSURE TO TRAFFIC. IN GENERAL, THIS WILL BE OPPOSITE THE FLOW OF TRAFFIC AS SHOWN BELOW.



TRAFFIC FLOW

5. CONSIDERATION SHOULD BE GIVEN TO EXISTING JOINT USE RISERS AND THE POTENTIAL FOR JOINT USE RISERS TO BE ADDED IN THE FUTURE. EACH JOINT USER CAN BE ALLOWED THEIR OWN CONDUIT. FOR CLIMBING PURPOSES, THE COMBINATION OF JOINT USE AND COMPANY RISERS SHOULD STILL ALLOW AT LEAST ONE, AND PREFERABLY TWO, CLEAN QUADRANTS OF THE POLE.

6. AN EXCEPTION FOR A THIRD COMPANY RISER CAN BE ALLOWED WHEN ALL OF THE FOLLOWING CONDITIONS ARE MET:

   - THE THIRD RISER MUST BE NO LARGER THAN 2”.
   - THE POLE IS EASILY ACCESSIBLE BY A BUCKET TRUCK.
   - OTHER UTILITIES ARE NOT LIKELY TO INSTALL A RISER ON THE POLE.
   - LOCAL MANAGEMENT AGREES THAT THE ADDITIONAL RISER WILL NOT HINDER COMPANY PERSONNEL WORKING ON THE POLE IN THE FUTURE.
   - THE RISER CAN BE POSITIONED ON THE POLE SUCH THAT THE CABLE CAN BE EASILY ROUTED AROUND ALL FACILITIES AT THE TOP OF THE POLE SUCH AS NEUTRALS, SECONDARIES, OTHER UTILITIES, ETC.

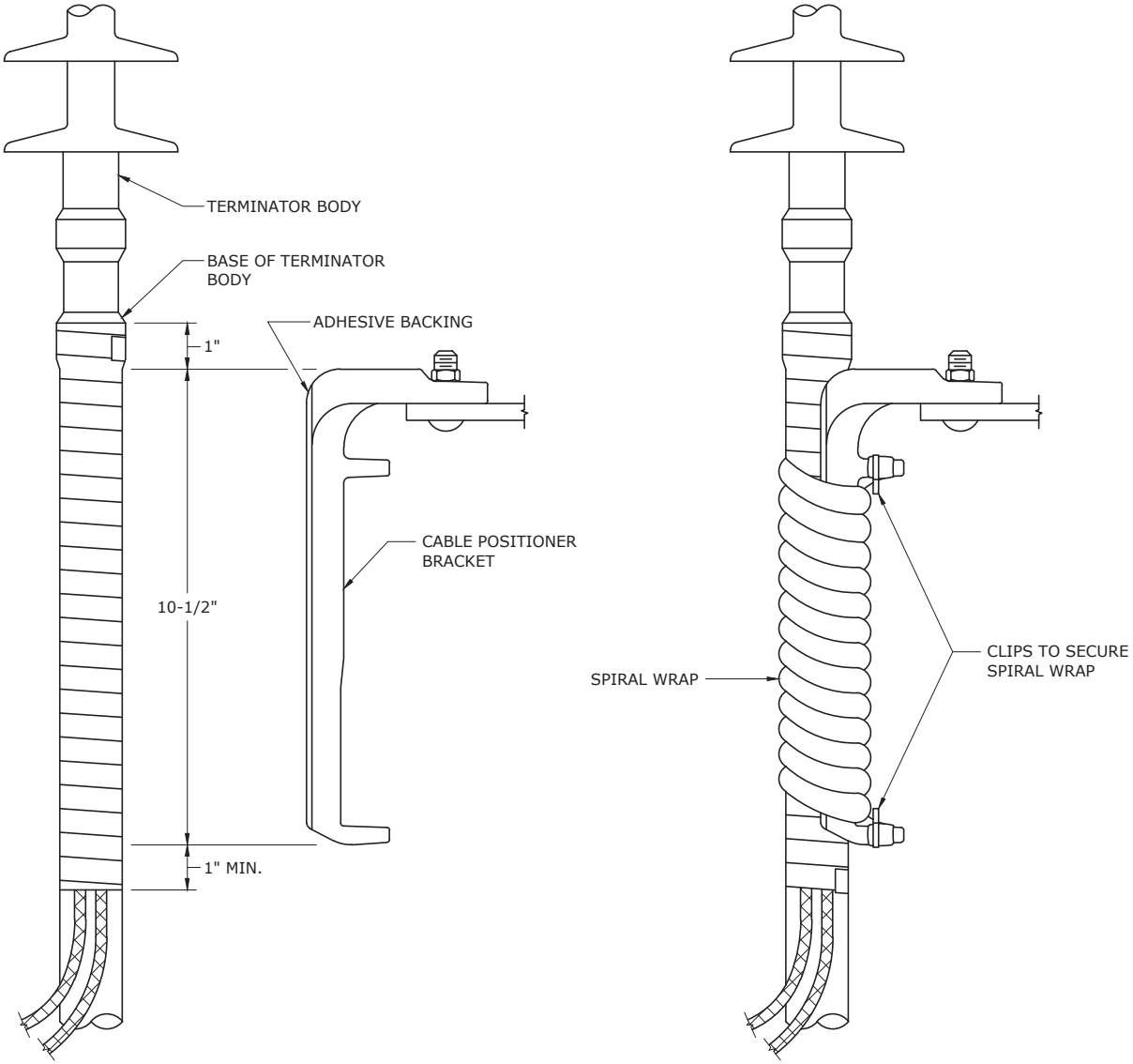
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

MULTIPLE RISERS ON A POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.00-110



STARTING 1" ABOVE THE BASE OF THE TERMINATOR BODY, WRAP 2 HALF-LAPPED LAYERS OF HIGH VOLTAGE TAPE OVER THE GROUND BRAIDS OR CONCENTRIC NEUTRAL WIRE AND THE CABLE JACKET. THE TAPE SHOULD EXTEND TO AT LEAST 1" BELOW THE BOTTOM OF THE CABLE POSITIONER BRACKET.

EXPOSE THE ADHESIVE BACKING ON THE CABLE POSITIONER BRACKET AND POSITION THE CABLE AS SHOWN.

INSTALL THE SPIRAL WRAP (PROVIDED WITH THE CABLE POSITIONER BRACKET) TO SECURE THE CABLE TO THE BRACKET.

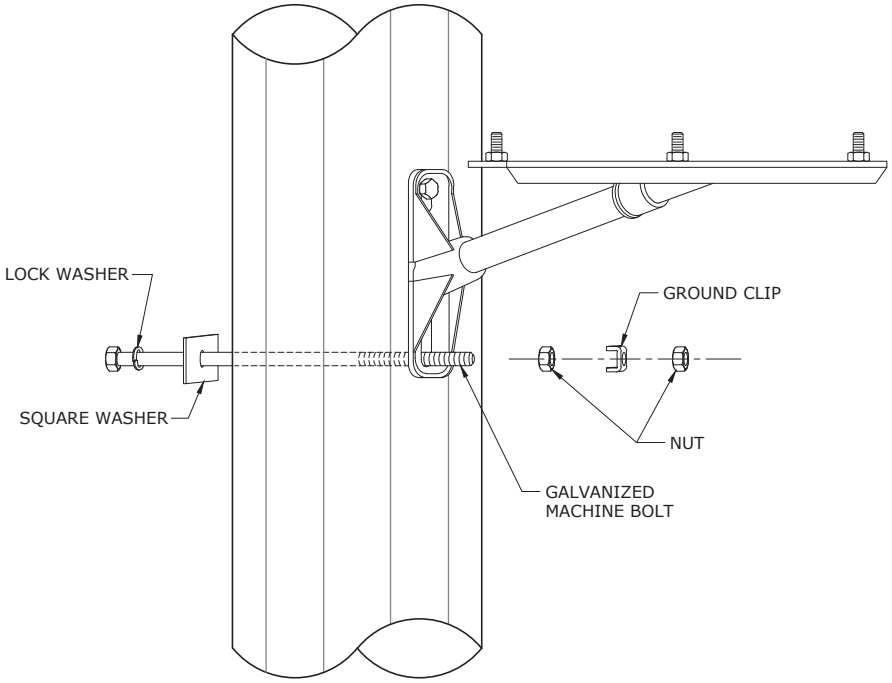
CABLE POSITIONER BRACKET AND ALL ITEMS SHOWN ABOVE ARE INCLUDED IN THE CU FOR THE TERMINATION KIT. SEE SECTION 26 CABLE ACCESSORIES FOR ALL PRIMARY TERMINATION KIT COMPATIBLE UNITS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

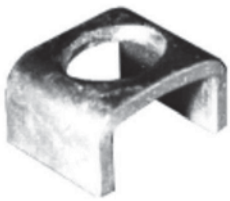
TERMINATION CABLE POSITIONER BRACKET

DEC	DEM	DEP	DEF
X	X	X	X

21.00-130



GROUNDING STEEL POLES



GROUND CLIP COMPATIBLE UNITS		
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
GND-POLE-CLIP-5/8-F	50121452	CLIP, BONDING, GALV. STEEL, 5/8"
GND-POLE-CLIP-3/4-F	50124574	CLIP, BONDING, GALV. STEEL, 3/4"

NOTES:

1. GROUNDING CLIP DOES NOT INCLUDE NUT.

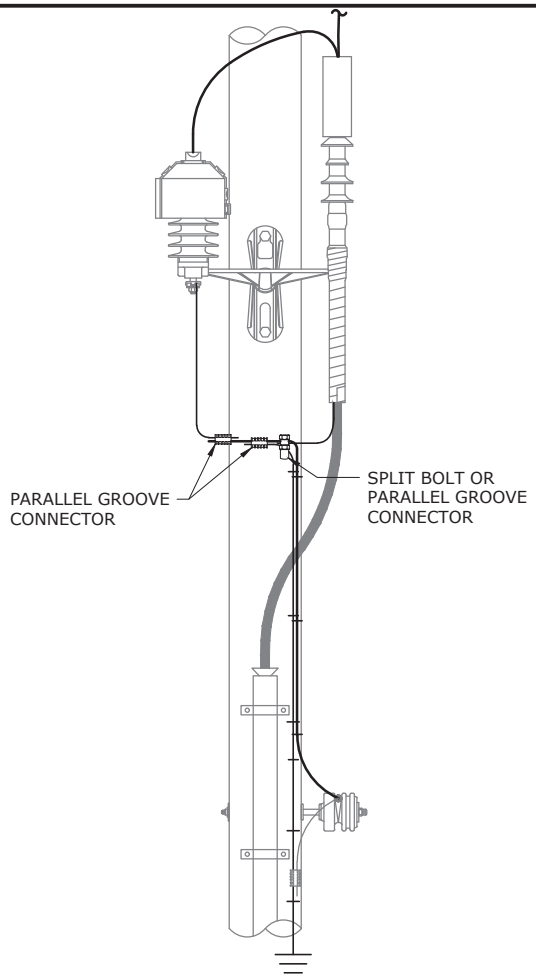
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

GROUNDING AND BONDING
GROUND CLIP FOR THREADED BOLTS
IN STEEL POLES

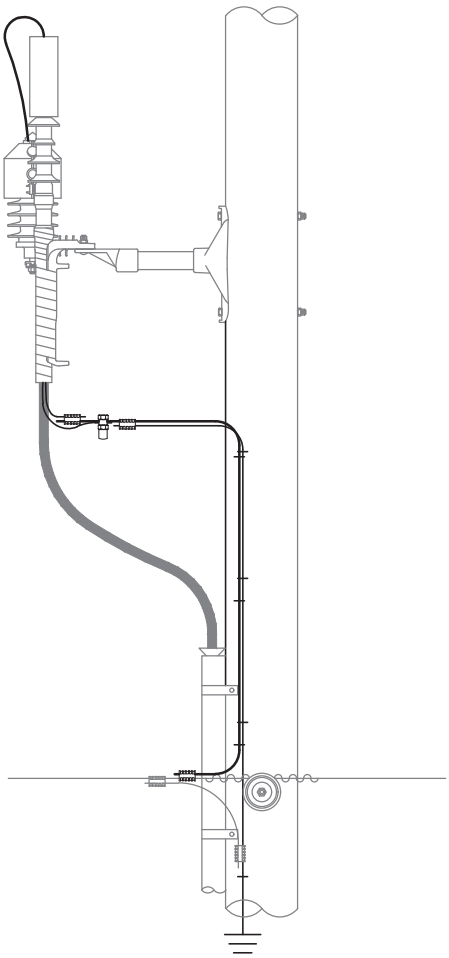
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.00-131



FRONT VIEW

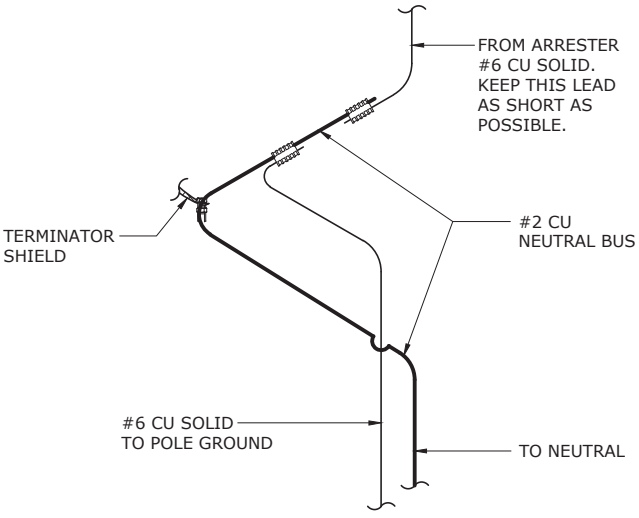


SIDE VIEW

NOTES:

1. EITHER SPLIT BOLT OR PARALLEL GROOVE CONNECTIONS MAY BE USED TO CONNECT TERMINATION BRAIDS OR CONCENTRIC NEUTRALS TO NEUTRAL BUS. ALL OTHER CONNECTIONS SHOWN ARE PARALLEL GROOVE TYPE SQUEEZE-ON CONNECTIONS.

2. CONNECT NEUTRAL BUS AS CLOSE AS POSSIBLE TO WHERE BRAIDS OR CONCENTRIC NEUTRALS EXIT TAPE AT BOTTOM OF CABLE POSITIONER BRACKET. CUT OFF EXCESS LENGTH OF BRAID.



NEUTRAL BUS AND GROUND DETAIL

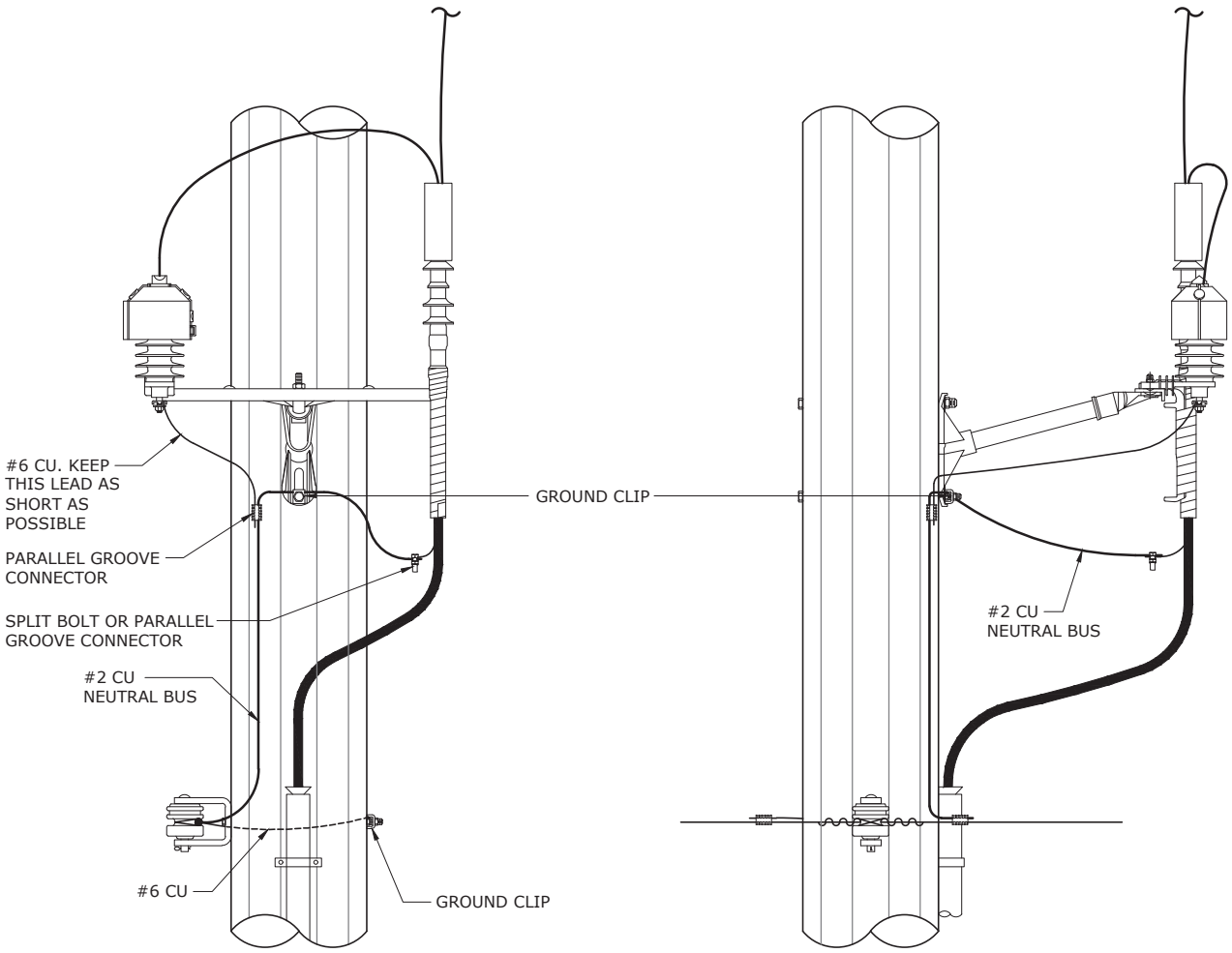
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

GROUNDING AND BONDING
SINGLE-PHASE RISER DETAIL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.00-132



FRONT VIEW

SIDE VIEW
(FROM LEFT SIDE)

NOTES:

1. EITHER SPLIT BOLT OR PARALLEL GROOVE CONNECTIONS MAY BE USED TO CONNECT TERMINATION BRAIDS OR CONCENTRIC NEUTRALS TO NEUTRAL BUS. ALL OTHER CONNECTIONS SHOWN ARE PARALLEL GROOVE TYPE SQUEEZE-ON CONNECTIONS.

2. CONNECT NEUTRAL BUS AS CLOSE AS POSSIBLE TO WHERE BRAIDS OR CONCENTRIC NEUTRALS EXIT TAPE AT BOTTOM OF CABLE POSITIONER BRACKET. CUT OFF EXCESS LENGTH OF BRAID.

3. THE SYSTEM NEUTRAL SHALL BE BONDED TO EVERY STEEL POLE.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

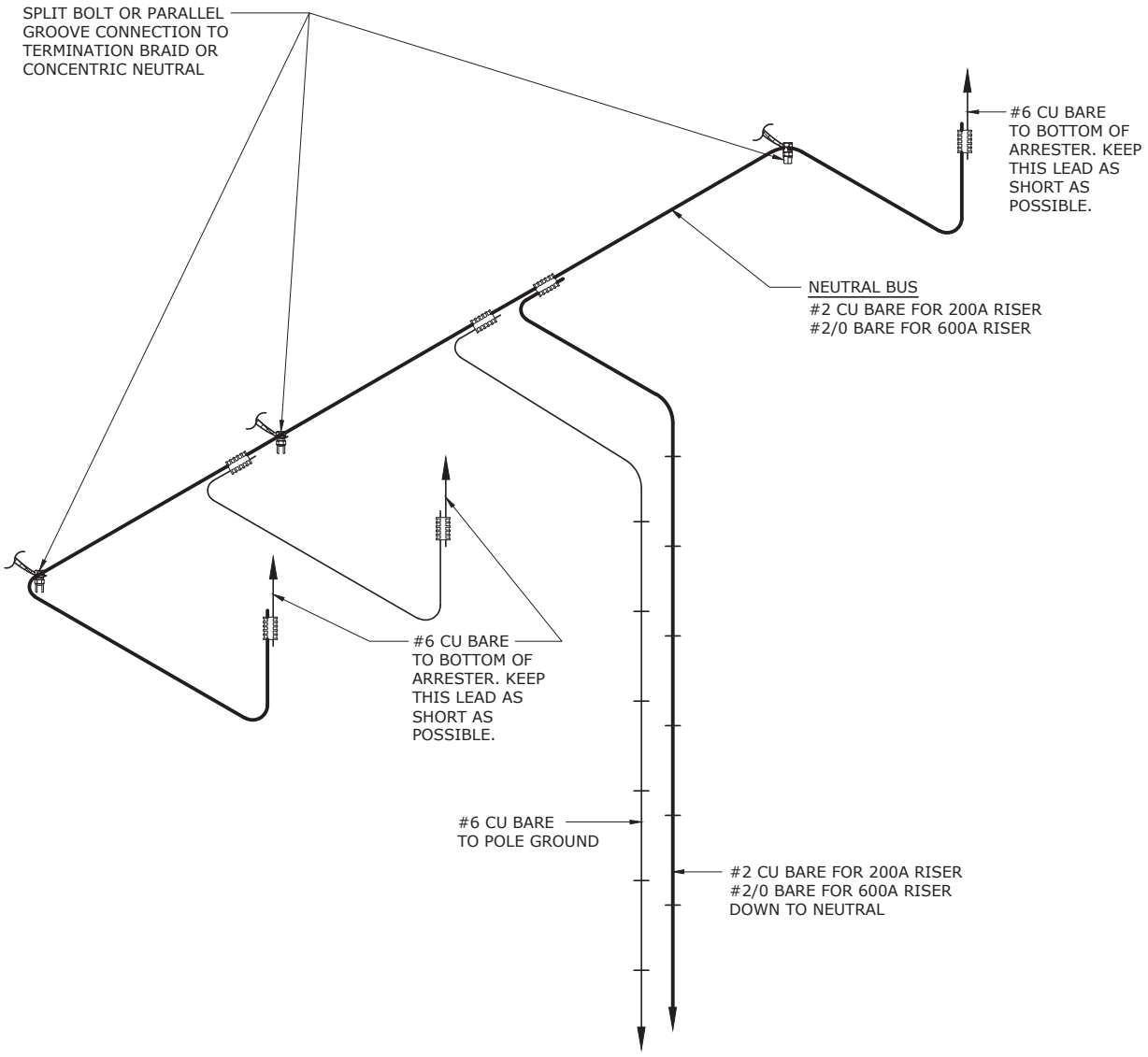
DUKE ENERGY.

GROUNDING AND BONDING

SINGLE-PHASE RISERS ON STEEL POLES

DEC	DEM	DEP	DEF
X	X	X	X

21.00-133



NEUTRAL BUS AND GROUND DETAIL

NOTES:

1. EITHER SPLIT BOLT OR PARALLEL GROOVE CONNECTIONS MAY BE USED TO CONNECT TERMINATION BRAIDS OR CONCENTRIC NEUTRALS TO NEUTRAL BUS. ALL OTHER CONNECTIONS SHOWN ARE PARALLEL GROOVE TYPE SQUEEZE-ON CONNECTIONS.

2. CONNECT NEUTRAL BUS AS CLOSE AS POSSIBLE TO WHERE BRAIDS OR CONCENTRIC NEUTRALS EXIT TAPE AT BOTTOM OF CABLE POSITIONER BRACKET. CUT OFF EXCESS LENGTH OF BRAID.

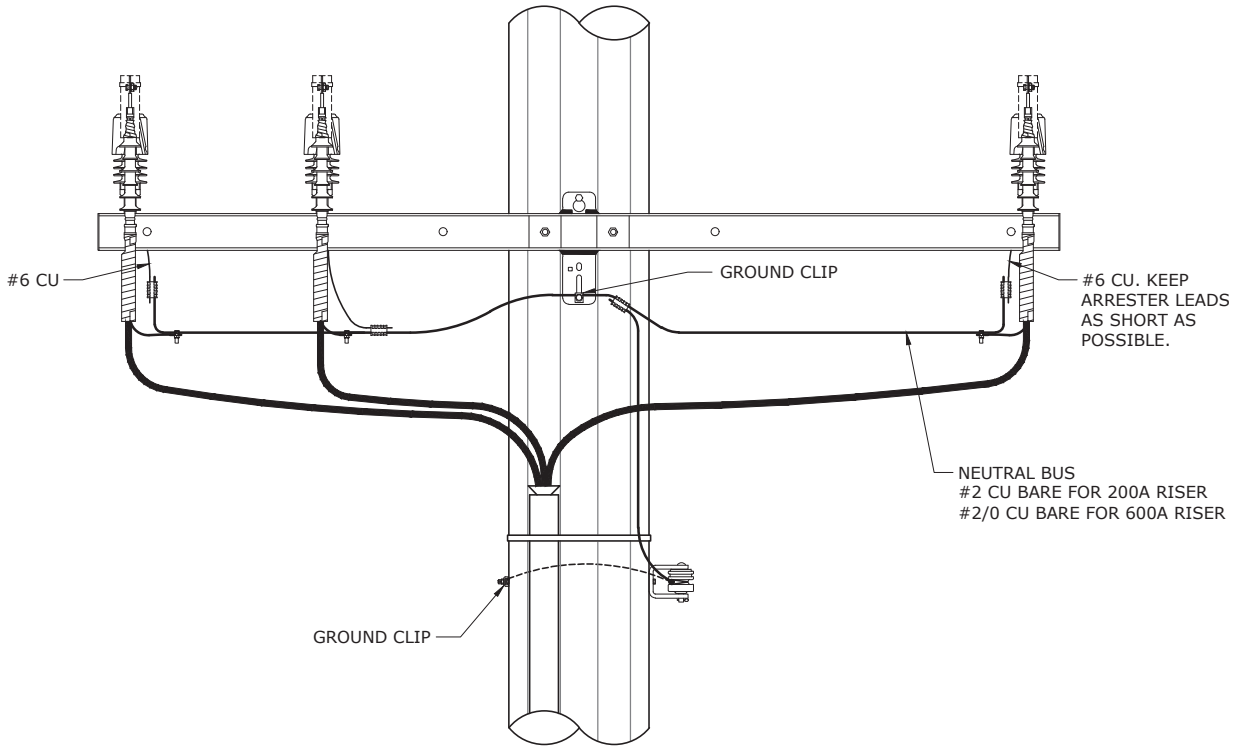
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

GROUNDING AND BONDING
THREE-PHASE RISER DETAIL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.00-134



NOTES:

1. THE NEUTRAL BUS IS BONDED TO THE POLE AT THE CROSSARM MOUNTING PLATE AND CONTINUES DOWN TO CONNECT TO THE SYSTEM NEUTRAL.

2. EITHER SPLIT BOLT OR PARALLEL GROOVE CONNECTIONS MAY BE USED TO CONNECT TERMINATION BRAIDS OR CONCENTRIC NEUTRALS TO NEUTRAL BUS. ALL OTHER CONNECTIONS SHOWN ARE PARALLEL GROOVE TYPE SQUEEZE-ON CONNECTIONS.

3. CONNECT NEUTRAL BUS AS CLOSE AS POSSIBLE TO WHERE BRAIDS OR CONCENTRIC NEUTRALS EXIT TAPE AT BOTTOM OF CABLE POSITIONER BRACKET. CUT OFF EXCESS LENGTH OF BRAID.

4. THE SYSTEM NEUTRAL SHALL BE BONDED TO EVERY STEEL POLE.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

GROUNDING AND BONDING
THREE-PHASE RISERS ON STEEL POLES

DEC	DEM	DEP	DEF
X	X	X	X

21.00-135

DEC COMPATIBLE UNIT TABLE - RISER NEUTRAL, GROUNDING, AND BONDING CONDUCTORS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GND-POLE-6-C	1	234664	30 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			1490676	1 LB.	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA, BEZINAL COATED
2	GND-EQUIP-2-BOND-C	1	106164	4 LB.	WIRE/CABLE, ELECT., BARE, RISER, SOL, 2 AWG, CU, SOFT DRAWN
			62745	1	CONNECTOR, ELECT., SPLIT BOLT, 6 SOL - 2 STR AWG CONDUCTOR
3	GND-EQUIP-2/0-BOND-C	1	1502506	1	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER

DEM COMPATIBLE UNIT TABLE - RISER NEUTRAL, GROUNDING, AND BONDING CONDUCTORS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GND-POLE-6-M	1	50127414	4 LB.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, 25 LB SPOOL
			1490676	0.02 LB.	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA, BEZINAL COATED
2	GND-EQUIP-2-BOND-M	1	106164	4 LB.	WIRE/CABLE, ELECT., BARE, RISER, SOL, 2 AWG, CU, SOFT DRAWN
			933366	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 6 X 1 STR ACSR
3	GND-EQUIP-2/0-BOND-M	1	1502506	1	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER

DEP COMPATIBLE UNIT TABLE - RISER NEUTRAL, GROUNDING, AND BONDING CONDUCTORS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GND-POLE-6-P	1	234664	40 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			1490676	2 LB.	STAPLE, 1-1/2" LG, STL, 8 GA - .162" DIA, BEZINAL COATED
			933366	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 6 X 1 STR ACSR
2	GND-EQUIP-2-BOND-P	1	4173267	5 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
3	GND-EQUIP-2/0-BOND-P	5	1502506	1 FT.	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER

DEF COMPATIBLE UNIT TABLE - RISER NEUTRAL, GROUNDING, AND BONDING CONDUCTORS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	GND-POLE-6-F	1	234664	40 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			4001715	40	STAPLE, DIAMOND PT, 2" X 5/8" X 3/16", GALV STL
			933366	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 6 X 1 STR ACSR
2	GND-EQUIP-2-BOND-F	1	4173267	5 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
3	GND-EQUIP-2/0-BOND-F	1	1502506	1	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER

DUKE ENERGY.

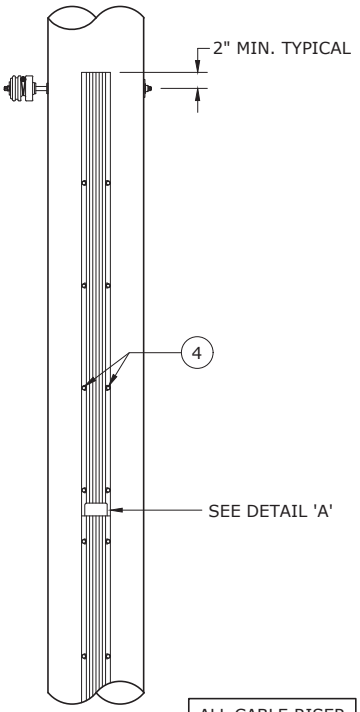
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

GROUNDING AND BONDING

COMPATIBLE UNIT TABLES FOR CONDUCTORS

DEC	DEM	DEP	DEF
X	X	X	X

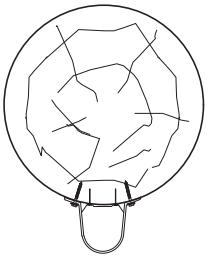
21.00-140



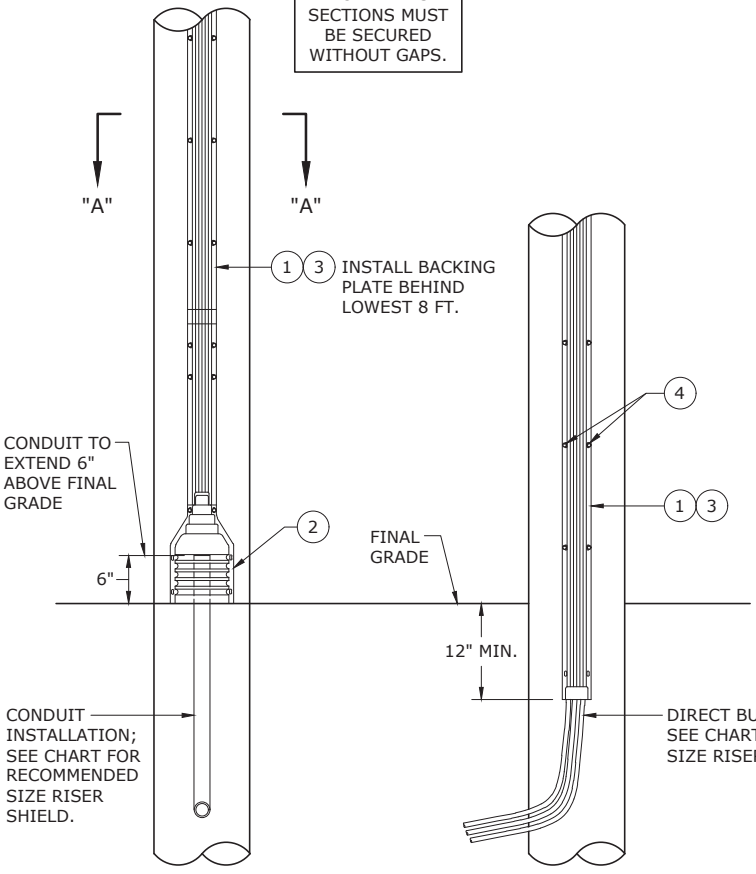
RISER SHIELD SIZE FOR DIRECT BURIED CABLES		
RISER SHIELD	PRIMARY	600 VOLT
2"	ONE 1/0 AL 15KV LC ONE 4/0 AL 15KV J.C.N. ONE 1/0 AL 35KV J.C.N.	UP TO THREE 4/0 AWG
3"	THREE 1/0 AL 15KV LC THREE 4/0 AL 15KV J.C.N. THREE 1/0 AL 35KV J.C.N.	UP TO FOUR 500KCMIL
5"	THREE 500KCMIL AND LARGER OF 15 KV AND 35KV	UP TO FOUR 1000KCMIL

RISER SHIELD SIZE FOR CONDUIT INSTALLATIONS	
RISER SHIELD	CONDUIT SIZE
2"	2" & 3"
3"	4" & 5"
5"	5" W/POWER CABLES & 6"

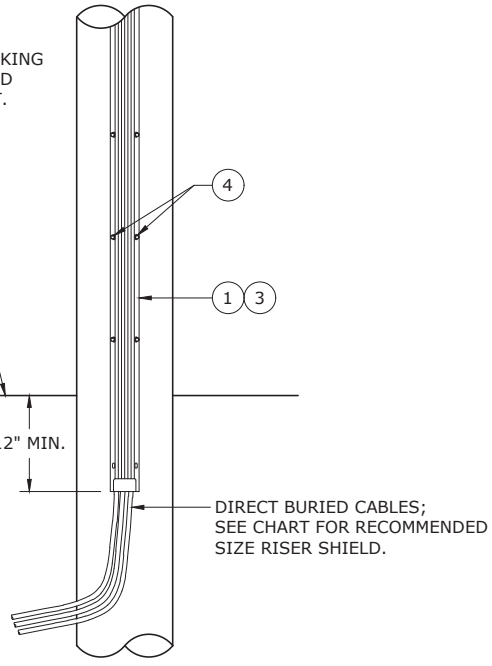
ALL CABLE RISER SECTIONS MUST BE SECURED WITHOUT GAPS.



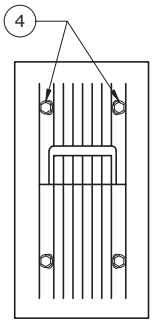
SECTION "A-A"



CONDUIT INSTALLATIONS



DIRECT BURIED CABLE INSTALLATIONS



DETAIL 'A'

NOTES:

1. SEE DWG. 21.01-105B FOR NOTES AND BILL OF MATERIALS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

RISER U-GUARD ON WOOD POLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
	X	X	X

21.01-105A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1,3,4	RISER-2 1/4IN-UGUARD-3PC-F	1	4004660	3	GUARD, CABLE, 2-1/4" X 10", PVC, W/ ONE BELLED END
			4001700	60	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
			900754	1	PLATE, BACKING, 2" WD X 9' 6" LG, GRAY PVC
1,2,3,4	RISER-3 1/2IN-UGUARD-3PC-F	1	4004661	3	GUARD, CABLE, 3-1/2" X 10', PVC, W/ ONE BELLED END
			4001700	60	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
			4197434	1	GUARD, U, 3", VENTILATED, CABLE BOOT 3" U- GUARD TO 4 " CONDUIT
			900755	1	PLATE, BACKING, 3" WD X 9' 6" LG, PVC
	RISER-5IN-PROTECT-F	1	837325	1	SHIELD, CABLE DUCT, NYLON, BELL END
1,2,3,4	RISER-5IN-UGUARD-3PC-F	1	4004662	3	GUARD, CABLE, 5" X 10', PVC, W/ ONE BELLED END PER FPC MS 116
			4001700	75	SCREW, LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
			4004663	1	GUARD, VENTILATOR CABLE, BOOT 4" TO 5", F/ USE W/ CABLE GUARD
			900758	1	PLATE, BACKING, 5" WD X 9' 6" LG, GRAY PVC
	RISER-5IN-PROTECT-F	1	837325	1	SHIELD, CABLE DUCT, NYLON, BELL END

NOTES:

1. SEE DWG. 21.01-105A FOR DESIGN SPECIFICATIONS.
2. RISER BACKING PLATE SHALL BE INSTALLED BEHIND THE LOWEST 8 FT. OF RISER SHIELD.
3. A MAXIMUM OF TWO RISER SHIELDS SHOULD BE MOUNTED DIRECTLY ONTO A POLE. IF IS KNOWN THAT TWO SERVICES WILL BE REQUIRED FROM SAME POLE, INSTALL SECONDARY PEDESTAL AT BASE OF POLE INSTEAD OF TWO RISERS.
4. RISERS SHOULD BE LOCATED ON THE POLE IN THE SAFEST AVAILABLE POSITION WITH RESPECT TO CLIMBING AND POSSIBLE EXPOSURE TO TRAFFIC.
5. LAG SCREWS MUST BE INSTALLED IN ALL RISER SHIELD MOUNTING HOLES.
6. RISER SHIELD MUST PROPERLY OVERLAP THE ADAPTER WHEN USED.
7. RISER SHIELD MUST EXTEND A MINIMUM OF 40" ABOVE THE UPPERMOST COMMUNICATION ATTACHMENT. **EXCEPTION:** PRIMARY CABLES MEETING N.E.S.C. RULE 230C1A (LC-SHIELDED CABLES) MAY EXIT THE RISER GUARD AT A SPECIFIED LOCATION BELOW THE SYSTEM NEUTRAL. PRIMARY CABLES WITH CONCENTRIC NEUTRAL OR FLAT STRAP SHIELDS **DO NOT** MEET THIS EXCEPTION.
8. SEE DWG. 21.07-107 TO SPECIFY CABLE GRIP SUPPORTS.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

RISER U-GUARD ON WOOD POLES

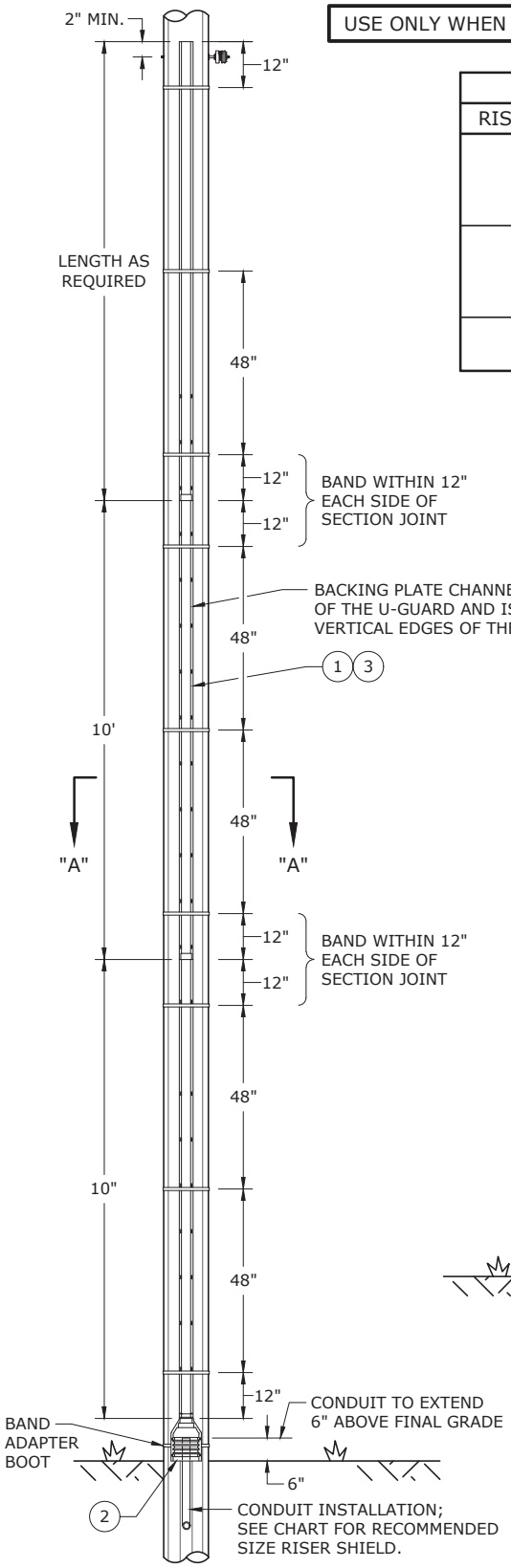
DEC	DEM	DEP	DEF
			X

21.01-105B

USE ONLY WHEN A CONDUIT RISER CANNOT BE INSTALLED

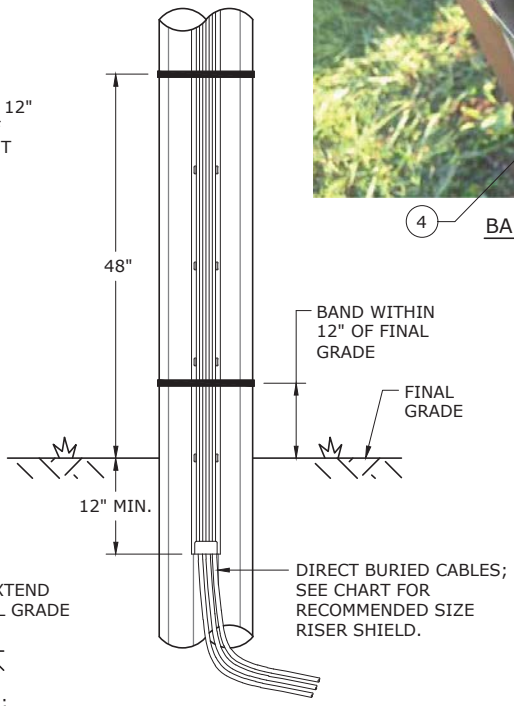
RISER SHIELD SIZE FOR DIRECT BURIED CABLES		
RISER SHIELD	PRIMARY	600 VOLT
2"	ONE 1/0 AL 15KV LC ONE 4/0 AL 15KV J.C.N. ONE 1/0 AL 35KV J.C.N.	UP TO THREE 4/0 AWG
3"	THREE 1/0 AL 15KV LC THREE 4/0 AL 15KV J.C.N. THREE 1/0 AL 35KV J.C.N.	UP TO FOUR 500KCMIL
5"	THREE 500KCMIL AND LARGER OF 15 KV AND 35KV	UP TO FOUR 1000KCMIL

RISER SHIELD SIZE FOR CONDUIT INSTALLATIONS	
RISER SHIELD	CONDUIT SIZE
2"	2" & 3"
3"	4" & 5"
5"	5" W/POWER CABLES & 6"

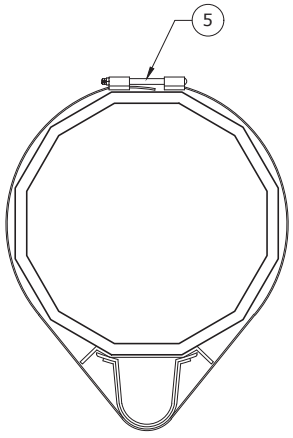


CONDUIT INSTALLATIONS

BANDING DETAIL



DIRECT BURIED CABLE INSTALLATIONS



SECTION "A-A"

NOTES:

1. SEE DWG. 21.01-106B FOR NOTES AND BILL OF MATERIALS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

RISER U-GUARD ON STEEL AND CONCRETE POLES

DEC	DEM	DEP	DEF
	X	X	X

21.01-106A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1, 3	RISER-2IN-UGUARD-STLPOLE-F	1	4004660	3	GUARD, CABLE, 2-1/4" X 10", PVC, W/ ONE BELLED END
			1543304	3	PLATE, BACKING,4-3/4"" WD X 10' LG,GRAY PVC
1, 2, 3	RISER-3IN-UGUARD-STLPOLE-F	1	4004661	3	GUARD, CABLE, 3-1/2" X 10', PVC, W/ ONE BELLED END
			4197434	1	GUARD, U, 3", VENTILATED, CABLE BOOT 3" U- GUARD TO 4 " CONDUIT
			1543307	3	PLATE, BACKING, 6-1/2"" WD X 10' LG, GRAY PVC
	RISER-5IN-PROTECT-F	1	837325	1	SHIELD, CABLE DUCT, NYLON, BELL END
1, 2, 3	RISER-5IN-UGUARD-STLPOLE-F	1	4004662	3	GUARD, CABLE, 5" X 10', PVC, W/ ONE BELLED END
			4004663	1	GUARD, VENTILATOR CABLE, BOOT 4" TO 5", F/ USE W/ CABLE GUARD
			1543309	3	PLATE, BACKING, 7.9" WD X 10' LG, GRAY PVC
	RISER-5IN-PROTECT-F	1	837325	1	SHIELD, CABLE DUCT, NYLON, BELL END
4	POLE-BAND-STRAP-SM-STL-F	1	438852	100 FT.	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 201 SS
5	POLE-BAND-STRAP-BUCKLE-SM-STL-F	10	438806	1	BOLT, CARRIAGE, 3/4" DIA, 6" LG, GALV, ASTM A449, GR 5, ASSY

NOTES:

1. SEE DWG. 21.01-106A FOR DESIGN SPECIFICATIONS.
2. RISER BACKING PLATE CHANNEL SHALL BE INSTALLED THE ENTIRE LENGTH OF THE RISER SHIELD TO CONTAIN THE VERTICAL EDGES. SEE BANDING DETAIL ON DWG. 21.01-106A.
3. A MAXIMUM OF TWO RISER SHIELDS SHOULD BE MOUNTED DIRECTLY ONTO A POLE. IF IS KNOWN THAT TWO SERVICES WILL BE REQUIRED FROM SAME POLE, INSTALL SECONDARY PEDESTAL AT BASE OF POLE INSTEAD OF TWO RISERS.
4. RISERS SHOULD BE LOCATED ON THE POLE IN THE SAFEST AVAILABLE POSITION WITH RESPECT TO CLIMBING AND POSSIBLE EXPOSURE TO TRAFFIC.
5. RISER SHIELD AND BACKING CHANNEL IS BANDED TO THE POLE AS SHOWN ON DWG. 21.01-106A.
6. RISER SHIELD MUST PROPERLY OVERLAP THE ADAPTER, WHEN USED.
7. RISER SHIELD MUST EXTEND A MINIMUM OF 40" ABOVE THE UPPERMOST COMMUNICATION ATTACHMENT. **EXCEPTION:** PRIMARY CABLES MEETING N.E.S.C. RULE 230C1A (LC-SHIELDED CABLES) MAY EXIT THE RISER GUARD AT A SPECIFIED LOCATION BELOW THE SYSTEM NEUTRAL. PRIMARY CABLES WITH CONCENTRIC NEUTRAL OR FLAT STRAP SHIELDS **DO NOT** MEET THIS EXCEPTION.
8. SEE DWG. 21.07-107 TO SPECIFY CABLE GRIP SUPPORTS.

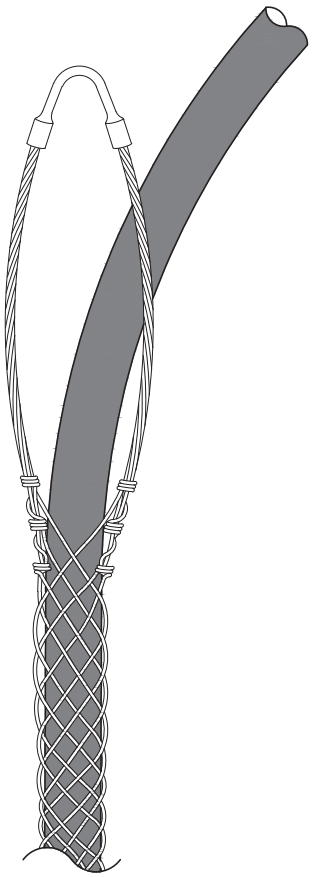
DUKE ENERGY.

3					
2					
1					
0	3/31/18	GORLEY	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

RISER U-GUARD ON STEEL AND CONCRETE POLES

DEC	DEM	DEP	DEF
			X

21.01-106B



CABLE SUPPORT GRIP COMPATIBLE UNITS			
COMPATIBLE UNIT	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CABLE-GRIP-SGL-SM-F (1" TO 1-1/4" RANGE)	905041	1	GRIP, CABLE, SUPPORTING, 1" TO 1-1/4" CABLE, ALUM, CLOSED SINGLE CABLE
CABLE-GRIP-SGL-MD-F (2" TO 2-12" RANGE)	4004643	1	GRIP, CABLE, SUPPORT & RISER, SINGLE "U" EYE, 2 X 2-1/2 IN.
CABLE-GRIP-SGL-LG-F (2-1/2" TO 3" RANGE)	905045	1	GRIP, CABLE, SUPPORTING, 2-1/2" TO 3" CABLE, ALUM, SINGLE-U-EYE

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" - 1-1/4"
500 KCM AL 15KV 175 MILS	2" - 2-1/2"
1000 KCM AL 15KV 175 MILS	2" - 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" - 1-1/4"
2 #6 AL ST. LT. CABLE	1" - 1-1/4"
#2 AL UG TPX XLP	1" - 1-1/4"
2/0 AL UG TPX XLP	2" - 2-1/2"
4/0 AL UG TPX XLP	2" - 2-1/2"
350 MCM AL UG TPX XLP	2" - 2-1/2"
4/0 AL UG QPX XLP	2" - 2-1/2"
500 MCM AL UG TPX	3" - 2-1/2"
500 MCM AL UG QPX	3" - 2-1/2"

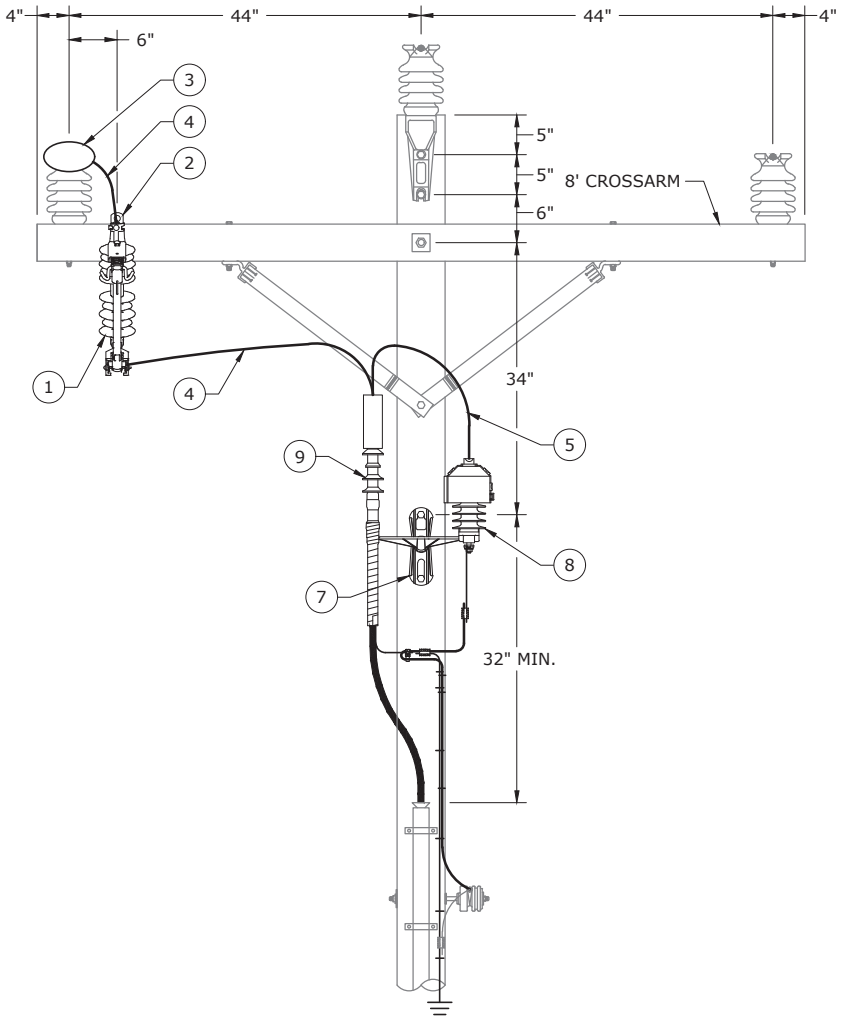
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

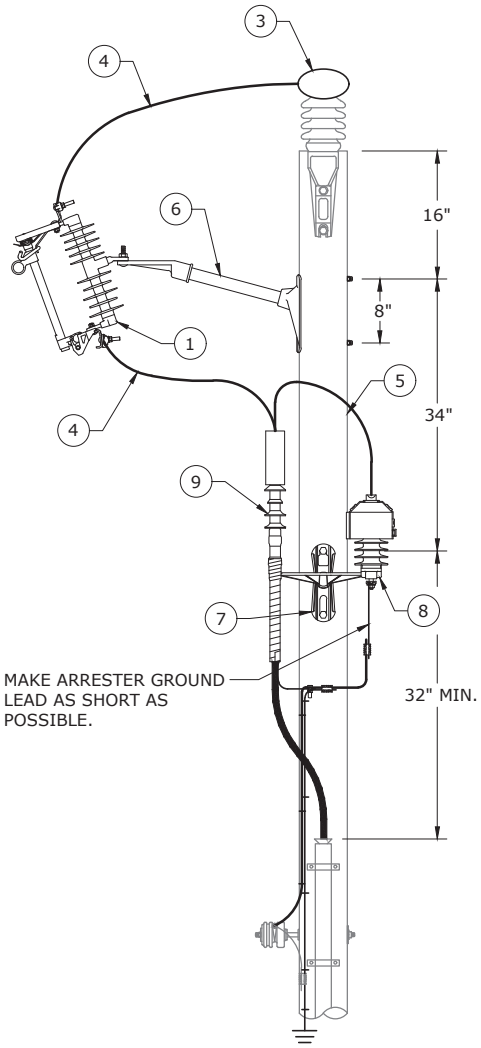
CABLE SUPPORT GRIPS

DEC	DEM	DEP	DEF
			X

21.01-107



FRONT VIEW
THREE-PHASE OVERHEAD LINE



FRONT VIEW
SINGLE-PHASE OVERHEAD LINE

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
2. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
3. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
4. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

SINGLE-PHASE IN-LINE RISER, 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.02-100A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F (FOR CUTOUT INSTALLED ON CROSSARM)	1	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GRADE B
3	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	1	4192427	12 FT	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
7	BKT-TERM-POLE-1P-FG-F	1	1400589	1	BRACKET, TERMINATION, 12" LG, FIBERGLASS, TO INCLUDE UV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			936449	1	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, FETTER DRIVE
	HDWR-MACH-SM-14IN-GALV-F	1	931571	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 14" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			4001673	1	WASHER, LOCK, SPLIT, 5/8" NOM, GALV STL, F/ 5/8 BOLT PACKAGE
8	ARR-RISER-10KV-BKT-F	1	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
8	ARR-RISER-18KV-BKT-F	1	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
9	-	1	-	-	SEE SECTION 26 FOR CABLE TERMINATION

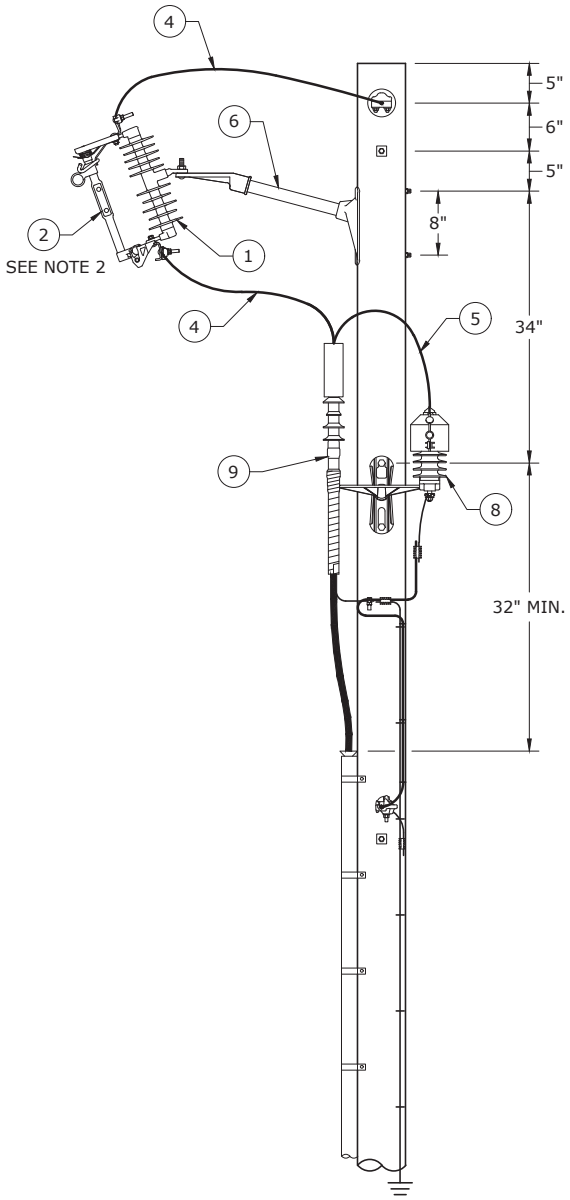
DUKE ENERGY.

3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

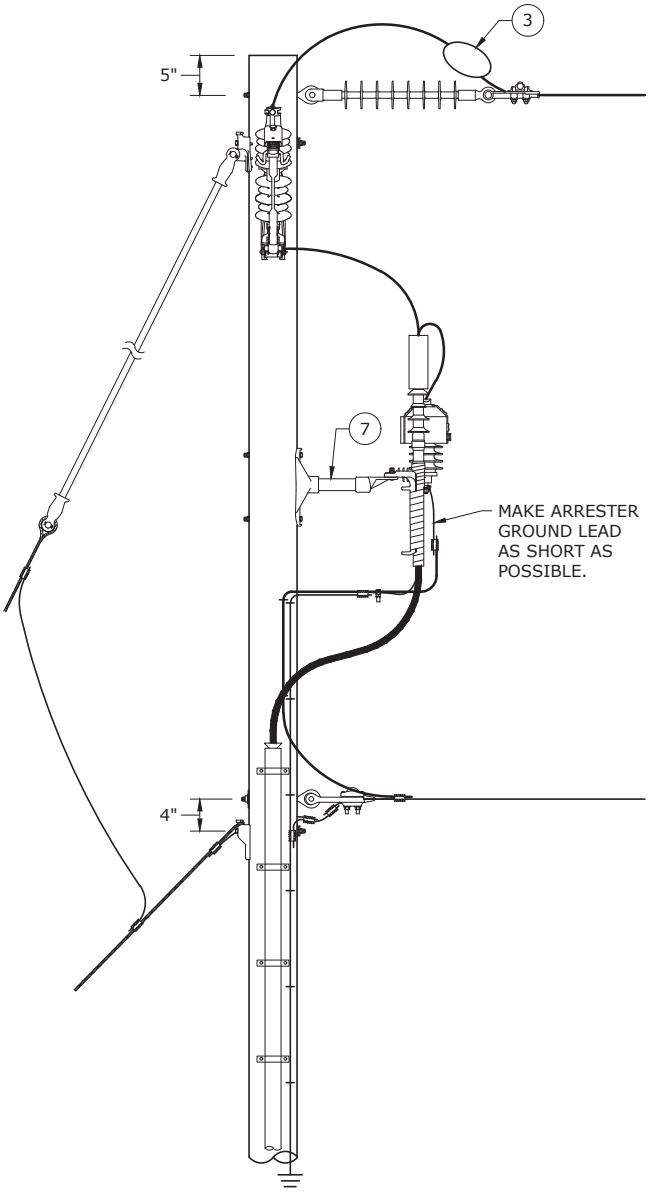
SINGLE-PHASE IN-LINE RISER, 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.02-100B



FRONT VIEW



SIDE VIEW

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
2. THE ITEM IN BUBBLE #2 (SOLID BLADE) MAY NOT BE REQUIRED. SEE NOTE 5 ON DWG. 21.02-105B FOR FUSING METHODS.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE RISER ON DEADEND POLE
15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-105A

NOTES:

1. MAKE THE GROUND LEAD FROM ARRESTER TO TERMINATION AS SHORT AS POSSIBLE.

2. THE TERMINATION GROUNDING BRAID IS USED FOR LC-SHIELDED CABLES.

3. A REMEDIAL ROD TREATMENT SHALL BE APPLIED WHEN INSTALLING AN UNDERGROUND RISER TO AN EXISTING CREOSOTE OR PENTACHLOROPHENOL TREATED DUKE OWNED POLE.

4. ANIMAL GUARD MUST NOT COVER MORE THAN THE TOP SKIRT OF THE ARRESTER.

5. ON ALL NEW INSTALLATIONS WITH SHORT TAPS TO RISERS (NO LONGER THAN 2 SPANS), INSTALL CUTOUTS AT BOTH THE TAP POLE AND THE RISER POLE. USE EITHER METHOD 1 OR METHOD 2 BELOW FOR FUSING. THE FUSING DESIGN IS AT THE DISCRETION OF DISTRIBUTION PLANNING AND DESIGN:

   METHOD 1: INSTALL THE RISER FUSES AT THE TAP POLE AND PLACE SOLID BLADES IN THE CUTOUTS AT THE RISER POLE.

   THE FOLLOWING CONDITIONS APPLY TO METHOD 1:

   I. THE FUSES AT THE TAP POLE MUST BE THE SAME SIZE AS WOULD NORMALLY HAVE BEEN USED AT THE RISER POLE.

   II. THE TAP POLE MUST BE IN SIGHT OF THE RISER POLE.

   III. THERE MUST BE NO MORE THAN ONE (1) SINGLE-PHASE RISER OR ONE (1) THREE-PHASE RISER ON THE TAP.

   IV. THE TAP MUST NOT HAVE ANY OVERHEAD TRANSFORMERS.

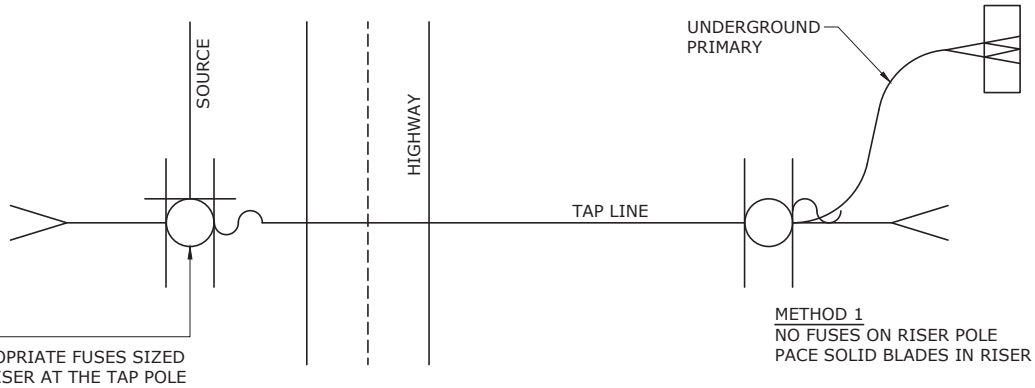
   V. THE FUSE DESIGN MUST BE CHANGED TO METHOD 2 IF THE TAP LINE IS EXTENDED OR IF OVERHEAD TRANSFORMERS OR ADDITIONAL RISERS ARE ADDED.

   METHOD 2: INSTALL COORDINATED FUSES AT THE TAP POLE, AND FUSES SPECIFIC TO THE RISER AT THE RISER POLE. THIS METHOD IS ALSO RECOMMENDED FOR TAPS LONGER THAN 2 SPANS. ADDITIONAL MATERIALS NEEDED AT THE TAP POLE (I.E. CUTOUTS, FUSES, BRACKETS) ARE NOT LISTED IN THE BILL OF MATERIALS FOR THIS STANDARD.

6. IN RARE CASES, THE TAP POLE MAY BE DETERMINED INACCESSIBLE FOR FUSES DUE TO LOCATION, HEAVY TRAFFIC, EXCESSIVE FLAGGING OR OTHER REASONS. DOCUMENT THESE SITUATIONS ON THE JOB DRAWING AND IN EMAX.

7. POTENTIAL RELIABILITY PROBLEMS SHOULD STILL BE CORRECTED ON THE TAP AND RISER POLE. INSTALL ANIMAL GUARDS, INSULATED LEAD WIRE, REMOVE UNNECESSARY GROUNDS ABOVE THE NEUTRAL, ETC. RELOCATING A RISER FUSE TO THE TAP POLE DOES NOT JUSTIFY IGNORING NEEDED RELIABILITY IMPROVEMENTS ON TAP OR RISER POLE.

SEE THE GRAPHICAL EXAMPLE BELOW.



FUSING TAP TO RISER POLE

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE RISER ON DEADEND POLE

15KV/25KV/35 KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-105B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	SW-BLADE-300-15KV-1P-CUTOUT-F	1	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL, 12KA
3	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	1	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	1	4192427	12 FT	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	BKT-EM-POLE-1P-FG-F	1	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, EQUIPMENT
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
7	BKT-TERM-POLE-1P-FG-F	1	1400589	1	BRACKET, TERMINATION, 12" LG, FIBERGLASS, TO INCLUDE UV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			936449	1	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, FETTER DRIVE
	HDWR-MACH-SM-14IN-GALV-F	1	931571	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 14" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			4001673	1	WASHER, LOCK, SPLIT, 5/8" NOM, GALV STL, F/ 5/8 BOLT PACKAGE
8	ARR-RISER-10KV-BKT-F	1	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
8	ARR-RISER-18KV-BKT-F	1	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
9	-	1	-	-	SEE SECTION 26 FOR CABLE TERMINATION

DUKE ENERGY.

3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/17	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

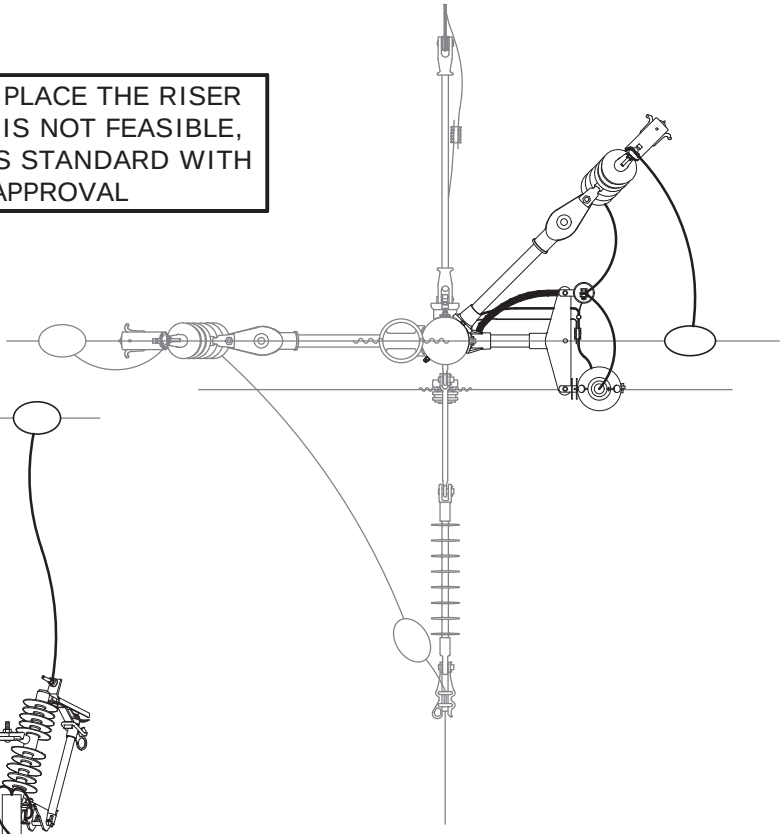
SINGLE-PHASE RISER ON DEADEND POLE

15KV/25KV/35 KV

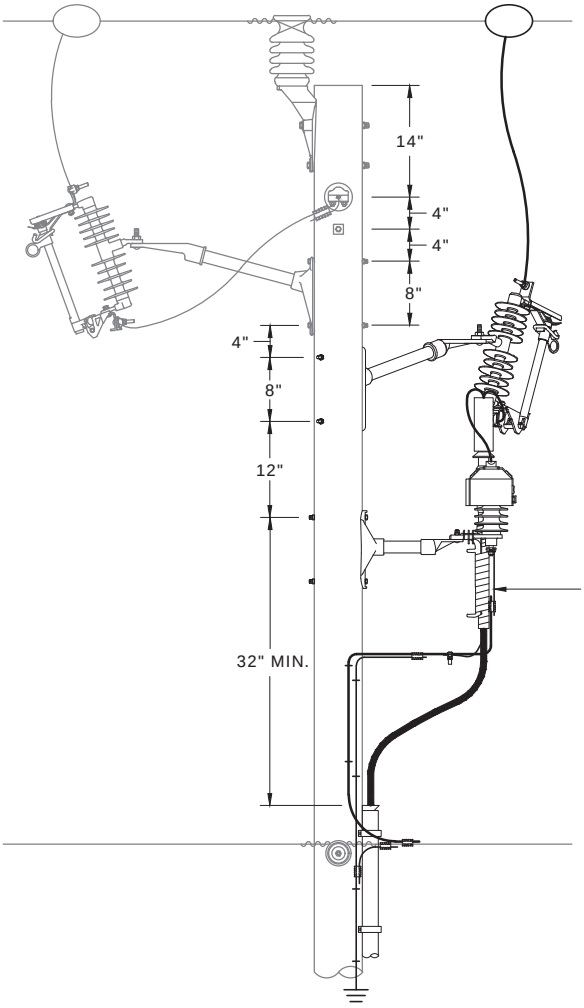
DEC	DEM	DEP	DEF
			X

21.02-105C

RECOMMENDED DESIGN IS TO PLACE THE RISER ON A SEPARATE POLE. IF THIS IS NOT FEASIBLE, IT IS PERMISSIBLE TO USE THIS STANDARD WITH LOCAL MANAGEMENT APPROVAL



PLAN VIEW



FRONT VIEW
SINGLE-PHASE OVERHEAD LINE
WITH SINGLE-PHASE TAP

NOTES:

1. THE PURPOSE OF THIS DRAWING IS TO SHOW FRAMING DETAILS. FOR BILL OF MATERIALS SEE DWG. 21.02-100B, SINGLE-PHASE IN-LINE RISER.
2. THIS INSTALLATION MUST BE ACCESSIBLE FROM A BUCKET TRUCK.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

DUKE ENERGY.

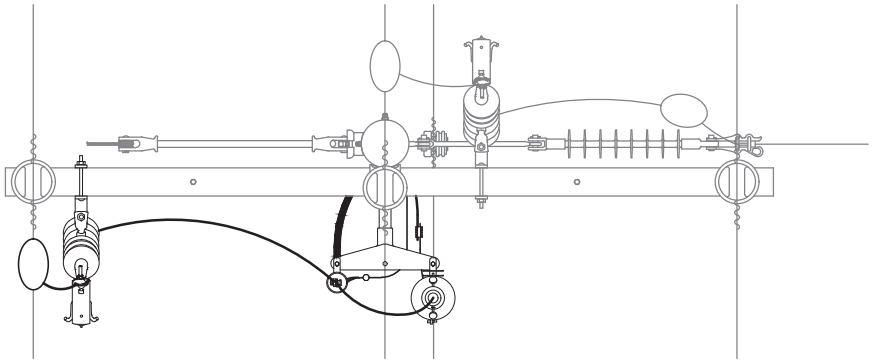
REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

SINGLE-PHASE RISER ON POLE WITH EXISTING SINGLE-PHASE OVERHEAD TAP 15KV/25KV/35KV

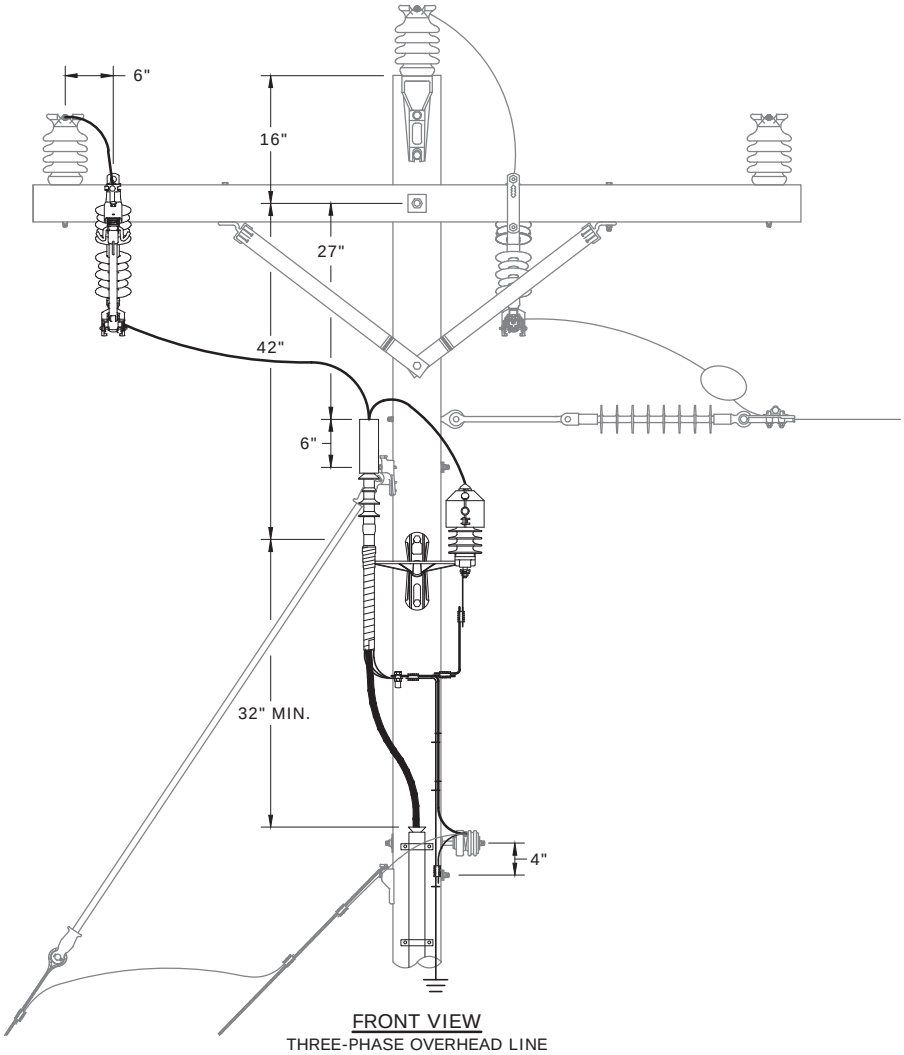
DEC	DEM	DEP	DEF
X	X	X	X

21.02-107A

RECOMMENDED DESIGN IS TO PLACE THE RISER ON A SEPARATE POLE. IF THIS IS NOT FEASIBLE, IT IS PERMISSIBLE TO USE THIS STANDARD WITH LOCAL MANAGEMENT APPROVAL



PLAN VIEW



FRONT VIEW
THREE-PHASE OVERHEAD LINE
WITH SINGLE-PHASE TAP

NOTES:

1. SEE NOTES ON DWG. 21.02-107A.
2. IF CINCINNATI BELL JOINT USE SPACING APPLIES, THE INSTALLATION ABOVE REQUIRES A 45 FT POLE MINIMUM.

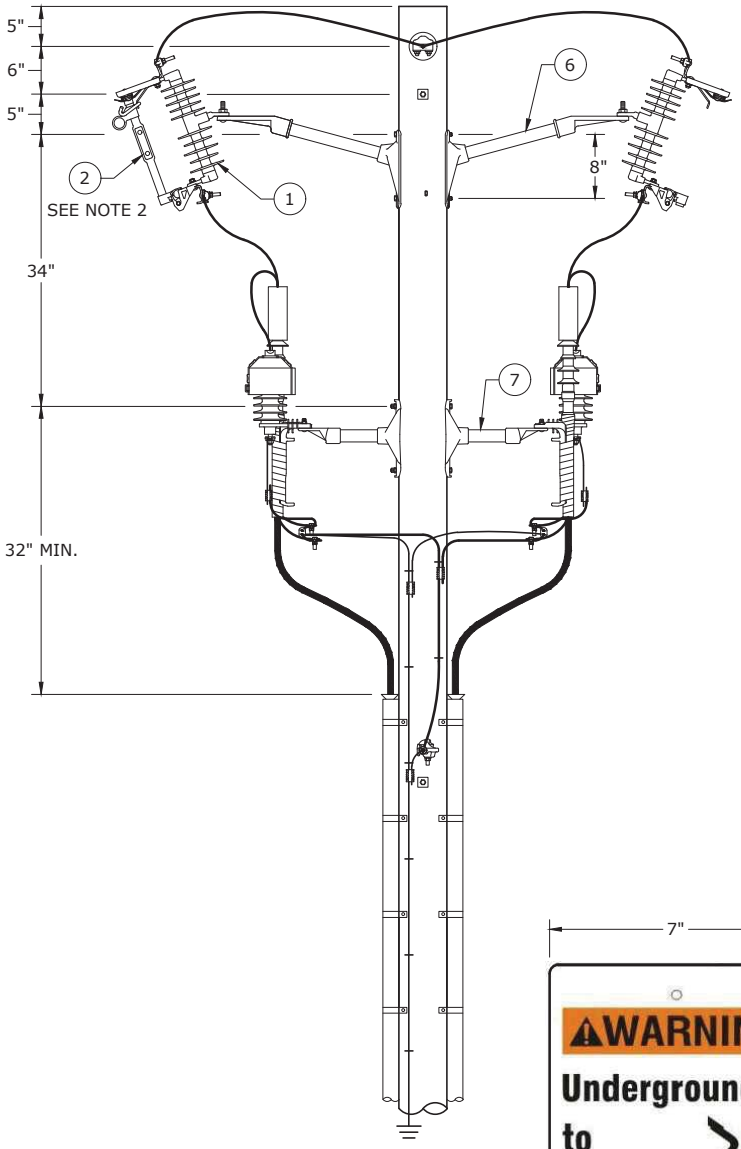
3				
2				
1	6/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE RISER ON POLE WITH
EXISTING SINGLE-PHASE OVERHEAD TAP
15KV/25KV/35KV

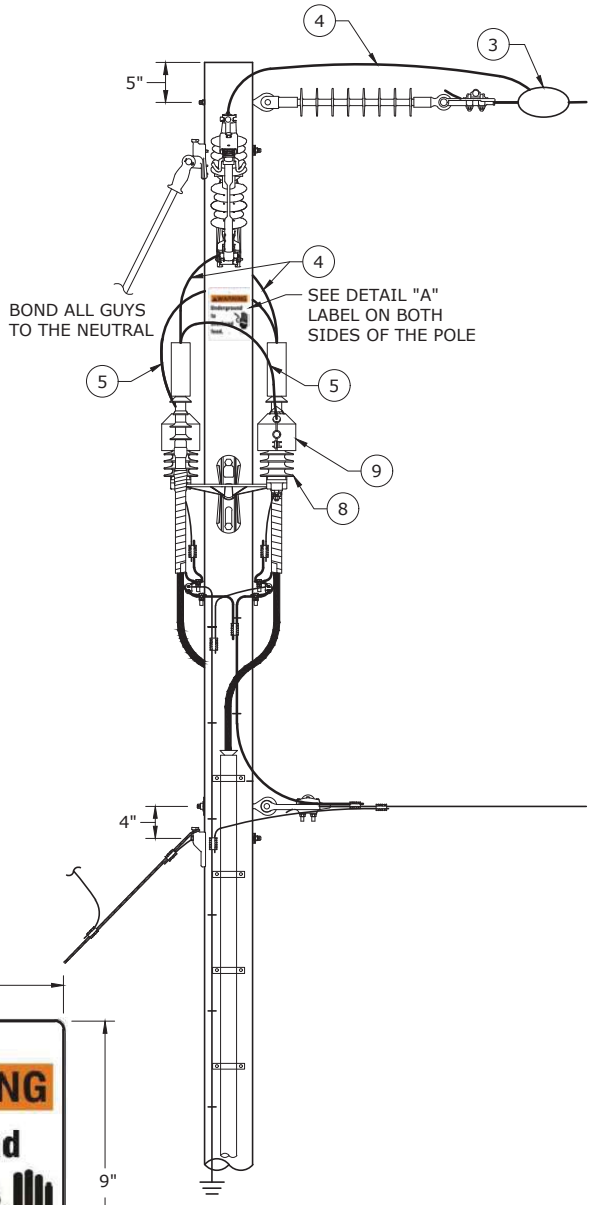
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-107B



FRONT VIEW



SIDE VIEW

DETAIL "A"
WARNING SIGN
ITEM # 4169777

NOTES:

1. ONE RISER IS INTENDED AS A BACKUP. DO NOT INSTALL A CUTOUT DOOR IN THE BACKUP.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; DWG. 21.01-105A FOR U-GUARD RISERS
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE REVERSE RISER SERVING OVERHEAD LINE 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	2	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	SW-BLADE-300-15KV-1P-CUTOUT-F	1	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL
3	-	2	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	2	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	2	4192427	12 FT.	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	BKT-EM-POLE-1P-FG-F	2	81207	1	BRACKET, CUTOUT, 1-1/2" DIA X 18" LG, FIBERGLASS, SINGLE PHASE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
7	BKT-TERM-POLE-1P-FG-F	2	1400589	1	BRACKET, TERMINATION, 12" LG, FIBERGLASS
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			936449	1	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, GALV STL
	HDWR-MACH-SM-14IN-GALV-F	2	931571	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 14" LG, SQ HEAD, HOT DIP GALV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			4001673	1	WASHER, LOCK, SPLIT, 5/8" NOM, GALV STL, F/ 5/8 BOLT PACKAGE
8	ARR-RISER-10KV-BKT-F	2	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLYMER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	ARR-RISER-18KV-BKT-F	2	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	-	2	-	-	SEE SECTION 26 FOR CABLE TERMINATION

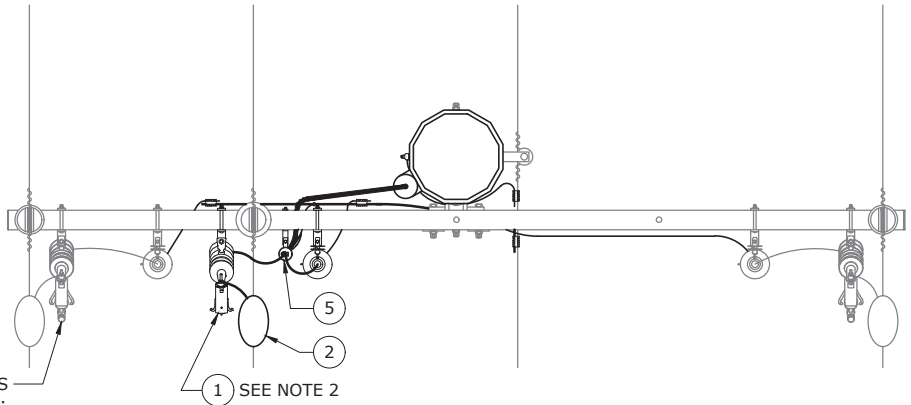
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

SINGLE-PHASE REVERSE RISER
SERVING OVERHEAD LINE
15KV/25KV/35KV

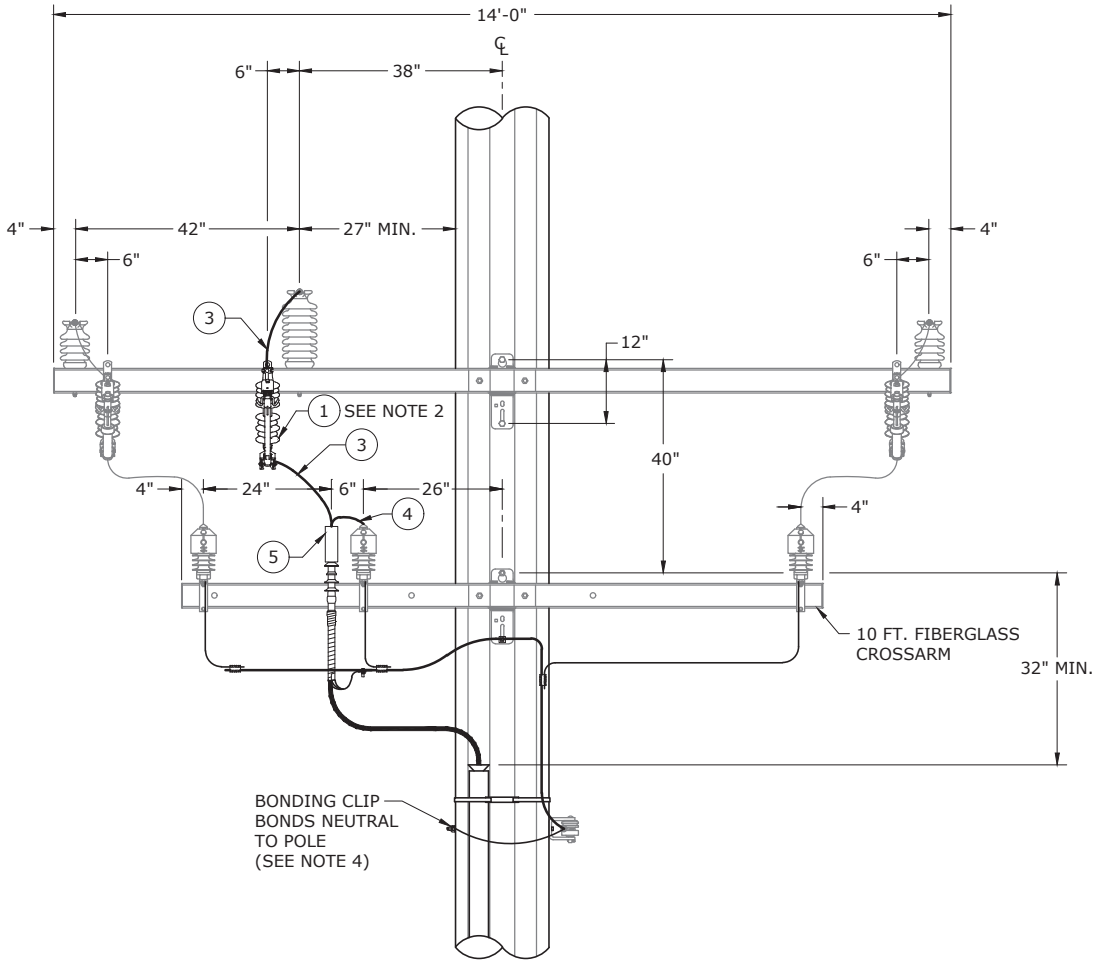
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.02-110B



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 21.02-125B FOR SIDE VIEW AND NOTES.
2. STANDARD RISER CUTOUT REPLACES EXISTING FAULT TAMER CUTOUT FOR RISER TAP. REUSE MOUNTING BRACKET FOR CUTOUT.
3. RISER ARRESTER IS ASSUMED TO BE EXISTING, AND IS NOT LISTED IN BILL OF MATERIALS.
4. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

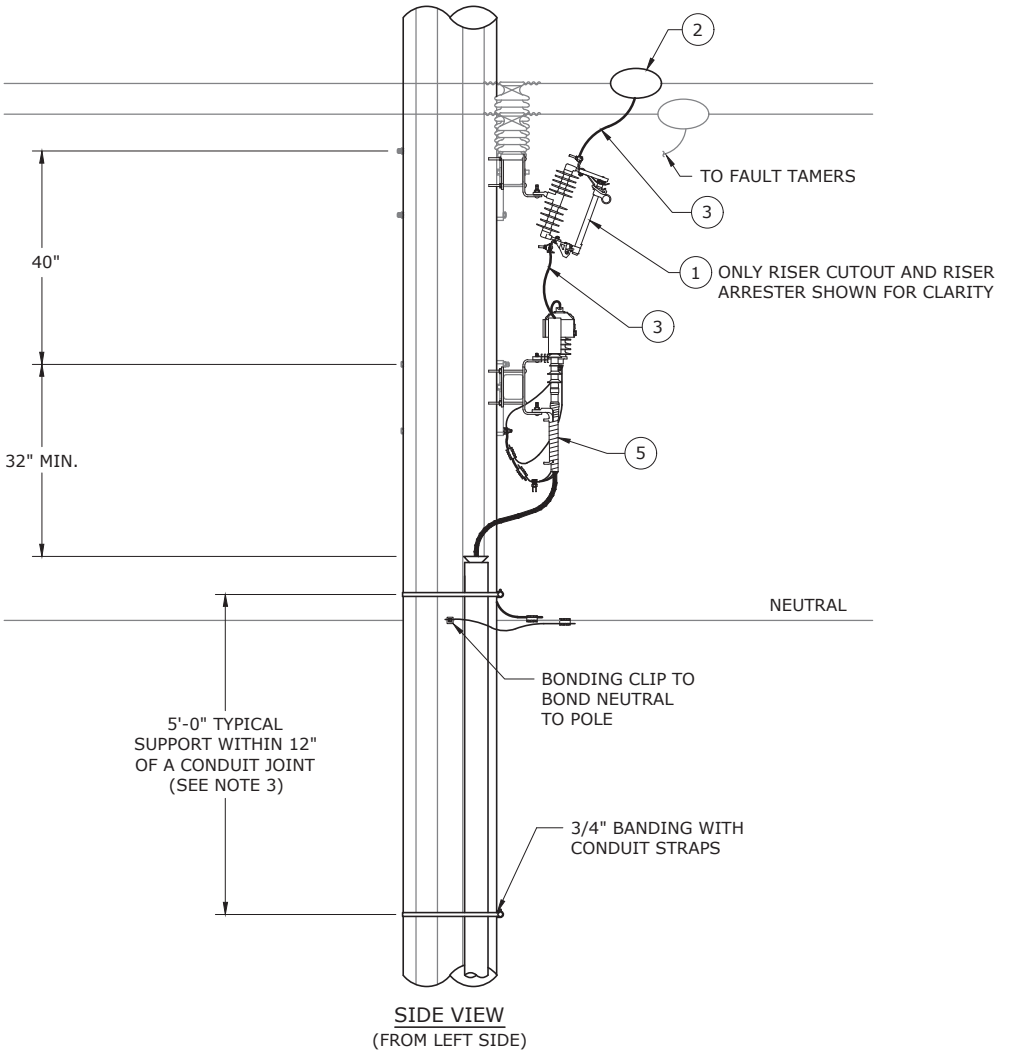
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE (HORIZONTAL CONSTRUCTION) 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-125A



SIDE VIEW
(FROM LEFT SIDE)

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISOR.
2. SEE DWG. 21.02-125A FOR FRONT AND PLAN VIEWS.
3. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. FOR U-GUARD AND MOUNTING HARDWARE, SEE DWG. 21.01-106A.
4. LADDER HOOKS ARE FACTORY INSTALLED ON THE FRONT AND REAR FACES OF THE 12 SIDED POLES. RISERS WILL NEED TO INSTALL TO AN ADJACENT FACE AND NOT CONFLICT WITH LADDER CLIPS.
5. WHERE POSSIBLE, TAP TO A SEPARATE WOOD DISTRIBUTION RISER POLE TO MINIMIZE EQUIPMENT INSTALLED ON TRANSMISSION POLES.
6. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

SINGLE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE (HORIZONTAL CONSTRUCTION) 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-125B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
3	LEAD-EQ-2-CU-COVER-F	1	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12 FT	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	-	1	-	-	SEE SECTION 26 FOR CABLE TERMINATION

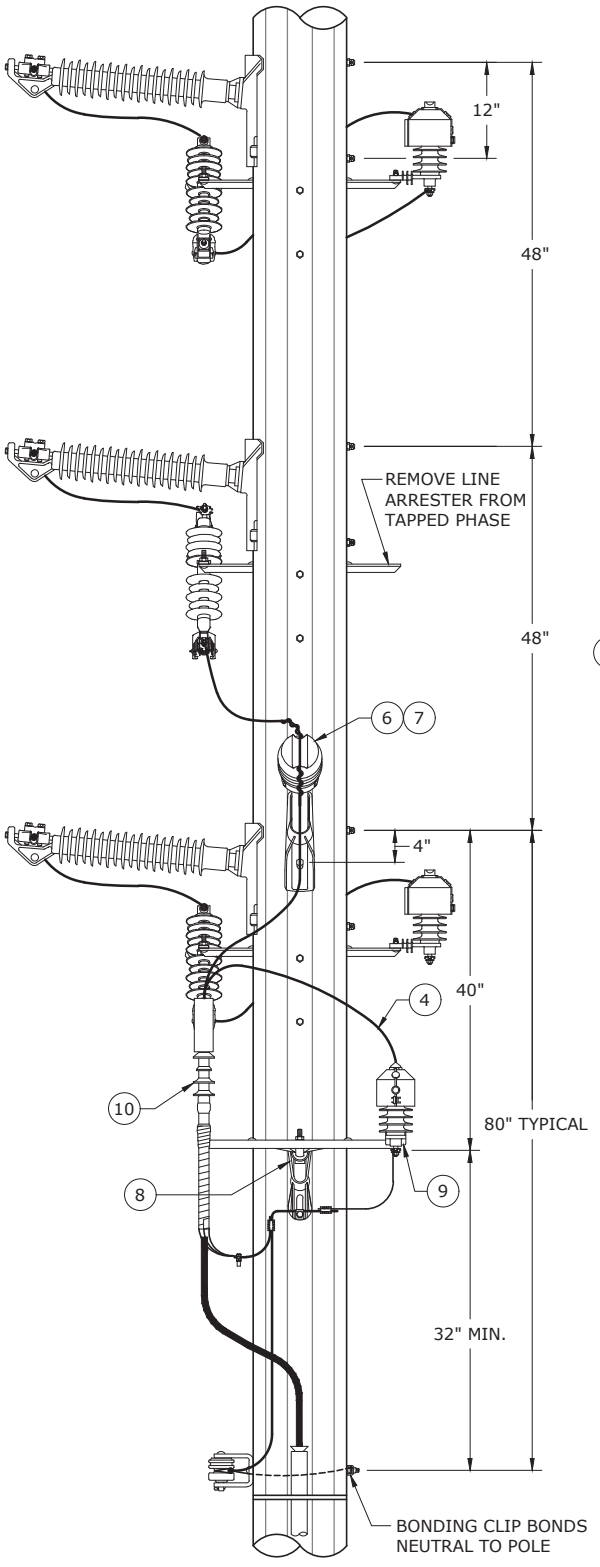
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

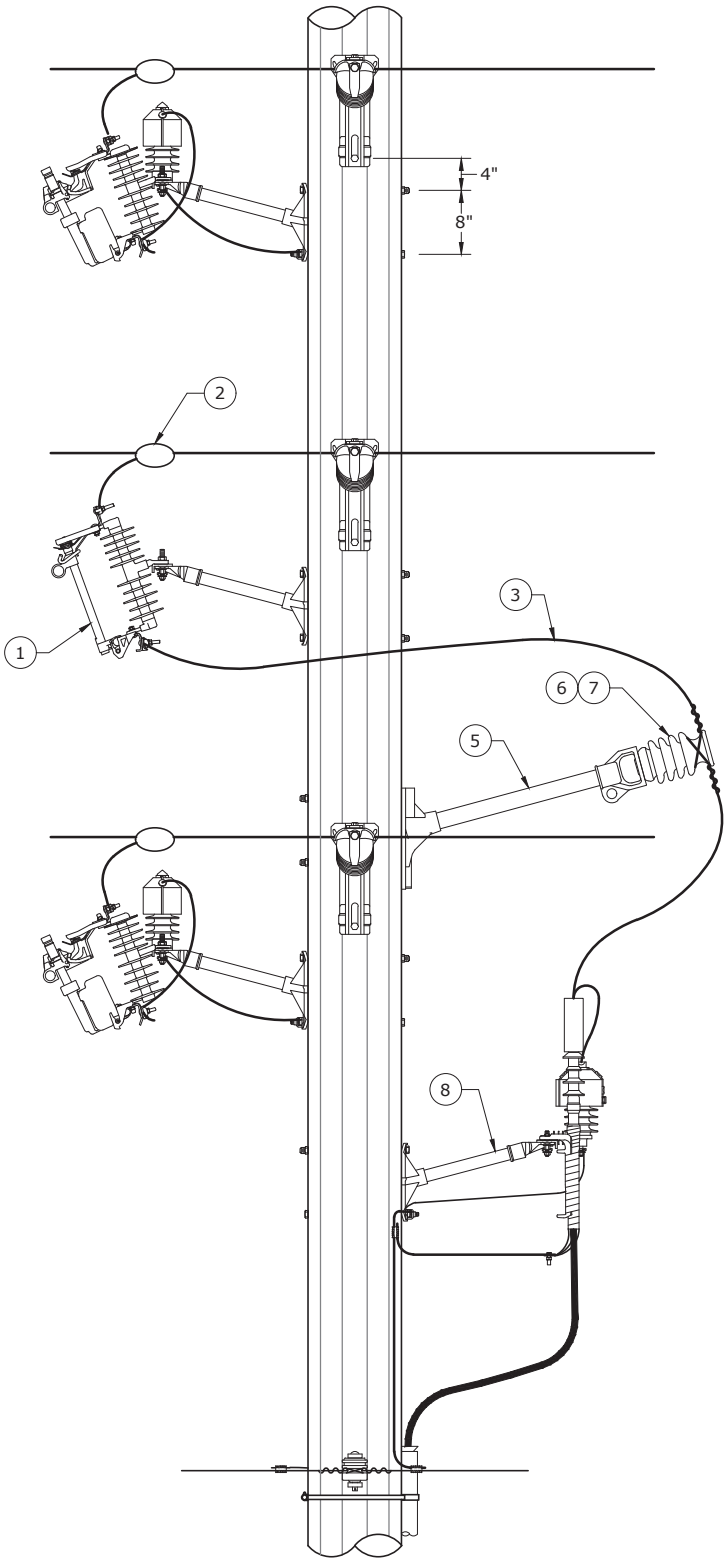
SINGLE-PHASE RISER UNDERBUILD
ON STEEL TRANSMISSION POLE
(HORIZONTAL CONSTRUCTION)
15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.02-125C



FRONT VIEW



SIDE VIEW
(FROM LEFT SIDE)

NOTES:

1. SEE DWG. 21.02-126B FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE (VERTICAL CONSTRUCTION) 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.02-126A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	1	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	-	1	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
3	LEAD-EQ-2-CU-COVER-F	1	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
4	LEAD-EQ-6-CU-COVER-F	1	4192427	12 FT.	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
5	BKT-INSL-POST-POLE-LG-FG-F	1	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS, HORZ, UV
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, UNC, 26" LG, SQ HEAD, GALV STL
6	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN, ANSI
7	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA, 6 AWG
8	BKT-TERM-POLE-1P-FG-F	1	1400589	1	BRACKET, TERMINATION, 12" LG, FIBERGLASS, TO INCLUDE UV
			930030	1	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	1	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			936449	1	SCREW, LAG, 1/2" DIA, 4" LG, SQ HD, DRIVE POINT, FETTER DRIVE
	HDWR-MACH-SM-26IN-GALV-F	1	931619	1	BOLT, MACHINE, 5/8" DIA, UNC, 26" LG, SQ HEAD, GALV STL
9	ARR-RISER-10KV-BKT-F	1	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT.	WIRE/CABLE ELECTRICAL BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
9	ARR-RISER-18KV-BKT-F	1	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE ELECTRICAL BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
10	-	1	-	-	SEE SECTION 26 FOR CABLE TERMINATION

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISOR.
2. SEE DWG. 21.02.126A FOR FRONT AND SIDE VIEWS.
3. STANDARD RISER CUTOUT REPLACES EXISTING FAULT TAMER CUTOUT FOR RISER TAP.
4. REMOVE LINE ARRESTER FROM TAPPED PHASE. INSTALL NEW RISER ARRESTER DOWN ON TERMINATION BRACKET.
5. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. FOR U-GUARD AND MOUNTING HARDWARE, SEE DWG. 21.01-106A.
6. LADDER HOOKS ARE FACTORY INSTALLED ON THE FRONT AND REAR FACES OF THE 12-SIDED POLES. RISERS WILL NEED TO INSTALL TO AN ADJACENT FACE AND NOT CONFLICT WITH LADDER CLIPS.
7. WHERE POSSIBLE, TAP TO A SEPARATE WOOD DISTRIBUTION POLE TO MINIMIZE EQUIPMENT INSTALLED ON TRANSMISSION POLES.
8. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
9. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

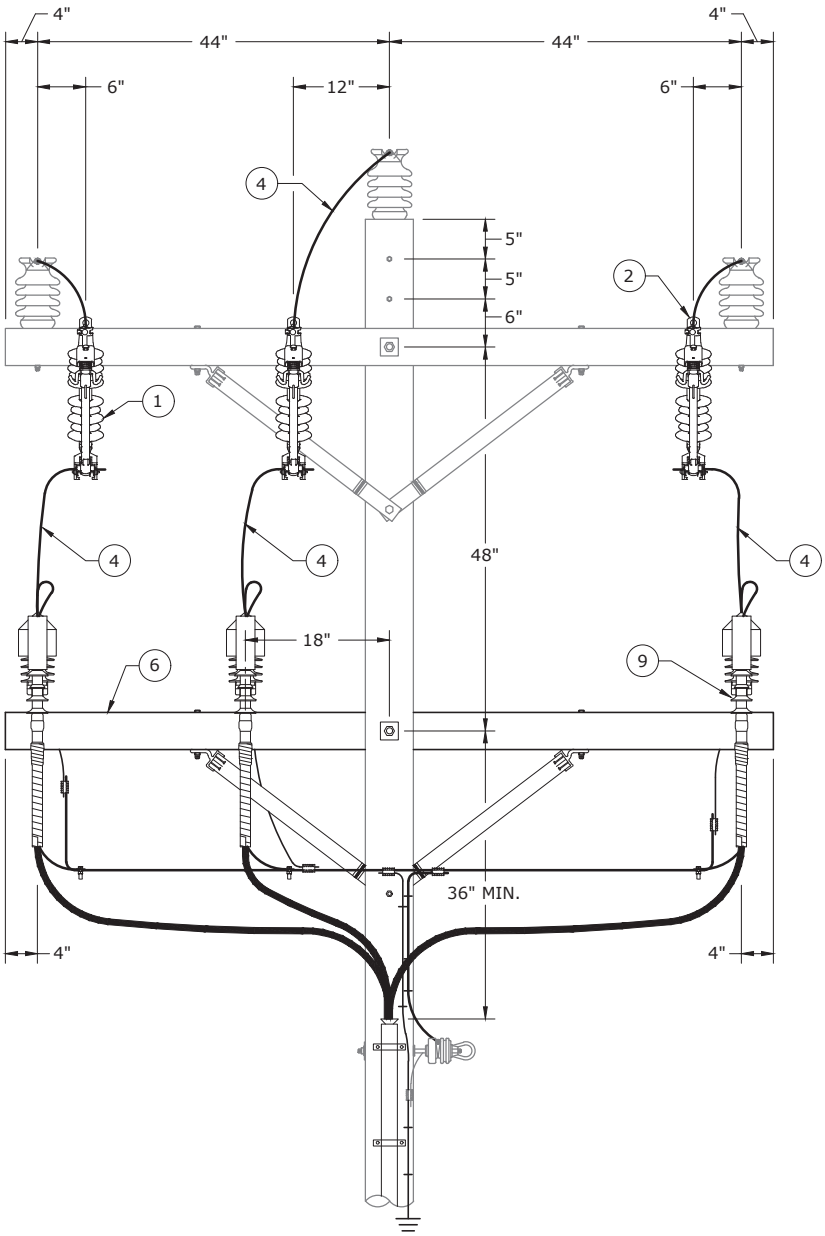
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

SINGLE-PHASE RISER UNDERBUILD
ON STEEL TRANSMISSION POLE
(VERTICAL CONSTRUCTION) 15KV/25KV/35KV

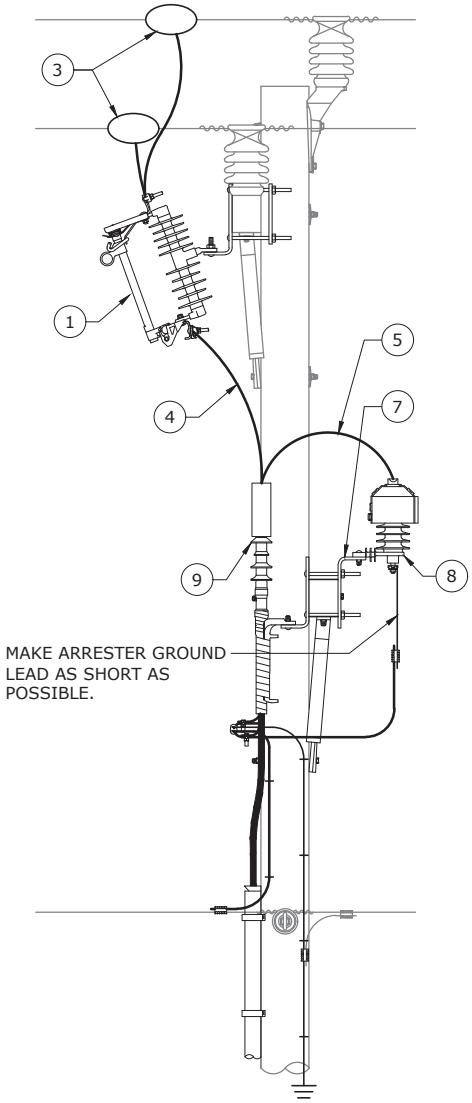
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.02-126B



FRONT VIEW



SIDE VIEW

NOTES:

1. AN EXISTING 8 FOOT CROSSARM MAY BE USED IF THE REQUIRED 24" SPACING BETWEEN PHASES CAN BE OBTAINED AND IF THE ARM IS IN GOOD CONDITION. IF NOT, REPLACE WITH A 10 FOOT CROSSARM. NEW INSTALLATIONS REQUIRE A 10 FOOT CROSSARM.

2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.

3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; DWG. 21.01-105A FOR U-GUARD RISERS.

5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE IN-LINE RISER ON HORIZONTAL CONSTRUCTION, 200A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-100A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS, MOUNTING HOLES PER FPC
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

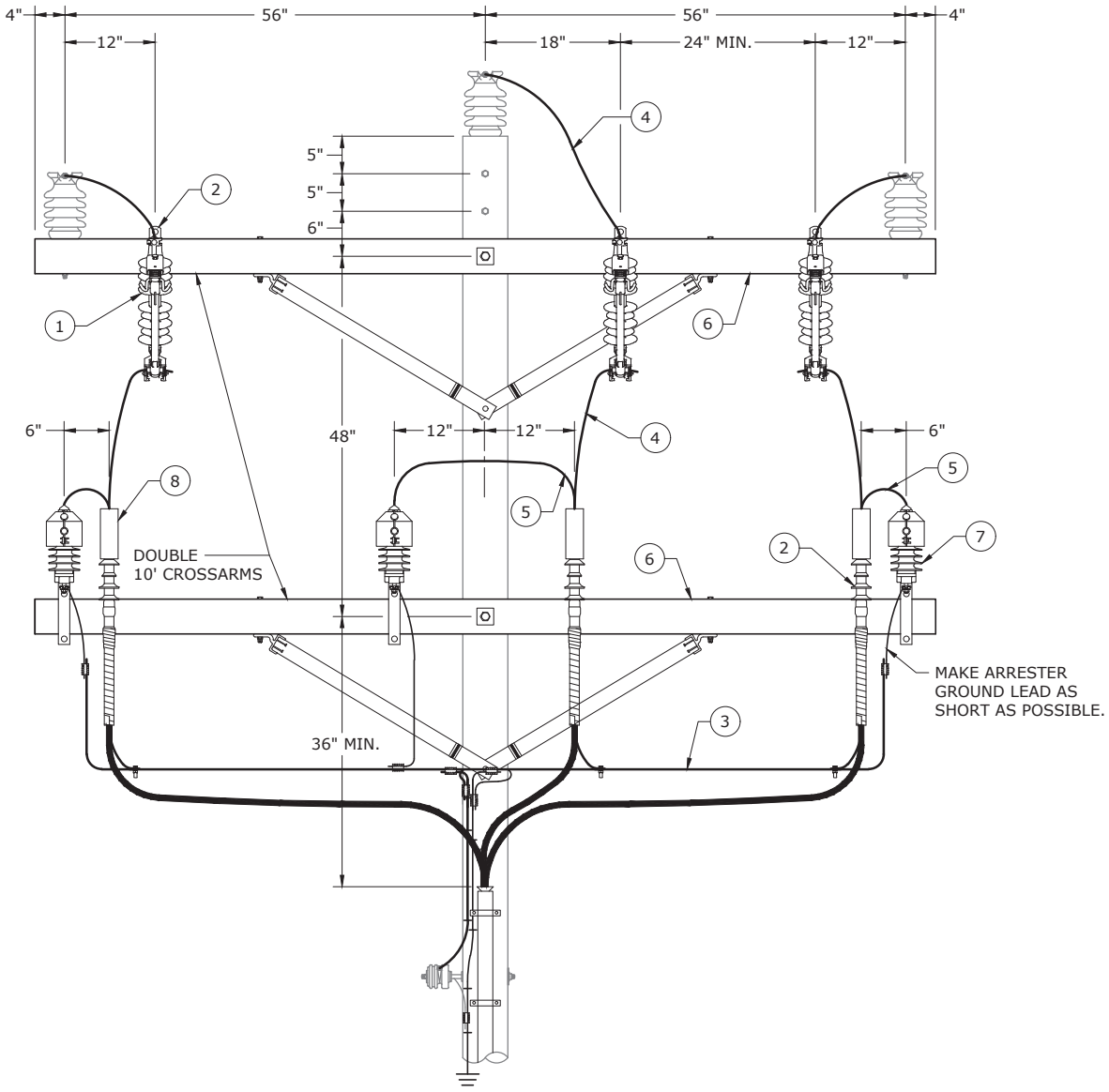
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE IN-LINE RISER ON HORIZONTAL CONSTRUCTION, 200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.03-100B



FRONT VIEW

NOTES:

1. SEE DWG. 21.03-105B FOR SIDE VIEW.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NEEDED.

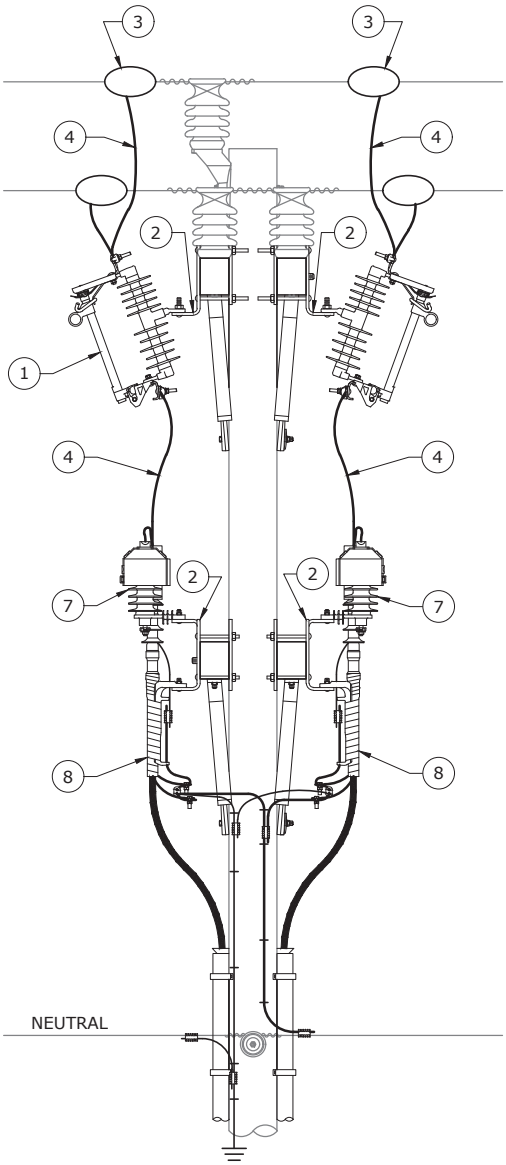
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

DOUBLE THREE-PHASE IN-LINE RISERS ON HORIZONTAL CONSTRUCTION, 200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-105A



SIDE VIEW

NOTES:

1. SEE DWG. 21.03-105A FOR FRONT VIEW AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

DOUBLE THREE-PHASE IN-LINE RISERS
ON HORIZONTAL CONSTRUCTION,
200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-105B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	6	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	18	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	6	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	6	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V, 45 MI
5	LEAD-EQ-6-CU-COVER-F	6	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-10-FBG-NB-F	4	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	ARR-RISER-10KV-BKT-F	6	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
7	ARR-RISER-18KV-BKT-F	6	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	-	6	-	-	SEE SECTION 26 FOR CABLE TERMINATION

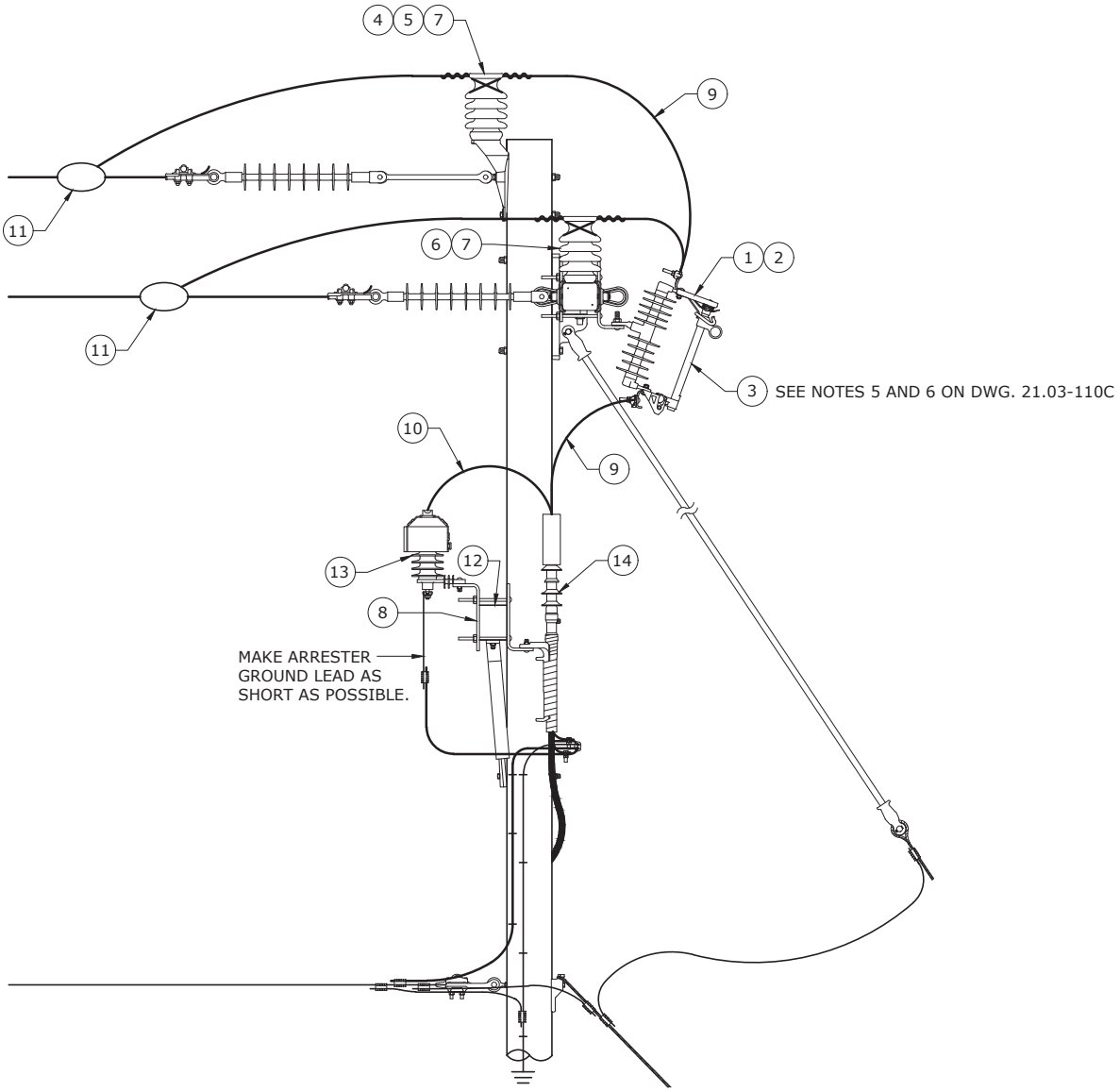
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

DOUBLE THREE-PHASE IN-LINE RISERS
ON HORIZONTAL CONSTRUCTION,
200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.03-105C



SIDE VIEW

NOTES:

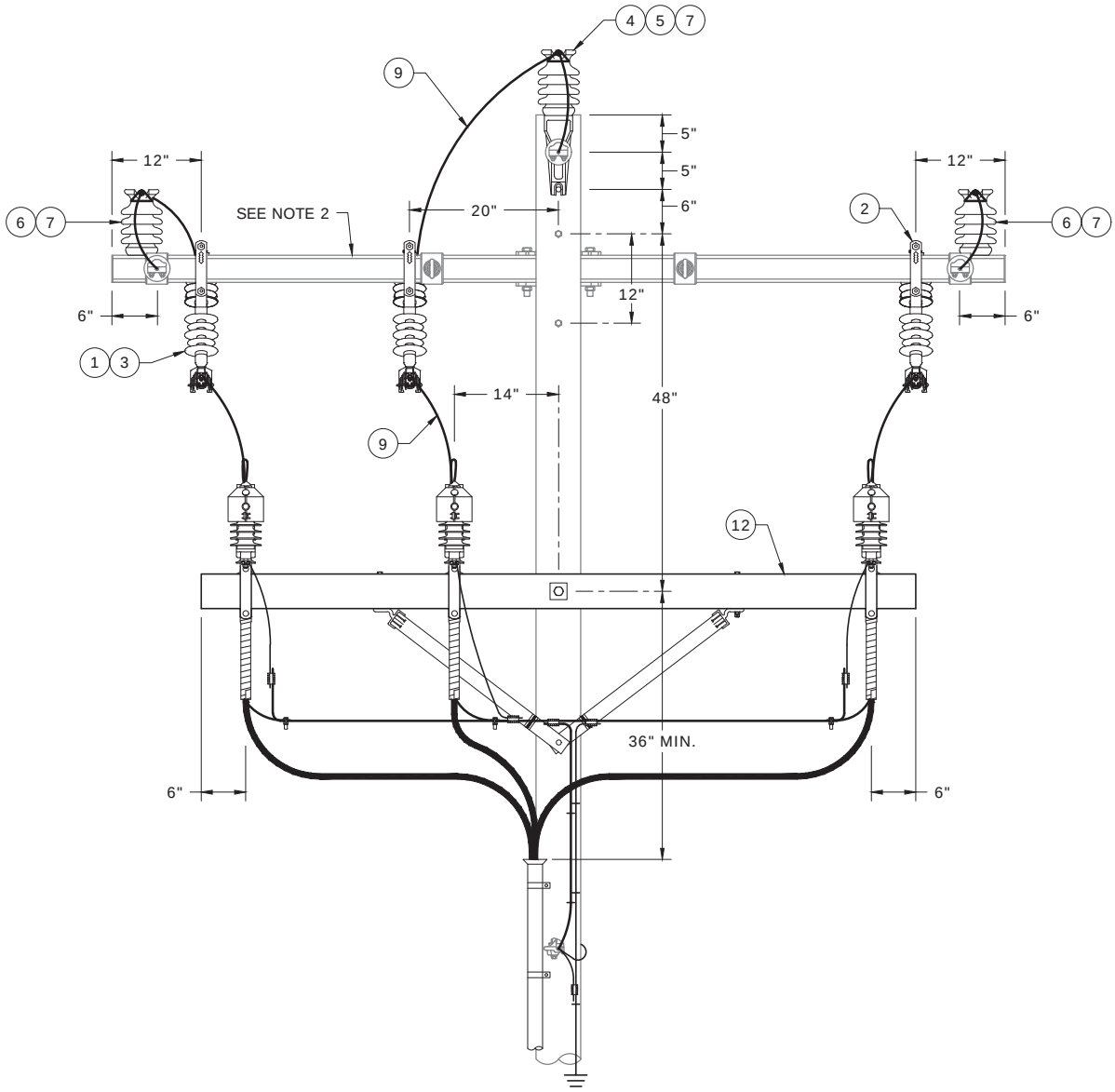
1. SEE DWG. 21.03-110B FOR FRONT VIEW AND DIMENSIONS.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. THE ITEM IN BUBBLE 3 (CUTOUT BLADE 300A) MAY NOT BE REQUIRED. SEE NOTE 5 ON DWG. 21.03-110C FOR FUSING METHODS.
4. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
5. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
6. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NEEDED.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DEADEND POLE, 200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-110A



FRONT VIEW

NOTES:

1. SEE DWG. 21.03-110A FOR SIDE VIEW AND NOTES.

2. SHOWN WITH 10 FT. DEADEND ARM FOR NEW CONSTRUCTION. AN EXISTING 8 FT. DEADEND ARM MAY BE USED IF THE REQUIRED 24" SPACING BETWEEN THE PHASES CAN BE OBTAINED AND IF THE ARM IS IN GOOD CONDITION.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER
ON HORIZONTAL DEADEND POLE,
200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-110B

NOTES:

1. MAKE THE GROUND LEAD FROM ARRESTER TO TERMINATION AS SHORT AS POSSIBLE.

2. THE TERMINATION GROUNDING BRAID IS USED FOR LC-SHIELDED CABLES.

3. A REMEDIAL ROD TREATMENT SHALL BE APPLIED WHEN INSTALLING AN UNDERGROUND RISER TO AN EXISTING CREOSOTE OR PENTACHLOROPHENOL TREATED DUKE OWNED POLE.

4. ANIMAL GUARD MUST NOT COVER MORE THAN THE TOP SKIRT OF THE ARRESTER.

5. ON ALL NEW INSTALLATIONS WITH SHORT TAPS TO RISERS (NO LONGER THAN 2 SPANS), INSTALL CUTOUTS AT BOTH THE TAP POLE AND THE RISER POLE. USE EITHER METHOD 1 OR METHOD 2 BELOW FOR FUSING. THE FUSING DESIGN IS AT THE DISCRETION OF DISTRIBUTION PLANNING AND DESIGN:

   METHOD 1: INSTALL THE RISER FUSES AT THE TAP POLE AND PLACE SOLID BLADES IN THE CUTOUTS AT THE RISER POLE.

   THE FOLLOWING CONDITIONS APPLY TO METHOD 1:

   I. THE FUSES AT THE TAP POLE MUST BE THE SAME SIZE AS WOULD NORMALLY HAVE BEEN USED AT THE RISER POLE.

   II. THE TAP POLE MUST BE IN SIGHT OF THE RISER POLE.

   III. THERE MUST BE NO MORE THAN ONE (1) SINGLE-PHASE RISER OR ONE (1) THREE-PHASE RISER ON THE TAP.

   IV. THE TAP MUST NOT HAVE ANY OVERHEAD TRANSFORMERS.

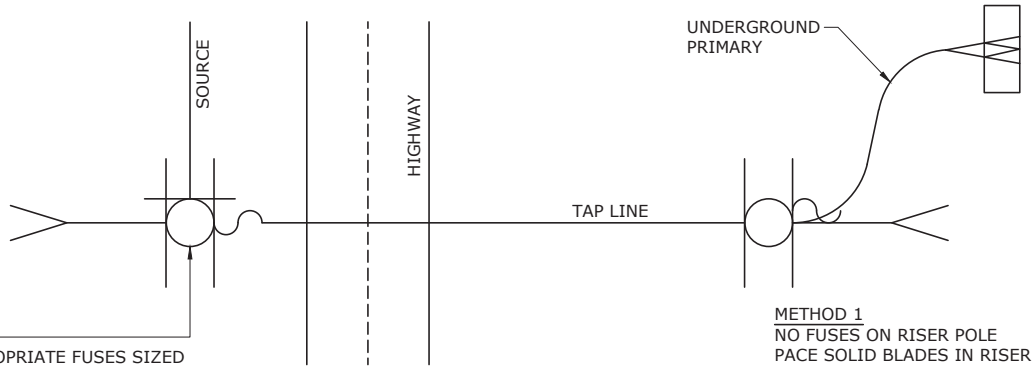
   V. THE FUSE DESIGN MUST BE CHANGED TO METHOD 2 IF THE TAP LINE IS EXTENDED OR IF OVERHEAD TRANSFORMERS OR ADDITIONAL RISERS ARE ADDED.

   METHOD 2: INSTALL COORDINATED FUSES AT THE TAP POLE, AND FUSES SPECIFIC TO THE RISER AT THE RISER POLE. THIS METHOD IS ALSO RECOMMENDED FOR TAPS LONGER THAN 2 SPANS. ADDITIONAL MATERIALS NEEDED AT THE TAP POLE (I.E. CUTOUTS, FUSES, BRACKETS) ARE NOT LISTED IN THE BILL OF MATERIALS FOR THIS STANDARD.

6. IN RARE CASES, THE TAP POLE MAY BE DETERMINED INACCESSIBLE FOR FUSES DUE TO LOCATION, HEAVY TRAFFIC, EXCESSIVE FLAGGING OR OTHER REASONS. DOCUMENT THESE SITUATIONS ON THE JOB DRAWING AND IN EMAX.

7. POTENTIAL RELIABILITY PROBLEMS SHOULD STILL BE CORRECTED ON THE TAP AND RISER POLE. INSTALL ANIMAL GUARDS, INSULATED LEAD WIRE, REMOVE UNNECESSARY GROUNDS ABOVE THE NEUTRAL, ETC. RELOCATING A RISER FUSE TO THE TAP POLE DOES NOT JUSTIFY IGNORING NEEDED RELIABILITY IMPROVEMENTS ON TAP OR RISER POLE.

SEE THE GRAPHICAL EXAMPLE BELOW.



FUSING TAP TO RISER POLE

REVISED	BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DEADEND POLE, 200A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-110C

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	SW-BLADE-300-15KV-1P-CUTOUT-F	3	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL
4 & 5	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	BKT-INSL-POST-PTOP-STL-F	1	4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			50129169	1	BRACKET, POLE TOP MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-MACH-SM-12IN-GALV-F	2	931563	2	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
6	INSL-POST-35KV-PORC-TT-F	2	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
7	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
8	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLTS
			938532	2	WASHER, LOCK,SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
9	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
10	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
11	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
12	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
13	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
13	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
14	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

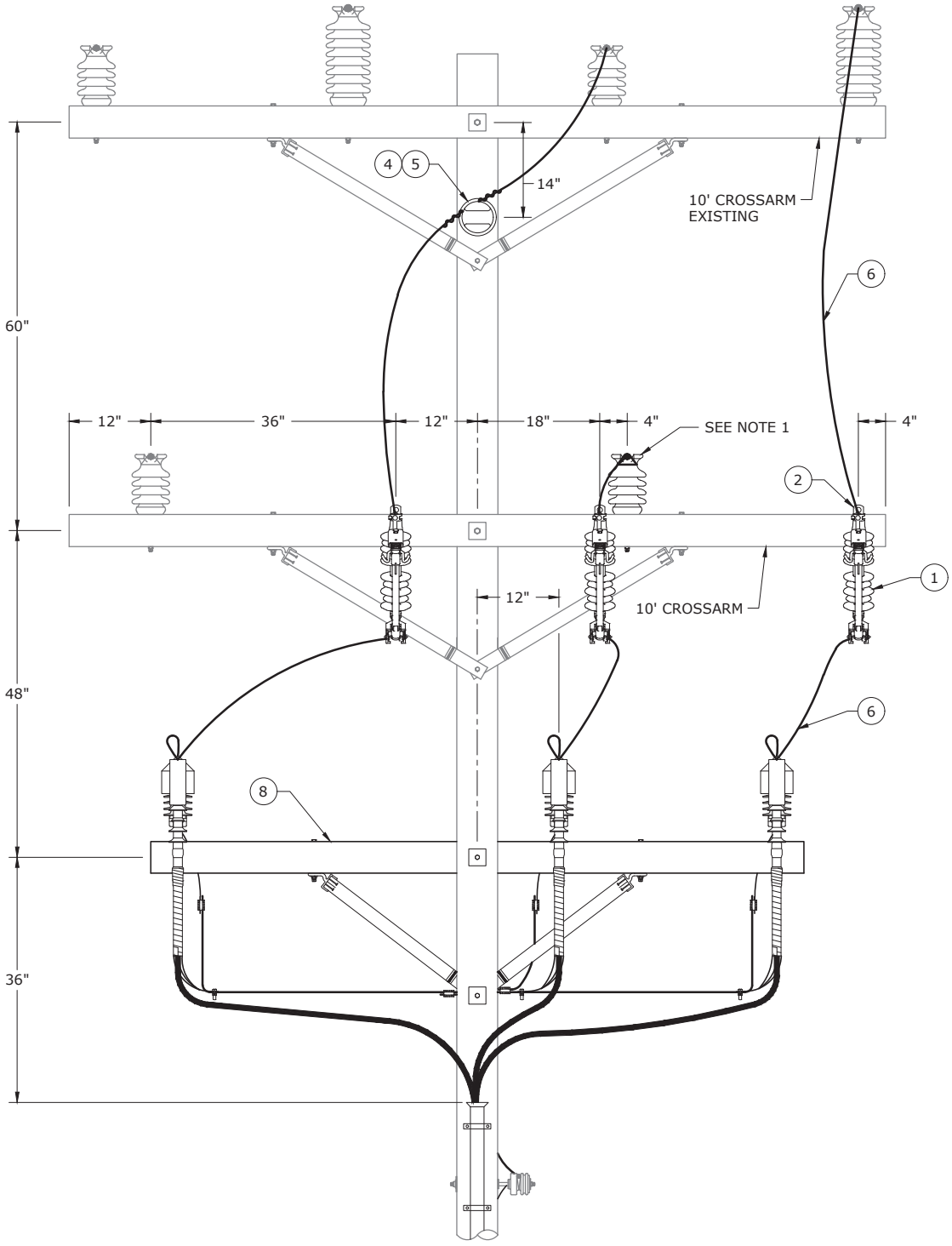
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER
ON HORIZONTAL DEADEND POLE,
200A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.03-110D



FRONT VIEW

NOTES:

1. FOR EXISTING CONSTRUCTION, LOWER PHASE MUST TRANSFER IN AS SHOWN.
2. SEE DWG. 21.03-115B FOR SIDE VIEW.
3. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
4. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
5. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
6. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NEEDED.

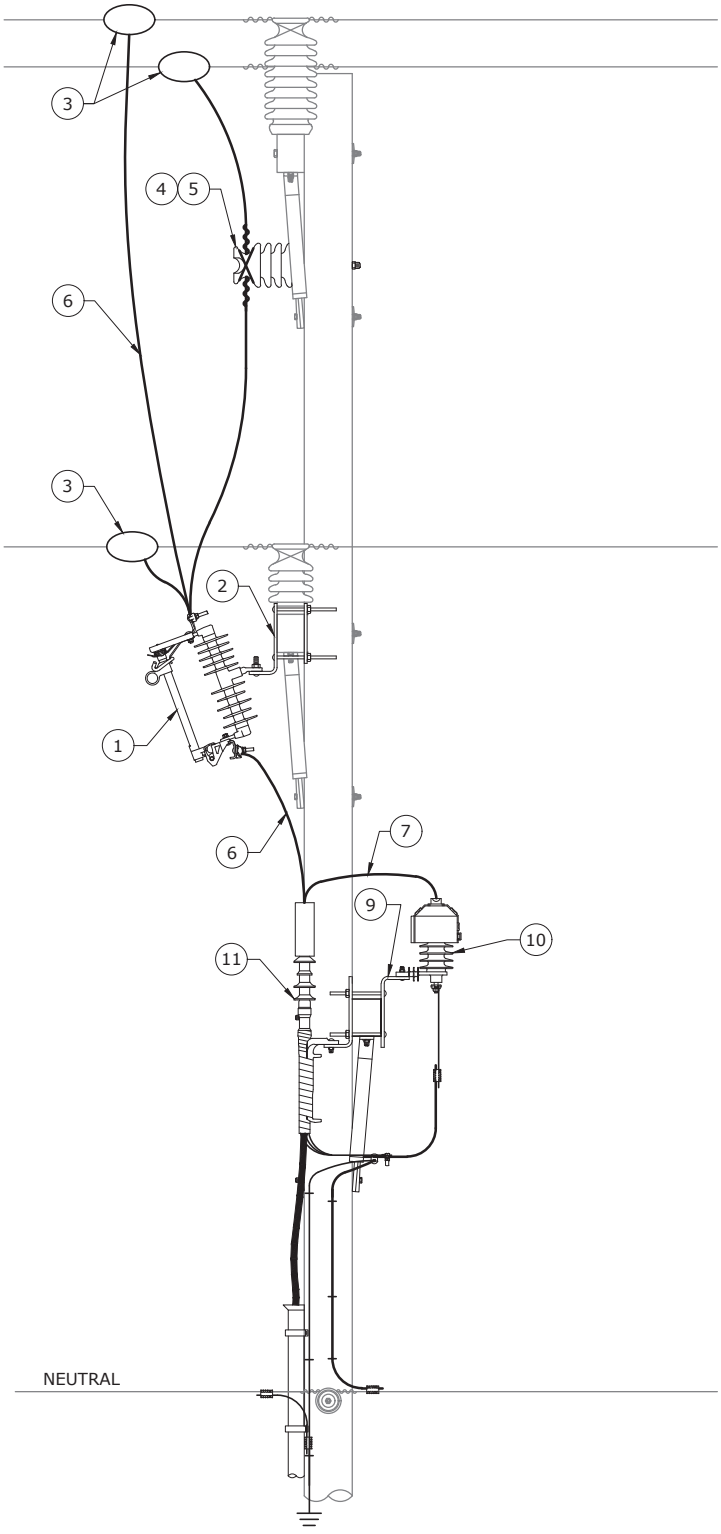
DUKE ENERGY.

3					
2					
1					
0	3/31/18	GORLEY	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 200A, 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.03-115A



SIDE VIEW

NOTES:

1. SEE DWG. 21.03-115A FOR FRONT VIEW AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 200A, 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-115B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-GAIN-LG-F	1	4002383	1	BRACKET, INSULATOR SPACER, 5-1/2", GALV DI, W/ 5 DEG ANGLE
	HDWR-DA-LG-14IN-GALV-F	1	930913	1	BOLT, DOUBLE ARMING, 3/4" DIA, 14" LG, GALV STL, THD UNC ROLL
5	TIE-COMP-SM-COV-FNECK-F	1	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA, 6 AWG
6	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V, 45 MI
7	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS, MOUNTING HOLES PER FPC
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
9	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
10	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

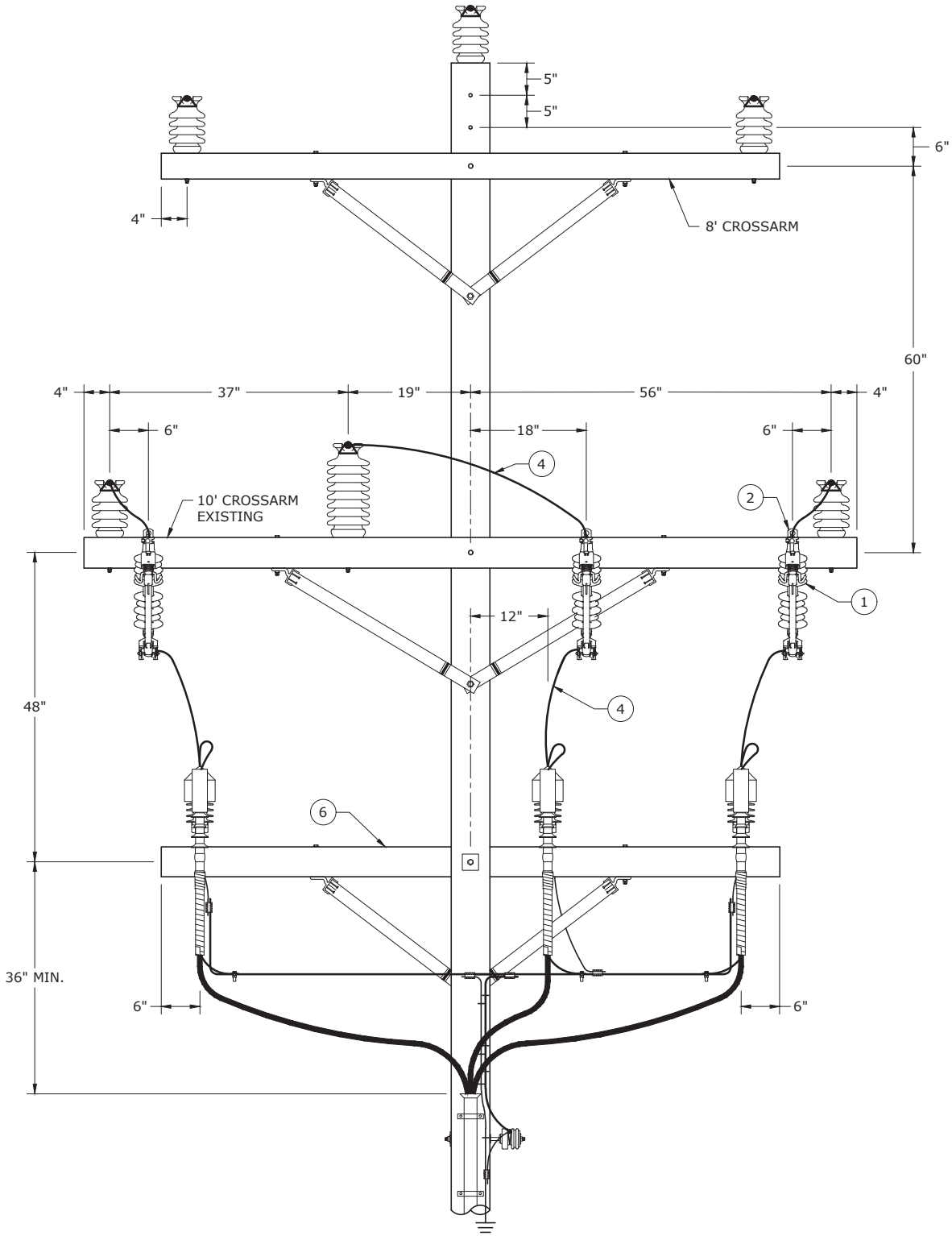
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 200A, 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.03-115C



FRONT VIEW

NOTES:

1. SEE DWG. 21.03-116B FOR SIDE VIEW.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; SEE DWG. 21.01-105A FOR U-GUARD RISERS.
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE THE ANIMAL PROTECTION. CUT BACK IF NECESSARY.

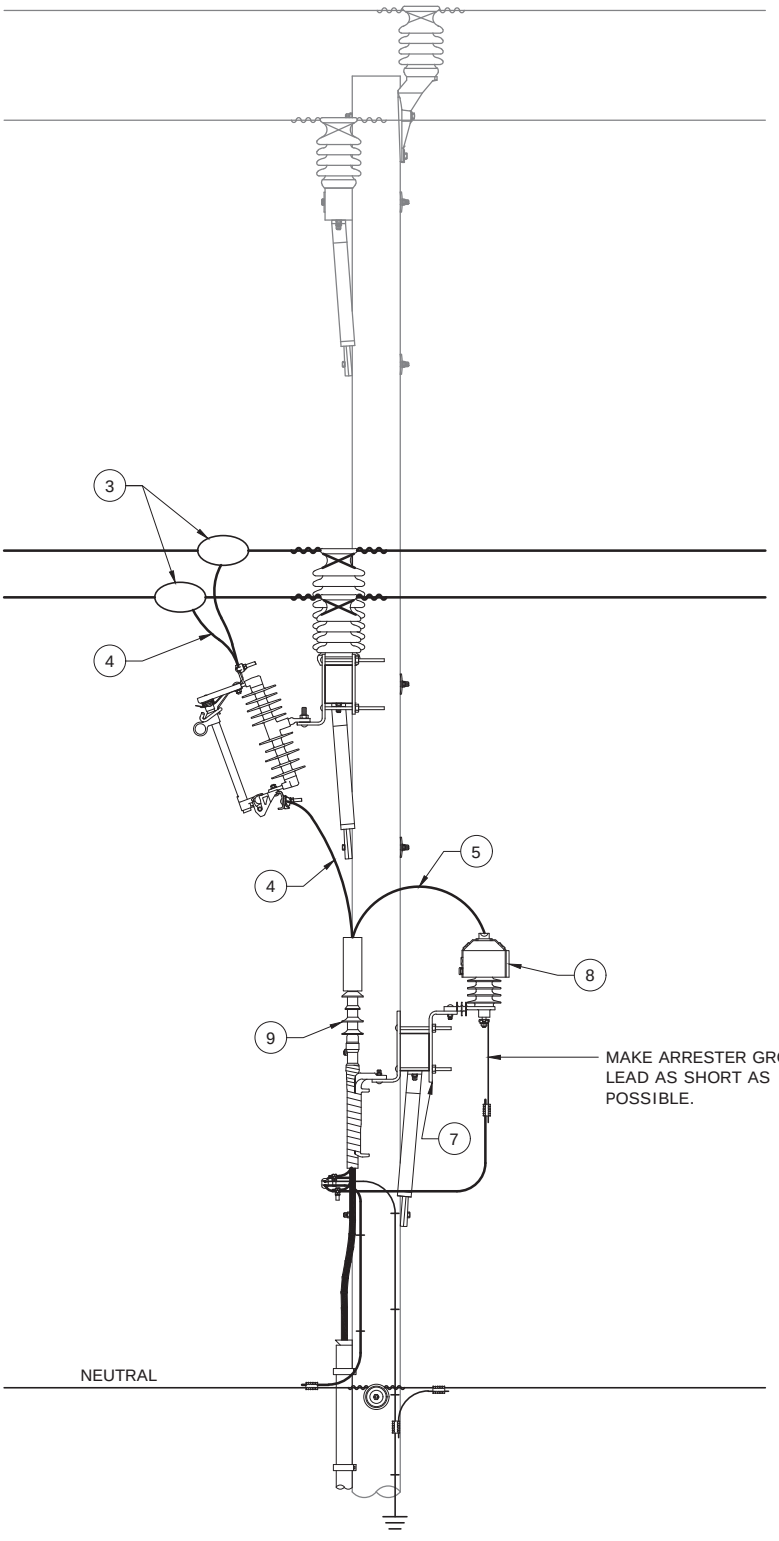
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT OVER/UNDER CONSTRUCTION 200A, 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-116A



SIDE VIEW

NOTES:

1. SEE DWG. 21.03-116A FOR FRONT VIEW AND NOTES.

3				
2				
1	4/4/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT OVER/UNDER CONSTRUCTION 200A, 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-116B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS, MOUNTING HOLES PER FPC
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV CS
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

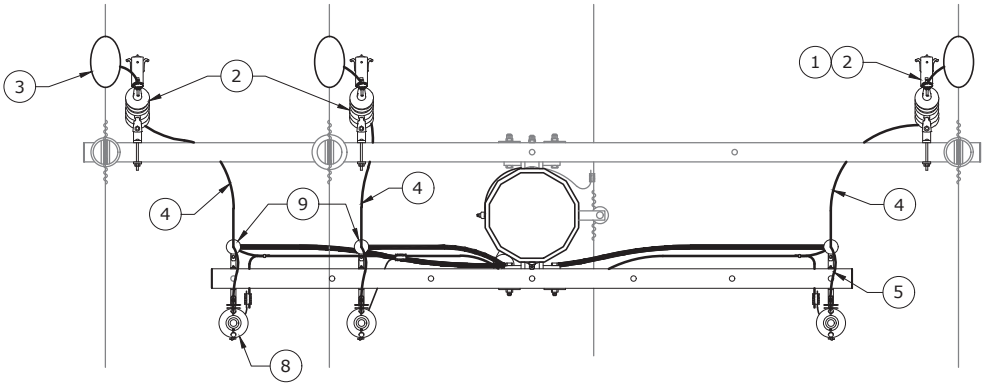
REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	GORLEY	EANES	ADCOCK
1	4/4/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT OVER/UNDER CONSTRUCTION 200A, 15KV/25KV/35KV

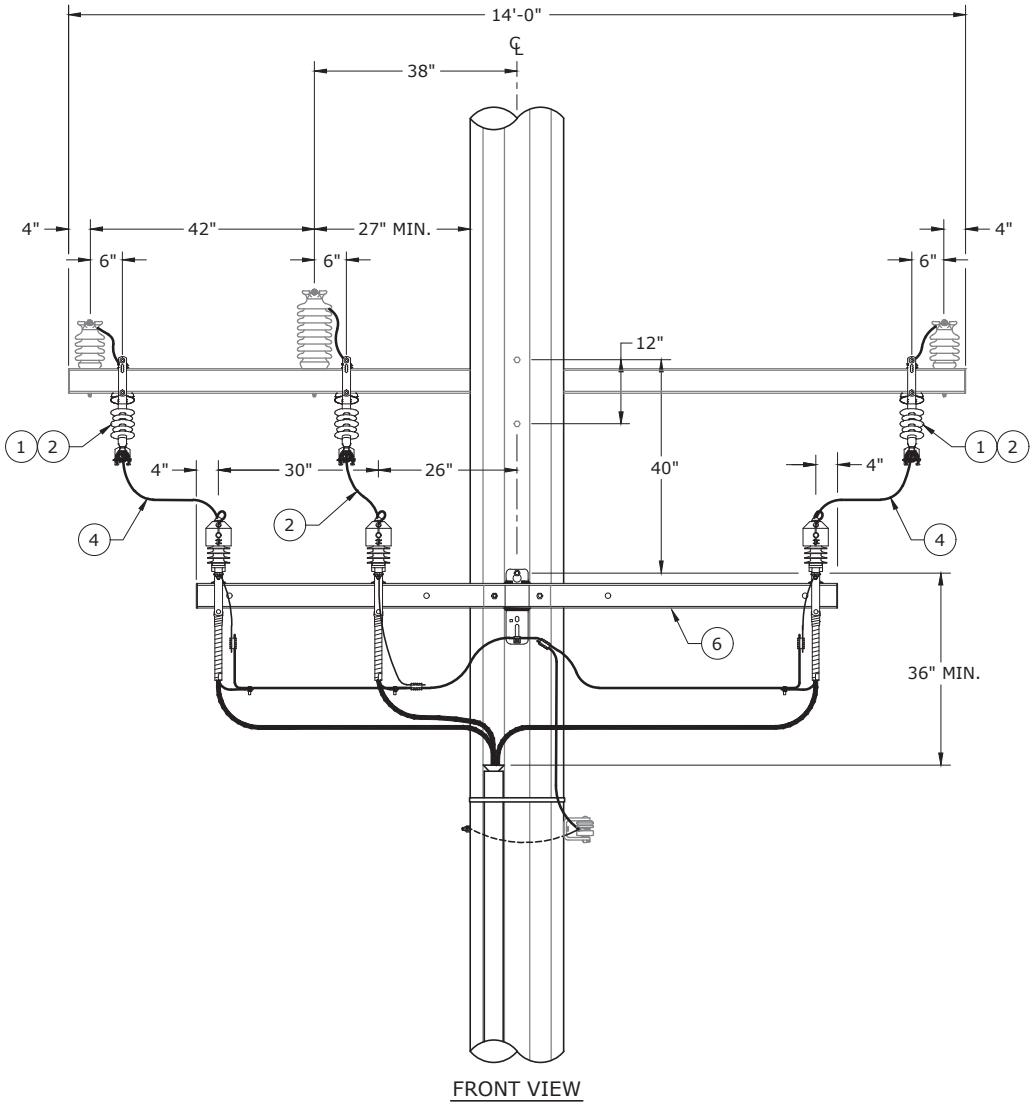
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.03-116C



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 21.03-120B FOR SIDE VIEW AND NOTES.

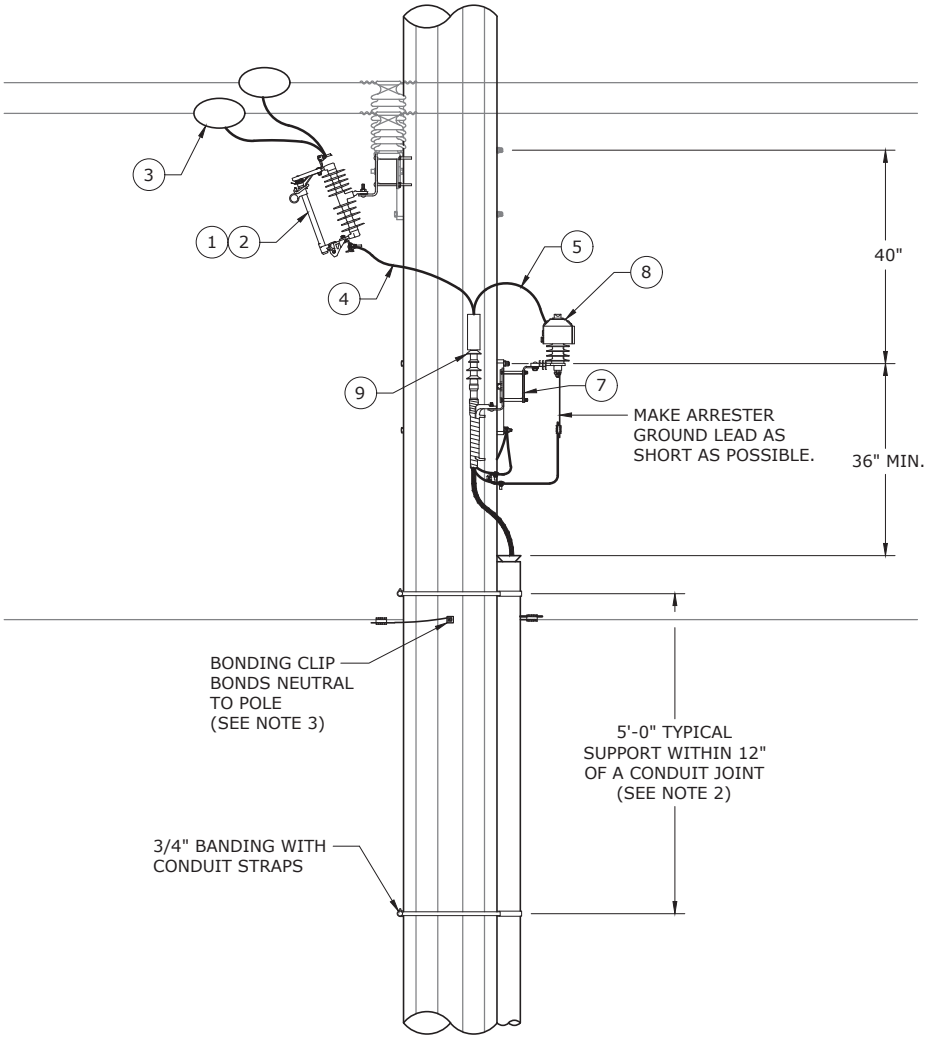
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-120A



SIDE VIEW

NOTES:

1. SEE DWG. 21.03-120A FOR FRONT AND PLAN VIEWS.
2. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. SEE DWG. 21.01-106A FOR U-GUARD.
3. SEE SECTION 21.00 FOR BONDING AND GROUNDING DETAILS.
4. LADDER HOOKS ARE FACTORY INSTALLED ON THE FRONT AND REAR FACES OF THE 12 SIDED POLES. RISERS WILL NEED TO INSTALL TO AN ADJACENT FACE AND NOT CONFLICT WITH LADDER CLIPS.
5. WHERE POSSIBLE, TAP TO SEPARATE DISTRIBUTION RISER POLE TO MINIMIZE EQUIPMENT INSTALLED ON TRANSMISSION POLES.
6. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
7. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
8. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.03-120B

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
5	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-10-FBG-NB-F	1	1519861	1	CROSSARM, POLE, 3-5/8" X 4-5/8" CROSS SECTION, 10' LG, FBG
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
	HDWR-MACH-LG-26IN-GALV-F	1	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

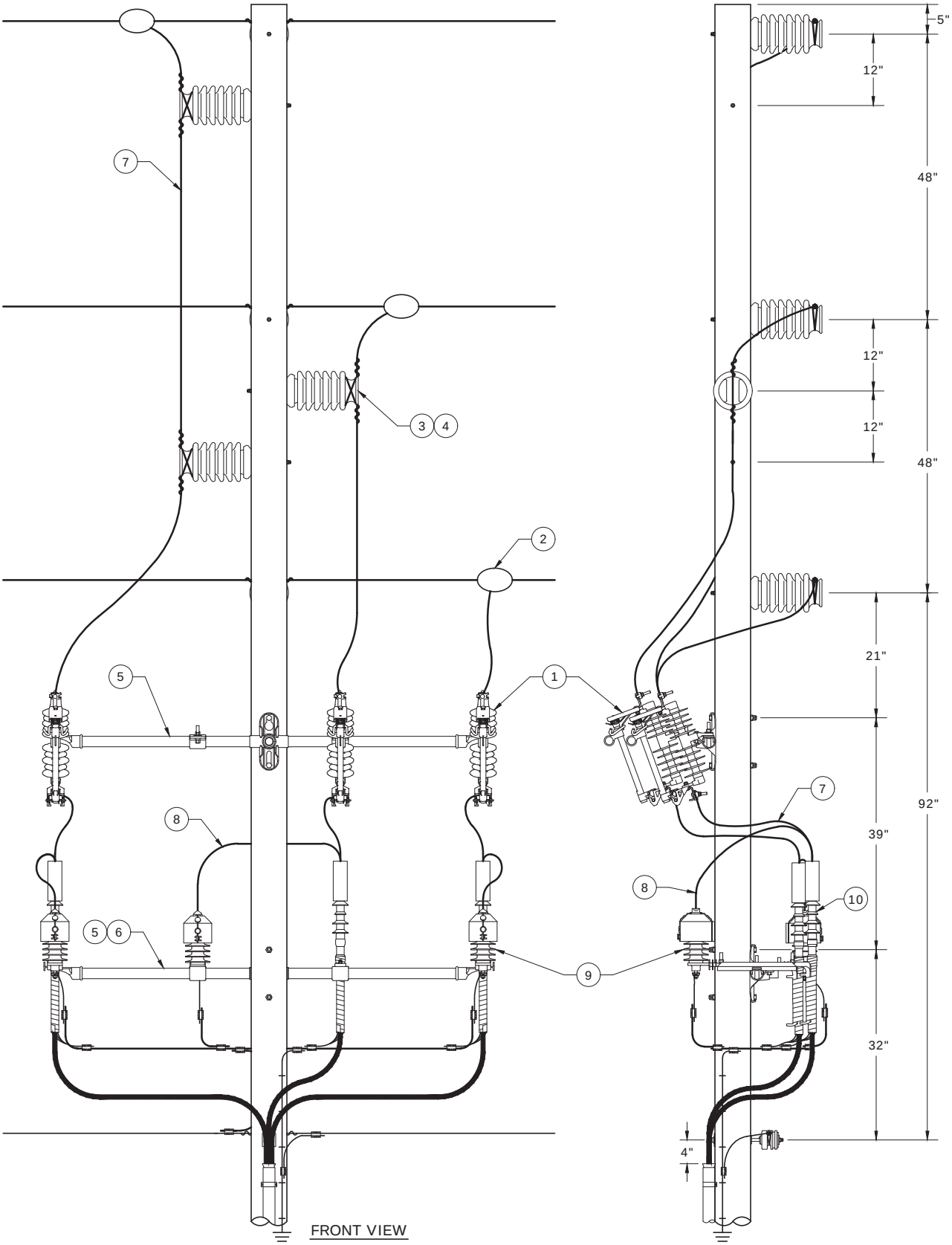
REVISED		BY	CHK'D	APPR.
3				
2				
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER UNDERBUILD
ON STEEL TRANSMISSION POLE
15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.03-120C



NOTES:

1. SEE DWG. 21.04-100B FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE IN-LINE RISER ON VERTICAL CONSTRUCTION 200A 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.04-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
3	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
	INSL-GAIN-LG-F	3	4002383	1	BRACKET, INSULATOR SPACER, 5-1/2", GALV DI, W/ 5 DEG ANGLE
4	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
5	BKT-EM-POLE-3P-FG-XL-F	2	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS,
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8" NOM, GALV STL, 750 PER PACK
			938975	2	WASHER, SQ CURVED, 3" NOM, 13/16" ID, 3" OD, 1/4" THK, GALV
	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
6	BKT-EM-ADPT-1POS-2POS-AL-F	2	1561611	1	BRACKET, ADAPTER, 12" LG, ALUM, F/ EQUIPMENT MOUNTING
7	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
8	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
9	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLYMER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

NOTES:

1. SEE DWG. 21.04-100A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. SEE DWG. 21.01-106A FOR U-GUARD.
3. SEE SECTION 21.00 FOR BONDING AND GROUNDING DETAILS.
4. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
5. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M ENGINEERING SUPERVISION.

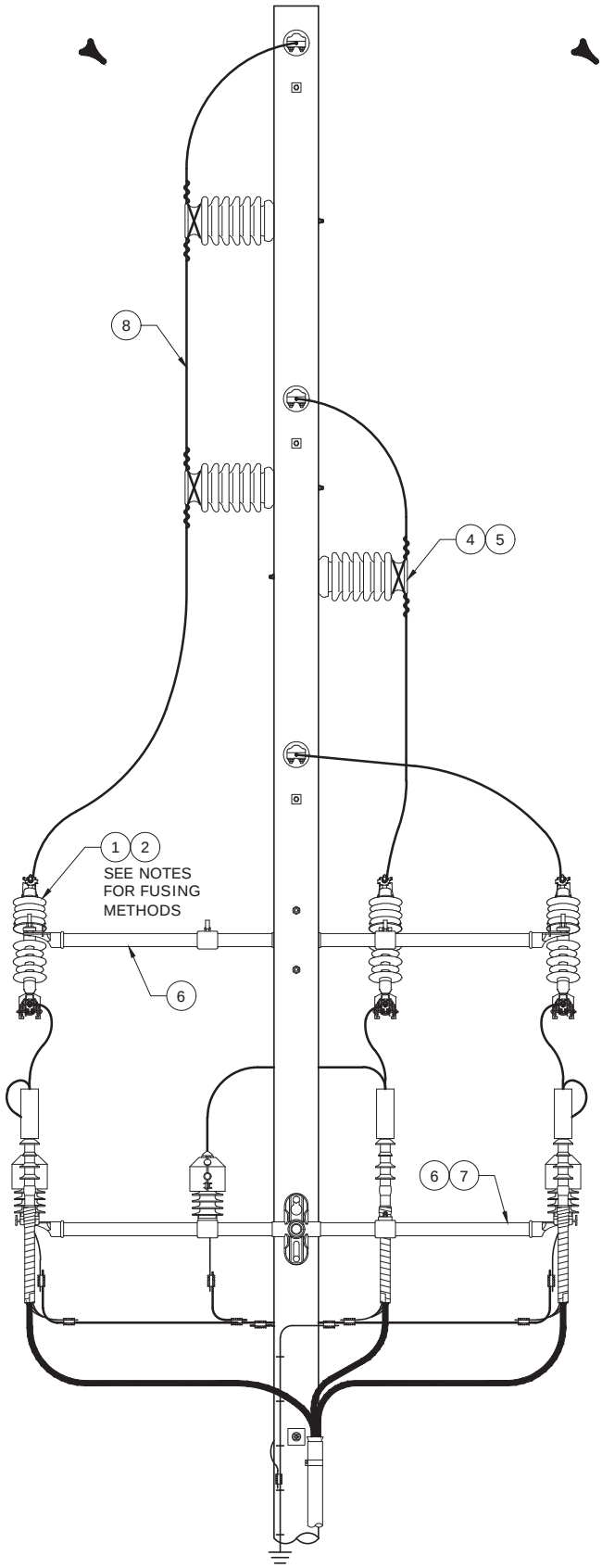
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	GORLEY	EANES	ADCOCK
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

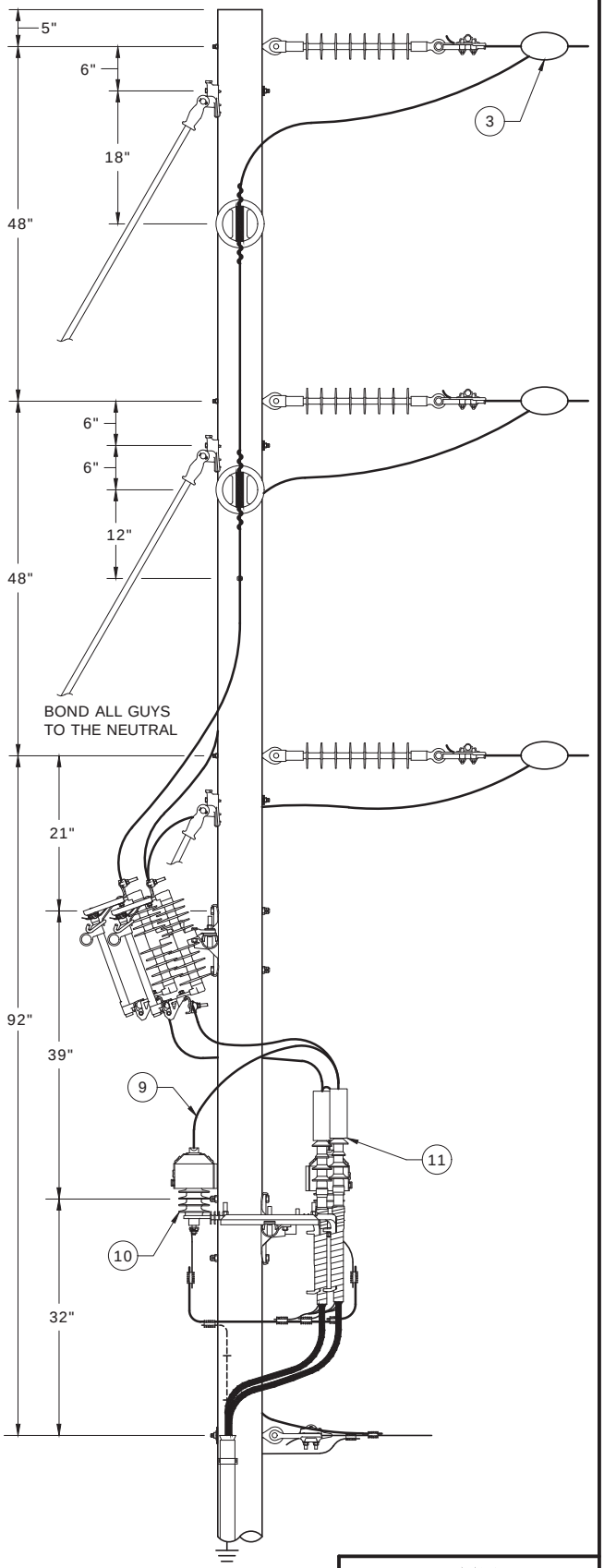
THREE-PHASE IN-LINE RISER ON VERTICAL CONSTRUCTION 200A 15KV/25KV

DEC	DEM	DEP	DEF
			X

21.04-100B



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 21.04-110C FOR BILL OF MATERIALS AND NOTES.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON VERTICAL DEADEND POLE 200A 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.04-110A

NOTES:

1. MAKE THE GROUND LEAD FROM ARRESTER TO TERMINATION AS SHORT AS POSSIBLE.

2. THE TERMINATION GROUNDING BRAID WILL NOT BE USED IN 4/0 AWG 15KV INSTALLATIONS.

3. A REMEDIAL ROD TREATMENT SHALL BE APPLIED WHEN INSTALLING AN UNDERGROUND RISER TO AN EXISTING CREOSOTE OR PENTACHLOROPHENOL TREATED DUKE OWNED POLE.

4. ANIMAL GUARD MUST NOT COVER MORE THAN THE TOP SKIRT OF THE ARRESTER.

5. ON ALL NEW INSTALLATIONS WITH SHORT TAPS TO RISERS (NO LONGER THAN 2 SPANS), INSTALL CUTOUTS AT BOTH THE TAP POLE AND THE RISER POLE. USE EITHER METHOD 1 OR METHOD 2 BELOW FOR FUSING. THE FUSING DESIGN IS AT THE DISCRETION OF DISTRIBUTION PLANNING AND DESIGN:

   METHOD 1: INSTALL THE RISER FUSES AT THE TAP POLE AND PLACE SOLID BLADES IN THE CUTOUTS AT THE RISER POLE.

   THE FOLLOWING CONDITIONS APPLY TO METHOD 1:

   I. THE FUSES AT THE TAP POLE MUST BE THE SAME SIZE AS WOULD NORMALLY HAVE BEEN USED AT THE RISER POLE.

   II. THE TAP POLE MUST BE IN SIGHT OF THE RISER POLE.

   III. THERE MUST BE NO MORE THAN ONE (1) SINGLE-PHASE RISER OR ONE (1) THREE-PHASE RISER ON THE TAP.

   IV. THE TAP MUST NOT HAVE ANY OVERHEAD TRANSFORMERS.

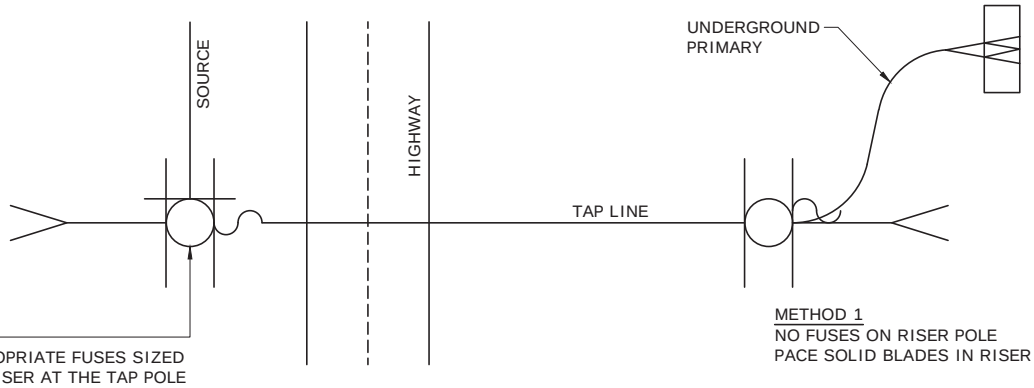
   V. THE FUSE DESIGN MUST BE CHANGED TO METHOD 2 IF THE TAP LINE IS EXTENDED OR IF OVERHEAD TRANSFORMERS OR ADDITIONAL RISERS ARE ADDED.

   METHOD 2: INSTALL COORDINATED FUSES AT THE TAP POLE, AND FUSES SPECIFIC TO THE RISER AT THE RISER POLE. THIS METHOD IS ALSO RECOMMENDED FOR TAPS LONGER THAN 2 SPANS. ADDITIONAL MATERIALS NEEDED AT THE TAP POLE (I.E. CUTOUTS, FUSES, BRACKETS) ARE NOT LISTED IN THE BILL OF MATERIALS FOR THIS STANDARD.

6. IN RARE CASES, THE TAP POLE MAY BE DETERMINED INACCESSIBLE FOR FUSES DUE TO LOCATION, HEAVY TRAFFIC, EXCESSIVE FLAGGING OR OTHER REASONS. DOCUMENT THESE SITUATIONS ON THE JOB DRAWING AND IN EMAX.

7. POTENTIAL RELIABILITY PROBLEMS SHOULD STILL BE CORRECTED ON THE TAP AND RISER POLE. INSTALL ANIMAL GUARDS, INSULATED LEAD WIRE, REMOVE UNNECESSARY GROUNDS ABOVE THE NEUTRAL, ETC. RELOCATING A RISER FUSE TO THE TAP POLE DOES NOT JUSTIFY IGNORING NEEDED RELIABILITY IMPROVEMENTS ON TAP OR RISER POLE.

SEE THE GRAPHICAL EXAMPLE BELOW.



METHOD 1
INSTALL APPROPRIATE FUSES SIZED
FOR THE UG RISER AT THE TAP POLE

METHOD 2
INSTALL APPROPRIATE FUSES COORDINATED
FOR THE TAP AT THE TAP POLE

METHOD 1
NO FUSES ON RISER POLE
PACE SOLID BLADES IN RISER POLE CUTOUTS

METHOD 2
INSTALL APPROPRIATE FUSES SIZED
FOR THE UG RISER AT THE RISER POLE

FUSING TAP TO RISER POLE

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER
ON VERTICAL DEADEND POLE,
200A 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.04-110B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	SW-BLADE-300-15KV-1P-CUTOUT-F	3	194487	1	BLADE, ELECTRICAL, DISCONNECT, 15KV, 300A, CU, SOL
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
	INSL-GAIN-LG-F	3	4002383	1	BRACKET, INSULATOR SPACER, 5-1/2", GALV DI, W/ 5 DEG ANGLE
5	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
6	BKT-EM-ADPT-1POS-2POS-AL-F	2	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS
7	BKT-EM-POLE-3P-FG-XL-F	2	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS
			930030	2	WASHER,LOCK, DBL COIL SPRING, 5/8" NOM, GALV STL, 750 PER PACK
			938975	2	WASHER, SQ CURVED, 3" NOM, 13/16" ID, 3" OD, 1/4" THK, GALV
	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT,MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GAL
8	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
9	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
10	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLYMER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

NOTES:

1. SEE DWG. 21.04-110A FOR DESIGN SPECIFICATIONS.
2. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. SEE DWG. 21.01-106A FOR U-GUARD.
3. SEE SECTION 21.00 FOR BONDING AND GROUNDING DETAILS.
4. ITEM 2 (SOLID BLADE SWITCH) MAY NOT BE REQUIRED. SEE NOTE 5 ON DWG. 21.04-110B FOR FUSING MEDTHODS.
5. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
6. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M ENGINEERING SUPERVISION.

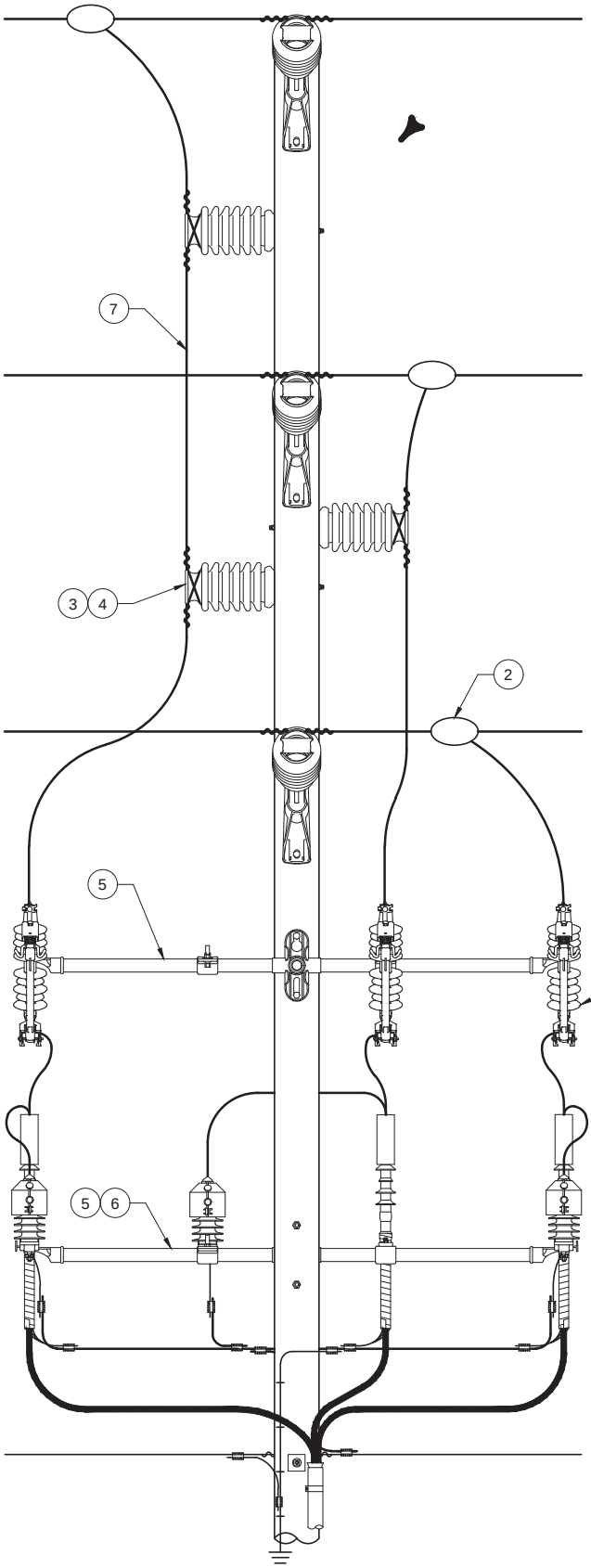
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	GORLEY	EANES	ADCOCK
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

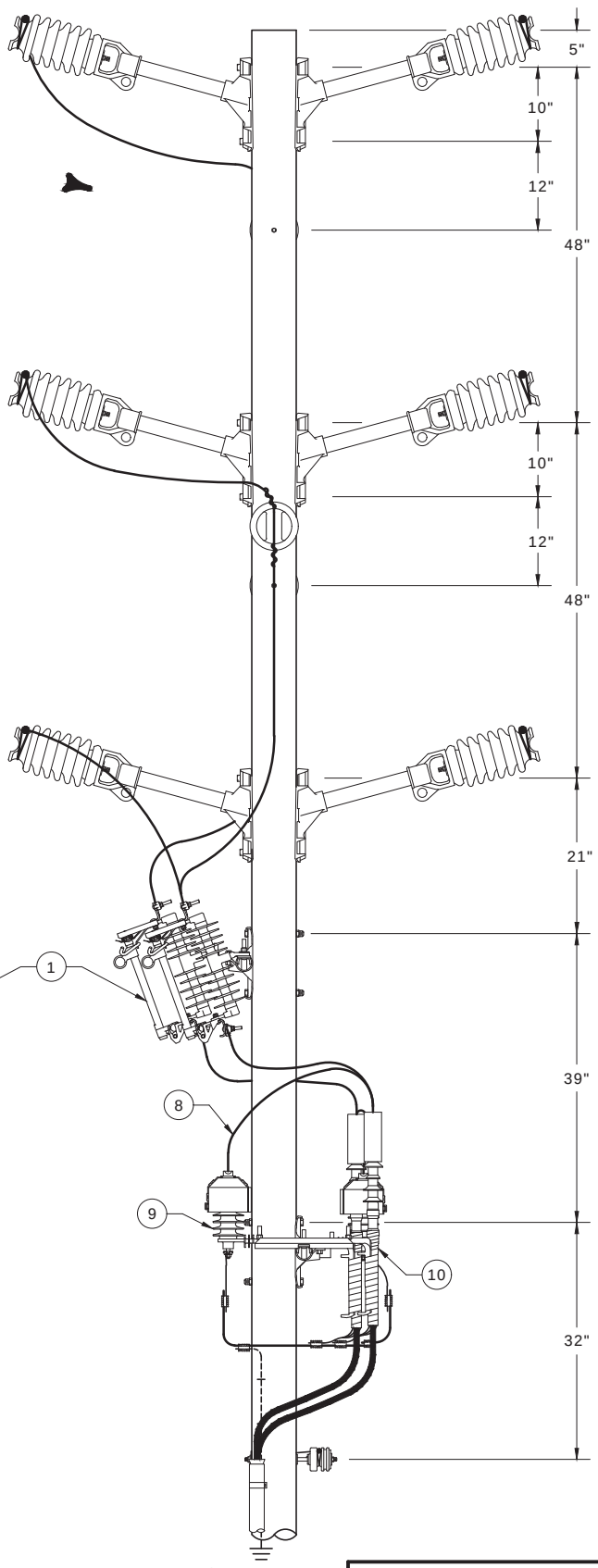
THREE-PHASE RISER ON
VERTICAL DEADEND POLE
200A 15KV/25KV

DEC	DEM	DEP	DEF
			X

21.04-110C



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 21.04-115B FOR BILL OF MATERIALS.

3				
2				
1	6/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE IN-LINE RISER ON VERTICAL DOUBLE CIRCUIT 200A, 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.04-115A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	-	-	-	-	SEE SECTION 04 FOR CONNECTOR DETAILS
3	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-STUD-STL-10IN-THD-F	3	134390	1	STUD, INSULATOR, 5/8" DIA, 10" LG, 11 UNC, 6" THD LG, GALV STL
	INSL-GAIN-LG-F	3	4002383	1	BRACKET, INSULATOR SPACER, 5-1/2", GALV DI, W/ 5 DEG ANGLE
4	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
5	BKT-EM-POLE-3P-FG-XL-F	2	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8" NOM, GALV STL, 750 PER PACK
			938975	2	WASHER, SQ CURVED, 3" NOM, 13/16" ID, 3" OD, 1/4" THK, GALV
	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GAL
6	BKT-EM-ADPT-1POS-2POS-AL-F	2	1561611	1	BRACKET, ADAPTER, 12" LG, ALUM, F/ EQUIPMENT MOUNTING
7	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
8	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
9	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLYMER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	-	-	-	-	SEE SECTION 26 FOR CABLE TERMINATION

NOTES:

1. SEE DWG. 21.04-115A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. SEE DWG. 21.01-106A FOR U-GUARD.
3. SEE SECTION 21.00 FOR BONDING AND GROUNDING DETAILS.
4. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
5. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M ENGINEERING SUPERVISION.

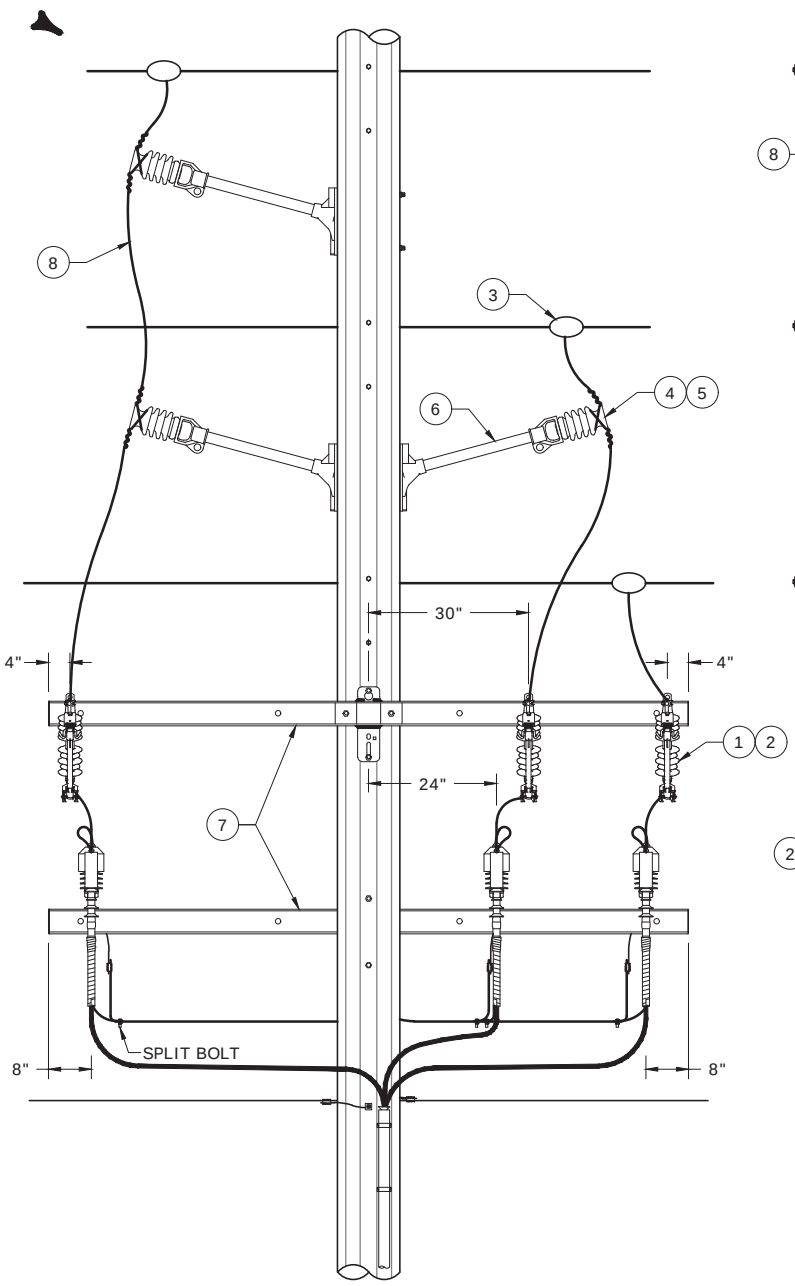
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3	1/31/19	GORLEY	EANES	ADCOCK
2	6/30/18	GORLEY	EANES	ADCOCK
1	4/30/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

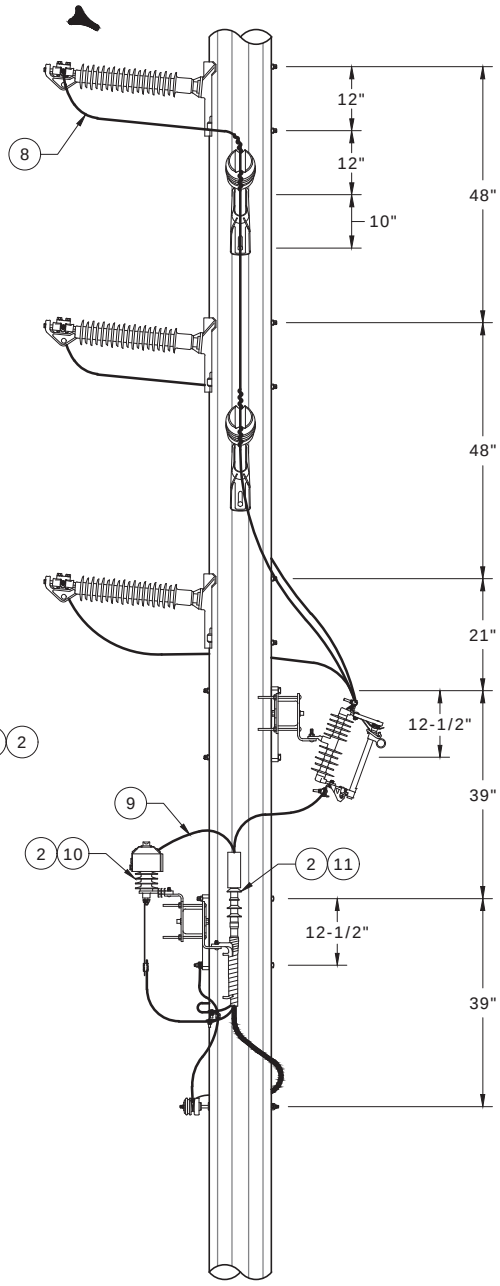
THREE-PHASE IN-LINE RISER ON VERTICAL DOUBLE CIRCUIT 200A, 15KV/25KV

DEC	DEM	DEP	DEF
			X

21.04-115B



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 21.04-120B FOR BILL OF MATERIALS AND NOTES.

3				
2	6/30/18	GORLEY	EANES	ADCOCK
1	4/12/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER UNDERBUILD ON
STEEL TRANSMISSION POLE (VERTICAL CONSTRUCTION)
200A, 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.04-120A

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	FUSE-CUTOUT-100-15KV-POLY-LINE-F	3	1501218	1	CUTOUT, FUSE, NON-LOADBREAK, 100A, 16KAIC, 15KV, POLYMER
2	BKT-EM-ARM-1P-STL-SM-F	9	1412032	1	BRACKET, CROSSARM, 3/8" THK, W/ FRONT & BACK PLATES
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	INSL-POST-35KV-PORC-TT-F	3	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
5	TIE-COMP-SM-COV-FNECK-F	3	214569	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA
6	BKT-INSL-POST-POLE-LG-FG-F	3	1513237	1	BRACKET, STANDOFF, 2" DIA X 30" LG, FIBERGLASS, HORZ
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
			4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
	HDWR-MACH-SM-26IN-GALV-F	2	931619	1	BOLT, MACHINE, 5/8" DIA, UNC, 26" LG, SQ HEAD, GALV STL
7	ARM-SGL-10-FBG-NB-F	2	1519861	1	CROSSARM, POLE, 3 5/8" X 4 5/8" CROSS SECTION 10 LG. FIBERGLASS
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL 750 PER PACKAGE
	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
8	LEAD-EQ-2-CU-COVER-F	3	4192428	12 FT.	WIRE/CABLE, ELECTRICAL, 2 AWG, CU CONDUCTOR, SOL, 600V
9	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
10	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, POLYMER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

NOTES:

1. SEE DWG. 21.04-120A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 21.01-101A FOR RISER CONDUIT AND ATTACHMENT HARDWARE. SEE DWG. 21.01-106A FOR U-GUARD.
3. SEE SECTION 21.00 FOR BONDING AND GROUNDING DETAILS.
4. LADDER HOOKS ARE FACTORY INSTALLED ON THE FRONT AND REAR FACES OF THE 12 SIDED POLES. RISERS WILL NEED TO INSTALL TO AN ADJACENT FACE AND NOT CONFLICT WITH LADDER CLIPS.
5. WHERE POSSIBLE, TAP TO SEPARATE DISTRIBUTION RISER POLE TO MINIMIZE EQUIPMENT INSTALLED ON TRANSMISSION POLES.
6. SYSTEM NEUTRAL SHALL BE BONDED TO STEEL POLES. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
7. PRIMARY TERMINATION STEM CONNECTOR MUST NOT EXTEND ABOVE ANIMAL PROTECTION. CUT BACK IF NECESSARY.
8. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M ENGINEERING SUPERVISION.

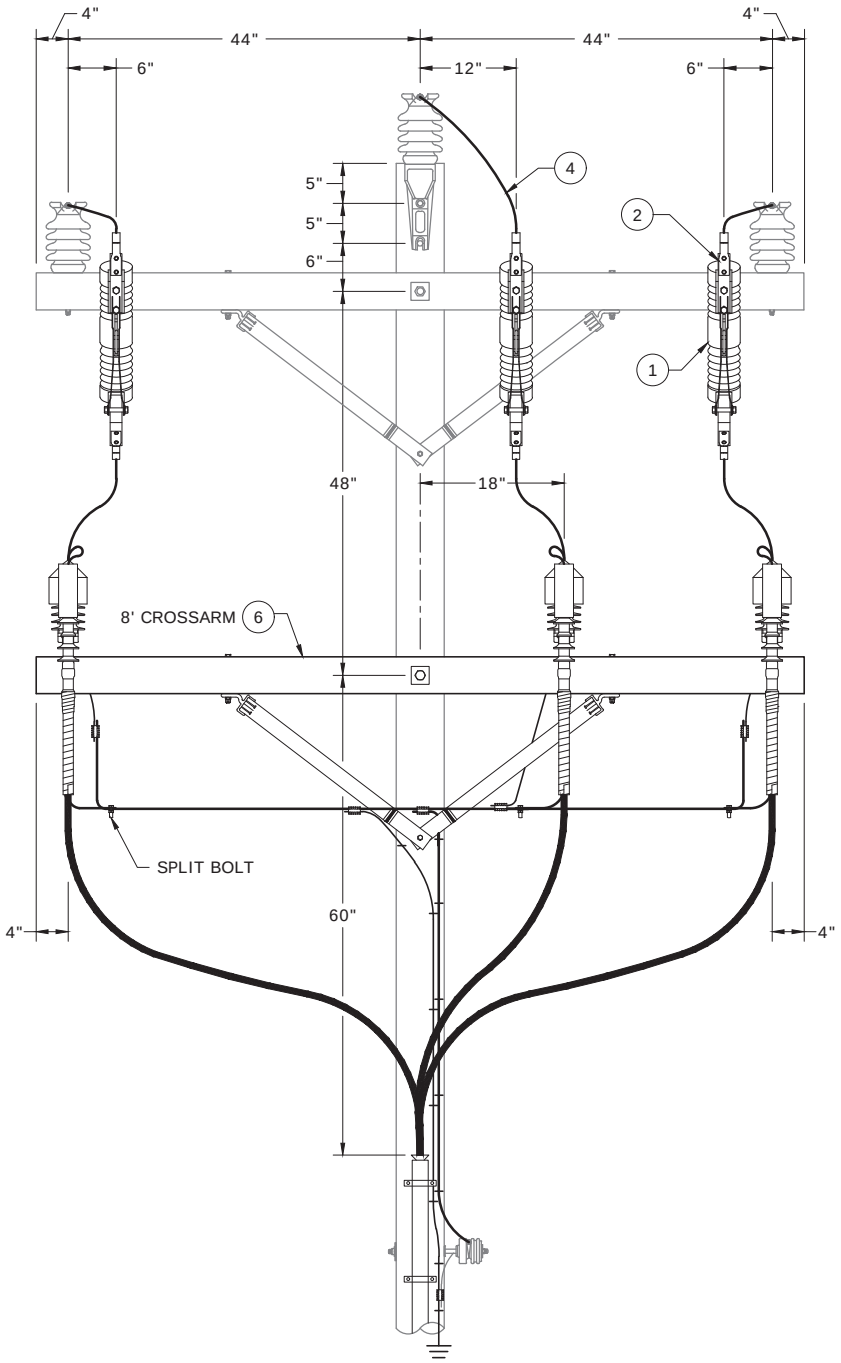
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2	4/30/18	GORLEY	EANES	ADCOCK
1	4/12/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

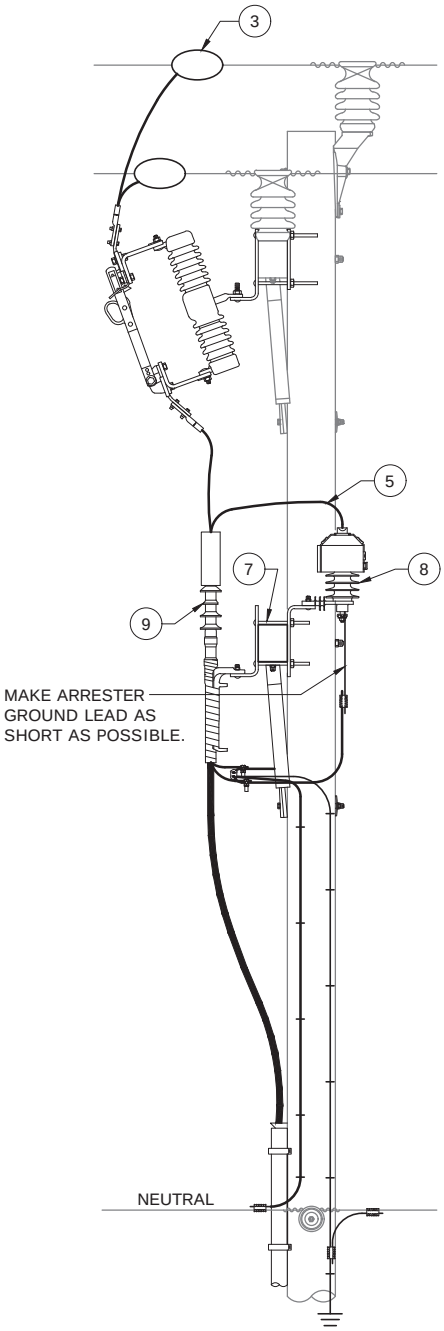
THREE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE (VERTICAL CONSTRUCTION) 200A, 15KV/25KV

DEC	DEM	DEP	DEF
			X

21.04-120B



FRONT VIEW



SIDE VIEW

NOTES:

1. AN EXISTING 8 FOOT CROSSARM MAY BE USED IF THE REQUIRED 24" SPACING BETWEEN PHASES CAN BE OBTAINED AND IF THE ARM IS IN GOOD CONDITION. IF NOT, REPLACE WITH A 10 FOOT CROSSARM. NEW INSTALLATIONS REQUIRE A 10 FOOT CROSSARM.

2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.

3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

4. SEE DWG. 21.01-100A FOR CONDUIT RISERS; DWG. 21.01-105A FOR U-GUARD RISERS.

DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE IN-LINE RISER ON HORIZONTAL CONSTRUCTION, 600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.05-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-CUTOUT-600-25KV-1P-NLB-F	3	486011	1	SWITCH, DISCONNECT, LOADBREAK, 27KV 600A, SPST, (2) HOLE NEMA
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
5	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL, ELEC
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
9	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

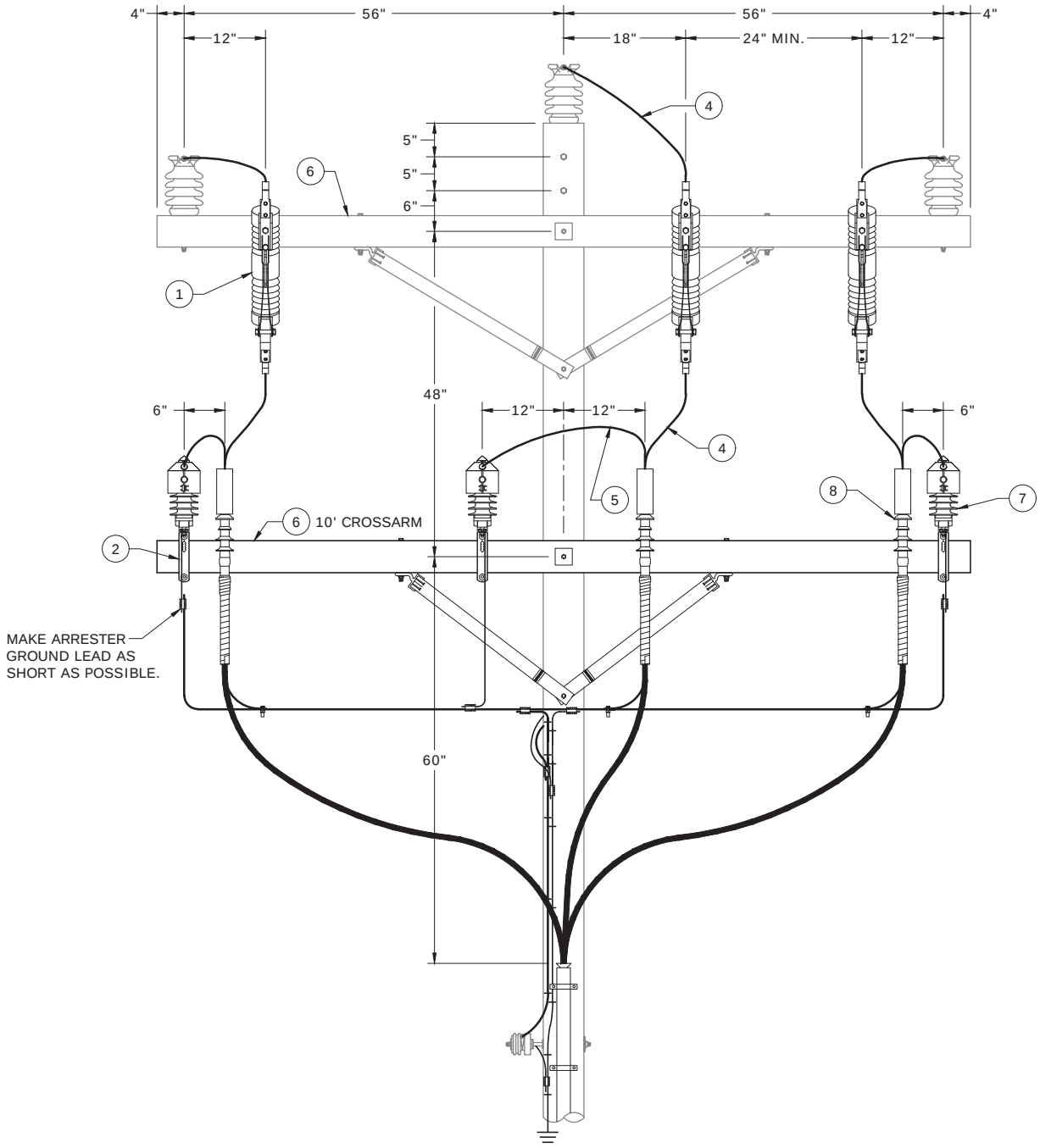
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE IN-LINE RISER ON HORIZONTAL CONSTRUCTION, 600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.05-100B



FRONT VIEW

NOTES:

1. SEE DWG. 21.05-105B FOR SIDE VIEW AND GROUNDING DETAIL.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. FOR CONDUIT RISERS, SEE DWG. 21.01-100A. FOR U-GUARD RISERS, SEE DWG. 21.01-105A.

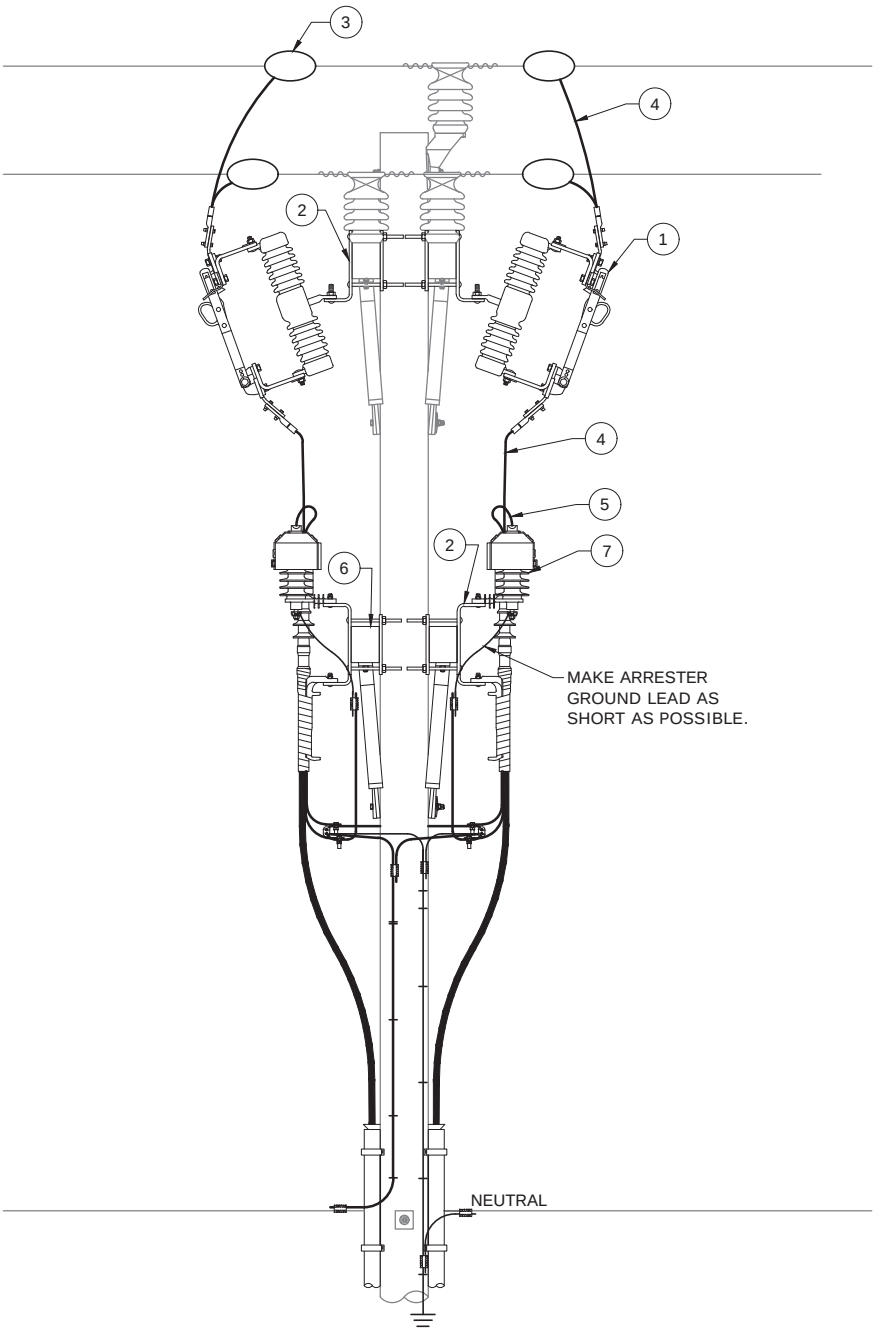
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

DOUBLE THREE-PHASE IN-LINE RISERS
ON HORIZONTAL CONSTRUCTION,
600A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-105A



SIDE VIEW

NOTES:

1. SEE DWG. 21.05-105A FOR FRONT VIEW AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE THREE-PHASE IN-LINE RISERS
ON HORIZONTAL CONSTRUCTION,
600A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-105B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-CUTOUT-600-25KV-1P-NLB-F	6	486011	1	SWITCH, DISCONNECT, LOADBREAK, 27KV 600A, SPST, (2) HOLE NEMA
2	BKT-EM-ARM-1P-STL-SM-F	18	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	6	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-500-AL-COVER-F	6	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
5	LEAD-EQ-6-CU-COVER-F	6	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
6	ARM-SGL-10-FBG-NB-F	4	1519861	1	CROSSARM, POLE 3-5/8" X 4-5/8" CROSS SECTION 10' LG FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	4	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
7	ARR-RISER-10KV-BKT-F	6	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
7	ARR-RISER-18KV-BKT-F	6	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
8	-	6	-	-	SEE SECTION 26 FOR CABLE TERMINATION

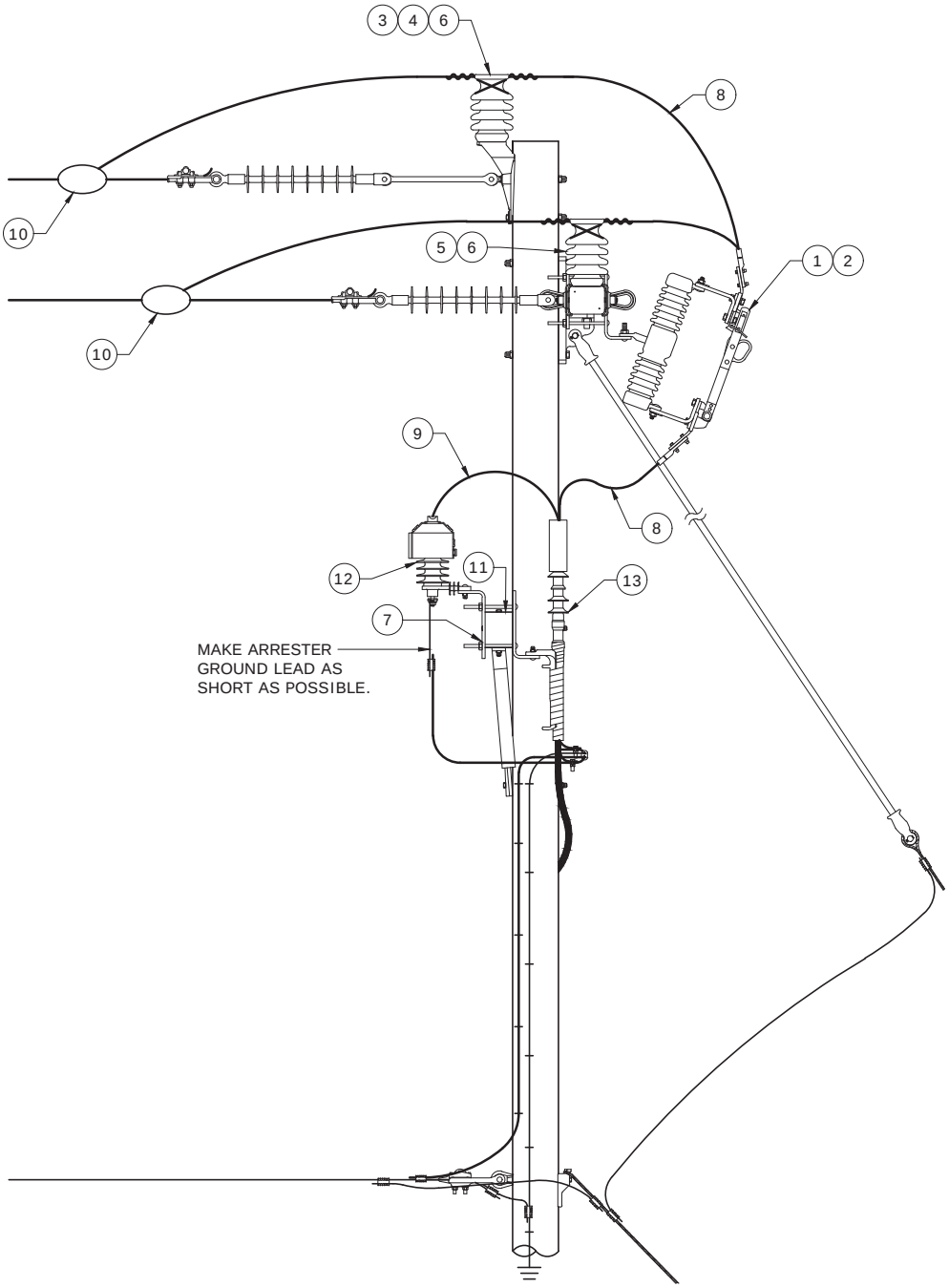
DUKE ENERGY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DOUBLE THREE-PHASE IN-LINE RISERS
ON HORIZONTAL CONSTRUCTION,
600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.05-105C



SIDE VIEW

NOTES:

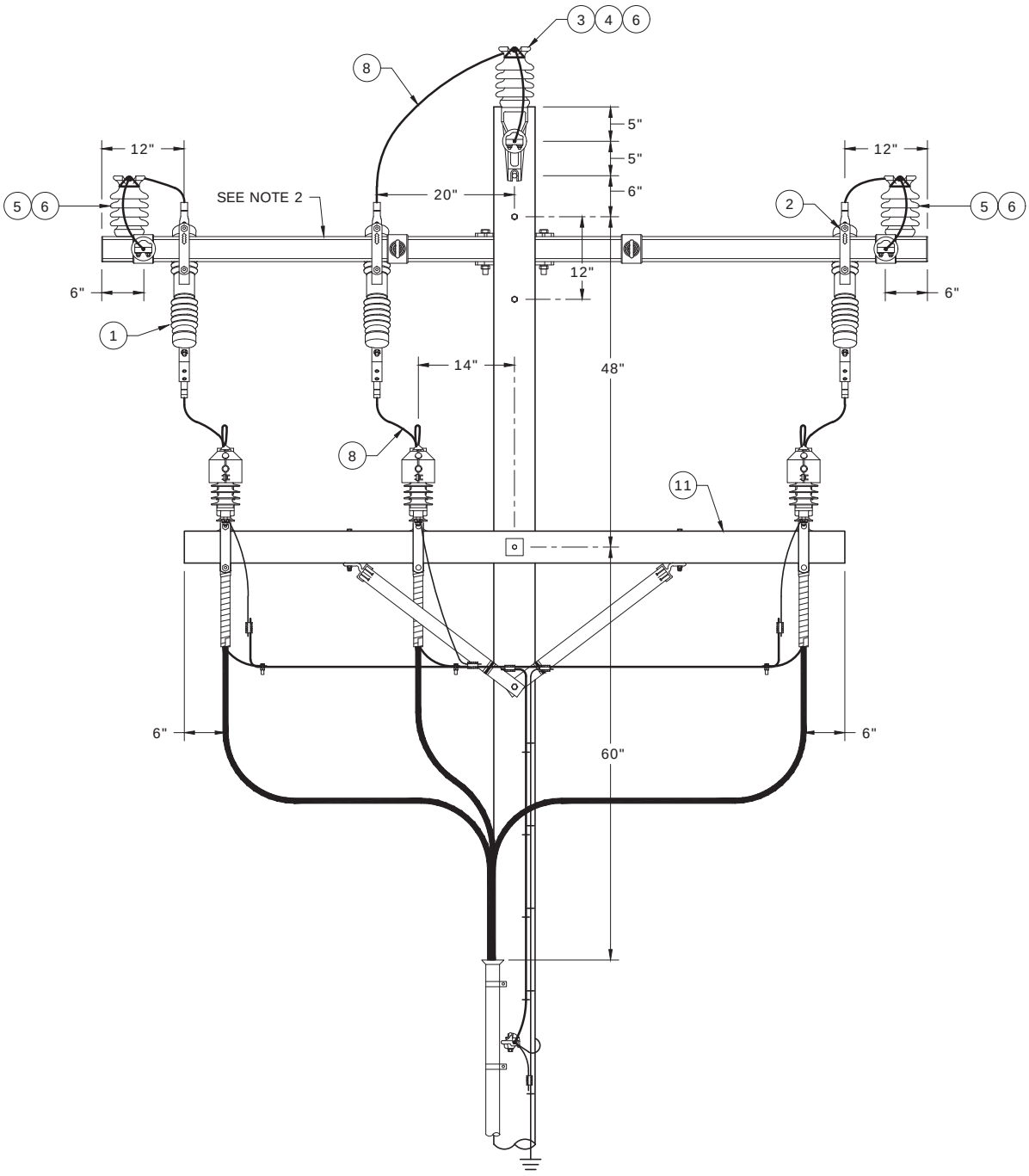
1. SEE DWG. 21.05-110B FOR FRONT VIEW AND DIMENSIONS.
2. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
3. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
4. SEE DWG. 21.01-100A FOR CONDUIT RISERS. SEE DWG. 21.01-105A FOR U-GUARD RISERS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER ON HORIZONTAL DEADEND POLE, 600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.05-110A



FRONT VIEW

NOTES:

1. SEE DWG. 21.05-110A FOR SIDE VIEW AND NOTES.

2. REQUIRES 10 FT. DEADEND ARM.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER ON HORIZONTAL DEADEND POLE, 600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
X	X	X	X

21.05-110B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-CUTOUT-600-25KV-1P-NLB-F	3	486011	1	SWITCH, DISCONNECT, LOADBREAK, 27KV 600A, SPST, (2) HOLE NEMA
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3 & 4	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	BKT-INSL-POST-PTOP-STL-F	1	4002374	1	STUD, LINE POST INSULATOR, 5/8" DIA, 1-3/4" LG, HOT DIP GALV
			50129169	1	BRACKET, POLE TOP MOUNTING, 10-5/8" LG, STL, 5" BETWEEN HOLES
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STL
	HDWR-MACH-SM-12IN-GALV-F	2	931563	2	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
5	INSL-POST-35KV-PORC-TT-F	2	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-STUD-STL-7IN-THD-F	2	50125899	1	STUD, INSULATOR, 5/8" DIA, 7" LG, 11 UNC, 4" THD LG, GALV
6	TIE-COMP-LG-COV-FNECK-F	3	301747	1	TIE, INSULATOR, F NECK INSUL, 2-7/8" INSULATOR DIA, 336-500 MCM
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
9	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
10	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
11	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS, MOUNTING HOLES PER FPC
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL, ELEC
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
12	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
12	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
13	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

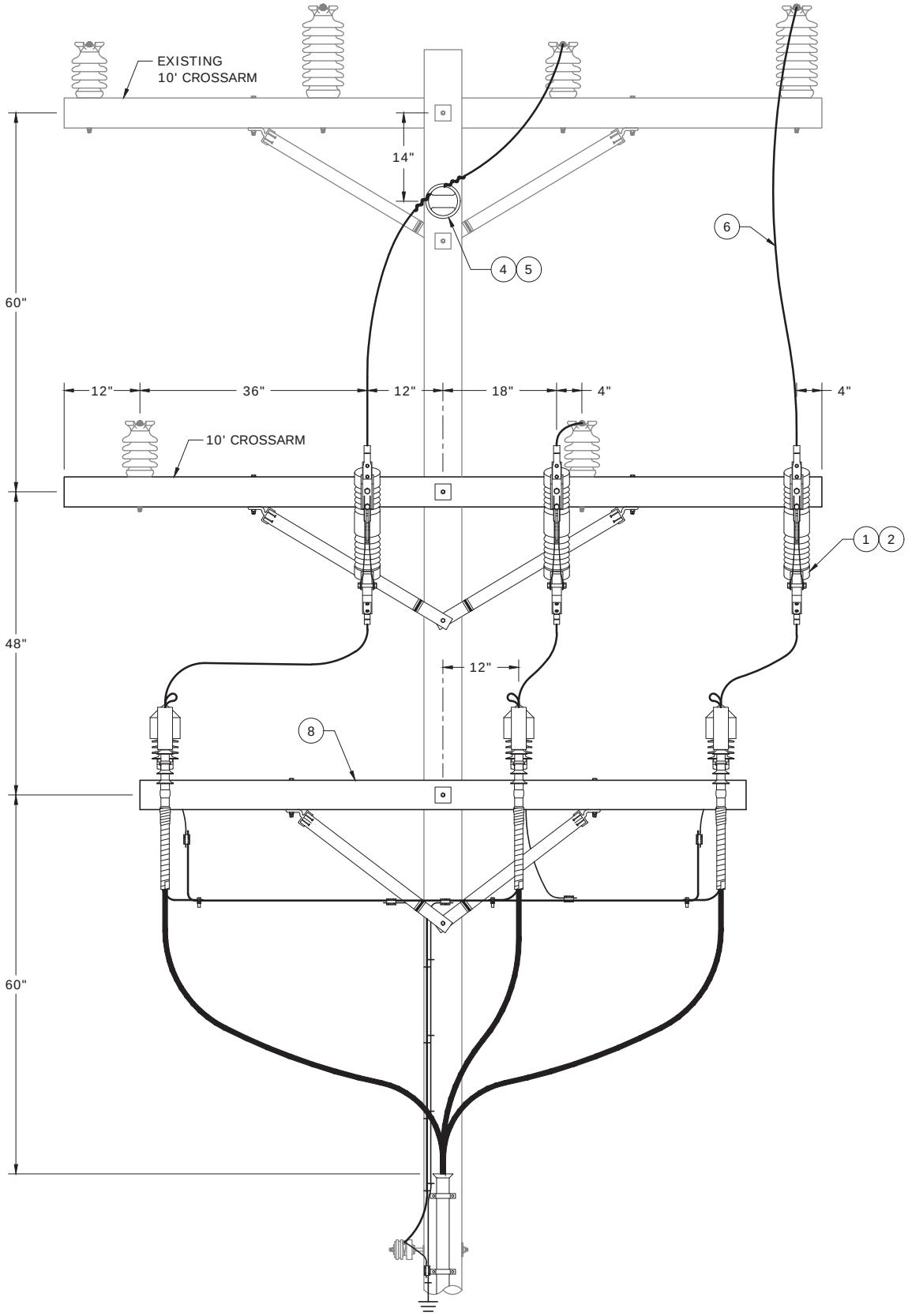
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	5/17/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DEADEND POLE, 600A 15KV/25KV/35KV

DEC	DEM	DEP	DEF
			X

21.05-110C



FRONT VIEW

NOTES:

1. SEE DWG. 21.05-115B FOR SIDE VIEW AND NOTES.

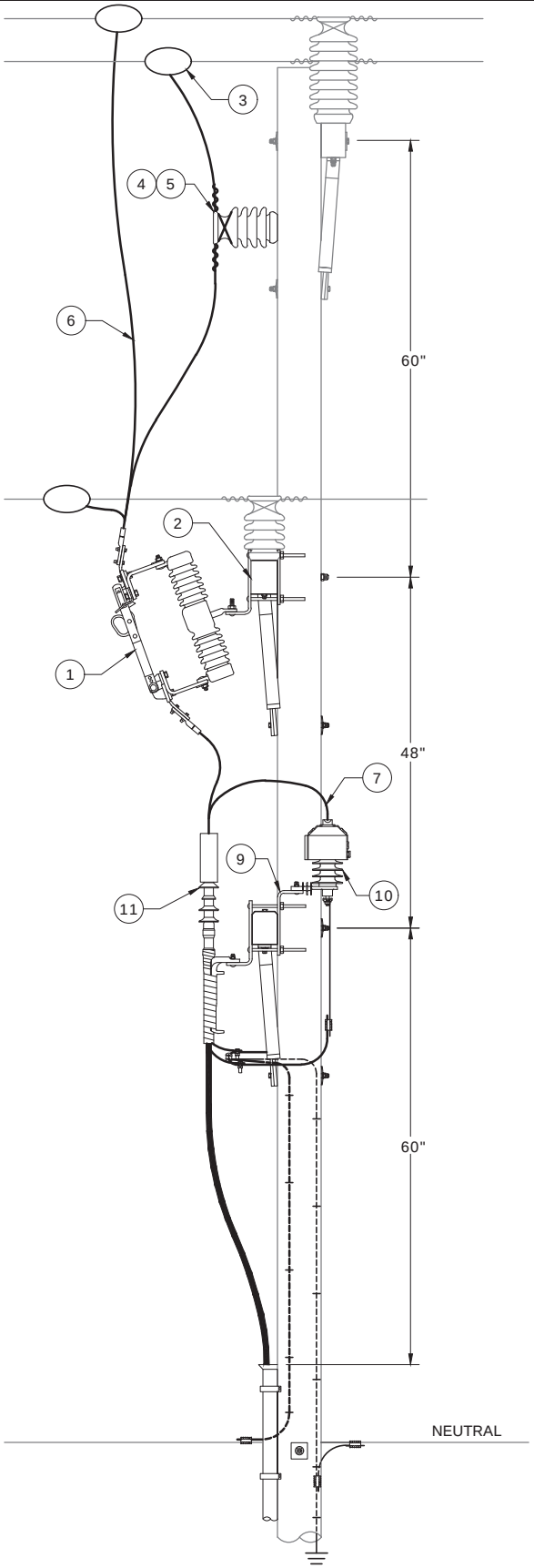
3					
2					
1					
0	3/31/18	GORLEY	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 600A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-115A



SIDE VIEW

NOTES:

1. FOR EXISTING CONSTRUCTION, LOWER PHASE MUST TRANSFER IN AS SHOWN ON DWG. 21.05-115A.
2. SEE DWG. 21.05-115A FOR FRONT VIEW.
3. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK EXCEPT WHEN APPROVED BY C&M AND ENGINEERING SUPERVISION.
4. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
5. FOR CONDUIT RISERS, SEE DWG. 21.01-100A. FOR U-GUARD RISERS, SEE DWG. 21.01-105A.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 600A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-115B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-CUTOUT-600-25KV-1P-NLB-F	3	486011	1	SWITCH, DISCONNECT, LOADBREAK, 27KV 600A, SPST, (2) HOLE NEMA
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GRADE B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	INSL-POST-35KV-PORC-TT-F	1	131552	1	INSULATOR, LINE POST, 35KV, 6" DIA X 12" LG, PORCELAIN
	INSL-GAIN-LG-F	1	4002383	1	BRACKET, INSULATOR SPACER, 5-1/2", GALV DI, W/ 5 DEG ANGLE
	HDWR-DA-LG-14IN-GALV-F	1	930913	1	BOLT, DOUBLE ARMING, 3/4" DIA, 14" LG, GALV STL, THD UNC ROLLED
5	TIE-COMP-LG-COV-FNECK-F	1	301747	1	TIE, INSULATOR, F NECK INSUL, 2-7/8" INSULATOR DIA, 336-500 MCM
6	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
7	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
8	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL, ELEC
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL
	HDWR-MACH-LG-10IN-GALV-F	1	931659	1	BOLT, MACHINE, 3/4" DIA, 10 UNC, 10" LG, SQ HEAD, HOT DIP GALV
9	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GRADE B
10	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
10	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

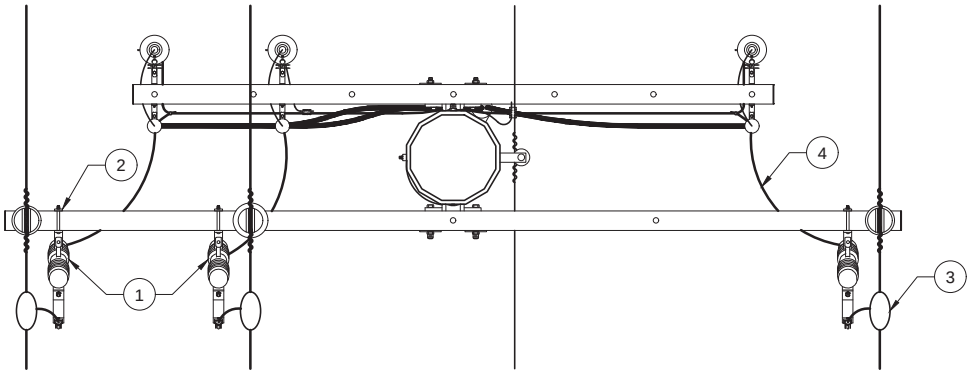
REVISED		BY	CHK'D	APPR.
3				
2				
1	5/17/18	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON HORIZONTAL DOUBLE CIRCUIT SIDE-BY-SIDE CONSTRUCTION 600A 15KV/25KV/35KV

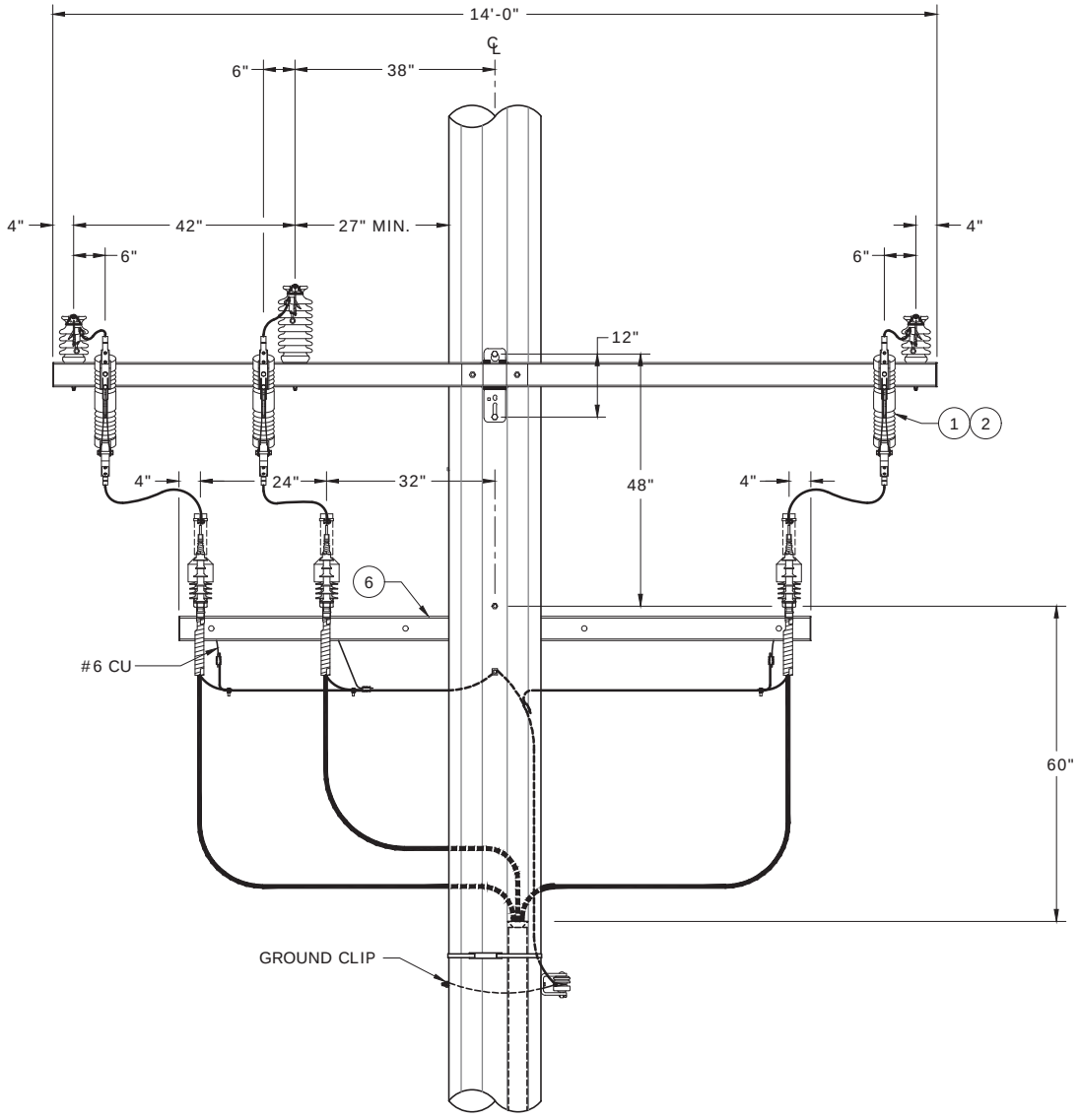
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.05-115C



PLAN VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 21.05-120B FOR SIDE VIEW AND NOTES.

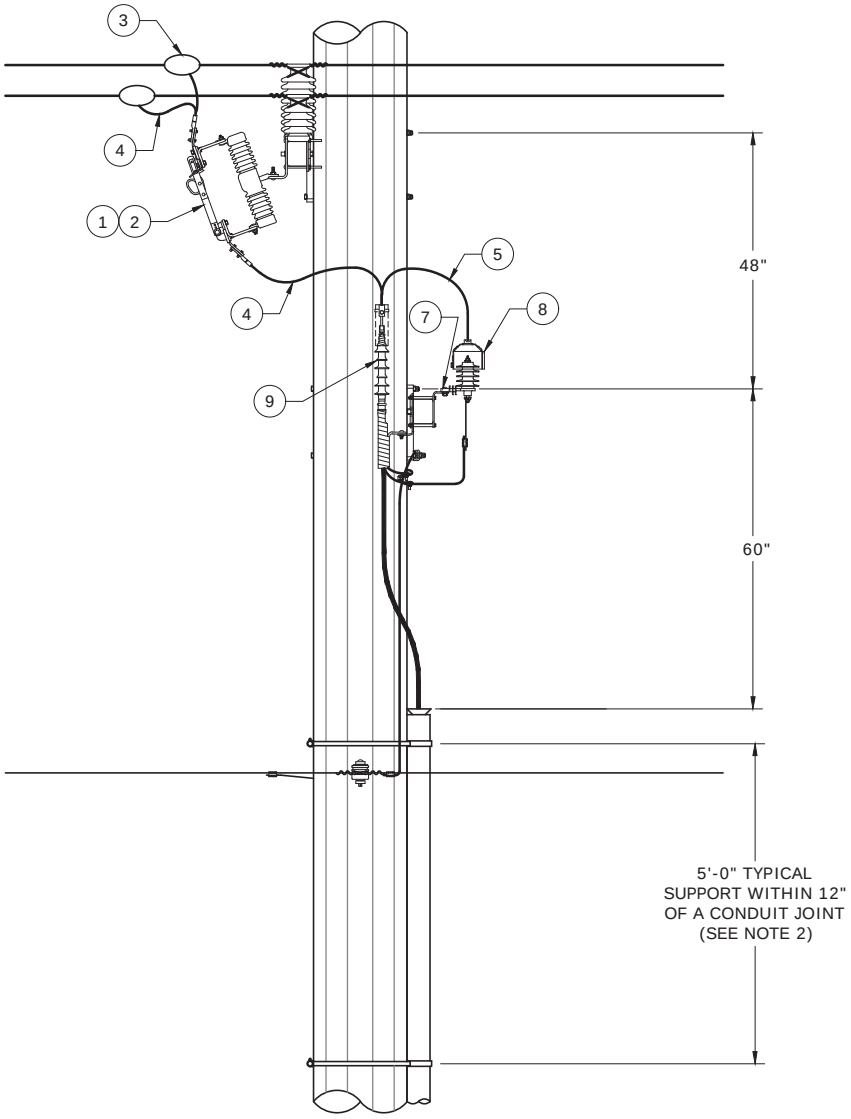
3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE 600A 15KV/25KV/35KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-120A



SIDE VIEW

NOTES:

1. SEE DWG. 21.05-120A FOR FRONT AND PLAN VIEWS.
2. PLACE THE FIRST CONDUIT SUPPORT 3 FT ABOVE GRADE LEVEL. PLACE A CONDUIT SUPPORT WITHIN 12" OF ANY CONDUIT JOINT.
3. LADDER HOOKS ARE FACTORY INSTALLED ON THE FRONT AND REAR FACES OF THE 12 SIDED POLES. RISERS WILL NEED TO INSTALL TO AN ADJACENT FACE AND NOT CONFLICT WITH LADDER CLIPS.
4. WHERE POSSIBLE, TAP TO SEPARATE DISTRIBUTION RISER POLE TO MINIMIZE EQUIPMENT INSTALLED ON TRANSMISSION POLES.
5. FOR MULTIPLE RISERS AND/OR FOREIGN UTILITY RISERS ON THE SAME POLE, CONSULT LOCAL DISTRIBUTION ENGINEERING.
6. NEUTRAL SHALL BE BONDED TO STEEL POLE. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE RISER UNDERBUILD ON STEEL TRANSMISSION POLE 600A 15KV/25KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

21.05-120B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-CUTOUT-600-25KV-1P-NLB-F	3	486011	1	SWITCH, DISCONNECT, LBK, 27KV 600A, SPST, (2) HOLE NEMA PAD MOUNT
2	BKT-EM-ARM-1P-STL-SM-F	3	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
3	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS
4	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECT, UNDERGROUND, 1 CONDUCTOR, 500 MCM, ALUM COND.
5	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECT, 6 AWG, CU CONDUCTOR, SOL SD, 600V, W/ INSULATION
6	ARM-SGL-8-FBG-NB-F	1	4001743	1	CROSSARM, TANGENT, 8' LG, FIBERGLASS
			930031	2	WASHER, LOCK, DBL COIL SPRING, 3/4", DYKO PLTD GALV STL
			939033	2	WASHER, SQ, 3/4", 2-1/4" ID, 2-1/4" OD, 3/16" THK, GALV STL, ASTM A153
	HDWR-MACH-LG-26IN-GALV-F	2	4021304	1	BOLT, MACHINE, 3/4" DIA, 10 THD, 26" LG, HEX HEAD, GALV STL, HEX
7	BKT-EM-ARM-1P-STL-SM-F	6	1412032	1	BRACKET, CROSSARM MOUNTING, 3/8" THK, W/ FRONT & BACK PLATES
			938532	2	WASHER, LOCK, SPRING, 3/8", 7/16" ID, 1/8" THK, GALV STL, GR B
8	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECT, SURGE, DISTRIBUTION, 10KV, RISER POLE METAL OXIDE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
8	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECT, SURGE, DISTRIBUTION, 18KV, POLE RISER, 15.3 MCOV
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, ULTRAVIOLET RESISTANT
9	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION

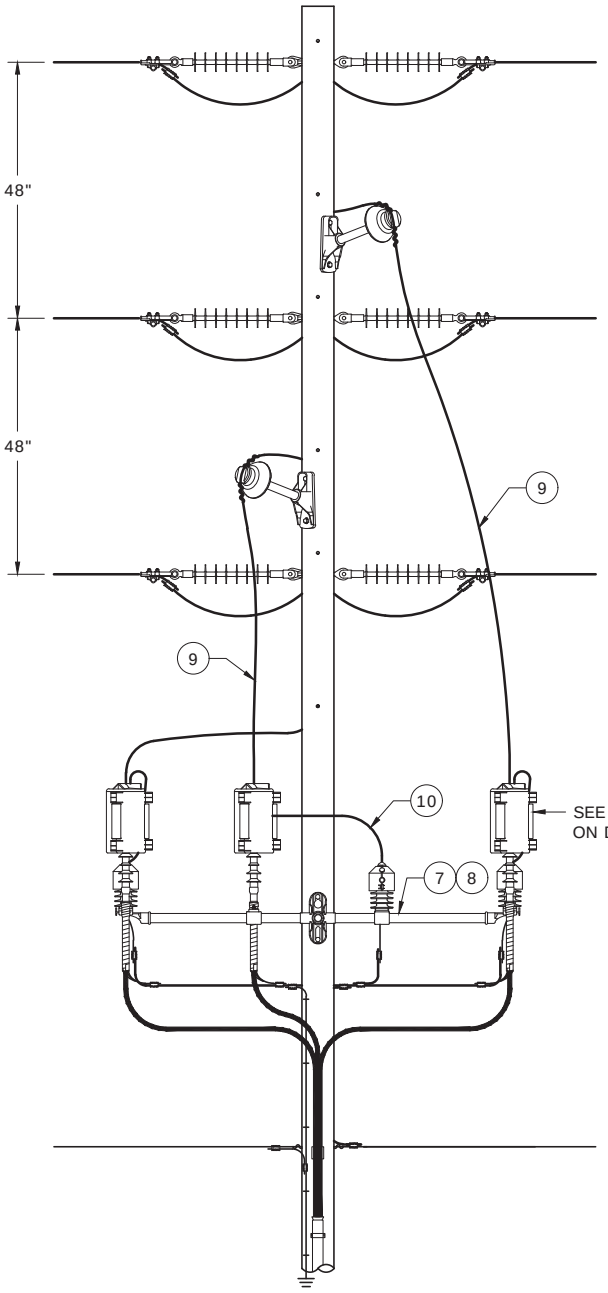
DUKE ENERGY.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

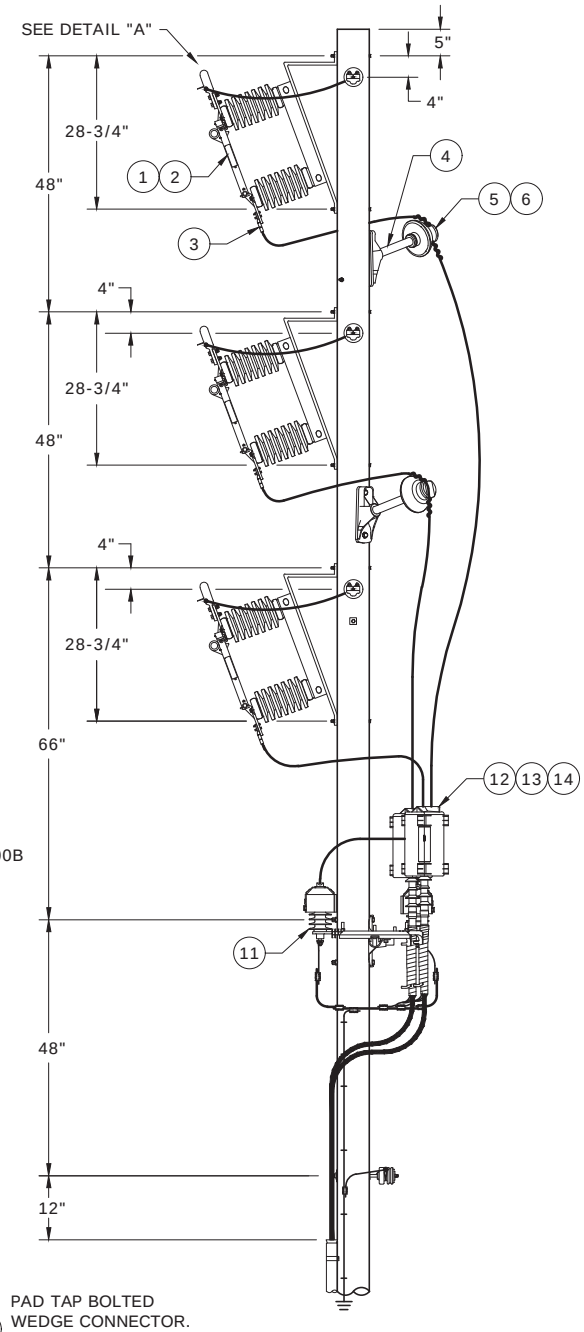
THREE-PHASE RISER UNDERBUILD
ON STEEL TRANSMISSION POLE
600A 15KV/25KV/25KV

DEC	DEM	DEP	DEF
			X

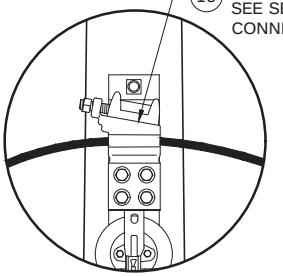
21.05-120C



FRONT VIEW



SIDE VIEW



DETAIL "A"

NOTES:

1. SEE DWG. 21.06-100B FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

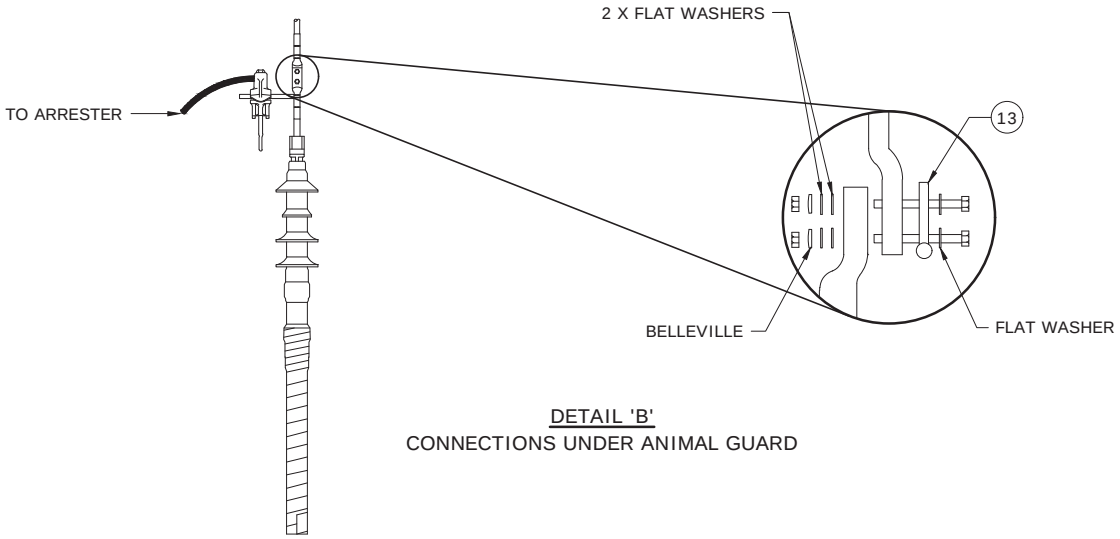
THREE-PHASE IN-LINE RISER ON VERTICAL CONSTRUCTION 600A, 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.06-100A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-VRT-600-15KV-1P-NLB-F	3	4003944	1	SWITCH, DISCONNECT, OVERHEAD, LOADBREAK, 15KVAC NOM. 600A 1PH
			4002878	2	BOLT, MACHINE, 1/2" DIA, 2" LG, HEX HEAD, GALV STL, ASTM A307
			1421012	12	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			94540	4	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			90121	4	WASHER, BELLEVILLE, 1/2" ID, 1" OD, 0.083" THK, 300 SERIES SS
			93787	4	NUT, HEX, 1/2" DIA, 13 UNC, SILICONE BRZ, GR B
2	BKT-SW-POLE-VRT-STL-F	3	4002336	1	BRACKET, MOUNTING, MNTG WD/CNCR POLE, F/ SOL BLADE DISC SWITCHES
			939033	2	WASHER, SQ, 3/4", 2-1/4" OD, 3/16" THK, GALV STL, ASTM A153
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
3	CONN-OH-LUG-COMP-500-2H-90DEG-F	6	4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
4	BKT-INSL-POST-POLE-SM-FG-F	2	4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV STL
5	INSL-PIN-25KV-POLY-F	2	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
6	TIE-COMP-LG-COV-FNECK-F	2	301747	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA, 336-500 MCM
7	BKT-EM-POLE-3P-FG-XL-F	1	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS, IN LINE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8" NOM, GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3" NOM, 13/16" ID, 3" OD, 1/4" THK, GALV
	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV
8	BKT-EM-ADPT-1POS-2POS-AL-F	2	1561611	1	BRACKET, ADAPTER, 12" LG, ALUM, F/ EQUIPMENT MOUNTING
9	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
10	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
11	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
12	WG-BUSH-COV-LG-F	3	1475865	1	GUARD, WILDLIFE, 18" LG X 8" DP, PLASTIC/POLYMER, UV RESISTANT
13	CONN-OH-SPADE-STEM-2H-F	3	4004597	1	CONNECTOR, ELECTRICAL, TERMINAL, LUG, (2) HOLE TERMINATION
14	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION
15	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS



DETAIL 'B'
CONNECTIONS UNDER ANIMAL GUARD

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK.
2. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
3. SEE DWG. 21.01-105A FOR U-GUARD RISERS.
4. SNAP-AROUND STYLE ANIMAL GUARD MUST ENCLOSE ALL EXPOSED ENERGIZED PARTS, INCLUDING THE SPADE STEM FOR THE ARRESTER CONNECTION.

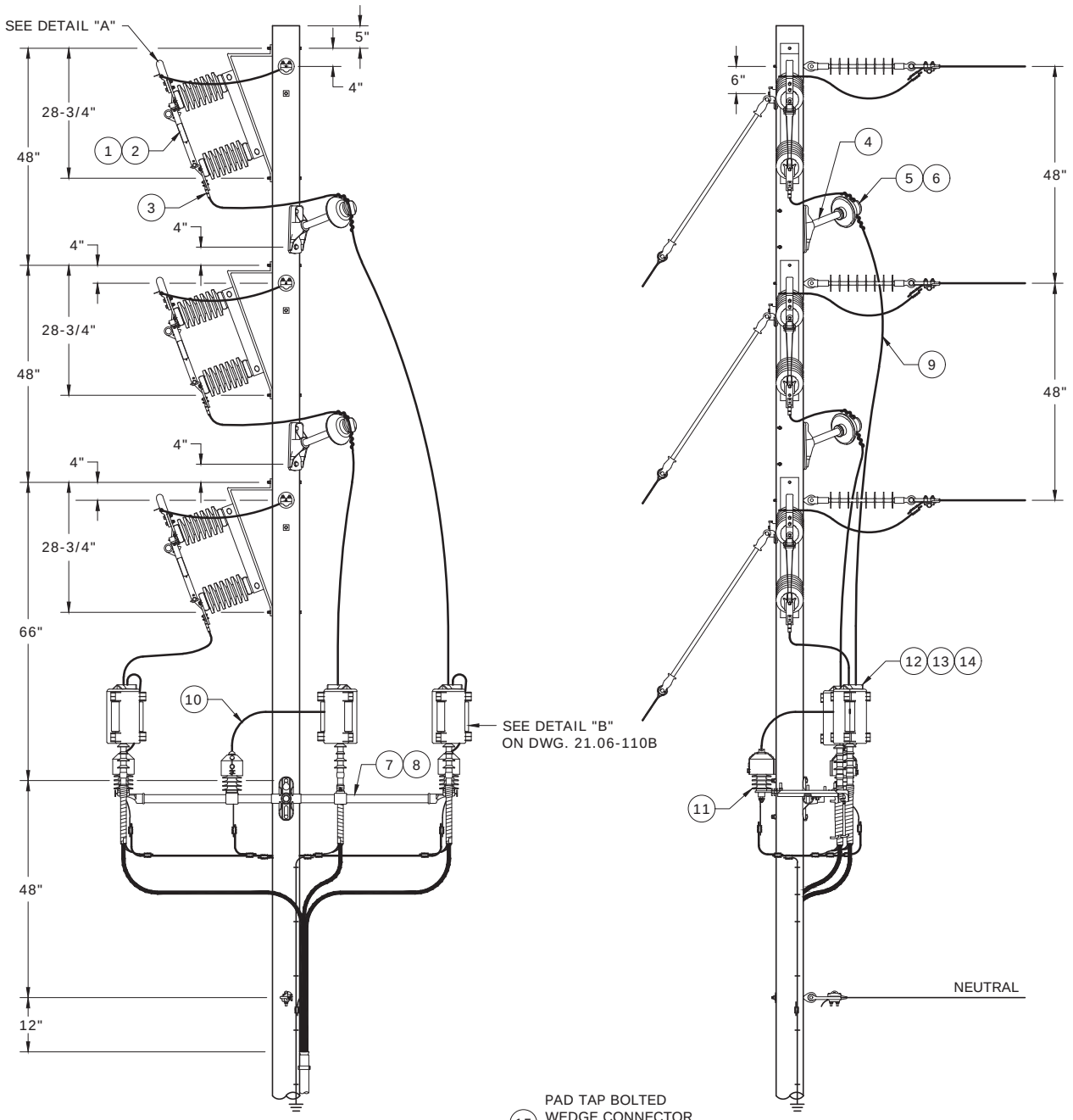
REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	GORLEY	EANES	ADCOCK
1	12/31/18	BRUINS	BURLISON	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

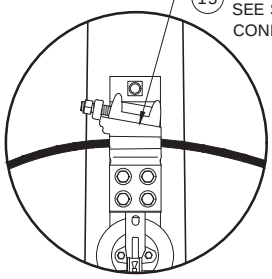
THREE-PHASE IN-LINE RISER ON VERTICAL CONSTRUCTION 600A, 15KV/25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.06-100B





DETAIL "A"

NOTES:

1. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.

3				
2				
1				
0	3/31/18	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

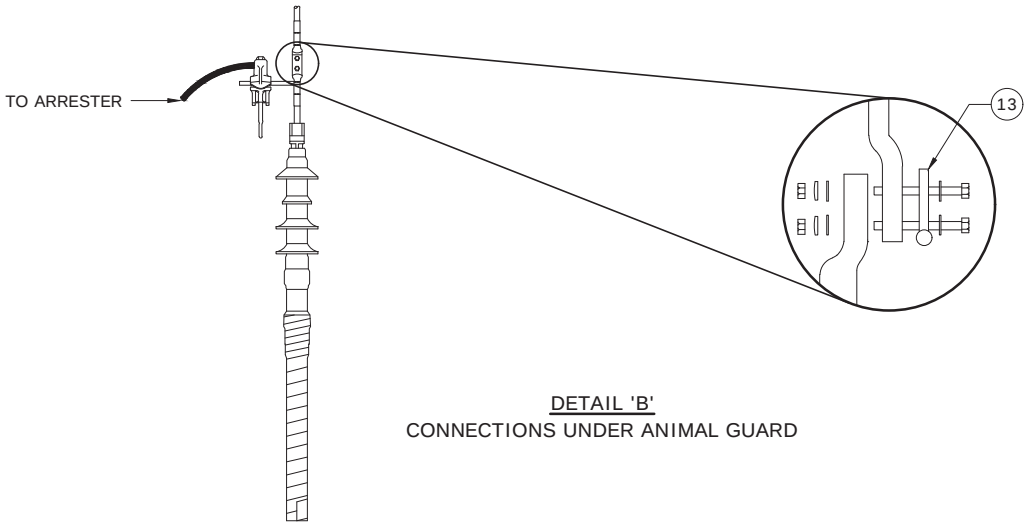
THREE-PHASE RISER ON VERTICAL DEADEND POLE 600A 15KV AND 25KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.06-110A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	SW-VRT-600-15KV-1P-NLB-F	3	4003944	1	SWITCH, DISCONNECT, OVERHEAD, LOADBREAK, 15KVAC NOM. 600A 1PH
			4002878	2	BOLT, MACHINE, 1/2" DIA, 2" LG, HEX HEAD, GALV STL, ASTM A307
			1421012	12	WASHER, FLAT, 1/2" NOM, 0.562" ID, 1-1/4" OD, 0.062" THK, SS 304
			94540	4	BOLT, MACHINE, 1/2" DIA, 13 UNC, 2" LG, HEX HEAD, SS, GR 18-8
			4001661	4	WASHER, LOCK, RND BELLEVILLE SPRING, 1/2" NOM, 17/32" ID, 1-1/4" OD
2	BKT-SW-POLE-VRT-STL-F	3	4002336	1	BRACKET, MOUNTING, MNTG WD/CNCR POLE, F/ SOL BLADE DISC SWITCHES
			939033	2	WASHER, SQ, 3/4", 2-1/4" OD, 3/16" THK, GALV STL, ASTM A153
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
3	CONN-OH-LUG-COMP-500-2H-90DEG-F	6	4154823	1	LUG, TIN PLTD, 2 HOLE, NEMA, F/ ALUM & CU TERMINATIONS
4	BKT-INSL-POST-POLE-SM-FG-F	2	4156108	1	BRACKET, STANDOFF, 1-3/8" X 16" LG, FIBERGLASS, 1-3/8" PVC THD
	HDWR-MACH-SM-12IN-GALV-F	4	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV STL
5	INSL-PIN-25KV-POLY-F	2	4156342	1	INSULATOR, 25KV, 1-3/8" THD, POLYMER
6	TIE-COMP-LG-COV-FNECK-F	2	301747	1	TIE, INSULATOR, F NECK INSULATOR, 2-7/8" INSULATOR DIA, 336-500 MCM
7	BKT-EM-POLE-3P-FG-XL-F	1	1561610	1	BRACKET, SGL POSITION 3PH, 1-1/2" DIA X 72" LG, FIBERGLASS, IN LINE
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STL, 750 PER PACKAGE
			938975	2	WASHER, SQ CURVED, 3" NOM, 13/16" ID, 3" OD, 1/4" THK, GALV
	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, 5/8" DIA, 11 UNC, 12" LG, SQ HEAD, HOT DIP GALV STL
8	BKT-EM-ADPT-1POS-2POS-AL-F	2	1561611	1	BRACKET, ADAPTER, 12" LG, ALUM, F/ EQUIPMENT MOUNTING
9	LEAD-EQ-500-AL-COVER-F	3	4003570	12 FT	WIRE/CABLE, ELECTRICAL, UNDERGROUND, 1 CONDUCTOR, 500 MCM
10	LEAD-EQ-6-CU-COVER-F	3	4192427	1 LB	WIRE/CABLE, ELECTRICAL, 6 AWG, CU CONDUCTOR, SOL SD, 600V
11	ARR-RISER-10KV-BKT-F	3	4022990	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 10KV, RISER POLE
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
11	ARR-RISER-18KV-BKT-F	3	4022989	1	ARRESTER, ELECTRICAL, SURGE, DISTRIBUTION, 18KV, POLE RISER
			234664	2 FT	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			50125214	1	GUARD, WILDLIFE, 5-1/4" DIA X 5-1/2" HT, UV RESISTANT POLYMER
12	WG-BUSH-COV-LG-F	3	1475865	1	GUARD, WILDLIFE, 18" LG X 8" DP, PLASTIC/POLYMER, UV RESISTANT
13	CONN-OH-SPADE-STEM-2H-F	3	4004597	1	CONNECTOR, ELECTRICAL, TERMINAL, LUG, (2) HOLE TERMINATION
14	-	3	-	-	SEE SECTION 26 FOR CABLE TERMINATION
15	-	3	-	1	SEE SECTION 04 FOR CONNECTOR DETAILS



DETAIL 'B'
CONNECTIONS UNDER ANIMAL GUARD

NOTES:

1. THIS INSTALLATION MUST BE ACCESSIBLE FOR OPERATION FROM A BUCKET TRUCK.
2. SEE SECTION 21.00 FOR GROUNDING AND BONDING DETAILS.
3. SEE DWG. 21.01-105A FOR U-GUARD RISERS.
4. SNAP-AROUND STYLE ANIMAL GUARD MUST ENCLOSE ALL EXPOSED ENERGIZED PARTS, INCLUDING THE SPADE STEM FOR THE ARRESTER CONNECTION.

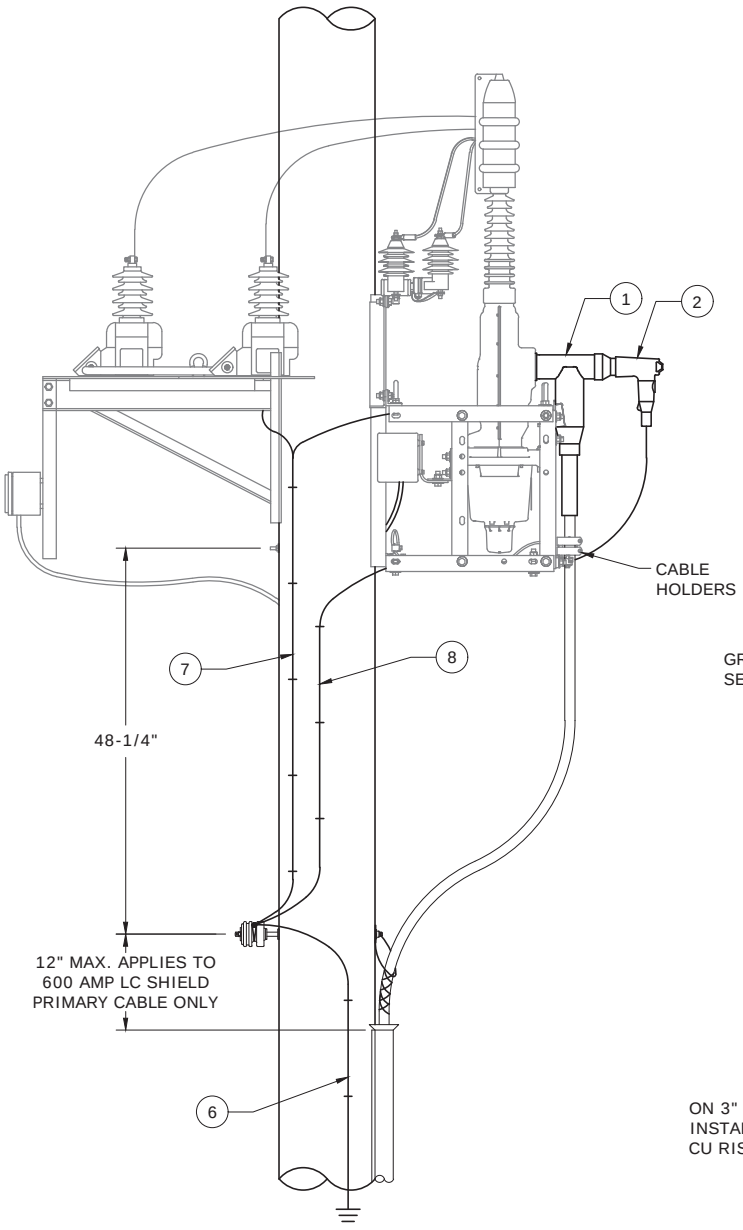
REVISED		BY	CHK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	3/31/18	GORLEY	EANES	ADCOCK

THREE-PHASE RISER ON VERTICAL DEADEND POLE 600A, 15KV/25KV

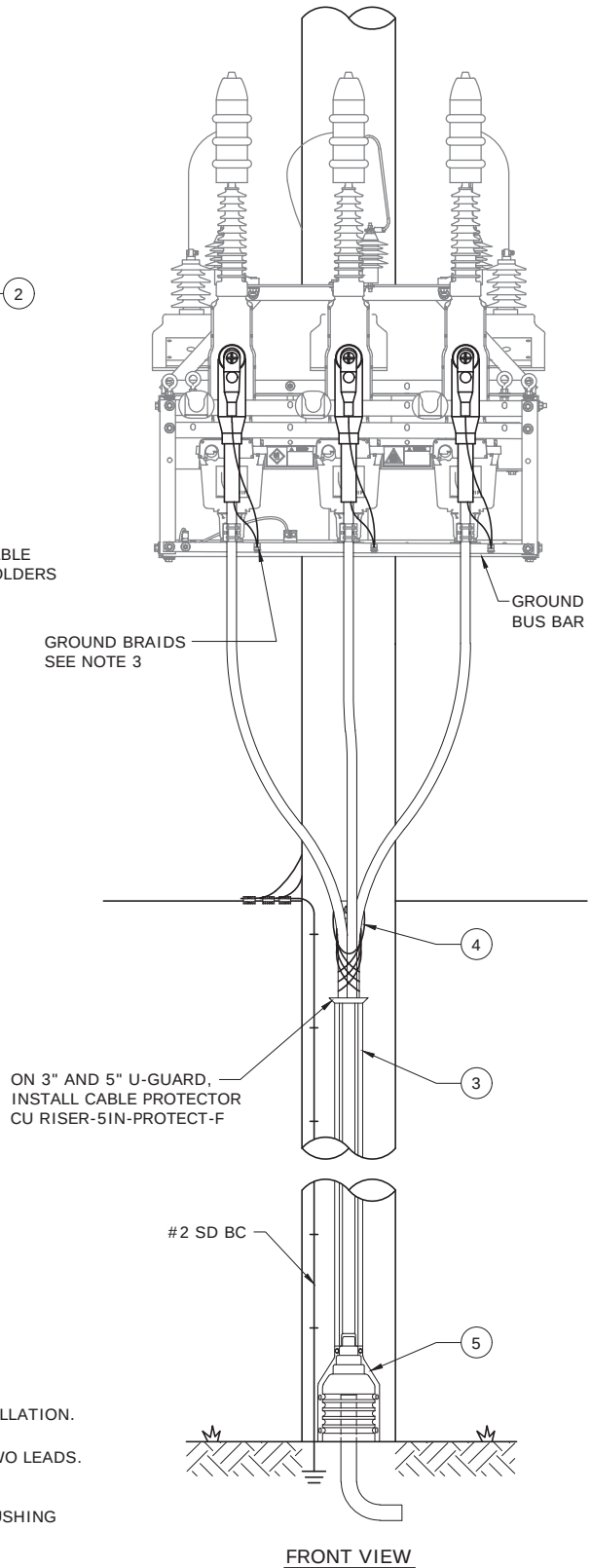
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.06-110B



SIDE VIEW



FRONT VIEW

NOTES:

1. SEE DWG. 21.05-125B FOR BILL OF MATERIALS.
2. SEE DWGS. 08.06-115A THROUGH 08.06-115D FOR RECLOSER INSTALLATION.
3. WHEN INSTALLED PROPERLY, THE LC SHIELD GROUND BRAID HAS TWO LEADS. CONNECT BOTH TO THE RECLOSER GROUND BUS BAR.
4. INSTALL ELBOW ARRESTERS ON ALL LINE CABLES USING 200 AMP BUSHING INTERFACE IN T-BODY.
5. INSTALL LAG SCREWS IN EACH HOLE OF MOLDING.
6. ON CONCRETE POLES, INSTALL 3 STAINLESS STEEL BANDS PER 10' SECTION OF CABLE GUARD.
7. FOR DETAIL INSTALLATION REFERENCE TO THE CABLE ACCESSORIES SECTION.

3				
2				
1				
0	3/31/18	BRAVO	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

THREE-PHASE 600 AMP RECLOSER RISER, VERTICAL CONSTRUCTION, 15 KV

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

21.06-125A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	ELBOW-T-1000-AL-600A-15KV-NLB-F	3	4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A 15KV
			4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS
2	ARR-ELBOW-10KV-F	3	4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
			1000572	1	ARRESTER, ELECT., DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER
3	RISER-5IN-UGUARD-1PC-F	3	4004662	1	GUARD, CABLE, 5" X 10', PVC, W/ ONE BELLED END PER FPC MS 116
			4001700	15	SCREW,LAG, 1/4" DIA, 2" LG, HEX HEAD, PILOT PT, GALV STL
4	CABLE-GRIP-SGL-LG-F	3	905045	1	GRIP, CABLE, SUPPORTING,2-1/2" TO 3" CABLE, ALUM, SINGLE-U-EYE
5	RISER-6IN-VENT-F	1	4004663	1	GUARD, VENTILATOR CABLE, BOOT 4" TO 5", F/ USE W/ CABLE GUARD
6	GND-POLE-6-F	1	234664	40 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
			4001715	40	STAPLE, DIAMOND PT, 2" X 5/8" X 3/16", GALV STL
			933365	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 5 X 1 STR ACSR
7	GND-EQUIP-2-BOND-F	1	4173267	5 FT.	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
8	GND-EQUIP-2/0-BOND-F	1	1502506	5 FT.	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19STR, BARE

NOTES:

1. SEE DWG. 21.06-125A FOR DESIGN SPECIFICATIONS.

2. SEE DWG. 08.06-115A FOR RECLOSER INSTALLATION.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/18	BRAVO	EANES	ADCOCK

THREE-PHASE 600 AMP RECLOSER RISER,
VERTICAL CONSTRUCTION,

DEC	DEM	DEP	DEF
			X

21.06-125B

22.00 GENERAL

22.01 TRENCHING

22.02 DIRECTIONAL BORING

22.03 CONDUIT USE

22.04 CONDUIT AND CONDUIT ACCESSORIES

22.05 CONDUIT INSTALLATION AND REPAIR

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	10/20/16	KATIGBAK	EANES	ADCOCK
0	12/31/15	KATIGBAK	EANES	ADCOCK

SECTION 22 - TRENCHING, DIRECTIONAL BORING, CONDUIT & DUCT BANK
TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

22.06 DUCT BANKS

22.07 CABLE PULLING

DUKE ENERGY IS A "DIRECT BURIED" UTILITY. THIS MEANS THE COMPANY TYPICALLY DIRECTLY BURIES ALL 600 VOLT AND MEDIUM VOLTAGE PRIMARY CABLE IN THE GROUND WITHOUT THE USE OF CONDUIT.

ONE MAJOR EXCEPTION IS THE FACILITIES INSTALLED IN OHIO AND KENTUCKY. CABLES IN THOSE STATES ARE TYPICALLY INSTALLED IN CONDUIT, MUCH OF WHICH IS PROVIDED BY THE CUSTOMER. THIS IS DONE TO COMPLY WITH STATE REGULATIONS.

OTHER EXAMPLES OF SITUATIONS WHERE CABLE MAY BE INSTALLED IN CONDUIT OR AN EMPTY CONDUIT INSTALLED FOR FUTURE USE IS PROVIDED ON DWG. 22.03-100 (USES FOR CONDUIT).

CONDUIT IS NOT REQUIRED FOR DIRECTIONAL BORE INSTALLATIONS EXCEPT WHEN MANDATED BY THE PERMITTING AUTHORITY.

REFER TO SECTION 36 FOR THE FOLLOWING INFORMATION:

- CLEARANCES
- JOINT USE TRENCH DESIGNS
- TRENCHING NEAR STRUCTURES
- TRENCHING/DIRECTIONAL BORING NEAR TREES

DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

GENERAL INFORMATION

DEC	DEM	DEP	DEF
X	X	X	X

22.00-100

TABLE 1: MINIMUM CABLE COVER			
CABLE OR APPLICATION	MINIMUM COVER	SPECIFIC NOTES	JOINT TRENCH
SECONDARY / SERVICE	30"	SEE NOTES 2 AND 3	SEE SECTION 36 FOR JOINT TRENCH CONSTRUCTION
PRIMARY (1Ø OR 3Ø)	36"	SEE NOTES 2 AND 3	
ROAD CROSSINGS (ANY VOLTAGE)	36"	SEE NOTE 5	
RAILROAD CROSSINGS (ANY VOLTAGE)	PERMIT SPECIFIC	SEE NOTE 5	
PARKING LOT CROSSINGS (ANY VOLTAGE)	36"	SEE NOTES 2, 3 AND 5	

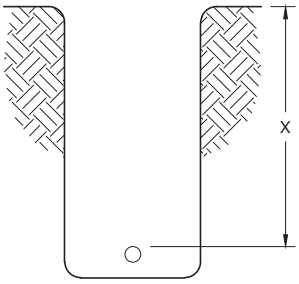


TABLE 2: REQUIRED MINIMUM SEPARATION BETWEEN CABLES WHEN SEPARATION IS TO BE OBTAINED HORIZONTALLY (CABLES ARE BURIED AT THE SAME DEPTH)					
COLUMN 1	MINIMUM HORIZONTAL SEPARATION FROM CABLES IN COLUMN 1				
CABLE	SECONDARY/ SERVICE	PRIMARY, 200A (1Ø OR 3Ø)	PRIMARY, 200A (1Ø OR 3Ø) WHEN BOTH CABLES **ARE NOT** PART OF THE SAME LOOP	PRIMARY, 200A (1Ø OR 3Ø) WHEN BOTH CABLES **ARE** PART OF THE SAME LOOP	FEEDER (>200A)
SECONDARY / SERVICE	RANDOM LAY	RANDOM LAY			36"
PRIMARY, 200A (1Ø OR 3Ø)	RANDOM LAY		RANDOM LAY *	36"	36"
FEEDER (>200A)	36"	36"			36"

* SEE NOTE 7 FOR ADDITIONAL DEC REQUIREMENT

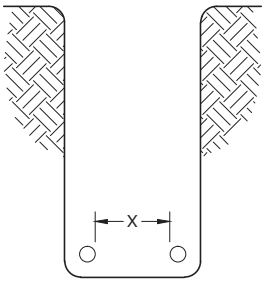
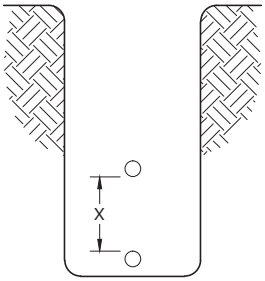


TABLE 3: REQUIRED MINIMUM SEPARATION BETWEEN CABLES WHEN SEPARATION IS TO BE OBTAINED VERTICALLY (CABLES ARE BURIED AT THE DIFFERENT DEPTHS)					
COLUMN 1	MINIMUM VERTICAL SEPARATION FROM CABLES IN COLUMN 1				
CABLE	SECONDARY/ SERVICE	PRIMARY, 200A (1Ø OR 3Ø)	PRIMARY, 200A (1Ø OR 3Ø) WHEN BOTH CABLES **ARE NOT** PART OF THE SAME LOOP	PRIMARY, 200A (1Ø OR 3Ø) WHEN BOTH CABLES **ARE** PART OF THE SAME LOOP	FEEDER (>200A)
SECONDARY / SERVICE	RANDOM LAY	RANDOM LAY			12"
PRIMARY, 200A (1Ø OR 3Ø)	RANDOM LAY		RANDOM LAY *	12"	12"
FEEDER (>200A)	12"	12"			SEE NOTE 6

* SEE NOTE 7 FOR ADDITIONAL DEC REQUIREMENT



NOTES:

1. MINIMUM SEPARATION BETWEEN CABLES MAY BE OBTAINED EITHER HORIZONTALLY OR VERTICALLY.
2. IF REQUIRED MINIMUM DEPTH CANNOT BE OBTAINED, INSTALL CABLE IN SCHEDULE 40 OR GREATER CONDUIT WITH A MINIMUM OF TWO (2) INCHES OF CONCRETE ABOVE AND BESIDE THE CONDUIT AND A MINIMUM OF SIX (6) INCHES OF COVER.
3. RISER CONDUIT BENDS AND BRIDGE TRANSITIONS ARE EXCEPTIONS TO THE MINIMUM COVER REQUIREMENT.
4. REFER TO SECTION 36 FOR JOINT TRENCH INFORMATION AND CONSTRUCTION DETAILS.
5. IF PERMIT IS REQUIRED, MINIMUM DEPTH WILL BE PERMIT SPECIFIC RATHER THAN THE DEPTH LISTED, BUT NEVER LESS THAN NESC REQUIREMENTS.
6. FEEDERS (>200A) MUST BE SEPARATED HORIZONTALLY BY 36". VERTICAL SEPARATION ONLY IS NOT AN OPTION.
7. DEC REQUIRES A MINIMUM OF 12" VERTICAL SEPARATION BETWEEN 1Ø AND 3Ø CABLES AND BETWEEN SECONDARY/SERVICE AND 3Ø CABLES.
8. TABLES 2 AND 3 SPECIFY APPLICATIONS THAT REQUIRE SEPARATION BETWEEN CABLES. ALL OTHER APPLICATIONS WILL USE "RANDOM LAY" WHICH MEANS CABLES MAY BE PLACED INTO A TRENCH WITH NO REQUIRED SEPARATION.
9. EITHER ONE WIDE TRENCH OR TWO NARROW TRENCHES MAY BE USED, BASED ON ECONOMICS, TO OBTAIN REQUIRED HORIZONTAL SEPARATION.

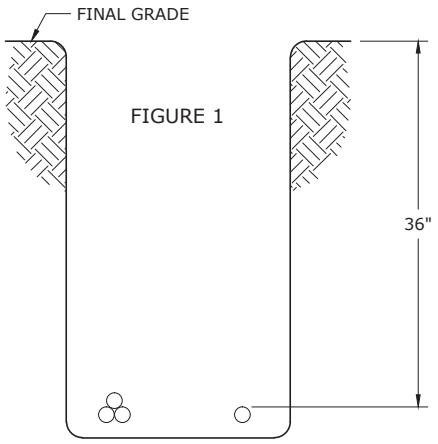
DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

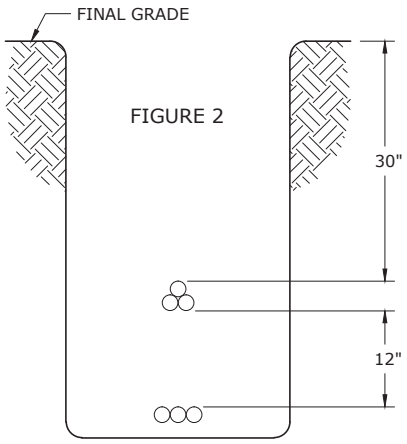
MINIMUM CABLE COVER AND SEPARATION

DEC	DEM	DEP	DEF
X	X	X	X

22.01-101

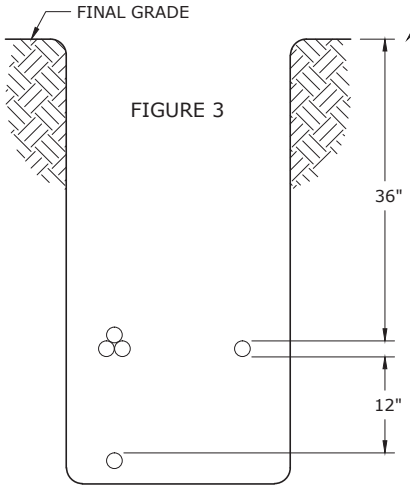


SECONDARY/ SERVICE WITH
200A SINGLE-PHASE PRIMARY

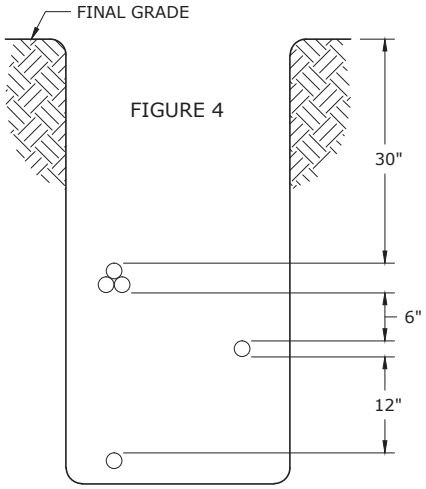


SECONDARY/ SERVICE WITH
200A THREE-PHASE PRIMARY

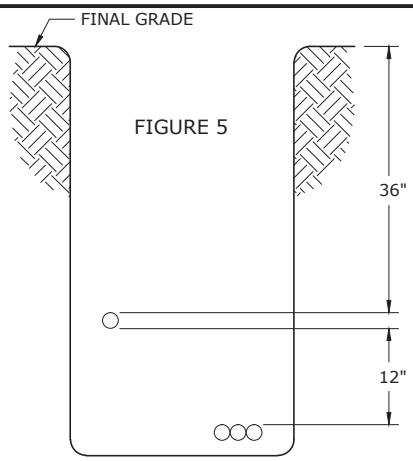
OPTIONAL METHODS



SECONDARY/ SERVICE WITH
TWO 200A SINGLE-PHASE PRIMARIES
THAT ARE BOTH PART OF THE SAME LOOP



SECONDARY/ SERVICE WITH
TWO 200A SINGLE-PHASE PRIMARIES
THAT ARE BOTH PART OF THE SAME LOOP



ONE 200A SINGLE-PHASE PRIMARY WITH
ONE 200A THREE-PHASE PRIMARY

NOTES:

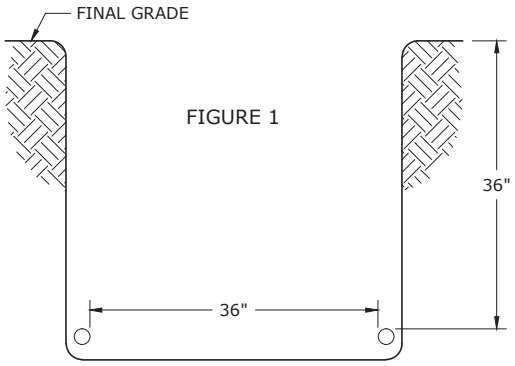
1. SEE DWG. 22.01-102B FOR NOTES.
2. THESE CONFIGURATIONS ARE REQUIRED FOR DEC ONLY. THEY ARE OPTIONAL FOR ALL OTHER LOCATIONS.
3. CABLES AT THE SAME DEPTH CAN BE RANDOM LAY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

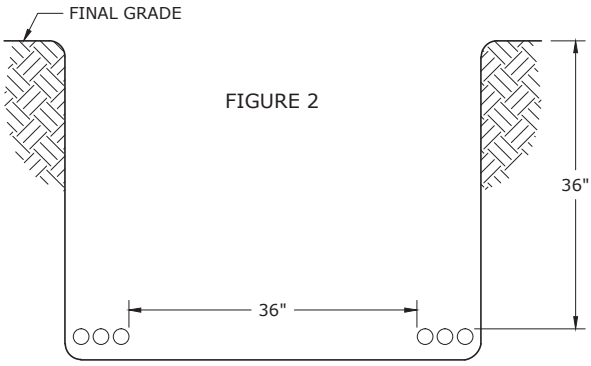
TRENCH CONFIGURATIONS

DEC	DEM	DEP	DEF
X	X	X	X

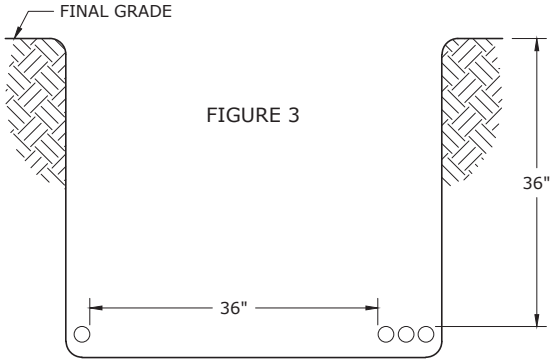
22.01-102A



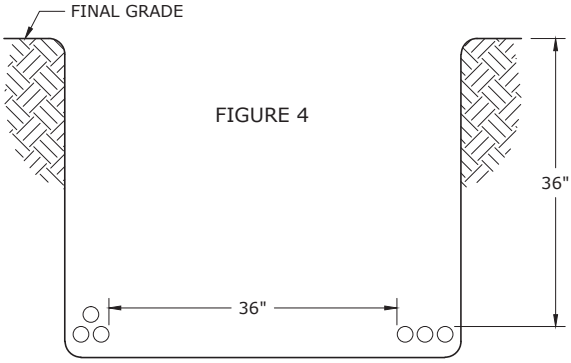
TWO SINGLE-PHASE PRIMARY CABLES
BOTH PART OF THE **SAME** LOOP



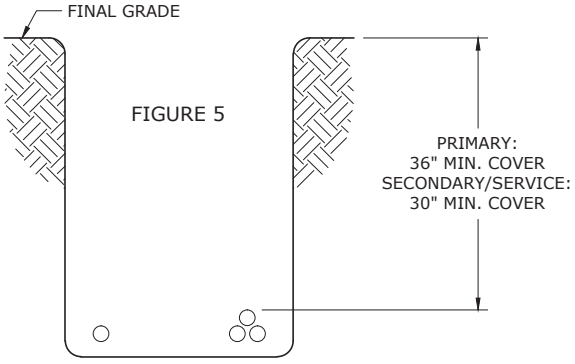
TWO 200A THREE-PHASE PRIMARIES
BOTH PART OF THE **SAME** LOOP OR
200A THREE-PHASE WITH A FEEDER (>200A)
OR TWO FEEDERS (>200A)



SINGLE-PHASE WITH A FEEDER (>200A)



SECONDARY/SERVICE WITH A FEEDER (>200A)



RANDOM LAY

NOTES:

1. THE TRENCH CONFIGURATIONS SHOWN ON DWG. 22.01-102A AND THIS DRAWING WITH A SPECIFIED SEPARATION BETWEEN CABLES ARE THE ONLY APPLICATIONS THAT REQUIRE SEPARATION BETWEEN CABLES. SEPARATION MAY BE OBTAINED EITHER VERTICALLY AS SHOWN ON DWG. 22.01-102A OR HORIZONTALLY AS SHOWN ON THIS DRAWING. ALL OTHER APPLICATIONS WILL USE THE RANDOM LAY CONFIGURATION SHOWN ABOVE IN FIGURE 5. RANDOM LAY ALLOWS CABLES TO BE PLACED INTO A TRENCH WITH NO REQUIRED SEPARATION.

2. EITHER ONE WIDE TRENCH OR TWO NARROW TRENCHES MAY BE USED BASED ON ECONOMICS TO OBTAIN REQUIRED HORIZONTAL CABLE SEPARATION.

3. IF REQUIRED CABLE SEPARATION CANNOT BE OBTAINED DUE TO SPACE LIMITATIONS, PROVIDE MECHANICAL PROTECTION BY INSTALLING THE CABLE IN SCHEDULE 40 OR GREATER PVC CONDUIT WITH A MINIMUM OF TWO (2) INCHES OF CONCRETE ABOVE AND BESIDE THE CONDUIT.

4. JOINT TRENCH CONFIGURATIONS ARE PROVIDED IN SECTION 35: UNDERGROUND CLEARANCES AND JOINT USE.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

TRENCH CONFIGURATIONS

DEC	DEM	DEP	DEF
X	X	X	X

22.01-102B

TRENCH

RIGHTS-OF-WAY/EASEMENTS AND STREETS SHALL BE CLEARED AND TO FINAL GRADE BEFORE TRENCHING BEGINS.

STANDARD TRENCH DEPTHS ARE SHOWN ON DWGS. 21.01-102A AND 21.01-102B. DUKE ENERGY REQUIRES A MINIMUM COVER OF THIRTY (30) INCHES FOR 600V CABLE AND THIRTY-SIX (36) INCHES FOR MEDIUM VOLTAGE (PRIMARY) CABLE.

REFER TO DWG. 22.01-101 WHEN IT IS NOT POSSIBLE TO OBTAIN THE ABOVE DEPTHS.

THE BOTTOM OF THE TRENCH SHALL BE SMOOTH, UNDISTURBED EARTH, WELL-TAMPED CLEAN BACKFILL OR SAND, FREE OF ROCKS, DEBRIS OR ROOTS. WHEN EXCAVATION IS IN ROCK OR ROCKY SOIL, CABLE, CONDUITS OR CABLE-IN-CONDUIT SHALL BE LAID ON A WELL-TAMPED LAYER OF CLEAN BACKFILL AT LEAST FOUR (4) INCHES THICK.

SHORING

THE PERFORMANCE OF EXCAVATION WORK INCLUDING TRENCHING, SLOPING, BENCHING, AND SHORING MUST, AT MINIMUM, MEET THE REQUIREMENTS OF OSHA 1926 SUBPART P AND ANY LOCAL JURISDICTIONAL REQUIREMENTS.

REFER TO THE TRENCHING AND EXCAVATIONS SECTION OF THE HEALTH AND SAFETY HANDBOOK FOR DUKE ENERGY REQUIREMENTS.

BACKFILL

BACKFILL WITHIN SIX (6) INCHES OF THE CABLE OR CONDUIT SHALL BE FREE OF ROCK OR ANY MATERIAL THAT MAY DAMAGE THE CABLE OR CONDUIT. THE REMAINING BACKFILL SHOULD BE FREE OF MATERIAL GREATER THAN FOUR (4) INCHES IN MAXIMUM DIMENSION.

COMPACTION

BACKFILL MUST BE ADEQUATELY COMPACTED. BACKFILL SHALL BE COMPACTED SUCH THAT WASHING AND SETTLING OF THE TRENCH SURFACE WILL NOT OCCUR. ADDITIONAL BUILDUP OF THE BACKFILL MAY BE NECESSARY TO PREVENT SETTLING. FINAL SURFACE COMPACTION SHALL LIMIT THE AMOUNT OF SETTLING TO 1/2" OR LESS. ANY REWORK OF THE TRENCH IS THE RESPONSIBILITY OF THE INSTALLER.

MACHINE COMPACTION SHALL NOT BE USED WITHIN SIX (6) INCHES OF THE CABLE OR CONDUIT.

WHEN MACHINE COMPACTION IS REQUIRED, TRENCHES SHALL BE BACKFILLED BY ALTERNATING FILL AND TAMPING THE FIRST 12 INCHES AND IN EACH ADDITIONAL 12 INCH INCREMENT.

COMPACTION FOR STREET CROSSINGS MUST COMPLY WITH LOCAL JURISDICTIONAL REQUIREMENTS.

EXTREME SLOPES OR OTHER UNUSUAL FIELD CONDITIONS MAY REQUIRE ADDITIONAL MECHANICAL TAMPING OR SODDING AT THE DISCRETION OF THE FIELD ENGINEER OR COMPANY DESIGNATED REPRESENTATIVE.

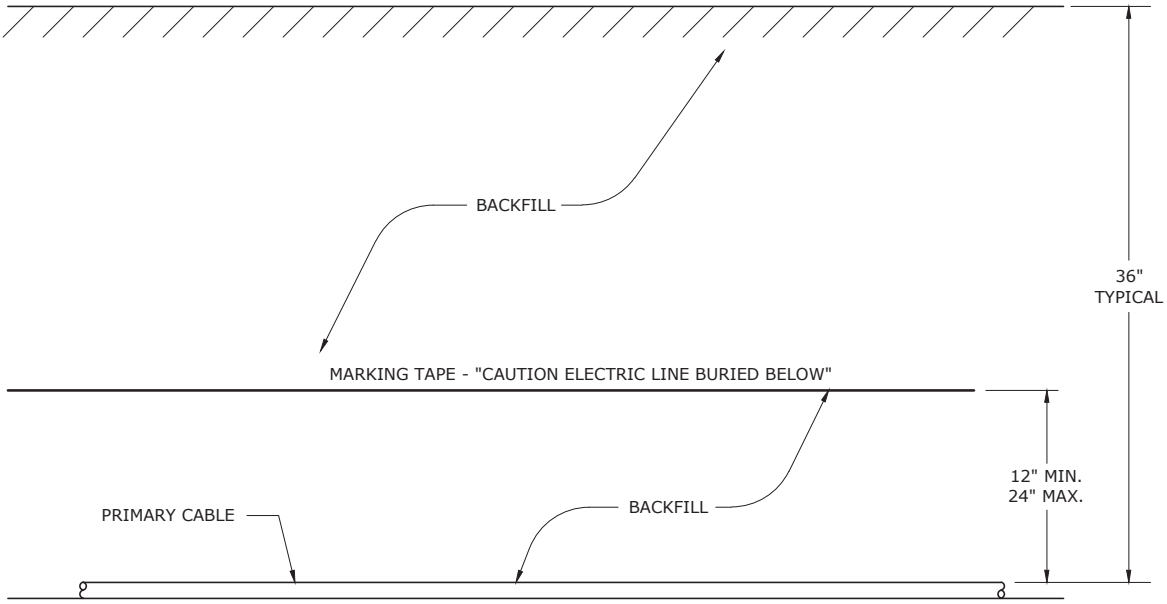
DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

TRENCH, BACKFILL AND COMPACTION REQUIREMENTS

DEC	DEM	DEP	DEF
X	X	X	X

22.01-104



REGION	COMPATIBLE UNIT	ITEM NUMBER
DEC	-	354165
DEM	-	50086491
DEP	-	4028082
DEF	-	4028082

NOTES:

1. THE USE OF MARKING TAPE DOES NOT GUARANTEE A REDUCTION IN DIG-INS. AS A RESULT, IT IS NOT RECOMMENDED FOR REGULAR USAGE. HOWEVER, MARKING TAPE IS AVAILABLE FOR INSTALLATION AT THE REQUEST OF A CUSTOMER OR GOVERNMENT AGENCY. NORMAL CHARGING PRACTICES WILL APPLY.

2. CONSIDERATION SHOULD BE GIVEN TO PLACING CABLES IN CONDUIT, CONCRETE ENCASED CONDUIT, OR DUCT BANK IN ORDER TO REDUCE DIG-INS.

3. MARKING TAPE IS A 3" (6" IN DEM) WIDE RED TAPE WITH "CAUTION ELECTRIC LINE BURIED BELOW" PRINTED REPEATEDLY ALONG ITS LENGTH AND IS SUPPLIED IN 1,000 FOOT ROLLS.

4. INSTALL MARKING TAPE 12" MINIMUM TO 24" MAXIMUM ABOVE THE PRIMARY CABLE.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

MARKING TAPE - BURIED ELECTRICAL LINE

DEC	DEM	DEP	DEF
X	X	X	X

22.01-106

OVERVIEW

DIRECTIONAL BORING IS A STEERABLE TRENCHLESS METHOD OF INSTALLING UNDERGROUND CABLES, CONDUITS AND PIPES ALONG A PRESCRIBED PATH BY USING A SURFACE LAUNCHED DRILLING RIG. THIS METHOD HAS MINIMAL IMPACT ON THE SURROUNDING AREA. IT IS TYPICALLY USED WHEN TRENCHING OR EXCAVATING IS NOT PRACTICAL (I.E. UNDER CONCRETE OR PAVEMENT) OR WHEN CUSTOMER SATISFACTION (I.E. CABLE REPLACEMENT) IS A MAJOR CONCERN.

PROCESS

THE DRILLING RIG, POSITIONED AT THE STARTING POINT, PUSHES THE DRILLING HEAD INTO THE SOIL AND PUMPS FLUID TO THE HEAD. THE FLUID, TYPICALLY BENTONITE, IS PUMPED AT HIGH PRESSURE IN FRONT OF THE DRILLING HEAD IN THE DIRECTION THE OPERATOR WANTS THE HEAD TO TRAVEL. THIS FLUID SOFTENS THE SOIL IN THAT DIRECTION AND THE HEAD MOVES IN THAT DIRECTION SINCE IT IS THE PATH OF LEAST RESISTANCE. THAT IS HOW THE OPERATOR STEERS THE DRILLING HEAD ALONG THE ROUTE TO THE RECEIVING POINT AT THE END OF THE BORE. THE FLUID ALSO COOLS THE HEAD AND HELPS TO REMOVE DISLODGED SOIL. THE DRILLING HEAD IS CONNECTED TO HIGH STRENGTH STEEL "RODS" THAT ARE APPROXIMATELY 10 TO 15 FEET LONG. THE DRILLING CREW CONTINUES TO ADD ADDITIONAL RODS UNTIL THE DRILLING HEAD REACHES THE END OF THE BORE.

ONCE THE INITIAL BORE IS COMPLETE, THE OPERATOR PULLS A REAMING HEAD BACK THROUGH THE BORE TOWARD THE DRILLING RIG. AT THE SAME TIME, CABLE, CONDUIT OR PIPE IS PULLED BACK THROUGH THE BORE.

DUKE ENERGY REQUIREMENT

DIRECTIONAL DRILLING EQUIPMENT CAN APPLY EXCESSIVE TENSION WHICH CAN SERIOUSLY DAMAGE CABLE BEING PULLED THROUGH A BORE.

FOR THE ABOVE REASON, DUKE ENERGY REQUIRES DIRECTIONAL DRILLING CONTRACTORS TO UTILIZE A TENSION LIMITING DEVICE WHEN PULLING CABLE THROUGH A BORE. THIS CAN BE A PIECE OF BARE #6 AWG SOLID COPPER WIRE FOR 1/0 AWG MEDIUM VOLTAGE CABLE. TENSION LIMITING ATTACHMENTS (TYPICALLY BREAK-AWAY DEVICES) ARE AVAILABLE FROM VARIOUS TOOL MANUFACTURERS FOR USE WITH OTHER CABLES. MAXIMUM ALLOWABLE PULLING TENSIONS FOR ALL MEDIUM VOLTAGE CABLES ARE PROVIDED IN SECTION 23 (UNDERGROUND CABLES).

DIRECTIONAL BORING NEAR TREES

SEE SECTION 36, UNDERGROUND CLEARANCES AND JOINT USE, FOR DETAILS.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DIRECTIONAL BORING

DEC	DEM	DEP	DEF
X	X	X	X

22.02-100

DUKE ENERGY TYPICALLY DIRECT BURIES ALL 600 VOLT AND MEDIUM VOLTAGE PRIMARY CABLE IN THE GROUND WITHOUT THE USE OF CONDUIT. HOWEVER, LISTED BELOW ARE SOME EXAMPLES OF SITUATIONS WHERE CABLE MAY BE INSTALLED IN CONDUIT OR SPARE (EMPTY) CONDUITS INSTALLED.

FUTURE MAINTENANCE (REPLACEMENT) CONSIDERATIONS

APPLICATIONS WHERE FUTURE REPLACEMENT OF CABLE WOULD NOT BE POSSIBLE USING TRENCHING OR DIRECTIONAL BORING METHODS. DIRECTIONAL BORING LIMITATIONS ARE AS FOLLOWS:

- BORE WOULD BE LONGER THAN MAXIMUM CABLE FOOTAGE ON A REEL
- BORE LENGTH EXCEEDS EQUIPMENT CAPABILITIES (TYPICALLY 500' BUT CONSULT WITH CONTRACTOR)
- EXCESSIVE CABLE PULLING TENSIONS THROUGH CONDUIT WOULD BE ENCOUNTERED
- NOT ADEQUATE "GREEN" SPACE FOR BORE PITS

PROJECT TIMING

CROSSINGS UNDER PAVEMENT WHERE CABLE CANNOT BE INSTALLED PRIOR TO THE PAVEMENT. EFFORT SHOULD BE MADE TO INSTALL CABLE IF TIMING AND FIELD CONDITIONS ALLOW.

CUSTOMER REQUEST

THE DUKE ENERGY STANDARD IS TO PROVIDE DIRECT-BURIED UNDERGROUND CABLES. CUSTOMER REQUESTS FOR A CONDUIT INSTALLATION SHOULD BE EVALUATED ON A CASE-BY-CASE BASIS AND WILL REQUIRE MANAGEMENT APPROVAL. THE CUSTOMER WILL BE RESPONSIBLE FOR PAYING ALL ADDITIONAL COSTS ASSOCIATED WITH THE REQUEST (I.E. CONDUIT, PULL BOXES, SPLICES, PULLING LABOR, ETC.)

SPECIFIC REGULATIONS

- RAILROAD AND GAS TRANSMISSION CROSSINGS
- CROSSING OTHER UTILITIES WHEN CODE CLEARANCES CANNOT BE MET
- REQUIRED BY DOT OR OTHER GOVERNMENTAL AGENCIES
- SUBSTATION EXITS TO THE TERMINATION POINT

FUTURE GROWTH

CONDUIT MAY BE NECESSARY TO ACCOMMODATE FUTURE PROJECT EXPANSIONS OR LOAD GROWTH. FOR LONGER TERM PROJECTS, AN ECONOMIC ANALYSIS SHOULD BE PERFORMED TO DETERMINE THE BEST OPTION (I.E. INSTALL CONDUIT NOW VS BORE IN THE FUTURE).

SHALLOW INSTALLATIONS

CABLE SHALL BE INSTALLED IN CONCRETE-ENCASED CONDUIT WHEN MINIMUM CABLE COVER REQUIREMENTS CANNOT BE MET. SEE DWG. 22.01-101 FOR DETAILS.

RADIAL PRIMARY FEEDS

WHEN THE MAJORITY OF THE CABLE SUPPLYING A SINGLE RADIAL-FED TRANSFORMER IS UNDER PAVEMENT OR CONCRETE, THE CABLE CAN BE INSTALLED IN CONDUIT OR AN EMPTY CONDUIT CAN BE INSTALLED ALONG THE ENTIRE ROUTE.

CABLE MAY ALSO BE INSTALLED IN CONDUIT AND EMPTY CONDUIT INSTALLED FOR FUTURE CABLE INSTALLATION WHEN IT IS SERVING A "SHORT-TERM RADIALLY-FED TRANSFORMER" (THE LOOP WILL BE COMPLETED AT SOME POINT IN THE FUTURE) WHEN IT WILL NOT BE POSSIBLE TO TRENCH AROUND THE TRANSFORMER OR DIRECTIONALLY BORE IN THE AREA TO INSTALL THE FUTURE CABLE.

DUCT BANK

MANY CITIES REQUIRE UTILITIES TO INSTALL THEIR FACILITIES UNDERGROUND IN DESIGNATED INNER-CITY AREAS. CABLE WOULD BE INSTALLED IN CONCRETE ENCASED DUCT BANK IN THESE DESIGNATED AREAS. SEE THE DUCT BANK PORTION OF THIS SECTION FOR DETAILS.

THERE MAY ALSO BE HEAVILY CONGESTED URBAN AREAS OUTSIDE OF THE INNER-CITY AREA WHERE EITHER DUKE ENERGY CHOOSES OR THE CITY MANDATES FOR UTILITIES TO INSTALL FACILITIES UNDERGROUND. CABLE WOULD BE INSTALLED IN CONCRETE ENCASED DUCT BANK IN THESE DESIGNATED AREAS. SEE SUBSECTION 22.06 FOR DETAILS.

DIRECTIONAL BORING

- WHEN CABLE PLACEMENT HAS TO BE DEEPER THAN 48"
- IF ANY OF THE ABOVE APPLICATIONS APPLY

MISCELLANEOUS

- ROCKY SOIL
- ROUGH TERRAIN

DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

USES FOR CONDUIT

DEC	DEM	DEP	DEF
X	X	X	X

22.03-100

SCHEDULE 40 PVC

- POLE AND BUILDING RISERS
- ROAD CROSSINGS (EXCEPT AS NOTED BELOW)
- DUCT BANKS
- BRIDGE ATTACHMENTS

SEE DWG. 22.04-100 FOR SCHEDULE 40 PVC CONDUIT INFORMATION.

CELLULAR CORE PVC

- POLE AND BUILDING RISERS
- ROAD CROSSINGS (EXCEPT AS NOTED BELOW)
- DUCT BANKS
- BRIDGE ATTACHMENTS

SEE DWG. 22.04-134 FOR CELLULAR CORE PVC CONDUIT INFORMATION.

HIGH DENSITY POLYETHYLENE (HDPE)

- 2", 4" AND 6": DIRECTIONAL BORE PROJECTS
- 7" SDR 13.5 (DEF ONLY): DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE IS REQUIRED BY THE PERMITTING AUTHORITY
- 7" SDR 11 (DEF ONLY): DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE AND SDR GRADE IS REQUIRED BY THE PERMITTING AUTHORITY

SEE DWG. 22.04-136 FOR HDPE CONDUIT INFORMATION.

FIBERGLASS

- JACK & BORE STEEL ENCASED DUCT SYSTEMS
- BRIDGE ATTACHMENTS

SEE DWG. 22.04-142 FOR FIBERGLASS CONDUIT INFORMATION.

STEEL

- RAILROAD CROSSINGS
- BRIDGE CROSSINGS
- GAS TRANSMISSION CROSSINGS
- WHERE REQUIRED BY LOCAL JURISDICTIONS

SEE DWG. 22.04-140 FOR STEEL CONDUIT INFORMATION.

BORE-GARD

- DIRECTIONAL BORE PROJECTS
- BOREGUARD 6" (DEF ONLY): DIRECTIONAL BORE PROJECTS WHERE FUSED PIPE IS NOT REQUIRED BY THE PERMITTING AUTHORITY

SEE DWG. 22.04-144 FOR BORE-GARD INFORMATION.

DUKE ENERGY.

3				
2				
1				
0	10/20/16	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

CONDUIT USE BY TYPE

DEC	DEM	DEP	DEF
	X		X

22.03-102

CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER	MIN. I.D. (IN)	MAX. O.D. (IN)	NOM. WALL THICK. (IN.)	MIN. CROSS SECT. AREA (SQ. IN.)
1"	DEC	-	61350	0.999	1.325	0.143	0.780
	DEM	COND-STICK-1IN-PVC-SCH40-M	1515374				
	DEP	COND-STICK-1IN-PVC-SCH40-P	61350				
	DEF	COND-STICK-1IN-PVC-SCH40-F	4005378				
1-1/4"	DEC	COND-STICK-1 1/4IN-PVC-SCH40-C	61352	1.328	1.672	0.150	1.390
	DEM	-	61352				
	DEP	-	-				
	DEF	-	-				
1-1/2"	DEC	COND-STICK-1 1/2IN-PVC-SCH40-C	61353	1.558	1.912	0.155	1.910
	DEM	-	61353				
	DEP	COND-STICK-1 1/2IN-PVC-SCH40-P	61353				
	DEF	COND-STICK-1 1/2IN-PVC-SCH40-F	4005379				
2"	DEC	COND-STICK-2IN-PVC-SCH40-C	61354	2.015	2.387	0.164	3.190
	DEM	-	61354				
	DEP	COND-STICK-2IN-PVC-SCH40-P	61354				
	DEF	COND-STICK-2IN-PVC-SCH40-F	4005380				
2-1/2"	DEC	COND-STICK-2 1/2IN-PVC-SCH40-C	61356	2.406	2.89	0.215	4.550
	DEM	-	-				
	DEP	COND-STICK-2 1/2IN-PVC-SCH40-P	61356				
	DEF	COND-STICK-2 1/2IN-PVC-SCH40-F	61356				
3"	DEC	COND-STICK-3IN-PVC-SCH40-C	900463	3.001	3.515	0.229	7.070
	DEM	-	900463				
	DEP	COND-STICK-3IN-PVC-SCH40-P	900463				
	DEF	-	-				
4"	DEC	COND-STICK-4IN-PVC-SCH40-C	61360	3.92	4.550	0.251	12.070
	DEM	COND-STICK-4IN-PVC-SCH40-M	61360				
	DEP	COND-STICK-4IN-PVC-SCH40-P	61368				
	DEF	COND-STICK-4IN-PVC-SCH40-F	4005381				
5"	DEC	COND-STICK-5IN-PVC-SCH40-C	50113466	4.935	5.613	0.274	19.130
	DEM	-	50113466				
	DEP	-	-				
	DEF	-	-				
6"	DEC	COND-STICK-6IN-PVC-SCH40-C	61362	5.947	6.675	0.297	27.780
	DEM	COND-STICK-6IN-PVC-SCH40-M	61362				
	DEP	-	4027778				
	DEF	COND-STICK-6IN-PVC-SCH40-F	4005382				

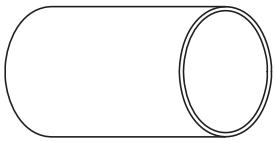
REVISED		BY	CHK'D	APPR.
3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK

(RIGID) PVC SCHEDULE 40 CONDUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

22.04-100



COUPLING

COUPLING - STANDARD - WITH CENTER STOP			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
3/4"	DEC	-	901549
	DEM	-	901549
	DEP	-	-
	DEF	-	-
1"	DEC	COND-CPLG-1IN-PVC-C	901556
	DEM	-	901556
	DEP	-	901556
	DEF	-	901556
1-1/4"	DEC	-	67266
	DEM	-	67266
	DEP	-	-
	DEF	-	-
1-1/2"	DEC	COND-CPLG-1 1/2IN-PVC-C	901557
	DEM	COND-CPLG-1 1/2IN-PVC-M	901557
	DEP	-	4005418
	DEF	-	4005418
2"	DEC	COND-CPLG-2IN-PVC-C	901550
	DEM	COND-CPLG-2IN-PVC-M	901550
	DEP	-	5011966
	DEF	-	5011966
2-1/2"	DEC	COND-CPLG-2 1/2IN-PVC-C	67260
	DEM	-	67260
	DEP	-	-
	DEF	-	-
3"	DEC	COND-CPLG-3IN-PVC-C	67262
	DEM	-	67262
	DEP	SEE SLIP COUPLING	-
	DEF	-	-
4"	DEC	COND-CPLG-4IN-PVC-C	67267
	DEM	COND-CPLG-4IN-PVC-M	67267
	DEP	SEE SLIP COUPLING	-
	DEF	SEE SLIP COUPLING	-
5"	DEC	COND-CPLG-5IN-PVC-C	67269
	DEM	COND-CPLG-5IN-PVC-M	901560
	DEP	SEE SLIP COUPLING	-
	DEF	SEE SLIP COUPLING	-
6"	DEC	COND-CPLG-6IN-PVC-C	901562
	DEM	COND-CPLG-6IN-PVC-M	901562
	DEP	SEE SLIP COUPLING	-
	DEF	SEE SLIP COUPLING	-

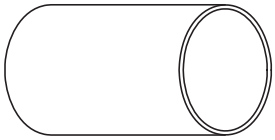
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC COUPLING - STANDARD - WITH CENTER STOP

DEC	DEM	DEP	DEF
X	X	X	X

22.04-102



SLIP COUPLING

SLIP COUPLING - NO CENTER STOP			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
2"	DEC	COND-CPLG-2IN-PVC-SLIP-C	313352
	DEM	-	313352
	DEP	SEE STANDARD COUPLING	-
	DEF	-	4005421
3"	DEC	COND-CPLG-3IN-PVC-SLIP-C	313351
	DEM	-	313351
	DEP	-	4027863
	DEF	-	-
4"	DEC	COND-CPLG-4IN-PVC-SLIP-C	1002231
	DEM	-	50119668
	DEP	-	4005417
	DEF	-	1002231
5"	DEC	COND-CPLG-5IN-PVC-SLIP-C	67282
	DEM	-	901560
	DEP	-	-
	DEF	-	-
6"	DEC	COND-CPLG-6IN-PVC-SLIP-C	901561
	DEM	COND-CPLG-6IN-PVC-SLIP-M	901561
	DEP	-	4027872
	DEF	-	4005423

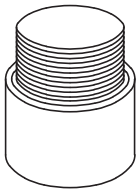
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC SLIP COUPLING - NO CENTER STOP

DEC	DEM	DEP	DEF
X	X	X	X

22.04-104



MALE TERMINAL ADAPTER

MALE TERMINAL ADAPTER			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
3/4"	DEC	-	50109756
	DEM	-	50109756
	DEP	-	-
	DEF	-	50109756
1"	DEC	COND-ADPT-1IN-PVC-THD-MALE-C	900827
	DEM	-	900827
	DEP	-	-
	DEF	-	4005388
1-1/4"	DEC	COND-ADPT-1 1/4IN-PVC-THD-MALE-C	50062733
	DEM	-	-
	DEP	-	-
	DEF	-	-
1-1/2"	DEC	-	711
	DEM	-	711
	DEP	-	-
	DEF	-	711
2"	DEC	COND-ADPT-2IN-PVC-THD-MALE-C	900822
	DEM	-	900822
	DEP	-	900822
	DEF	-	900822
2-1/2"	DEC	-	713
	DEM	-	-
	DEP	-	713
	DEF	-	713
3"	DEC	COND-ADPT-3IN-PVC-THD-MALE-C	714
	DEM	-	714
	DEP	-	714
	DEF	-	-
4"	DEC	COND-ADPT-4IN-PVC-THD-MALE-C	715
	DEM	-	715
	DEP	-	715
	DEF	-	715
5"	DEC	COND-ADPT-5IN-PVC-THD-MALE-C	900825
	DEM	-	900825
	DEP	-	-
	DEF	-	-
6"	DEC	-	900826
	DEM	-	900826
	DEP	-	900826
	DEF	-	-

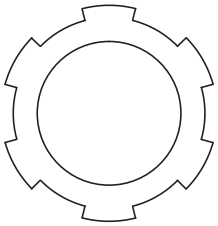
DUKE ENERGY.

3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC MALE TERMINAL ADAPTER

DEC	DEM	DEP	DEF
X	X	X	X

22.04-106



LOCKNUT

LOCKNUT			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
3/4"	DEC	-	133594
	DEM	-	-
	DEP	-	-
	DEF	-	133594
1"	DEC	COND-LNUT-1IN-STL-C	133587
	DEM	-	-
	DEP	-	-
	DEF	-	4005457
1-1/4"	DEC	COND-LNUT-1 1/4IN-STL-C	1001364
	DEM	-	-
	DEP	-	-
	DEF	-	-
1-1/2"	DEC	-	133589
	DEM	-	-
	DEP	-	-
	DEF	-	4005458
2"	DEC	-	902169
	DEM	-	902169
	DEP	-	1001365
	DEF	-	907518
2-1/2"	DEC	-	-
	DEM	-	-
	DEP	-	273032
	DEF	-	273032
3"	DEC	-	-
	DEM	-	-
	DEP	-	133591
	DEF	-	-
4"	DEC	COND-LNUT-4IN-STL-C	133593
	DEM	-	-
	DEP	-	907530
	DEF	-	907530
5"	DEC	-	133606
	DEM	-	-
	DEP	-	-
	DEF	-	-
6"	DEC	-	133608
	DEM	-	-
	DEP	-	133608
	DEF	-	-

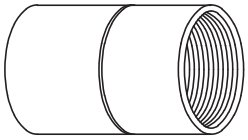
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

LOCKNUT

DEC	DEM	DEP	DEF
X	X	X	X

22.04-108



FEMALE ADAPTER

FEMALE ADAPTER			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
1"	DEC	COND-ADPT-1IN-PVC-THD-FEMALE-C	900813
	DEM	COND-ADPT-1IN-PVC-THD-FEMALE-M	900813
	DEP	-	-
	DEF	-	-
1-1/2"	DEC	-	-
	DEM	-	-
	DEP	-	-
	DEF	-	900814
2"	DEC	COND-ADPT-2IN-PVC-THD-FEMALE-C	900815
	DEM	-	900815
	DEP	-	900815
	DEF	-	-
3"	DEC	COND-ADPT-3IN-PVC-THD-FEMALE-C	900816
	DEM	-	900816
	DEP	-	900816
	DEF	-	-
4"	DEC	-	900817
	DEM	-	900817
	DEP	-	900817
	DEF	-	-
5"	DEC	-	900818
	DEM	-	900818
	DEP	-	-
	DEF	-	-
6"	DEC	-	900819
	DEM	-	900819
	DEP	-	-
	DEF	-	-

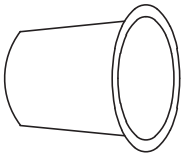
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC FEMALE ADAPTER

DEC	DEM	DEP	DEF
X	X	X	X

22.04-110



PLUG

PLUG/END CAP			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
1"	DEC	-	153027
	DEM	-	-
	DEP	-	-
	DEF	-	4005425
1-1/2"	DEC	-	153028
	DEM	-	-
	DEP	-	4181099
	DEF	-	-
2"	DEC	COND-PLUG-2 1/2IN-PVC-C (SEE NOTE 1)	153051
	DEM	-	153051
	DEP	-	153051
	DEF	-	4005407
2-1/2"	DEC	COND-PLUG-2 1/2IN-PVC-C	153051
	DEM	-	-
	DEP	-	-
	DEF	-	4005408
3"	DEC	COND-PLUG-3IN-PVC-C	153049
	DEM	COND-PLUG-3IN-PVC-M	901660
	DEP	-	153049
	DEF	-	-
4"	DEC	COND-PLUG-4IN-PVC-C	901662
	DEM	-	901662
	DEP	-	901662
	DEF	-	4005409
5"	DEC	-	47060
	DEM	-	-
	DEP	-	-
	DEF	-	-
6"	DEC	COND-PLUG-6IN-PVC-C	153024
	DEM	-	901668
	DEP	-	901668
	DEF	-	4005410

NOTES:

1. THIS COMPATIBLE UNIT IS APPLICABLE FOR BOTH 2" AND 2 1/2" CONDUIT.

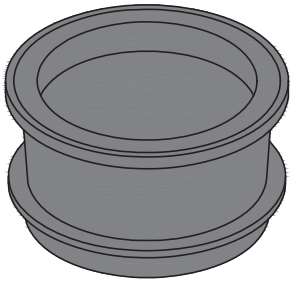
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK

PVC PLUG / END CAP

DEC	DEM	DEP	DEF
X	X	X	X

22.04-112



END BELL

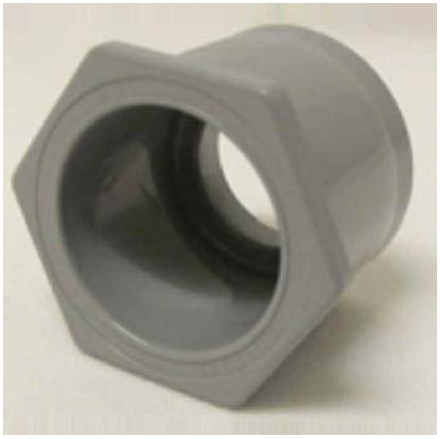
END BELL			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
2"	DEC	-	287192
	DEM	-	287192
	DEP	-	-
	DEF	-	-
3"	DEC	COND-END-3IN-PVC-C	343556
	DEM	-	343556
	DEP	-	-
	DEF	-	-
4"	DEC	-	50112216
	DEM	-	50112216
	DEP	-	-
	DEF	-	-
5"	DEC	-	903931
	DEM	-	903931
	DEP	-	-
	DEF	-	-
6"	DEC	COND-END-6IN-PVC-C	900931
	DEM	COND-END-6IN-PVC-M	900931
	DEP	-	-
	DEF	-	-

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC END BELL

DEC	DEM	DEP	DEF
X	X	X	X

22.04-114



REDUCERS			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
1" TO 3/4"	DEC	COND-REDR-1IN-PVC-C	50109746
	DEM	COND-REDR-1IN-PVC-M	50109746
	DEP	-	-
	DEF	-	-
1-1/2" TO 1/2"	DEC	-	-
	DEM	-	-
	DEP	-	-
	DEF	-	-
2" TO 1-1/2"	DEC	-	-
	DEM	-	-
	DEP	-	4027832
	DEF	-	-
2-1/2" TO 2"	DEC	-	-
	DEM	-	-
	DEP	-	-
	DEF	-	4005419
3" TO 2"	DEC	-	50118125
	DEM	-	50118125
	DEP	-	-
	DEF	-	-
3" TO 2-1/2"	DEC	-	600046
	DEM	-	-
	DEP	-	-
	DEF	-	-
4" TO 3"	DEC	-	900275
	DEM	-	900275
	DEP	-	-
	DEF	-	-

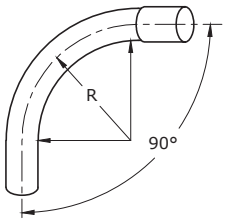
DUKE ENERGY.

3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC REDUCERS

DEC	DEM	DEP	DEF
X	X	X	X

22.04-116



BENDS - 90 DEGREES

BENDS - 90° - SCHEDULE 40				
CONDUIT SIZE	RADIUS	REGION	COMPATIBLE UNIT	ITEM NUMBER
1"	5.75"	DEC	COND-BEND-1IN-PVC-90DEG-R5-C	29510
	-	DEM	-	-
	18.00"	DEP	COND-BEND-1IN-PVC-90DEG-R18-P	4028635
	18.00"	DEF	-	-
1-1/2"	8.25"	DEC	COND-BEND-1 1/2IN-PVC-90DEG-R8-C	29511
	8.25"	DEM	-	29511
	12.00"	DEF	-	4005394
	24.00"	DEF	-	4005395
	36.00"	DEP	COND-BEND-1 1/2IN-PVC-90DEG-R36-P	4005396
	36.00"	DEF	COND-BEND-1 1/2IN-PVC-90DEG-R36-F	4005396
2"	9.50"	DEC	COND-BEND-2IN-PVC-90DEG-R9-C	29512
	18.00"	DEM	COND-BEND-2IN-PVC-90DEG-R18-M	906955
	36.00"	DEC	COND-BEND-2IN-PVC-90DEG-R36-C	1461383
	36.00"	DEM	COND-BEND-2IN-PVC-90DEG-R36-M	1461383
	36.00"	DEP	COND-BEND-2IN-PVC-90DEG-R36-P	1461383
	36.00"	DEF	COND-BEND-2IN-PVC-90DEG-R36-F	4005397
2-1/2"	10.50"	DEC	COND-BEND-2 1/2IN-PVC-90DEG-R10-C	29513
	-	DEM	-	-
	-	DEP	-	-
	24.00"	DEF	COND-BEND-2 1/2IN-PVC-90DEG-R24-F	4005398
	36.00"	DEF	COND-BEND-2 1/2IN-PVC-90DEG-R36-F	4005399
3"	13.00"	DEC	COND-BEND-3IN-PVC-90DEG-R13-C	50130471
	13.00"	DEM	-	50130471
	24.00"	DEP	-	4027806
	36.00"	DEC	COND-BEND-3IN-PVC-90DEG-R36-C	1461384
	36.00"	DEM	COND-BEND-3IN-PVC-90DEG-R36-M	1461384
	36.00"	DEP	COND-BEND-3IN-PVC-90DEG-R36-P	4027806
4"	16.00"	DEC	COND-BEND-4IN-PVC-90DEG-R16-C	29515
	-	DEM	-	-
	24.00"	DEF	-	50110650
	36.00"	DEC	COND-BEND-4IN-PVC-90DEG-R36-C	50110651
	36.00"	DEP	COND-BEND-4IN-PVC-90DEG-R36-P	50110651
	36.00"	DEF	COND-BEND-4IN-PVC-90DEG-R36-F	50110651
	48.00"	DEF	-	4005400
5"	24.00"	DEC	COND-BEND-5IN-PVC-90DEG-R24-C	50110652
	24.00"	DEM	-	50110652
	-	DEP	-	-
	-	DEF	-	-
6"	30.00"	DEC	COND-BEND-6IN-PVC-90DEG-R30-C	29552
	36.00"	DEC	COND-BEND-6IN-PVC-90DEG-R36-C	1461176
	36.00"	DEF	COND-BEND-6IN-PVC-90DEG-R36-F	1461176
	48.00"	DEP	COND-BEND-6IN-PVC-90DEG-R48-P	4027828
	48.00"	DEF	COND-BEND-6IN-PVC-90DEG-R48-F	4005401
	60.00"	DEM	-	908960

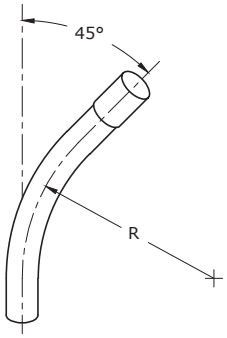
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK

PVC BENDS - 90 DEGREES - SCHEDULE 40

DEC	DEM	DEP	DEF
X	X	X	X

22.04-118



BEND - 45 DEGREES

BENDS - 45° - SCHEDULE 40				
CONDUIT SIZE	RADIUS	REGION	COMPATIBLE UNIT	ITEM NUMBER
1"	5.75"	DEC	COND-BEND-1IN-PVC-45DEG-R5-C	29536
	-	DEM	-	-
	-	DEP	-	-
	-	DEF	-	-
1-1/2"	8.25"	DEC	COND-BEND-1 1/2IN-PVC-45DEG-R8-C	29535
	8.25"	DEM	-	29535
	36.00"	DEP	COND-BEND-1 1/2IN-PVC-45DEG-R36-P	4005391
	36.00"	DEF	COND-BEND-1 1/2IN-PVC-45DEG-R36-F	4005391
2"	9.50"	DEC	COND-BEND-2IN-PVC-45DEG-R9-C	50130470
	9.50"	DEM	COND-BEND-2IN-PVC-45DEG-R9-M	50130470
	9.50"	DEP	COND-BEND-2IN-PVC-45DEG-R9-P	4027796
	36.00"	DEC	COND-BEND-2IN-PVC-45DEG-R36-C	1461380
	36.00"	DEP	COND-BEND-2IN-PVC-45DEG-R36-P	4027797
	36.00"	DEF	COND-BEND-2IN-PVC-45DEG-R36-F	4198797
2-1/2"	10.50"	DEC	COND-BEND-2 1/2IN-PVC-45DEG-R10-C	29547
	-	DEM	-	-
	-	DEP	-	-
	36.00"	DEF	COND-BEND-2 1/2IN-PVC-45DEG-R36-F	4005392
3"	13.00"	DEC	COND-BEND-3IN-PVC-45DEG-R13-C	50109247
	36.00"	DEC	COND-BEND-3IN-PVC-45DEG-R36-C	1461381
	13.00"	DEM	-	50109247
	36.00"	DEM	COND-BEND-3IN-PVC-45DEG-R36-M	50110986
	36.00"	DEP	COND-BEND-3IN-PVC-45DEG-R36-P	50110986
4"	16.00"	DEC	COND-BEND-4IN-PVC-45DEG-R16-C	29549
	16.00"	DEM	-	50094315
	36.00"	DEC	COND-BEND-4IN-PVC-45DEG-R36-C	1461382
	36.00"	DEM	COND-BEND-4IN-PVC-45DEG-R36-M	1461382
	36.00"	DEP	COND-BEND-4IN-PVC-45DEG-R36-P	1461382
	36.00"	DEF	COND-BEND-4IN-PVC-45DEG-R36-F	1461382
5"	24.00"	DEC	COND-BEND-5IN-PVC-45DEG-R24-C	29550
	24.00"	DEM	-	29550
	-	DEP	-	-
	-	DEF	-	-
6"	30.00"	DEC	COND-BEND-6IN-PVC-45DEG-R30-C	29545
	30.00"	DEM	-	29545
	36.00"	DEC	COND-BEND-6IN-PVC-45DEG-R36-C	1461180
	36.00"	DEM	COND-BEND-6IN-PVC-45DEG-R36-M	1461180
	48.00"	DEP	COND-BEND-6IN-PVC-45DEG-R48-P	4027829
	48.00"	DEF	COND-BEND-6IN-PVC-45DEG-R48-F	4005393

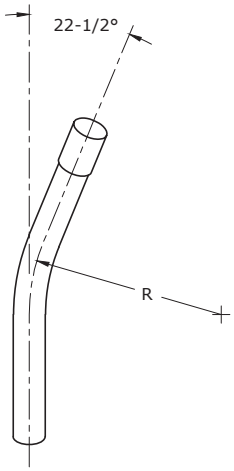
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC BENDS - 45 DEGREES - SCHEDULE 40

DEC	DEM	DEP	DEF
X	X	X	X

22.04-120



BENDS - 22-1/2 DEGREES

BENDS - 22-1/2° - SCHEDULE 40				
CONDUIT SIZE	RADIUS	REGION	COMPATIBLE UNIT	ITEM NUMBER
2"	36.00"	DEC	COND-BEND-2IN-PVC-22DEG-R36C	1461376
	36.00"	DEM	COND-BEND-2IN-PVC-22DEG-R36M	1461376
	-	DEP	-	-
	36.00"	DEF	COND-BEND-2IN-PVC-22DEG-R36F	1461376
2-1/2"	-	DEC	-	-
	-	DEM	-	-
	-	DEP	-	-
	36.00"	DEF	COND-BEND-2 1/2IN-PVC-22DEG-R36-F	4005402
3"	36.00"	DEC	COND-BEND-3IN-PVC-22DEG-R36C	1461377
	36.00"	DEM	COND-BEND-3IN-PVC-22DEG-R36M	1461377
	-	DEP	-	-
	-	DEF	-	-
4"	36.00"	DEC	COND-BEND-4IN-PVC-22DEG-R36-C	1461378
	36.00"	DEM	COND-BEND-4IN-PVC-22DEG-R36-M	1461378
	-	DEP	-	-
	36.00"	DEF	COND-BEND-4IN-PVC-22DEG-R36-F	1461378
6"	36.00"	DEC	COND-BEND-6IN-PVC-22DEG-R36-C	1461181
	36.00"	DEM	COND-BEND-6IN-PVC-22DEG-R36-M	1461181
	48.00"	DEP	COND-BEND-6IN-PVC-22DEG-R48-P	4027835
	36.00"	DEF	COND-BEND-6IN-PVC-22DEG-R36-F	1461181

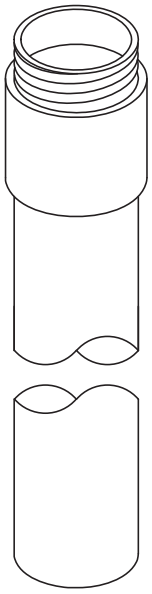
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC BENDS - 22-1/2 DEGREES - SCHEDULE 40

DEC	DEM	DEP	DEF
X	X	X	X

22.04-122



SERVICE RISER
6' PIECE OF CONDUIT WITH ATTACHED
MALE TERMINAL ADAPTER AND LOCKNUT

SERVICE RISER - SCHEDULE 40			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
1"	DEC	-	61348
	DEM	-	-
	DEP	-	-
	DEF	-	-
2"	DEC	RISER-2IN-COND-SVC-C	61355
	DEM	-	-
	DEP	-	-
	DEF	RISER-2IN-COND-SVC-F	4005431
2-1/2"	DEC	RISER-2 1/2IN-COND-SVC-C	61357
	DEM	-	-
	DEP	-	-
	DEF	-	4005432
3"	DEC	COND-ADPT-3IN-PVC-THD-MALE-6FT-C	61359
	DEM	-	-
	DEP	-	-
	DEF	-	-

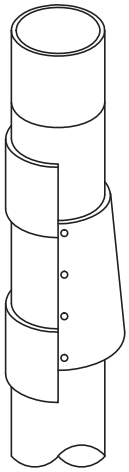
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC SERVICE RISER

DEC	DEM	DEP	DEF
X			X

22.04-124



DEC/DEM VENTED RISER

DEP VENTED RISER

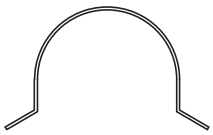
VENTED RISER			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
2"	DEC	RISER-2IN-VENT-C	173973
	DEM	RISER-2IN-VENT-M	173973
	DEP	-	-
	DEF	-	-
3"	DEC	RISER-3IN-VENT-C	173974
	DEM	RISER-3IN-VENT-M	173974
	DEP	-	-
	DEF	-	4197434
4"	DEC	RISER-4IN-VENT-C	173975
	DEM	RISER-4IN-VENT-M	173975
	DEP	-	-
	DEF	-	-
5"	DEC	RISER-5IN-VENT-C	173976
	DEM	-	-
	DEP	-	-
	DEF	-	-
6"	DEC	RISER-6IN-VENT-C	173977
	DEM	RISER-6IN-VENT-M	173977
	DEP	RISER-6IN-VENT-P	4030508
	DEF	-	-

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PVC VENTED RISERS

DEC	DEM	DEP	DEF
X	X	X	X

22.04-128



SUPPORT STRAPS

CONDUIT STRAPS - POLE			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
3/4"	DEC	COND-STRAP-3/4IN-STL-GALV-POLE-C	204225
	DEM	-	50114538
	DEP	-	-
	DEF	-	-
1"	DEC	COND-STRAP-1IN-STL-GALV-C	204211
	DEM	COND-STRAP-1IN-STL-GALV-M	937724
	DEP	-	4030709
	DEF	-	4030706
1-1/4"	DEC	COND-STRAP-1 1/4IN-STL-GALV-C	204212
	DEM	-	-
	DEP	-	-
	DEF	-	-
1-1/2"	DEC	-	-
	DEM	-	-
	DEP	-	4030707
	DEF	-	-
2"	DEC	COND-STRAP-2IN-STL-GALV-C	204213
	DEM	COND-STRAP-2IN-STL-GALV-M	204213
	DEP	-	4021798
	DEF	-	-
2-1/2"	DEC	COND-STRAP-2 1/2IN-STL-GALV-C	437016
	DEM	-	-
	DEP	-	-
	DEF	-	4005461
3"	DEC	COND-STRAP-3IN-STL-GALV-C	204215
	DEC	COND-STRAP-3IN-STL-GALV-POLE-C	204215
	DEM	COND-STRAP-3IN-STL-GALV-M	204215
	DEP	-	4021800
	DEF	-	-
4"	DEC	COND-STRAP-4IN-STL-GALV-C	204216
	DEC	COND-STRAP-4IN-STL-GALV-POLE-C	204216
	DEM	COND-STRAP-4IN-STL-GALV-M	204216
	DEP	-	4021801
	DEF	-	-
5"	DEC	COND-STRAP-5IN-STL-GALV-C	204217
	DEC	COND-STRAP-5IN-STL-GALV-POLE-C	204217
	DEM	COND-STRAP-5IN-STL-GALV-M	204217
	DEP	-	-
	DEF	-	-
6"	DEC	COND-STRAP-6IN-STL-GALV-C	204218
	DEC	COND-STRAP-6IN-STL-GALV-POLE-C	204218
	DEM	COND-STRAP-6IN-STL-GALV-M	204218
	DEP	-	4021802
	DEF	-	-

NOTES:

1. CONDUIT STRAPS ARE PROVIDED IN RISER COMPATIBLE UNITS.

DUKE ENERGY.

3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONDUIT SUPPORT STRAPS -
WOOD POLE MOUNT

DEC	DEM	DEP	DEF
X	X	X	X

22.04-130

CELLULAR CORE CONDUIT IS TYPICALLY A COEXTRUDED PVC PIPE HAVING A CELLULAR CORE SURROUNDED BY THIN CONCENTRIC INNER AND OUTER LAYERS. DUKE ENERGY REQUIRES ITS CELLULAR CORE CONDUIT TO HAVE THE SAME PHYSICAL PROPERTIES AS SCHEDULE 40 PVC CONDUIT AND THEY ARE PROVIDED TO DUKE ENERGY UNDER THE SAME ITEM NUMBERS AS SCHEDULE 40 PVC CONDUIT.

THE SAME CONDUIT ACCESSORIES ARE USED FOR BOTH SCHEDULE 40 PVC CONDUIT AND CELLULAR CORE CONDUIT.

CELLULAR CORE CONDUIT MAY BE RECEIVED FOR ANY OF THE ITEMS LISTED BELOW.

CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER	MIN. I.D. (IN)	MAX O.D. (IN)	NOM. WALL THICK. (IN)	MIN. CROSS SECT. AREA (SQ IN)
2"	DEC	-	-	2.015	2.387	0.164	3.190
	DEM	-	-				
	DEP	-	61354				
	DEF	COND-STICK-2IN-PVC-SCH40-F	4005380				
3"	DEC	-	-	3.001	3.515	0.229	7.070
	DEM	-	-				
	DEP	-	900463				
	DEF	-	-				
4"	DEC	-	-	3.920	4.550	0.251	12.070
	DEM	-	-				
	DEP	-	61368				
	DEF	COND-STICK-4IN-PVC-SCH40-F	4005381				
6"	DEC	-	-	5.947	6.675	0.297	27.780
	DEM	-	-				
	DEP	-	4027778				
	DEF	COND-STICK-6IN-PVC-SCH40-F	4005382				

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK

CELLULAR CORE PVC CONDUIT

DEC	DEM	DEP	DEF
X	X	X	X

22.04-134

CONDUIT SIZE	SDR	REGION	COMPATIBLE UNIT	ITEM NUMBER	LENGTH PER REEL
3/4"	SCH 40	DEC	COND-COIL-3/4IN-PVC-SCH40-C	900030	100'
		DEM	-	900030	100'
		DEP	-	-	-
		DEF	-	-	-
1-1/2"	SCH 40	DEC	-	-	-
		DEM	-	-	-
		DEP	-	-	-
		DEF	COND-COIL-1 1/2IN-HDPE-SCH40-F	4005374	1500'
2"	13.5	DEC	COND-COIL-2IN-HDPE-SDR13-C	1461182	3000'
		DEM	COND-COIL-2IN-HDPE-SDR13-M	1461182	
		DEP	COND-COIL-2IN-HDPE-SDR13-P	4027780	
		DEF	COND-COIL-2IN-HDPE-SDR13-F	1461182	
2"	SCH 40	DEC	COND-COIL-2IN-HDPE-SCH40-C	453872	50'
		DEM	-	-	-
		DEP	-	-	-
		DEF	COND-COIL-2IN-HDPE-SCH40-F	4005375	3500'
3"	SCH 40	DEC	COND-COIL-3IN-HDPE-SCH40-C	50100974	500'
		DEM	COND-COIL-3IN-HDPE-SCH40-M	50100974	500'
		DEP	-	-	-
		DEF	-	-	-
4"	13.5	DEC	COND-COIL-4IN-HDPE-C	50118877	550'
		DEM	COND-COIL-4IN-HDPE-SDR13-M	50118877	
		DEP	COND-COIL-4IN-HDPE-SDR13-P	4027777	
		DEF	COND-COIL-4IN-HDPE-SCH40-F	4005376	500'
6"	13.5	DEC	COND-COIL-6IN-HDPE-C	1461183	400'
		DEM	COND-COIL-6IN-HDPE-SDR13-M	1461183	
		DEP	-	-	-
		DEF	COND-COIL-6IN-HDPE-SDR13-F	4162087	40' to 45'
7"	11	DEC	-	-	-
		DEM	-	-	-
		DEP	-	-	-
		DEF	COND-COIL-7IN-HDPE-SRD11-F	4198711	40'

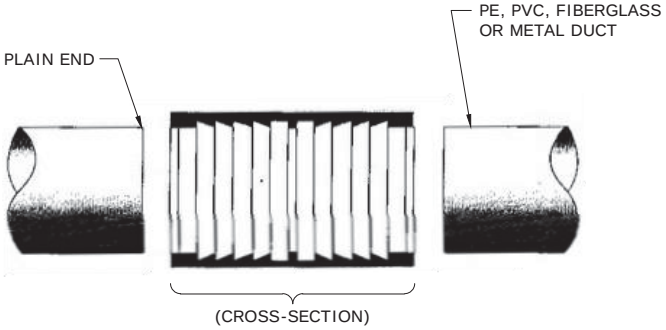
DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

HIGH DENSITY POLYETHYLENE (HDPE) CONDUIT

DEC	DEM	DEP	DEF
X	X	X	X

22.04-136



E-LOC COUPLING

HDPE CONDUIT COUPLING		
CONDUIT SIZE	COMPATIBLE UNIT	ITEM NUMBER
1-1/2"	-	4005411
2-1/2"	-	4005412
4"	-	4005415
6"	-	4005416

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

HDPE CONDUIT COUPLINGS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

22.04-138

CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER	NOM. I.D. (IN)	NOM. O.D. (IN)	MIN. WALL THICK. (IN.)	CROSS SECT. AREA (SQ. IN.)
1"	DEC	COND-STICK-1IN-STL-C	61248	1.063	1.315	0.126	0.887
	DEM	-	-				
	DEP	COND-STICK-1IN-STL-GRC-P	4027767				
	DEF	-	-				
1-1/2"	DEC	COND-STICK-1 1/2IN-STL-C	61250	1.624	1.900	0.138	2.071
	DEM	-	900713				
	DEP	-	-				
	DEF	COND-STICK-1 1/2IN-STL-GRC-F	4005440				
2"	DEC	COND-STICK-2IN-STL-C	61252	2.067	2.375	0.144	3.356
	DEM	-	900717				
	DEP	COND-STICK-2IN-STL-GRC-P	4027770				
	DEF	COND-STICK-2IN-STL-GRC-F	4005441				
2-1/2"	DEC	COND-STICK-2 1/2IN-STL-C	61254	2.489	2.878	0.193	4.865
	DEM	-	-				
	DEP	-	-				
	DEF	COND-STICK-2 1/2IN-STL-GRC-F	4005442				
3"	DEC	COND-STICK-3IN-STL-C	61256	3.068	3.500	0.203	7.393
	DEM	-	50027182				
	DEP	COND-STICK-3IN-STL-GRC-P	4027776				
	DEF	-	-				
4"	DEC	COND-STICK-4IN-STL-C	61257	4.026	4.500	0.223	12.730
	DEM	-	-				
	DEP	COND-STICK-4IN-STL-GRC-P	4027772				
	DEF	COND-STICK-4IN-STL-GRC-F	4005443				
5"	DEC	COND-STICK-5IN-STL-C	61258	5.073	5.563	0.243	20.210
	DEM	-	900733				
	DEP	-	-				
	DEF	-	-				
6"	DEC	-	-	6.065	6.625	0.263	28.890
	DEM	-	900738				
	DEP	COND-STICK-6IN-STL-GRC-P	4027771				
	DEF	COND-STICK-6IN-STL-GRC-F	4005444				

NOTES:

1. SEE DWG. 22.03-102 FOR STEEL CONDUIT APPLICATIONS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK

STEEL CONDUIT

DEC	DEM	DEP	DEF
X	X	X	X

22.04-140

FIBERGLASS CONDUIT IS TYPICALLY USED IN JACK & BORE INSTALLATIONS WHERE CONDUITS HAVE TO BE INSTALLED IN LARGE STEEL PIPES. THIS IS NECESSARY BECAUSE THE HEAT GENERATED BY THE CURING OF CONCRETE, FLOWABLE FILL, ETC. THAT IS USED TO FILL THE GAPS AROUND DUCTS IS HIGH ENOUGH TO DEFORM OR COLLAPSE PVC CONDUIT. FIBERGLASS CONDUIT IS ALSO AN OPTION FOR BRIDGE CROSSINGS.

FIBERGLASS CONDUIT IS NOT A STANDARD DUKE ENERGY PRODUCT DUE TO ITS VERY LIMITED USE; THEREFORE, IT HAS TO BE ORDERED FROM THE MANUFACTURER WHENEVER IT IS NEEDED FOR A PROJECT. CHAMPION FIBERGLASS, INC. IS ONE OF THE MAJOR US SUPPLIERS OF FIBERGLASS CONDUIT AND DUKE ENERGY HAS PURCHASED CONDUIT FROM THEM IN THE PAST. CONTACT INFORMATION FOR CHAMPION'S SALES REPRESENTATIVE AGENCIES MAY BE FOUND AT WWW.CHAMPIONFIBERGLASS.COM

THIS WEBSITE ALSO PROVIDES INFORMATION REGARDING FIBERGLASS CONDUIT AND THE RANGE OF PRODUCTS CHAMPION OFFERS.

3					
2					
1					
0	12/31/15	FLETCHER	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

FIBERGLASS CONDUIT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

22.04-142

BORE-GARD IS A SPECIALTY CONDUIT MANUFACTURED BY CARLON THAT IS DESIGNED TO BE USED IN DIRECTIONAL BORE APPLICATIONS WHERE HDPE IS TYPICALLY USED.

BORE-GARD CONDUIT COMES IN 10 FOOT LENGTHS. THE ENDS INCORPORATE A WATER-TIGHT SEAL AND LOCKING RING THAT ALLOWS CEMENT FREE ASSEMBLY THAT IS STRONG ENOUGH TO BE PULLED INTO A 1000 FOOT BORE.

THE FOLLOWING BORE-GARD CONDUITS ARE AVAILABLE FOR USE.

BORE-GARD CONDUIT			
CONDUIT SIZE	REGION	COMPATIBLE UNIT	ITEM NUMBER
6"	DEM	-	50103625
	DEP	COND-STICK-6IN-SCH40-BG-P	4139874
	DEF	COND-STICK-6IN-SCH40-BG-F	4139874

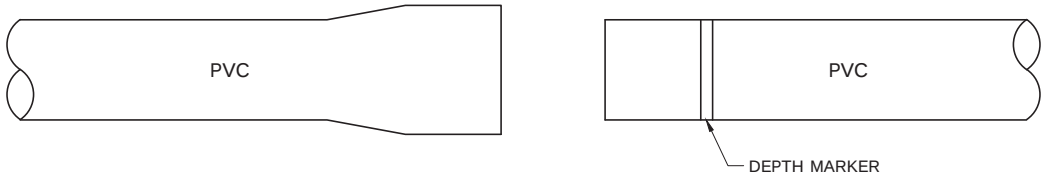
3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

BORE-GARD CONDUIT

DEC	DEM	DEP	DEF
	X	X	X

22.04-144

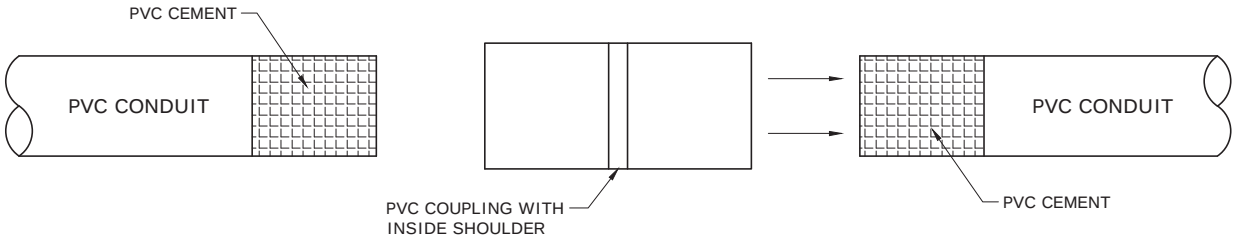
NEW CONDUIT CONNECTIONS



NOTES:

1. EXAMINE EACH LENGTH OF CONDUIT AND ENSURE THERE ARE NO INTERIOR OR EXTERIOR IMPERFECTIONS, CRACKS, ETC. REMOVE ANY FOREIGN MATTER (SAND, DEBRIS, ETC.) FROM INSIDE THE CONDUIT.
2. REMOVE ANY BURRS AND BEVEL ANY SHARP EDGES. WIPE DRY WITH A CLEAN, DRY CLOTH.
3. APPLY AN EVEN COAT OF PVC CEMENT TO THE OUTSIDE OF THE PLAIN CONDUIT END AND THE INSIDE OF THE BELLED CONDUIT END. DO NOT POUR OR SPLASH CEMENT ON CONDUIT.
4. IMMEDIATELY PUSH AND TWIST THE CONDUITS TOGETHER UNTIL THE DEPTH MARKER IS FLUSH WITH THE BELLED END. TWIST THEM APPROXIMATELY 1/4 TURN TO SPREAD THE CEMENT EVENLY.
5. HOLD JOINT TOGETHER FOR 15 SECONDS TO ALLOW INITIAL SET.

CUTTING CONDUIT AND CONNECTING WITH A COUPLING



NOTES:

6. EXAMINE EACH LENGTH OF CONDUIT ALONG WITH THE COUPLING AND ENSURE THERE ARE NO INTERIOR OR EXTERIOR IMPERFECTIONS, CRACKS, ETC. REMOVE ANY FOREIGN MATTER (SAND, DEBRIS, ETC.) FROM INSIDE THE CONDUIT.
7. CUT PIPE SQUARELY. REMOVE ANY BURRS AND BEVEL ANY SHARP EDGES. WIPE DRY WITH A CLEAN, DRY CLOTH.
8. APPLY AN EVEN COAT OF PVC CEMENT TO THE OUTSIDE OF THE PLAIN CONDUIT END AND THE INSIDE OF THE BELLED CONDUIT END. DO NOT POUR OR SPLASH CEMENT ON CONDUIT.
9. IMMEDIATELY PUSH AND TWIST THE CONDUITS TOGETHER UNTIL THE DEPTH MARKER IS FLUSH WITH THE BELLED END. TWIST THEM APPROXIMATELY 1/4 TURN TO SPREAD THE CEMENT EVENLY.
10. HOLD JOINT TOGETHER FOR 15 SECONDS TO ALLOW INITIAL SET.

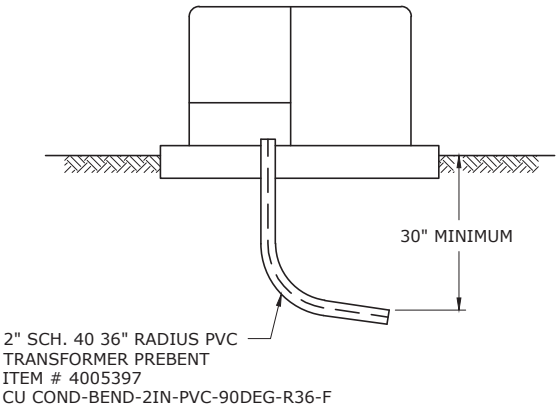
PVC CEMENT		
REGION	COMPATIBLE UNIT	ITEM NUMBER
DEC	-	414803
DEM	-	665822
DEP	-	1498047
DEF	-	1498047

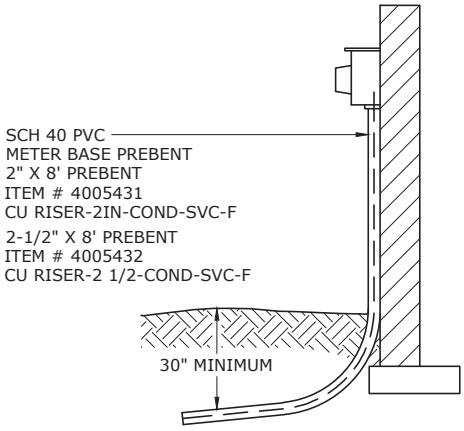
REVISED	BY	CHK'D	APPR.
3			
2	11/13/17	FLETCHER	EANES	ADCOCK
1	8/7/17	FLETCHER	EANES	ADCOCK
0	12/31/15	FLETCHER	EANES	ADCOCK

CUTTING AND JOINING PVC CONDUIT

DEC	DEM	DEP	DEF
X	X	X	X

22.05-100





NOTES:

1. USE TRANSFORMER PREBENT FOR ADJACENT LOT SERVICES TO AVOID DIGGING UNDER TRANSFORMERS.

2. INSTALL CONDUIT CAPS ON EACH END OF 90° PREBENT TO KEEP SAND OUT OF CONDUIT PRIOR TO INSTALLING SERVICE.

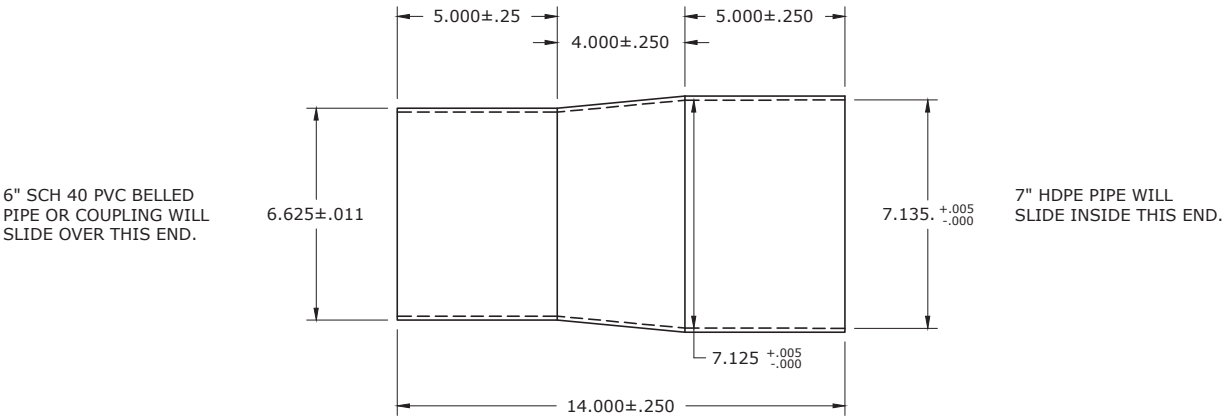
DUKE ENERGY.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

INSTALL PREBENTS

DEC	DEM	DEP	DEF
			X

22.05-102



TRANSITION COUPLING
ITEM # 4189275

NOTES:

1. USE FOR TRANSITION BETWEEN 7" HDPE AND 6" PVC.
2. USE BONDUIT EPOXY ON PVC TO HDPE CONNECTION.
3. BONDUIT EPOXY (ITEM # 4186182) AND USE WITH APPLICATION GUN (ITEM # 4186180).
4. INSTALL 2 BEADS OF EPOXY AROUND HDPE PIPE AT 1" AND 3" FROM END.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

JOINING 6" PVC TO 7" POLYETHYLENE PIPE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

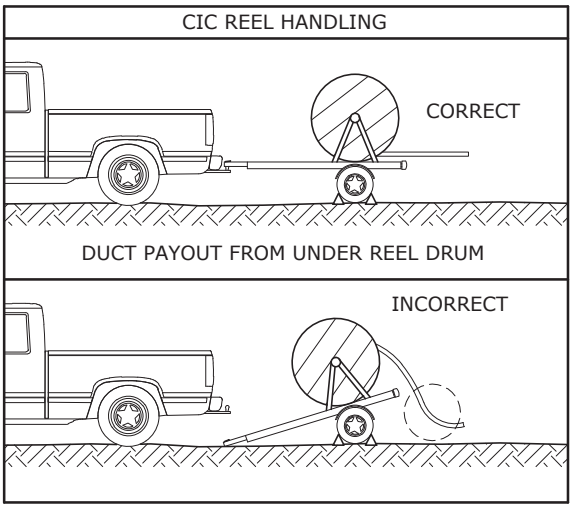
22.05-104

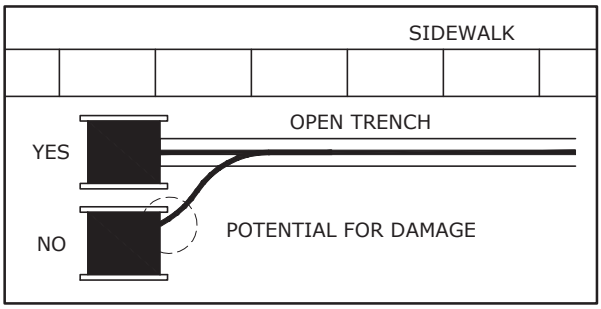
PVC CONDUIT PROCEDURE

NOTES:

1. ALL CONDUIT JOINTS SHOULD BE COMPLETED AND THE CEMENT SHOULD BE DRY BEFORE THE SECTIONS ARE PLACED IN TRENCH.
2. CAREFULLY LOWER CONDUIT INTO THE TRENCH. DO NOT KICK, OR THROW IT IN THE TRENCH.
3. SURROUNDING TRENCH BACKFILL MUST BE FREE OF ROCKS, CINDERS, OR OTHER DEBRIS THAT MIGHT DAMAGE THE CONDUIT DURING BACKFILL OR OVER TIME AS THE SOIL COMPRESSES.
4. INSTALL PROPER CONDUIT PLUGS AS LISTED ON DWG. 22.04-112.
5. ALL CONDUITS MUST BE KEPT PARALLEL TO EACH OTHER AND LEVEL.
6. ENCASE ALL 90° BENDS AND SWEEPS IN CONCRETE IN DEP AND DEF. DEC AND DEM SHOULD CONSIDER CONCRETE ENCASEMENT WHEN HIGH CABLE PULLING TENSIONS WILL BE ENCOUNTERED.
7. IN DEP, POWER MARKERS ARE TO BE USED TO IDENTIFY ALL PVC DEADENDS THAT ARE BURIED WITHOUT CABLE.

CIC INSTALLATION PROCEDURES





NOTES:

1. PAYOUT CIC CONDUIT FROM REEL TO AVOID "REVERSE BENDING" CONDUIT.
2. POSITION PAYOUT REEL TO MINIMIZE POSSIBILITY OF CONDUIT DAMAGE AND KINKING.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

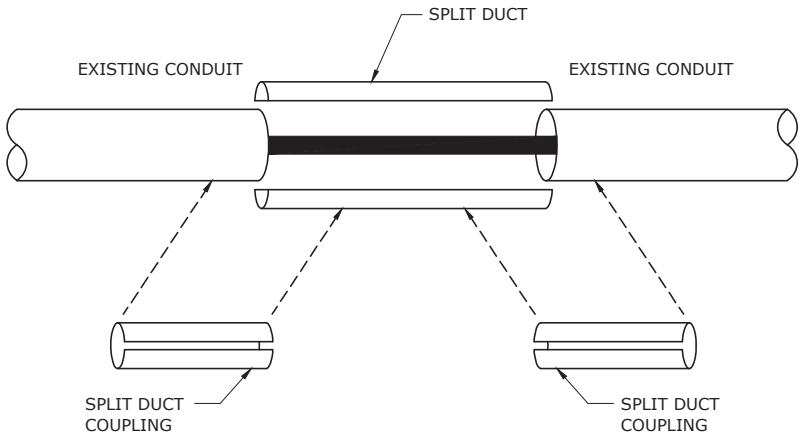
PVC CONDUIT AND CIC INSTALLATION PROCEDURE

DEC	DEM	DEP	DEF
X	X	X	X

22.05-106

REPAIRING EXISTING PVC CONDUIT WITH CABLE

FOLLOW THE ACCIDENT PREVENTION MANUAL WHEN WORKING WITH CABLE THAT IS IN CONDUIT.



DESCRIPTION	ITEM NUMBER			
	DEC	DEM	DEP	DEF
2" SPLIT DUCT - 10' LG	900782	900782	4176505	-
2-1/2" SPLIT DUCT - 10' LG	-	-	-	4005383
3" SPLIT DUCT - 10' LG	900783	900783	4176556	-
4" SPLIT DUCT - 10' LG	900784	900784	4005384	4005384
5" SPLIT DUCT - 10' LG	900264	900264	-	-
6" SPLIT DUCT - 10' LG	900553	900553	4005385	4005385
2" COUPLING	-	4176506	4176506	-
2-1/2" COUPLING - 5-3/4" LG	-	-	-	-
3" COUPLING	-	4176509	4176509	-
4" COUPLING - 8" LG	-	4005424	4005424	4005424
6" COUPLING - 10" LG	50130899	50130899	50130899	50130899

NOTES:

1. CUT DAMAGED PVC SQUARELY USING EXTREME CARE TO PREVENT DAMAGE TO CONDUCTORS.
2. REMOVE SAND AND FOREIGN DEBRIS FROM CONDUIT ENDS.
3. CUT SPLIT DUCT THE EXACT LENGTH OF DAMAGED AREA AND INSTALL IN EXPOSED AREA.
4. INSTALL TWO SPLIT DUCT COUPLINGS ON EACH END BY CENTERING OVER BUTT JOINTS.
5. SECURE SPLIT DUCT COUPLINGS WITH STAINLESS STEEL HOSE CLAMPS OR STAINLESS STEEL BANDING OR VINYL TAPE.
6. SECURE SPLIT DUCT SPLICE AT 12" INTERVALS.

DUKE ENERGY.

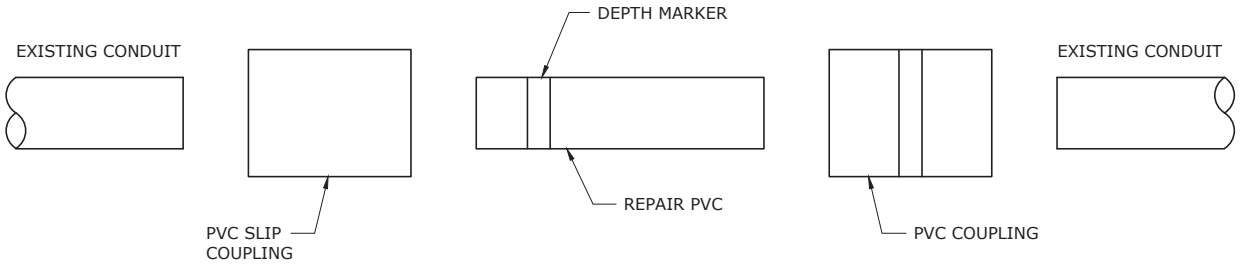
3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

REPAIRING EXISTING PVC CONDUIT
WHEN CONDUIT CONTAINS CABLE

DEC	DEM	DEP	DEF
X	X	X	X

22.05-108

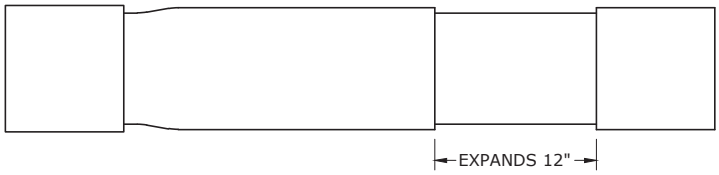
REPAIR OF EXISTING CONDUIT WITHOUT WIRE



NOTES:

1. CUT DAMAGED PVC SQUARELY.
2. REMOVE SAND AND FOREIGN DEBRIS FROM CONDUIT ENDS.
3. CUT REPAIR PVC TO PROPER LENGTH (LESS WIDTH OF STOP).
4. SLIDE SLIP COUPLING ON CONDUIT. SEE DWG. 22.04-104 FOR AVAILABLE COUPLINGS.
5. APPLY PVC GLUE ON INSIDE OF PVC COUPLING WITH STOP AND OUTSIDE OF REPAIR PVC. SEE DWG. 22.04-102 FOR AVAILABLE COUPLINGS.
6. SLIDE AND TWIST TOGETHER UNTIL REPAIR PVC IS FLUSH WITH STOP.
7. CREATE DEPTH MARKER ON OPPOSITE END OF REPAIR PVC FOR CENTERING SLIP COUPLING.
8. APPLY PVC GLUE ON INSIDE OF PVC COUPLING WITH STOP AND OUTSIDE OF EXISTING CONDUIT.
9. SLIDE AND TWIST TOGETHER UNTIL EXISTING PVC IS FLUSH WITH COUPLING STOP.
10. APPLY PVC GLUE ON OUTSIDE OF EXISTING PVC AND OUTSIDE OF REPAIR PVC.
11. SLIDE AND TWIST SLIP COUPLING TO CENTERED LOCATION (DEPTH MARKER).

EXPANSION COUPLING FOR PVC CONDUIT REPAIR (IN DEP ONLY)



EXPANSION COUPLINGS FOR PVC CONDUIT REPAIR		
COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
-	4028657	2" EXP. COUPLING
-	4027864	3" EXP. COUPLING
-	4027867	4" EXP. COUPLING
-	4027878	6" EXP. COUPLING

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

REPAIRING EXISTING PVC CONDUIT
WHEN CONDUIT DOES NOT CONTAIN CABLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

22.05-110

DUCT BANK APPLICATIONS

DUCT BANKS ARE TYPICALLY INSTALLED IN THE FOLLOWING APPLICATIONS.

- DESIGNATED INNER-CITY AREAS WHERE DUKE ENERGY HAS AGREEMENT WITH THE CITY TO INSTALL ITS FACILITIES UNDERGROUND.
- CONGESTED AREAS OF HIGH LOAD, SIMILAR TO INNER-CITY AREAS, WHERE DUKE ENERGY DETERMINES A DUCT BANK SYSTEM WOULD BE THE MOST BENEFICIAL DESIGN.
- AREAS TO BE SERVED UNDERGROUND WHERE THE POTENTIAL FOR A DIG-IN IS HIGH OR WHERE THE ABILITY TO ADD FUTURE CIRCUITS IS REQUIRED.
- SOLELY AS A RESULT OF A CUSTOMER'S REQUEST. THESE INSTALLATIONS WILL NORMALLY BE INSTALLED AT THE CUSTOMER'S EXPENSE.

DUCT BANK DESIGN CRITERIA

- PVC CONDUIT WITH A MINIMUM WALL THICKNESS OF SCHEDULE 40 SHALL BE USED FOR ALL DUCT BANK INSTALLATIONS. CONDUIT HAVING A THICKER WALL MAY BE SUBSTITUTED BASED ON AVAILABILITY AND OTHER FACTORS. IN ADDITION, HIGH DENSITY POLYETHYLENE (HDPE) FLEXIBLE CONDUIT CAN BE USED BASED ON DISTRIBUTION STANDARDS APPROVAL. SEE THE CONDUIT AND CONDUIT ACCESSORIES PORTION OF THIS MANUAL SECTION TO FIND AVAILABLE CONDUIT.

- SIX (6) INCH CONDUIT IS REQUIRED FOR ALL NEW PRIMARY DUCT BANK INSTALLATIONS, SMALLER SIZES OF CONDUITS (2”, 3' OR 4”) WOULD TYPICALLY BE USED FOR SECONDARY OR STREET LIGHT DUCT BANK INSTALLATIONS.

- WHERE POSSIBLE, DUCT BANKS SHOULD BE ROUTED WITH SLOW, GRADUAL BENDS. FOR SHARPER TURNS, PVC BEND FITTINGS WITH A MINIMUM WALL THICKNESS OF SCHEDULE 40 AND A MINIMUM BEND RADIUS OF 36" MAY BE USED. REFER TO THE CONDUIT ACCESSORIES PAGES IN THIS SECTION FOR AVAILABLE BENDS.

- TYPICAL PRIMARY DUCT BANKS ARE EITHER TWO (2) OR THREE (3) CONDUITS WIDE AND HAVE AS MANY AS SIX (6) CONDUITS HIGH. THE NUMBER AND SIZE OF CONDUITS TO BE INSTALLED IN THE DUCT BANK SHOULD BE DETERMINED BY THE QUANTITY AND SIZE OF CABLES BEING INSTALLED PLUS ADDITIONAL SPACE FOR EMERGENCY USE, FUTURE EXPANSION, AND FUTURE FIBER OPTIC CABLE INSTALLATION. THE NUMBER AND SIZE OF CONDUITS FOR PRIMARY DUCT BANK INSTALLATIONS SHOULD BE APPROVED BY LOCAL SUPERVISION. TYPICAL CROSS SECTIONS FOR 2-WIDE DUCT BANKS ARE SHOWN ON DWG. 22.06-102. TYPICAL CROSS SECTIONS FOR 3-WIDE DUCT BANKS ARE SHOWN ON DWG. 22.06-104.

- TYPICAL SECONDARY DUCT BANKS HAVE ONLY ONE OR TWO CONDUITS; HOWEVER, MORE CONDUITS MAY BE NEEDED FOR CERTAIN APPLICATIONS. TYPICAL CROSS SECTIONS FOR 2-WIDE SECONDARY DUCT BANKS ARE SHOWN ON DWG. 22.06-106.

- CONSIDERATION SHALL BE GIVEN DURING THE PLANNING STAGES TO ALLOW FOR ADDITIONAL DUCT SPACE FOR FUTURE FIBER OPTIC CABLE. FIBER OPTIC CABLE MAY EVENTUALLY NEED TO EXTEND TO ALL SWITCHGEAR AS A MINIMUM AND POSSIBLY TO ALL TRANSFORMERS.

- PRIOR TO BEGINNING DESIGN, THE ENGINEER SHOULD HAVE AN UNDERGROUND LOCATE PERFORMED IN ORDER TO TAKE INTO ACCOUNT THE LOCATION OF EXISTING UTILITIES IN THE DESIGN AREA. IN ADDITION, IT MIGHT BE NECESSSARY TO SPOT-CHECK (POTHOLE) THE DEPTHS OF EXISTING UTILITIES. GROUND PENETRATING RADAR IS ALSO AN OPTION THAT CAN BE USED TO MORE ACCURATELY LOCATE EXISTING UTILITIES. DUKE ENERGY HAS AN APPROVED VENDOR TO PERFORM THIS SERVICE. THE PROJECT ENGINEER WILL NEED TO DETERMINE THE LEVEL OF DETAIL REQUIRED FOR THE PROJECT. CONTACT DISTRIBUTION STANDARDS FOR ASSISTANCE.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK

DUCT BANK DESIGN CRITERIA

DEC	DEM	DEP	DEF
X	X	X	X

22.06-100A

- EACH CONDUIT RUN SHALL BE AS STRAIGHT AS POSSIBLE. THE TOTAL ANGULAR DEFLECTION OF ALL BENDS IN A CONDUIT RUN SHALL NOT EXCEED 180 DEGREES UNLESS PULLING CALCULATIONS ARE MADE AND THEY VERIFY THAT NO PROBLEM WILL BE ENCOUNTERED. INFORMATION REGARDING CABLE PULLING SOFTWARE MAY BE FOUND ON DWG. 22.07-114.

- ENGINEERS MUST BE CAREFUL TO LIMIT THE OVERALL LENGTH OF CONDUIT RUNS. PERFORM CABLE PULLING CALCULATIONS FOR ALL RUNS GREATER THAN 450 FEET BETWEEN TERMINATION POINTS.

- THE PROJECT ENGINEER SHOULD CONSIDER MANY FACTORS WHEN DETERMINING THE LOCATION OF MANHOLES, HANDHOLES, EQUIPMENT, AND RISER POLES. FOR EXAMPLE, IT IS A GOOD PRACTICE TO KEEP RISER POLES CLOSE TO A MANHOLE TO ALLOW FUTURE EXPANSION OF THE SYSTEM AND INSTALLATION OF CABLE. CONSIDERATION SHOULD ALSO BE GIVEN TO THE TYPE OF CABLE PULLING EQUIPMENT AND METHODS THAT WILL BE REQUIRED WHEN DESIGNING THE SYSTEM. CONSULT WITH C&M SUPERVISION REGARDING THE DISTANCE BETWEEN A RISER POLE AND THE FIRST MANHOLE OR PIECE OF PAD-MOUNTED EQUIPMENT.

- DUCT BANK SHOULD BE INSTALLED ON PRIVATE PROPERTY WHENEVER POSSIBLE IN ORDER TO AVOID FUTURE RELOCATION.

- DUCT BANK SHALL BE INSTALLED IN SUCH A LOCATION AS TO REMAIN ACCESSIBLE TO STANDARD DUKE ENERGY EQUIPMENT.

- EFFORT SHOULD BE MADE TO INSTALL THE DUCT BANK AT LEAST THREE FEET AWAY FROM FOREIGN UTILITIES WHEN POSSIBLE TO HELP PROVIDE CLEAR WORKING SPACE FOR MAINTENANCE OF FACILITIES. THE NATIONAL ELECTRICAL SAFETY CODE (NESC) ALLOWS FOR LESS SEPARATION WHEN NECESSARY DUE TO SPACE CONSTRAINTS.

- IF THE DUCT BANK IS TO BE INSTALLED IN THE PUBLIC RIGHT-OF WAY, ALL MUNICIPAL REQUIREMENTS FOR PERMITTING WORK AND CUTTING AND REPAIRING ROADWAYS SHALL BE FOLLOWED.

- JOINT-USE DUCT BANKS CONTAINING A COMBINATION OF ELECTRIC, SIGNALIZATION AND/OR COMMUNICATIONS INFRASTRUCTURE REQUIRE ADVANCE APPROVAL BY THE DUKE ENERGY PROJECT ENGINEER. GUIDELINES FOR JOINT-USE DUCT BANKS REQUIRE A MINIMUM OF THREE INCHES OF CONCRETE SEPARATION BETWEEN CONDUITS CONTAINING DUKE ENERGY FACILITIES AND CONDUIT CONTAINING OTHER INFRASTRUCTURE PER NESC SECTION 320-B. CONDUITS FOR JOINT-USE UTILITIES SHALL BE LOCATED BESIDE THE DUKE ENERGY DUCT BANK AND NEVER ABOVE IT. IN ADDITION, FOREIGN UTILITIES ARE NOT ALLOWED TO ENTER DUKE ENERGY MANHOLES OR VAULTS. THESE CONDUITS MUST SPLIT AWAY FROM THE DUCT BANK AND ROUTE AROUND MANHOLE, HANDHOLE, OR VAULT LOCATIONS. CARE SHOULD BE TAKEN TO INSTALL THESE FOREIGN CONDUITS IN A LOCATION AND ELEVATION THAT WILL NOT BLOCK THE CONDUIT OPENINGS IN THE MANHOLE OR VAULT THAT COULD BE USED FOR FUTURE EXPANSION. EXAMPLE CROSS SECTIONS OF JOINT-USE DUCT BANKS ARE PROVIDED ON DWG. 22.06-108.

- IF A CUSTOMER IS INSTALLING A DUCT BANK FOR DUKE ENERGY, THEY ARE REQUIRED TO PROVIDE A PLAN-VIEW DRAWING OF THE PROPOSED DUCT BANK TO THE DUKE ENERGY PROJECT ENGINEER FOR REVIEW PRIOR TO STARTING CONSTRUCTION. PROFILE-VIEW DRAWINGS OF THE PROPOSED DUCT BANK SHOULD ALSO BE REQUIRED FOR REVIEW ON COMPLEX PROJECTS. AT THE COMPLETION OF THE INSTALLATION, THE CUSTOMER IS REQUIRED TO PROVIDE DUKE ENERGY FINAL AS-BUILT DRAWINGS SHOWING THE INSTALLED LOCATION OF THE DUCT BANK.

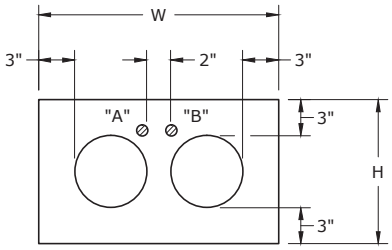
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK

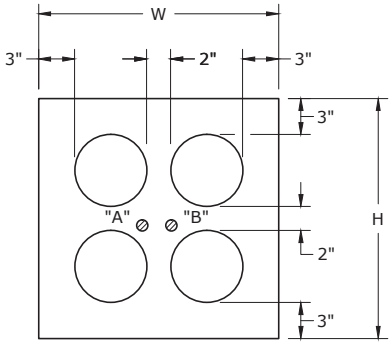
DUCT BANK DESIGN CRITERIA

DEC	DEM	DEP	DEF
X	X	X	X

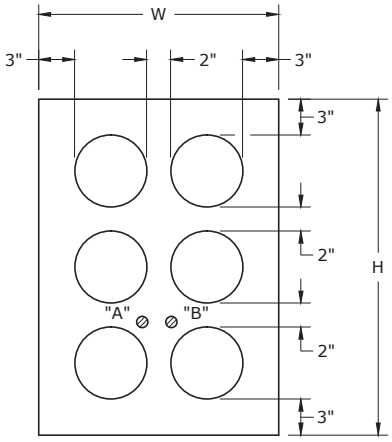
22.06-100B



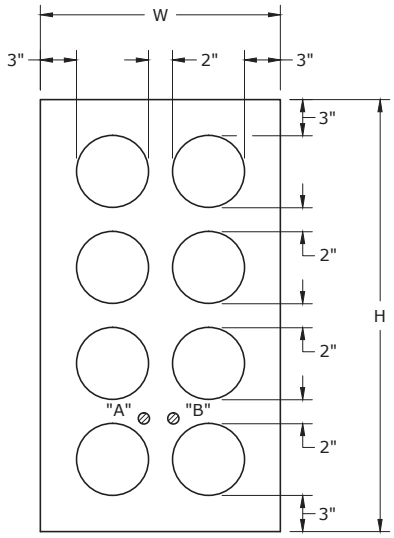
2W X 1H



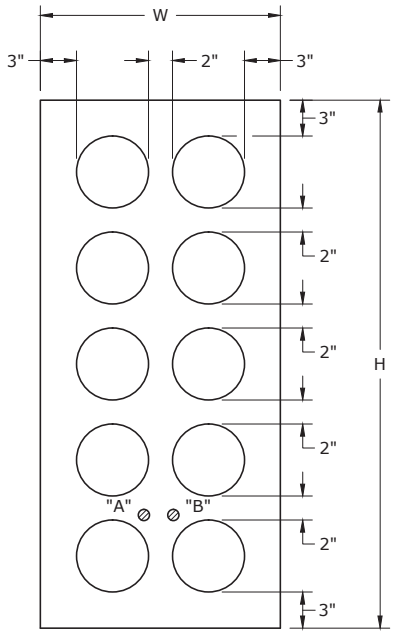
2W X 2H



2W X 3H



2W X 4H



2W X 5H

TWO COLUMN DUCT BANK OUTSIDE DIMENSIONS						
CONDUIT SIZE	DUCT WIDTH (W)	DUCT HEIGHT (H)				
		1 ROW	2 ROWS	3 ROWS	4 ROWS	5 ROWS
4"	17-1/4"	10-1/2"	17-1/4"	23-7/8"	30-1/2"	37-1/8"
5"	19-3/8"	11-1/2"	19-5/16"	27"	34-11/16"	42-3/8"
6"	21-1/2"	12-3/4"	21-3/8"	30"	38-5/8"	47-1/4"

CUBIC YARDS OF CONCRETE REQUIRED PER FOOT OF TWO COLUMN DUCT BANKS					
CONDUIT SIZE	DUCT HEIGHT (H)				
	1 ROW	2 ROWS	3 ROWS	4 ROWS	5 ROWS
4"	0.03841	0.06018	0.08140	0.10261	0.12383
5"	0.04487	0.07136	0.09723	0.12310	0.14898
6"	0.05278	0.08275	0.11273	0.14270	0.17267

NOTES:

1. SEE DWG. 22.06-112A FOR GROUNDING REQUIREMENTS.
2. "⊘" INDICATES THE END VIEW OF THE #2 BARE COPPER WIRE.
3. ALTERNATE THE POSITION OF THE #2 BARE COPPER WIRE FROM "A" TO "B" IN THE CONDUIT SPACERS.

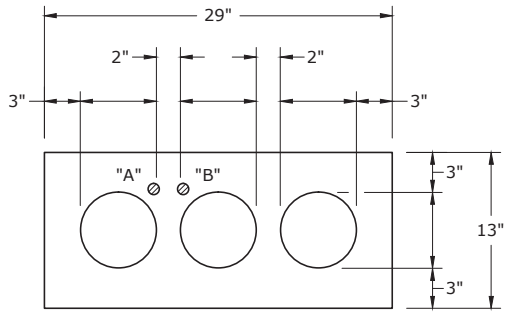
3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

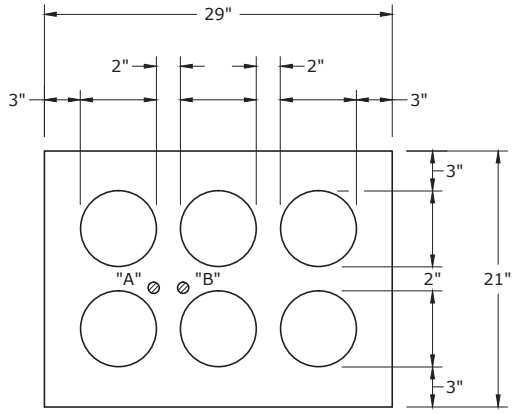
DUCT BANK CONFIGURATIONS
TWO WIDE

DEC	DEM	DEP	DEF
X	X	X	X

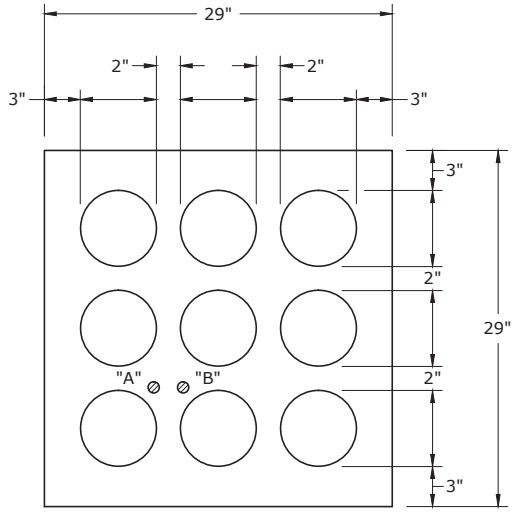
22.06-102



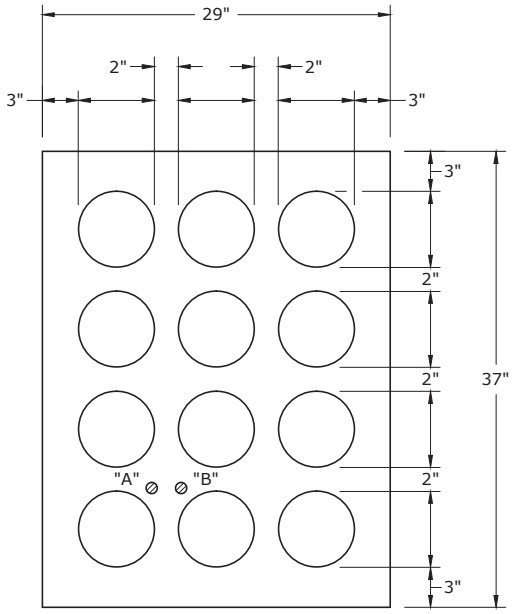
3 WAY - 6 INCH



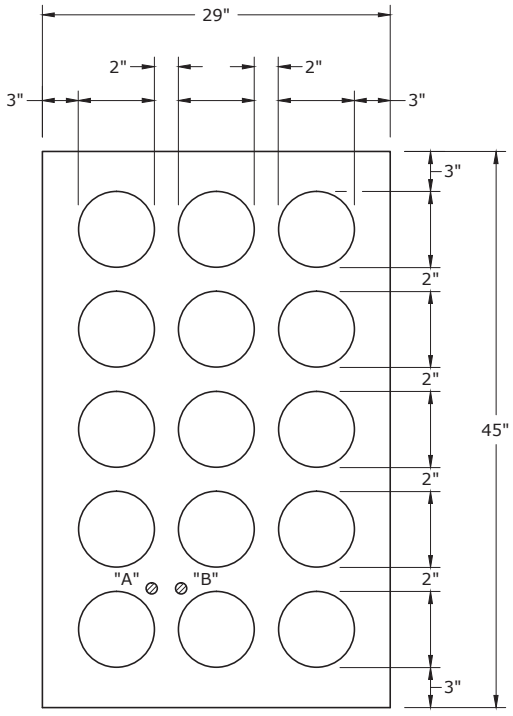
6 WAY - 6 INCH



9 WAY - 6 INCH



12 WAY - 6 INCH



15 WAY - 6 INCH

NOTES:

1. SEE DWG. 22.06-112A FOR GROUNDING REQUIREMENTS.
2. "⊘" INDICATES THE END VIEW OF THE #2 BARE COPPER WIRE.
3. ALTERNATE THE POSITION OF THE #2 BARE COPPER WIRE FROM "A" TO "B" IN THE CONDUIT SPACERS.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

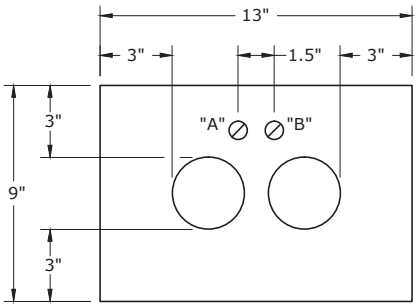
DUCT BANK CONFIGURATIONS

THREE WIDE

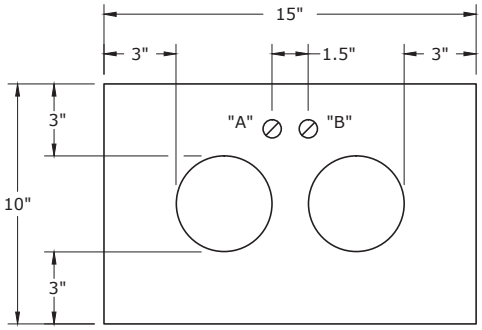
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

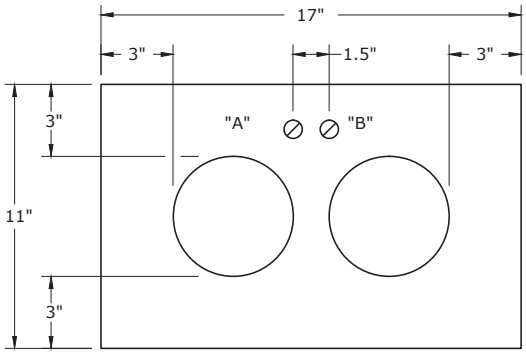
22.06-104



2 WAY - 2 INCH



2 WAY - 3 INCH



2 WAY - 4 INCH

NOTES:

1. SEE DWG. 22.06-112A FOR GROUNDING REQUIREMENTS.
2. "⊘" INDICATES THE END VIEW OF THE #2 BARE COPPER WIRE.
3. ALTERNATE THE POSITION OF THE #2 BARE COPPER WIRE FROM "A" TO "B" IN THE CONDUIT SPACERS.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

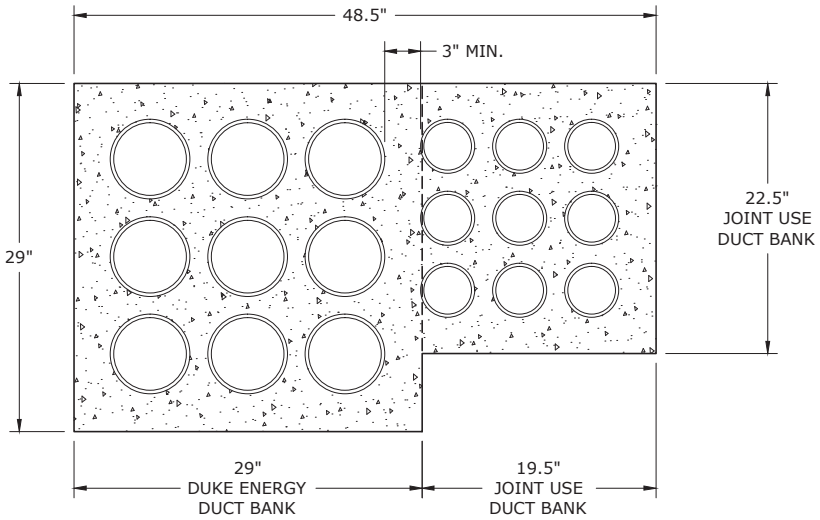
DUKE ENERGY.

DUCT BANK CONFIGURATIONS

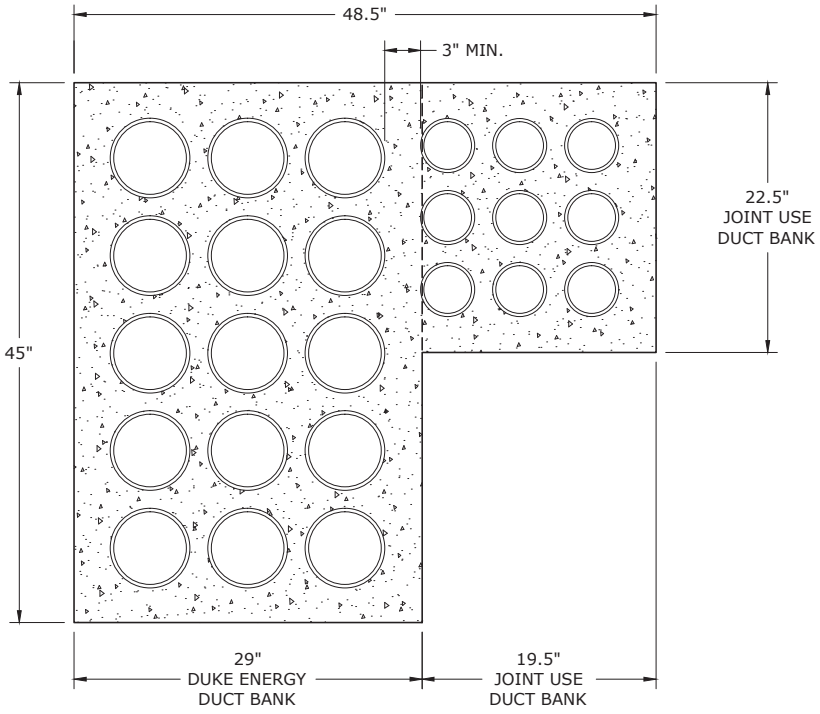
STREET LIGHTING

DEC	DEM	DEP	DEF
X	X	X	X

22.06-106



9-WAY 6" DUKE ENERGY DUCT BANK WITH 9-WAY 4" JOINT USE DUCT BANK



15-WAY 6" DUKE ENERGY DUCT BANK WITH 9-WAY 4" JOINT USE DUCT BANK

NOTES:

1. THE INTENT OF THIS STANDARD IS TO SHOW THAT PARALLEL, NON-DUKE ENERGY DUCT BANKS ARE TO BE POSITIONED BESIDE DUKE ENERGY DUCT BANKS AND NOT OVER OR UNDER THEM.

2. JOINT USE DUCT BANKS SHALL NOT ENTER DUKE ENERGY MANHOLES OR VAULTS.

3. THESE DRAWINGS ARE INTENDED TO BE EXAMPLES. ACTUAL SPECIFICATIONS WILL VARY BASED ON CONDUIT SIZE, QUANTITY AND ENCASEMENT REQUIREMENTS OF THE JOINT USE ENTITY.

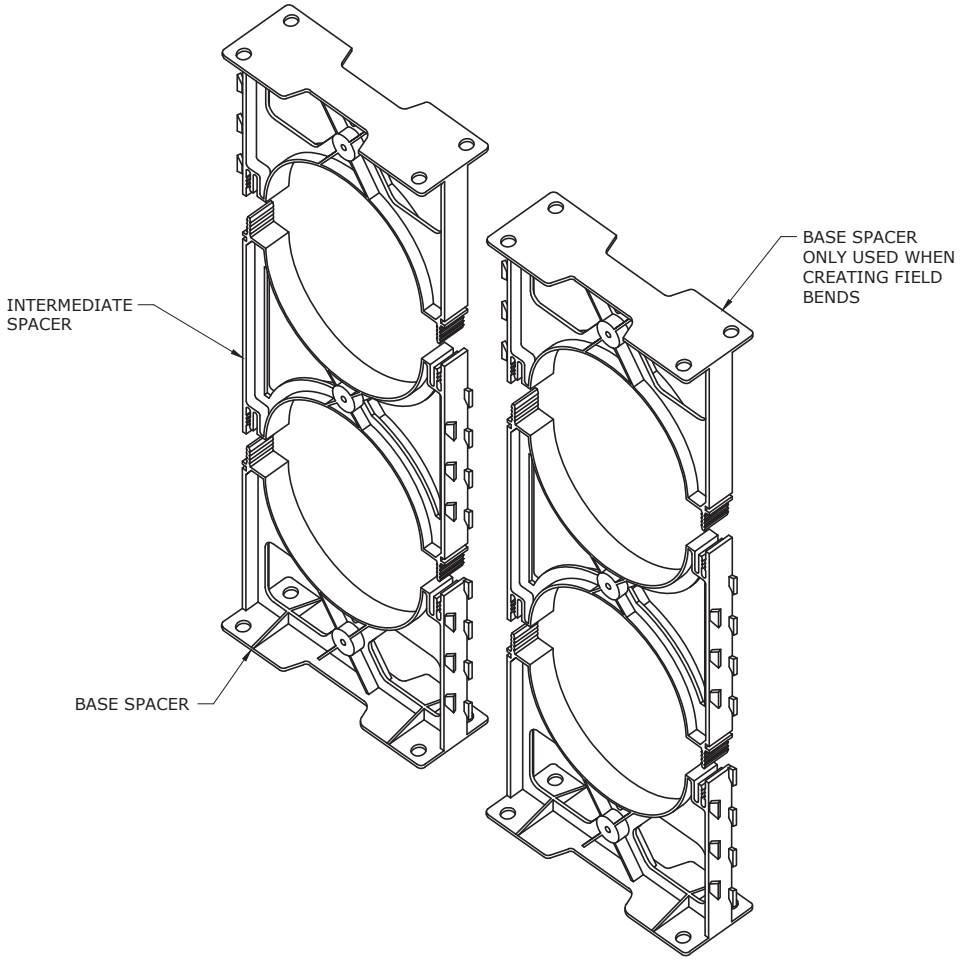
3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUCT BANK CONFIGURATIONS

JOINT USE

DEC	DEM	DEP	DEF
X	X	X	X

22.06-108



DUCT SIZE	REGION	ITEM NUMBER	
		BASE SPACER	INTERMEDIATE SPACER
2"	DEC	196423	1476143
3"	DEC	1476144	1476145
4"	DEC	1477614	1455529
	DEM	900272	900276
5"	DEC	196420	196419
	DEM	900271	900273
6"	DEC	196421	196422
	DEM	50110984	50117543
	DEP	50110984	50117543

NOTES:

1. SPACERS ARE ASSEMBLED BY PUSHING THEM TOGETHER.
2. BASE SPACERS AND INTERMEDIATE SPACERS INTERLOCK BOTH VERTICALLY AND HORIZONTALLY.
3. SPACERS SHOULD BE INSTALLED APPROXIMATELY EVERY FIVE FEET.
4. USE A BASE SPACER TURNED UPSIDE DOWN FOR TOP WHEN INSTALLING FIELD BENDS.
5. SEE DWGS. 22.06-102 AND 22.06-104 FOR PREFERRED CONFIGURATIONS OF DUCT BANK SPACERS AND FOR SPECIFIC INSTALLATION INSTRUCTIONS.

DUKE ENERGY.

3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUCT BANK SPACERS

DEC	DEM	DEP	DEF
X	X	X	X

22.06-110

DUKE ENERGY UTILIZES A UFER GROUNDING SYSTEM FOR ITS DUCT BANK INSTALLATIONS. AN EXPLANATION OF THIS SYSTEM IS PROVIDED ON DWG. 22.06-112B.

A #2 AWG BARE COPPER GROUND WIRE SHALL BE INSTALLED IN THE CONCRETE OF THE DUCT BANK INSTALLATION FOLLOWING THE INSTRUCTIONS BELOW. A TEN FOOT TAIL OF THE #2 COPPER SHOULD BE LEFT EXPOSED INSIDE EACH VAULT/ MANHOLE WITH THE ENTRY LOCATION GROUTED AND SEALED. A THREE FOOT TAIL SHOULD BE LEFT AT HAND HOLES.

1. INSTALL THE BOTTOM SPACERS AND THE BOTTOM ROW OF PVC CONDUITS IN THE TRENCH.

2. INSTALL THE #2 COPPER GROUND WIRE ALTERNATING THE WIRE FROM POSITION "A" TO POSITION "B" IN THE CONDUIT SPACERS. THE #2 COPPER GROUND WIRE SHOULD BE SAGGED WITH A MINIMUM TWO INCH CLEARANCE FROM THE BOTTOM OF THE TRENCH. REFER TO FIGURE 1 BELOW FOR DETAILS.

3. IF THE COPPER GROUND WIRE HAS TO BE SPLICED IN THE DUCT BANK BETWEEN MANHOLES, A COMPRESSION TYPE COPPER CONNECTOR OR EXOTHERMIC WELD SHALL BE USED.

4. INSTALL THE REMAINING SPACERS AND PVC CONDUITS AS SHOWN BELOW.

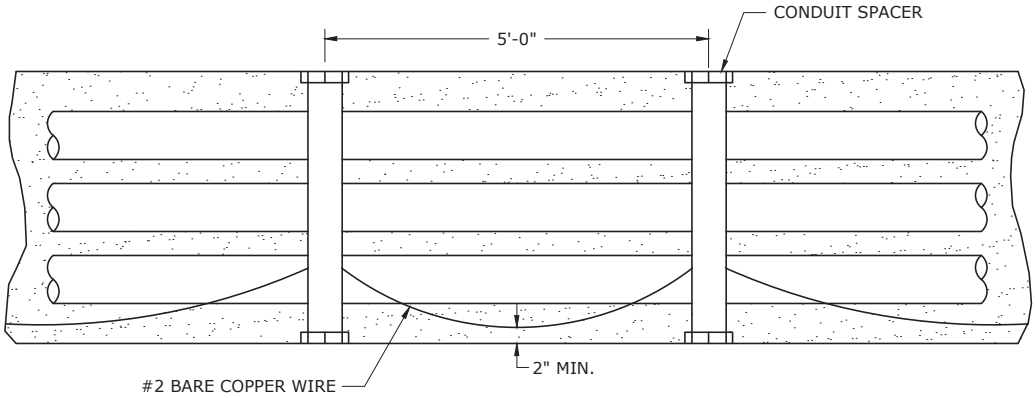
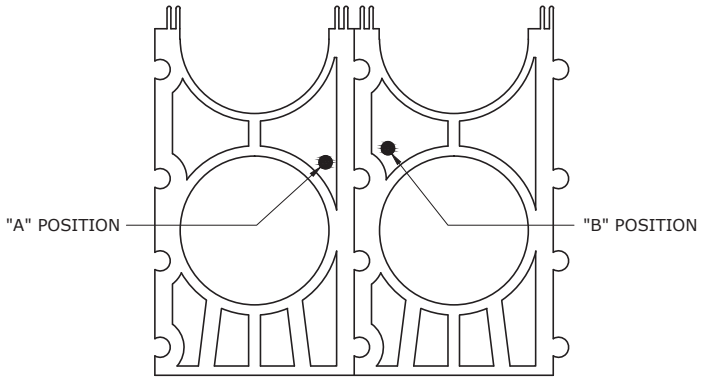


FIGURE 1



GROUND WIRE IN DUCT BANK

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUCT BANK GROUNDING

DEC	DEM	DEP	DEF
X	X	X	X

22.06-112A

EXPLANATION OF THE UFER GROUNDING SYSTEM:

THE GROUNDING METHOD PRESENTED HERE IS A "UFER" GROUNDING SYSTEM. THE SYSTEM IS NAMED FOR HERBERT G. UFER WHO DEVELOPED THE SYSTEM WHILE WORKING FOR THE US MILITARY DURING WWII. UFER DISCOVERED THAT CONCRETE HAD BETTER CONDUCTIVITY THAN MOST TYPES OF SOIL. CONCRETE ABSORBS MOISTURE QUICKLY AND LOSES MOISTURE VERY SLOWLY. THE MINERAL PROPERTIES OF CONCRETE (LIME AND OTHERS) AND THEIR INHERENT PH MEANS CONCRETE HAS A SUPPLY OF IONS TO CONDUCT CURRENT. THE SOIL AROUND CONCRETE BECOMES "DOPED" BY THE CONCRETE AND, AS A RESULT, THE PH OF THE SOIL RISES AND REDUCES THE RESISTANCE OF THE SOIL. THE MOISTURE PRESENT, (CONCRETE GIVES UP MOISTURE VERY SLOWLY), IN COMBINATION WITH THE "DOPED" SOIL AND THE LARGE SURFACE AREA OF THE CONCRETE , MAKE A GOOD CONDUCTOR FOR ELECTRICAL ENERGY OR LIGHTNING CURRENTS.

DUKE ENERGY.

						DEC	DEM	DEP	DEF
3									
2									
1						X	X	X	X
0	12/31/15	FLETCHER	EANES	ADCOCK					
REVISED		BY	CK'D	APPR.					

DUCT BANK GROUNDING

22.06-112B

THE FOLLOWING INFORMATION WILL ASSIST THE ENGINEER IN DETERMINING THE AMOUNT OF CONCRETE REQUIRED FOR A DUCT BANK PROJECT.

1. WORK WITH C&M TO DETERMINE THE WIDTH OF THE TRENCH THAT WILL ACTUALLY BE EXCAVATED FOR THE DUCT BANK.

2. ESTIMATE THE VOLUME OF THE TRENCH OCCUPIED BY THE DUCT BANK.

$$\text{VOLUME} = \frac{\text{TRENCH WIDTH (INCHES)}}{36} \times \frac{\text{DUCT BANK HEIGHT (INCHES) (SEE DWG. 22.06-102 OR 22.06-104)}}{36} \times \frac{\text{TRENCH LENGTH (FEET)}}{3}$$

3. DETERMINE THE VOLUME OF SPACE THAT WILL BE OCCUPIED BY THE CONDUIT BY MULTIPLYING THE APPROPRIATE VALUE IN THE TABLE BELOW BY THE TOTAL LENGTH OF THE DUCT BANK IN FEET.

DUCT BANK CONFIGURATION	CONDUIT SIZE				
	2	3"	4"	5"	6"
2 DUCTS WIDE X 1 DUCT HIGH	0.0023	0.0049	0.008	0.0123	0.0175
2 DUCTS WIDE X 2 DUCTS HIGH	0.0045	0.0098	0.0160	0.0246	0.0349
2 DUCTS WIDE X 3 DUCTS HIGH	0.0068	0.0147	0.0240	0.0368	0.0524
2 DUCTS WIDE X 4 DUCTS HIGH	0.0090	0.0196	0.0320	0.0491	0.0699
2 DUCTS WIDE X 5 DUCTS HIGH	0.113	0.0245	0.0400	0.0614	0.0873
3 DUCTS WIDE X 1 DUCT HIGH	0.0034	0.0074	0.0120	0.0184	0.0262
3 DUCTS WIDE X 2 DUCTS HIGH	0.0068	0.0147	0.0240	0.0368	0.0524
3 DUCTS WIDE X 3 DUCTS HIGH	0.0102	0.0221	0.0360	0.0553	0.0786
3 DUCTS WIDE X 4 DUCTS HIGH	0.0135	0.0294	0.0480	0.0737	0.1048
3 DUCTS WIDE X 5 DUCTS HIGH	0.0169	0.0368	0.0600	0.0921	0.1310
3 DUCTS WIDE X 6 DUCTS HIGH	0.0203	0.0442	0.0720	0.1105	0.1572

4. SUBTRACT THE VALUE OBTAINED IN STEP 3 FROM THE VALUE ESTIMATED IN STEP 2. THE DIFFERENCE IS THE NUMBER OF CUBIC YARDS OF CONCRETE THAT WILL BE NEEDED FOR THE DUCT BANK.

IN DEC, CONCRETE IS ESTIMATED BY USING THE "CONCRETE" CU. THIS CU PROVIDES NO MATERIAL, BUT REPRESENTS ONE DOLLAR OF CONCRETE COST. CONTACT A LOCAL CONCRETE COMPANY OR PREFERRED CONTRACTOR TO OBTAIN THE CURRENT COST OF CONCRETE. THEN ADD THIS NUMBER OF THE CONCRETE CU TO YOUR ESTIMATE. THE ACTUAL CONCRETE WILL NEED TO BE ORDERED FROM THE CONCRETE COMPANY.

THE ENGINEER WILL ALSO NEED TO WORK WITH C&M TO IDENTIFY THE PROPER QUANTITY AND TYPE OF MATERIAL REQUIRED TO HOLD THE CONDUIT IN POSITION DURING THE CONCRETE POUR. THIS MATERIAL WILL BE ORDERED LOCALLY AS WELL.

DUKE ENERGY.

3					
2					
1					
0	12/31/15	FLETCHER	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

ESTIMATING CONCRETE

DEC	DEM	DEP	DEF
X	X	X	X

22.06-114

1. MARK THE DUCT BANK ROUTE ON THE SURFACE BY CHALKING OR OTHERWISE INDICATING THE OUTER LIMITS OF THE TRENCH TO BE CUT. EACH DUCT RUN SHOULD BE AS STRAIGHT AS POSSIBLE.

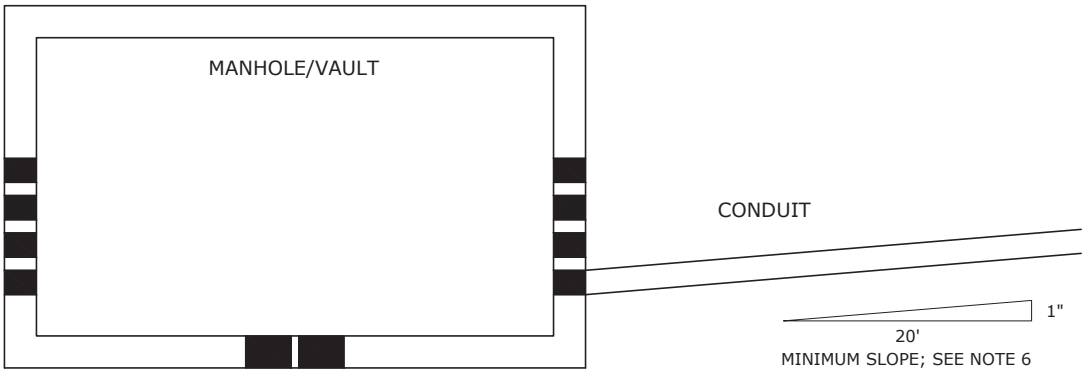
2. IF ASPHALT PAVEMENT IS TO BE REMOVED, IT SHOULD BE CUT A MINIMUM OF SIX INCHES WIDER THAN THE TRENCH IN ORDER TO PROVIDE AT LEAST A THREE-INCH SHELF OF UNDISTURBED EARTH ON EACH SIDE OF THE TRENCH.

3. REMOVE THE SURFACE BETWEEN THE MARKS. IF THE SURFACE IS SOD, REMOVE IT IN SQUARES AND SAVE FOR LATER REPLACEMENT.

4. WHEN DIGGING UNDERNEATH FOREIGN UTILITIES, CARE SHOULD BE TAKEN TO ADEQUATELY SUPPORT THESE FACILITIES SO THEY WILL NOT COLLAPSE INTO THE TRENCH.

5. THE TRENCH SHOULD BE EXCAVATED TO DEPTH WITH THE BOTTOM SMOOTH AND FREE OF ROCKS. A FOUR INCH BED OF SAND SHOULD BE ADDED IF THE BOTTOM OF THE TRENCH IS ROCKY. **THE TRENCH SHOULD BE DEEP ENOUGH TO ALLOW THE TOP OF THE DUCT BANK ENCASEMENT TO BE A MINIMUM OF TWO FEET BELOW GRADE**. THE TYPICAL MAXIMUM DEPTH FOR A DUCT BANK INSTALLATION IS FOUR FEET FROM GRADE TO THE TOP OF THE DUCT BANK, EXCEPT WHERE THE DUCT BANK IS ANGLED DOWN INTO A MANHOLE OR VAULT. ALSO, IT IS OCCASIONALLY NECESSARY TO GET ADDITIONAL DEPTH WHEN CROSSING UNDER ANOTHER UTILITY OR OBSTACLE.

6. THE TRENCH SHALL BE ANGLED DOWN TO MANHOLES AND VAULTS AT A MINIMUM SLOPE OF 1 INCH EVERY 20 FEET TO ALLOW WATER TO DRAIN OUT OF THE CONDUITS AS SHOWN IN THE FIGURE BELOW. WHEN TYING THE DUCT BANK INTO MANHOLES, THE CONDUITS SHALL BE INSTALLED INTO THE LOWEST AVAILABLE HOLES ON THE MANHOLE WITH THE SPACE AROUND THEM GROUTED AND SEALED. WHEN TYING DUCT BANK INTO VAULTS, THE CONDUITS SHALL BE INSTALLED INTO THE VAULT AT A HEIGHT AND LOCATION DETERMINED BY THE DUKE ENERGY PROJECT ENGINEER.



3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUCT BANK INSTALLATION INSTRUCTIONS

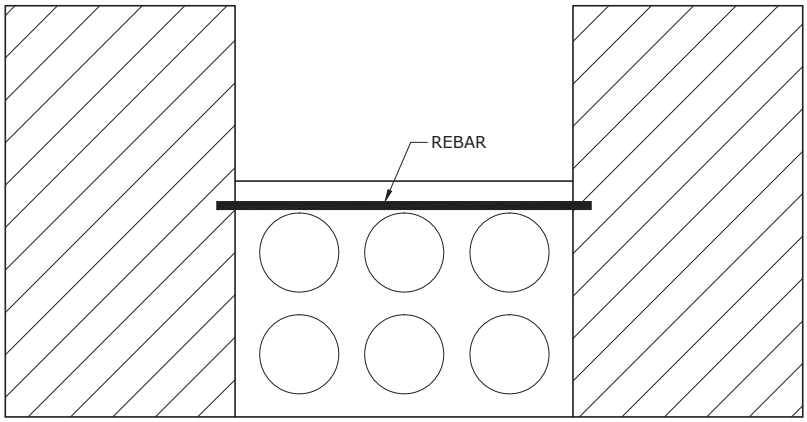
DEC	DEM	DEP	DEF
X	X	X	X

22.06-116A

7. DUCT SPACERS SHOULD BE INSTALLED APPROXIMATELY EVERY FIVE FEET ALONG THE DUCT BANK ROUTE.

8. LARGE RADIUS BENDS (FIELD BENDS WITH A RADIUS GREATER THAN 35 FEET) CAN BE INSTALLED BY THE GUIDELINES PROVIDED ON DWG. 22.06-118.

9. CONDUITS SHOULD BE PLACED ON SPACERS AND EACH JOINT PREPARED AND CEMENTED ACCORDING TO THE CEMENT MANUFACTURER'S REQUIREMENTS. THE CONDUITS MUST THEN BE SECURED IN POSITION TO PREVENT THEM FROM FLOATING TO THE TOP WHEN CONCRETE IS POURED INTO THE TRENCH. TYPICALLY, THIS IS ACCOMPLISHED BY DRIVING REBAR INTO THE TRENCH WALLS APPROXIMATELY EVERY TEN FEET AS SHOWN IN THE DRAWING BELOW.



10. READY MIX CONCRETE WITH A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3,000 PSI, A 3/8" MAXIMUM AGGREGATE SIZE, WITH A SLUMP OF 5" IS TO BE PLACED INTO THE TRENCH AROUND THE DUCT BANK. THE CONCRETE SHALL BE VIBRATED IN ORDER TO FILL ALL THE SPACES AROUND THE CONDUITS. **THERE MUST BE A MINIMUM OF THREE (3) INCHES OF CONCRETE ENCASEMENT SURROUNDING THE PERIMETER OF THE DUCT BANK.**

11. THE REMAINING TRENCH SHOULD BE BACKFILLED AND PROPERLY COMPACTED WITH EARTH THAT IS FREE OF VEGETATION, LARGE ROCKS, PIECES OF PAVEMENT AND OTHER FOREIGN MATERIAL. CONTROLLED DENSITY BACKFILLS SUCH AS FLOWABLE FILL CAN ALSO BE USED TO FILL IN THE TRENCH ON TOP OF THE DUCT BANK, IF NEEDED, DUE TO COMPACTION REQUIREMENTS AND/OR LOCAL MUNICIPAL GUIDELINES.

12. THERE ARE OCCASIONS WHEN PORTIONS OF A CONCRETE POUR FOR A SECTION OF DUCT BANK HAVE TO BE INSTALLED AT DIFFERENT TIMES. THIS COULD OCCUR WHEN THE CUSTOMER INSTALLS DUCT BANK TO THE PROPERTY LINE AND THEN DUKE EXTENDS THE DUCT BANK TO A MANHOLE AT A LATER TIME. IT ALSO HAPPENS WHEN DUKE IS INSTALLING A DUCT BANK SECTION AND THE ENTIRE LENGTH CANNOT BE COMPLETED WITHIN ONE DAY. WHEN THIS OCCURS, DUCT BANK JOINTS SHOULD BE INSTALLED AS DESCRIBED ON DWG. 22.06-120.

13. FOR ALL NEW DUCT BANK INSTALLATIONS, IT IS REQUIRED TO PULL A SOLID MANDREL THROUGH EACH CONDUIT IN THE DUCT BANK TO VERIFY THAT IT IS IN GOOD CONDITION AND FREE OF ANY OBSTACLES. THE MANDREL SHALL BE NO MORE THAN ONE HALF (1/2) INCH SMALLER THAN THE DIAMETER OF THE CONDUIT. A PULL STRING SHALL BE INSTALLED INSIDE EACH CONDUIT IN THE DUCT BANK. THE PULL STRING SHALL BE MADE FROM HIGH-STRENGTH POLYPROPYLENE OR EQUIVALENT AND BE MILDEW AND ROT RESISTANT. IF THE DUCT BANK IS INSTALLED BY A CUSTOMER, THEY ARE REQUIRED TO CONTACT THE DUKE ENERGY REPRESENTATIVE TO ALLOW THE DUCT BANK TO BE INSPECTED PRIOR TO CONCRETE BEING POURED AND AGAIN UPON COMPLETION OF CONSTRUCTION TO WITNESS THE MANDREL BEING PULLED THROUGH THE CONDUITS. SEE DWG. 22.06-124 FOR THE REQUIRED DUCT BANK INSPECTION CHECKLIST.

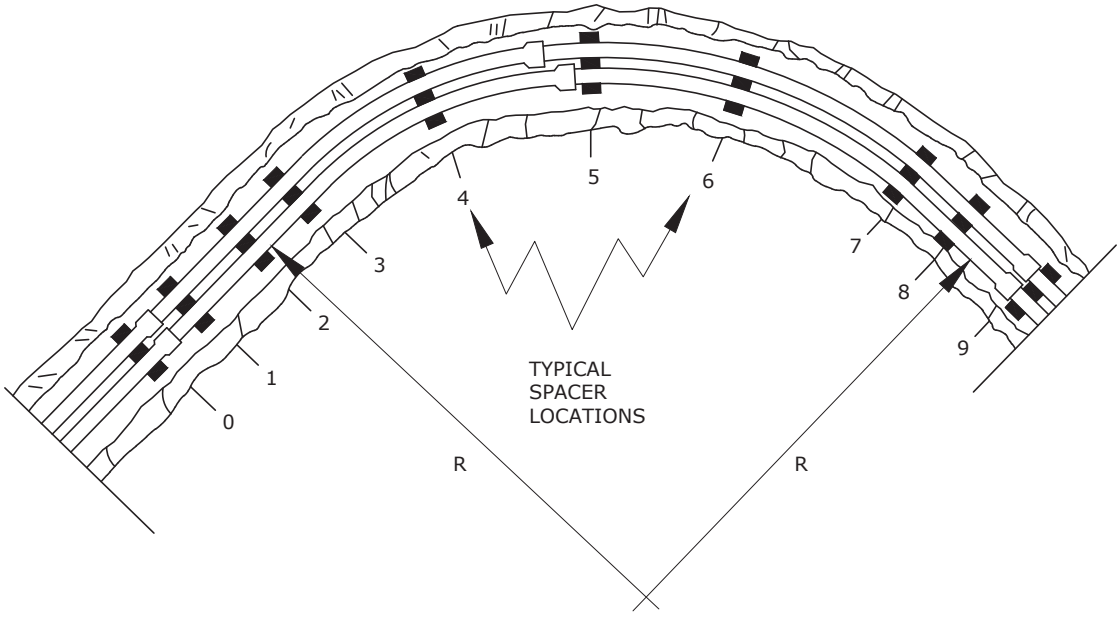
DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUCT BANK INSTALLATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X	X	X	X

22.06-116B



R=RADIUS OF BEND
(35' - 150')

NOTES:

1. SEE DWG. 22.06-102 OR 22.06-104 FOR CONFIGURATION DETAILS.

2. BENDS OF LESS THAN 35' RADIUS CAN BE ACCOMPLISHED USING FACTORY BENDS. BENDS GREATER THAN 150' GENERALLY REQUIRE NO SPECIAL TECHNIQUE.

3. JOINTS WHICH FALL WITHIN THE RADIUS OF THE CURVE ARE SUBJECTED TO THE SAME BENDING FORCES AS THE CONDUIT ITSELF. TO PREVENT THE TENSION SIDE (OUTSIDE OF CURVE) OF THE JOINT FROM FAILING, CAUTION MUST BE TAKEN TO ALLOW SUFFICIENT CURING TIME FOR ALL JOINTS IN THE RADIUS IN THE BEND. TWO HOURS CURING TIME IS REQUIRED AT 70°F. SHORTER TIMES MAY BE ADEQUATE IN HOTTER WEATHER AND LONGER TIMES MAY BE REQUIRED IN COLD WEATHER. SEE DWG. 22.05-100 FOR DETAILS ON JOINING PVC CONDUIT.

4. FOR BENDS WHERE THE RUNNING LENGTH OF DUCT REQUIRED IS 150' OR LESS, THE BENDING OPERATION IS SIMPLIFIED IF THE ENTIRE LENGTH IS PREASSEMBLED AND ALLOWED TO CURE PRIOR TO BENDING, PARTICULARLY IN INSTALLATIONS WHERE THE RADIUS OF CURVATURE IS LESS THAN 80'.

5. DRIVE REBAR INTO THE GROUND AT EACH SPACER LOCATION TO HOLD THE ASSEMBLY IN THE PROPER RADIUS.

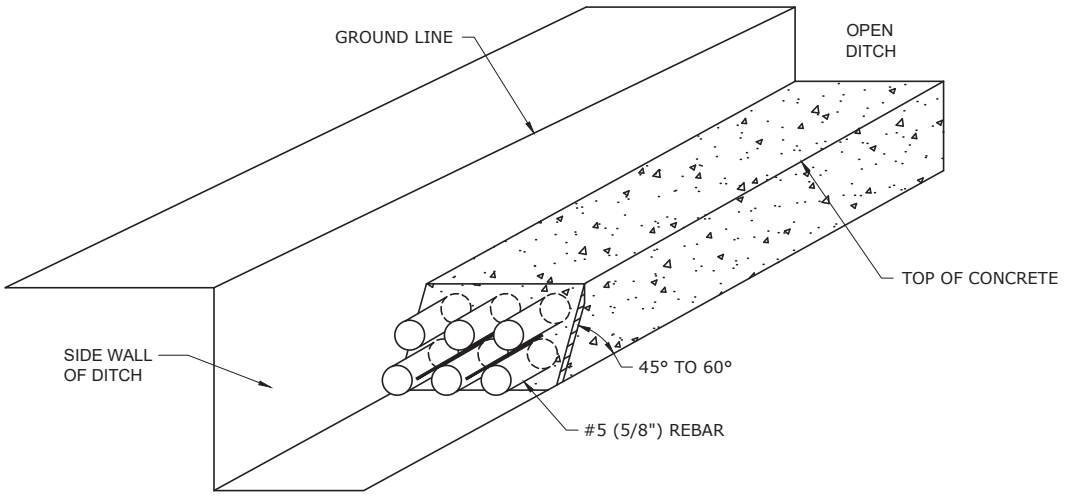
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK

DUCT BANK FIELD BENDS

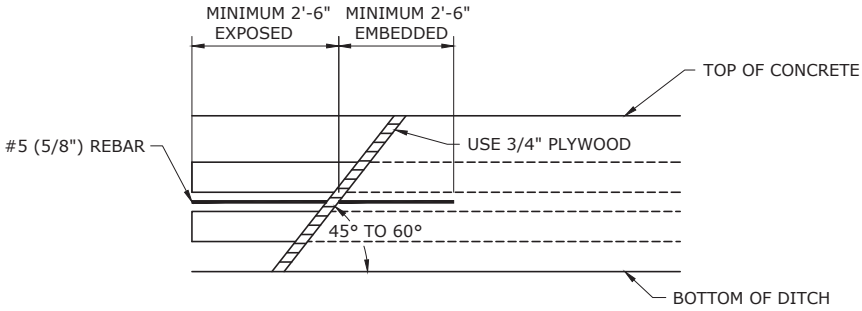
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

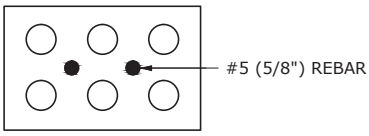
22.06-118



ISOMETRIC VIEW



SIDE VIEW



FRONT VIEW

NOTES:

THERE ARE OCCASIONS WHEN PORTIONS OF A CONCRETE POUR FOR A SECTION OF DUCT BANK HAVE TO BE INSTALLED AT DIFFERENT TIMES. THIS COULD OCCUR WHEN DUKE IS INSTALLING A DUCT BANK SECTION AND THE ENTIRE LENGTH CANNOT BE COMPLETED WITHIN ONE DAY. IN THESE SITUATIONS, THE FOLLOWING ACTIONS SHOULD BE TAKEN TO PROVIDE SUPPORT AND A STRONG BOND BETWEEN THE TWO DUCT BANK SECTIONS:

A. THE BARRICADE USED TO CONTAIN THE CONCRETE POUR FOR THE FIRST PORTION OF THE DUCT BANK SHOULD BE ANGLED FROM THE GROUND BACK TOWARD THE AREA BEING POURED. AN ANGLE OF 45 TO 60 DEGREES FROM THE BOTTOM OF THE TRENCH IS REQUIRED. THIS WILL PROVIDE SOME SUPPORT FOR THE CONCRETE THAT WILL BE INSTALLED WHEN THE DUCT BANK IS CONTINUED DURING THE SECOND CONCRETE POUR.
B. FIVE FOOT PIECES OF #5 GALVANIZED REBAR (5/8") SHOULD BE EMBEDDED 2'-6" INTO THE EDGE OF THE FIRST CONCRETE POUR. THIS WILL PROVIDE SUPPORT FOR THE SECOND CONCRETE POUR. INSTALL ONE PIECE OF REBAR ON EACH SIDE OF THE CENTER COLUMN OF CONDUIT ABOVE THE BOTTOM ROW OF CONDUIT AND BELOW THE TOP ROW OF CONDUIT. ONLY TWO PIECES OF REBAR ARE REQUIRED FOR 6-WAY OR LESS DUCT BANK SYSTEMS.
C. BE CERTAIN THAT THE FACE OF THE FIRST CONCRETE POUR IS CLEAN BEFORE MAKING THE SECOND POUR. THIS FACE COULD BECOME CONTAMINATED IN SITUATIONS SUCH AS WHEN IT RAINS BETWEEN POURS AND MUD ATTACHES TO THE FIRST CONCRETE FACE. IF THIS OCCURS, USE A WIRE BRUSH TO REMOVE ANY CONTAMINATION THAT IS PRESENT.
D. CONDUITS SHALL BE CAPPED OR SEALED TO PREVENT DIRT AND DEBRIS FROM ENTERING THE CONDUIT UNTIL THE DUCT BANK IS JOINED.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DUCT BANK JOINTS

DEC	DEM	DEP	DEF
X	X	X	X

22.06-120

DURING CONSTRUCTION

A PRE-CONSTRUCTION MEETING SHALL BE HELD BETWEEN THE CUSTOMER'S CONTRACTOR AND DUKE ENERGY REPRESENTATION PRIOR TO BEGINNING DUCT BANK INSTALLATION. THE CUSTOMER SHALL THEN CONTACT DUKE ENERGY FOR INSPECTION DURING CONDUIT INSTALLATION AND AGAIN PRIOR TO PLACEMENT OF CONCRETE.

1. _____ DUCT BANK INSTALLATION ROUTE FOLLOWS PLAN APPROVED BY DUKE ENERGY PROJECT ENGINEER.

2. _____ 180° MAXIMUM ANGULAR DEFLECTION BETWEEN TERMINATION POINTS.

3. _____ GRAY, ELECTRICAL GRADE PVC CONDUIT WITH A MINIMUM WALL THICKNESS OF SCHEDULE 40.

4. _____ GREATER THAN OR EQUAL TO 36" RADIUS BENDS (MINIMUM OF SCHEDULE 40).

5. _____ PROPER CONDUIT SIZE (GLUED TO MANUFACTURE SPECS) AND DUCT BANK CONFIGURATION AS SPECIFIED BY PROJECT ENGINEER.

6. _____ DUCT BANK DOES NOT EXCEED 450' BETWEEN TERMINATION POINTS OR 100' BETWEEN A TERMINATION POINT AND A RISER POLE UNLESS APPROVED BY PROJECT ENGINEER.

7. _____ MINIMUM 3" CONCRETE BOUNDARY AROUND THE PERIMETER OF THE DUCT BANK.

8. _____ MINIMUM 3" CONCRETE SEPARATION BETWEEN OTHER UTILITIES.

9. _____ DITCHES ARE FREE FROM DEBRIS AND ROCKS PRIOR TO INSTALLING DUCT BANK.

10. _____ DUCT BANK IS INSTALLED AT PROPER DEPTH AS SPECIFIED BY PROJECT ENGINEER.

11. _____ TRENCH IS SLOPED ACCORDING TO DUKE ENERGY SPECIFICATIONS ON DWG. 22.06-116A.

12. _____ SPACERS EVERY 5' AND CONDUITS ARE SECURED PROPERLY. SPACERS MUST PROVIDE MINIMUM SPACING. (SEE DWG. 22.06-110).

13. _____ CONDUITS ENTER INTO THE LOWEST POSITIONS AVAILABLE IN MANHOLES OR ENTER VAULTS AT LOCATION SPECIFIED BY DUKE ENERGY PROJECT ENGINEER AND ARE GROUTED AND SEALED PROPERLY.

14. _____ CONDUITS AT EQUIPMENT AND DIP POLE LOCATIONS ARE INSTALLED IN CONCRETE AND IN THE PROPER CONFIGURATION AS SPECIFIED BY THE PROJECT ENGINEER.

15. _____ #2 BARE COPPER GROUND WIRE IS PROPERLY INSTALLED THROUGHOUT DUCT BANK AND INTO MANHOLE. ENSURE THAT COPPER COMPRESSION CONNECTORS OR EXOTHERMIC WELDS ARE USED TO CONNECT GROUND WIRE SECTIONS TOGETHER. (SEE DWG. 22.06-112A).

16. _____ 3,000 PSI OR GREATER CONCRETE ORDERED WITH A 3/8" MAXIMUM AGGREGATE SIZE AND A SLUMP OF 5".

17. _____ NESC, STATE AND LOCAL ORDINANCES ON SEPARATION REQUIREMENTS BETWEEN UTILITIES ARE MET.

18. _____ NESC, STATE AND LOCAL ORDINANCES FOR PROPER BACKFILL AND COMPACTION OF THE DITCH AND RESTORATION OF THE GROUND AND/OR PAVEMENT ARE MET.

FINAL INSPECTION PRIOR TO DUKE ENERGY INSTALLING CABLE

19. _____ VERIFY ALL CONDUITS ARE CLEAR AND FREE FOR PROPER OPERATING CONDITIONS AFTER CONCRETE HAS BEEN PLACED. DUKE ENERGY REPRESENTATIVE MUST BE PRESENT TO WITNESS SOLID MANDREL BEING PULLED THROUGH CONDUITS BY CONTRACTOR.

20. _____ VERIFY PULL STRINGS HAVE BEEN INSTALLED IN EACH CONDUIT IN THE DUCT BANK BETWEEN ALL MANHOLE, EQUIPMENT AND/OR RISER POLE LOCATIONS.

21. _____ PROVIDE FINAL AS-BUILT "PLAN VIEW" DRAWINGS SHOWING LOCATION OF INSTALLED DUCT BANK. IN ADDITION, AS-BUILT "PROFILE VIEW" DRAWINGS WILL BE REQUIRED ON MORE COMPLEX PROJECTS AT THE DIRECTION OF THE DUKE ENERGY PROJECT ENGINEER.

THE CUSTOMER AND DUKE ENERGY CONTRACTORS ARE RESPONSIBLE FOR FOLLOWING ALL GUIDELINES RELATED TO DUCT BANK INSTALLATION PROVIDED ON THIS CHECKLIST AND IN THIS MANUAL. DUKE ENERGY WILL NOT ACCEPT ANY INSTALLATIONS THAT DO NOT MEET THESE REQUIREMENTS AND WILL REQUIRE THE CUSTOMER OR DUKE ENERGY CONTRACTOR TO REPAIR ANY DEFICIENCIES PRIOR TO DUKE ENERGY INSTALLING CABLE.

DUKE ENERGY.

3					
2					
1					
0	12/31/15	FLETCHER	EANES	ADCOCK	
REVISED		BY	CK'D	APPR.	

DUCT BANK INSPECTION CHECKLIST

DEC	DEM	DEP	DEF
X	X	X	X

22.06-124

JAMMING

THE JAM RATIO (J) IS DEFINED AS THE RATIO OF THE INSIDE DIAMETER OF THE DUCT (D) TO THE CABLE DIAMETER (d), i.e J = D/d.

WHEN THIS RATIO IS CLOSE TO 3.0, ONE OF THE CABLES IN A THREE-CABLE PULL MAY SLIP BETWEEN THE OTHER TWO CABLES CAUSING THE CABLES TO JAM IN THE DUCT. THIS IS MOST LIKELY TO OCCUR WHEN THE CABLES ARE PULLED AROUND A BEND. JAMMING IS NOT USUALLY A PROBLEM FOR ESSENTIALLY STRAIGHT CABLE PULLS.

IF J IS BETWEEN 2.8 AND 3.0, JAMMING COULD OCCUR AND IT IS NOT RECOMMENDED THAT CABLE PULLS WITH THIS JAM RATIO BE PERFORMED UNLESS THE CONDUIT RUN IS FREE OF ELBOWS OR SHARP BENDS.

CABLE CLEARANCE

IT IS IMPORTANT TO HAVE ADEQUATE CLEARANCE (C) TO ENSURE THAT CABLES WILL PHYSICALLY FIT IN THE CONDUIT INTENDED FOR INSTALLATION. DUKE ENERGY REQUIRES A MINIMUM CLEARANCE OF 0.5 INCHES WHICH IS CONSISTENT WITH VARIOUS INDUSTRY STANDARDS. A SLIGHTLY LESSER CLEARANCE MAY BE ACCEPTABLE FOR ESSENTIALLY STRAIGHT PULLS. THIS ALLOWS FOR VARIATIONS IN CABLE AND DUCT DIMENSIONS AND THE OVALITY OF BENDS.

MINIMUM BENDING RADIUS

IF A POWER CABLE, 600V OR PRIMARY, IS BENT IN A RADIUS THAT IS TOO SEVERE, THE CABLE STRUCTURE MAY BE DAMAGED. THE MINIMUM BENDING RADIUS FOR CABLES USED AT DUKE ENERGY MAY BE FOUND IN SECTION 23, UNDERGROUND CABLES.

SIDEWALL BEARING PRESSURE

SIDEWALL BEARING PRESSURE (SWBP) IS A RADIAL FORCE PER UNIT LENGTH EXERTED ON A CABLE BEING PULLED AROUND A BEND. EXCEEDING THE MAXIMUM ALLOWABLE SWBP MAY SUBJECT THE CABLE TO CRUSHING DAMAGE. FOR THIS REASON, SIDEWALL BEARING PRESSURE MAY BE THE MOST RESTRICTIVE FACTOR FOR INSTALLATIONS HAVING BENDS AND HIGH TENSIONS. THE RECOMMENDED MAXIMUM SIDEWALL BEARING PRESSURE RATINGS FOR ALL DUKE ENERGY CABLES ARE PROVIDED IN SECTION 23, UNDERGROUND CABLES.

TENSION - DESIGN LIMITS

THE MAXIMUM PULLING TENSION THAT CAN BE APPLIED TO A GIVEN CABLE SYSTEM IS DICTATED BY THE PHYSICAL LIMITATIONS OF THE CABLE (BOTH TENSILE AND CRUSHING STRENGTH), RATINGS OF THE PULLING ATTACHMENTS (PULLING EYES, GRIPS, ETC.) AND WHETHER A SINGLE PULLING ATTACHMENT IS PLACED OVER MULTIPLE CABLES OR IF A PULLING ATTACHMENT IS PLACED ON EACH CABLE.

A GRIP OR ATTACHMENT PLACED ON MULTIPLE CABLES DOES NOT SEAT AS WELL AS ONE THAT IS PLACED ON A SINGLE CABLE. THEREFORE, DIFFERENT RATINGS ARE NECESSARY FOR BOTH APPLICATIONS.

MAXIMUM PULLING TENSIONS FOR CABLES ARE PROVIDED IN SECTION 23, UNDERGROUND CABLES AND THE RATINGS FOR PULLING ATTACHMENTS ARE PROVIDED ON DWGS. 22.07-112A AND 22.07-112B.

TENSION - INSTALLATION LIMITS

EXCESSIVE PULLING TENSION CAN CAUSE SEVERE DAMAGE TO 600V OR PRIMARY UNDERGROUND CABLE. BECAUSE OF THIS, DUKE ENERGY REQUIRES THAT ONE OF THE FOLLOWING OPTIONS BE UTILIZED TO LIMIT TENSION APPLIED WHENEVER CABLE IS BEING PULLED INTO A DUCT.

- INSTALL A "BREAK-AWAY' DEVICE THAT SHEARS APART AT A TENSION THAT IS LESS THAN THE MAXIMUM ALLOWABLE TENSION FOR THE CABLE AND PULLING ATTACHMENT BEING USED. THESE DEVICES CAN BE OBTAINED FROM MOST ALL OF THE MANUFACTURERS OF CABLE PULLING EQUIPMENT.

- FOR 1/0 AWG CABLE, ATTACH A PIECE OF BARE #6 AWG COPPER HD WIRE BETWEEN THE CABLE AND THE PULLING LINE.

- UTILIZE PULLING EQUIPMENT THAT:

    1) ALLOWS TENSION TO BE LIMITED TO DESIRED VALUES AND
    2) PROVIDES DOCUMENTATION OF ACTUAL TENSIONS ENCOUNTERED THROUGHOUT THE PULL. DUKE ENERGY WOULD REQUIRE COPIES OF THE DOCUMENTATION SHOWING THAT ONLY ACCEPTABLE TENSIONS WERE APPLIED TO THE CABLE.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE PULLING - GENERAL INFORMATION

DEC	DEM	DEP	DEF
X	X	X	X

22.07-100A

PULLING SPEED

TYPICAL CABLE PULLING SPEEDS FOR POWER CABLES RANGE BETWEEN 10 AND 50 FEET PER MINUTE. AT THE HIGHER SPEEDS, ADDITIONAL CARE SHOULD BE TAKEN TO ASSURE THAT CABLE FROM THE FEED-IN REEL(S) DOES NOT BACKLASH WHEN THE PULL IS INTERRUPTED OR COMPLETED. THIS CAN BE ACCOMPLISHED BY USING BRAKES ON THE CABLE REEL STANDS. HIGH PULLING SPEEDS ALSO RESULT IN AN INCREASED RATE OF FRICTIONAL HEATING IN BENDS AND CAN RESULT IN ADDITIONAL WEAR IN PVC BENDS.

PULLING DIRECTION

THE TENSION REQUIRED TO PERFORM A CABLE PULL CAN CHANGE SIGNIFICANTLY BY SIMPLY CHANGING THE PULL DIRECTION. IN GENERAL, LOWER PULLING TENSIONS ARE ENCOUNTERED WHEN FEEDING THE CABLE INTO THE END OF THE DUCT RUN THAT CONTAINS THE LARGEST NUMBER OF BENDS, OR WHEN CABLE IS FED INTO THE UPHILL SIDE OF A CABLE RUN. THE DSTAR CPA CABLE PULLING SOFTWARE AUTOMATICALLY PROVIDES CALCULATIONS FOR PULLS IN BOTH DIRECTIONS. ENGINEERS MUST CONSULT WITH CONSTRUCTION PRIOR TO INSTALLATION WHEN IT IS NECESSARY FOR A CABLE TO BE PULLED IN ONE DIRECTION ONLY. THIS IS NECESSARY TO VERIFY THERE ARE NO OBSTACLES THAT WOULD PREVENT PULLING IN THE DESIRED DIRECTION, CONSTRUCTION IS AWARE OF THE REQUIRED DIRECTION OF THE PULL AND THAT THE PULL WILL NOT DAMAGE THE CABLE.

PULLING LINES AND DUCT WEAR

THERE ARE A WIDE VARIETY OF PULLING LINES BEING USED IN THE UTILITY INDUSTRY. DUCT WEAR IS STRONGLY AFFECTED BY THE DIAMETER OF THE LINE. AS THE DIAMETER OF THE LINE IS REDUCED, THE WEAR IS INCREASED. THIS OCCURS BECAUSE THE FORCE PER UNIT AREA OF THE LINE ON THE DUCT INCREASES AS THE LINE DIAMETER DECREASES. THE SURFACE CONDITION OF THE PULLING LINE ALSO AFFECTS DUCT WEAR. A COARSELY BRAIDED FIBER PULLING LINE OR STRANDED STEEL ROPE WILL WEAR THROUGH DUCT MUCH MORE RAPIDLY THAN A NYLON JACKETED PULLING LINE.

MISCELLANEOUS PULLING EQUIPMENT

PROPER FEED-IN DEVICES ARE ESSENTIAL TO AVOID SEVERE SCRAPING OF THE CABLE JACKET AS IT IS PULLED OVER MANHOLE COVER FRAMES, AGAINST THE TOP OF THE MANHOLE, AND INTO DUCTS. THE SAME PRECAUTIONS ALSO EXIST AT THE PULLING END. THESE DEVICES INCLUDE:

- SOFTENERS: METAL RACEWAYS WITH A LARGE, SMOOTH RADIUS THAT SITS ON THE EDGE OF THE MANHOLE FRAME.
- TUBES: FLEXIBLE METAL TUBES THAT EXTEND OVER THE SOFTENER AND INTO THE DUCT.
- PULLEYS: ONLY WIDE RADIUS PULLEYS SHOULD BE USED TO MINIMIZE STRESS ON CABLE.

POWERGLIDE CABLE JACKETS

THE DEC CABLES LISTED IN THE TABLE BELOW HAVE A SPECIAL JACKET THAT ALLOWS THEM TO BE PULLED WITH LITTLE TO NO CABLE LUBRICANT APPLIED.

CABLE DESCRIPTION	DEC CABLES	
	COMPATIBLE UNIT	ITEM NUMBER
350 MCM 25KV AL	CABLE-PRI-350-AL-TRXLPE-LC-25KV-LFRIC-C	1521014
750 MCM 25KV AL	CABLE-PRI-750-AL-TRXLPE-LC-25KV-LFRIC-C	1520991
750 MCM 25KV CU	CABLE-PRI-750-CU-TRXLPE-LC-25KV-LFRIC-C	1520994
1000 MCM 25KV AL	CABLE-PRI-1000-AL-TRXLPE-LC-25KV-LFRIC-C	1520998
1000 MCM 25KV CU	CABLE-PRI-1000-CU-TRXLPE-LC-25KV-LFRIC-C	1521000

CABLE SIZE	CABLE DIAMETER (SEE NOTE 1)	MINIMUM CONDUIT SIZE (INCHES) - SEE NOTE 2					
		PVC OR STEEL		POLYETHYLENE		FIBERGLASS	
		1 SVC	2 SVC/SEC'S	1 SVC	2 SVC/SEC'S	1 SVC	2 SVC/SEC'S
2 #10 CU	-	1-1/2"	2"	2"	2"	2"	2"
3 #10 CU	-	1-1/2"	2"	2"	2"	2"	2"
#6 AL DPX	0.71	1-1/2"	2"	2"	2"	2"	2"
#6 AL TPX	0.77	1-1/2"	2"	2"	2"	2"	2"
#2 AL TPX	-	1-1/2"	-	-	-	-	-
2/0 AL TPX	1.26	2"	3"	2"	4"	2"	3"
2/0 AL QPX	1.41	2"	4"	2"	4"	2"	4"
4/0 AL TPX	1.49	2"	4"	2"	4"	2"	4"
4/0 AL QPX	1.67	2-1/2"	4"	4"	4"	2"	4"
4/0 CU TPX	1.53	2"	4"	4"	4"	2"	4"
4/0 CU QPX	1.71	2-1/2"	4"	4"	4"	2"	4"
350 AL TPX	1.82	2-1/2"	6"	4"	6"	3"	6"
350 AL QPX	2.03	3"	6"	4"	6"	3"	6"
350 CU TPX	1.94	2-1/2"	6"	4"	6"	3"	6"
350 CU QPX	2.16	3"	6"	4"	6"	3"	6"
500 AL TPX	2.15	3"	6"	4"	6"	3"	6"
500 AL QPX	2.48	4"	6"	4"	6"	4"	6"
500 CU TPX	2.23	3"	6"	4"	6"	3"	6"
500 CU QPX	2.49	4"	6"	4"	6"	3"	6"
750 AL TPX	2.69	4"	6"	4"	-	4"	6"
750 AL QPX	3.01	4"	-	4"	-	4"	-
750 CU TPX	2.70	4"	6"	4"	-	4"	6"
750 CU QPX	3.12	4"	-	4"	-	4"	-
1000 AL TPX	3.03	4"	-	4"	-	4"	-
1000 AL QPX	3.39	4"	-	6"	-	4"	-
1000 CU TPX	3.04	4"	-	4"	-	4"	-
1000 CU QPX	3.40	4"	-	6"	-	4"	-

MINIMUM CONDUIT INSIDE DIAMETER (INCHES)			
CONDUIT SIZE	PVC OR STEEL	HIGH DENSITY POLYETHYLENE	FIBERGLASS
1-1/2"	1.558	-	-
2"	2.015	2.002	2.235
2-1/2"	2.406	-	-
3"	3.001	-	3.360
4"	3.920	3.794	4.320
6"	5.947	5.585	6.435

NOTES:

1. CABLE DIAMETERS WERE ESTABLISHED ASSUMING CABLE DIAMETERS WERE 1.05% THE MANUFACTURER'S PUBLISHED NOMINAL DIAMETERS.

2. USE THE NEXT LARGER SIZE OF CONDUIT IF THE ONE SHOWN ON THIS TABLE IS NOT AVAILABLE IN YOUR AREA.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

RECOMMENDED CONDUIT FILL

600V AL AND CU CABLES

DEC	DEM	DEP	DEF
X	X	X	X

22.07-102

VOLTAGE	CABLE SIZE	MINIMUM CONDUIT SIZE (INCHES) - SEE NOTE 2								
		PVC OR STEEL			POLYETHYLENE			FIBERGLASS		
		1 CABLE	2 CABLES	3 CABLES	1 CABLE	2 CABLES	3 CABLES	1 CABLE	2 CABLES	3 CABLES
15 KV	1/0 AWG	2*	3	3	2	4	4	2	3	3
	4/0 AWG	2	4	4	2	4	4	2	3	3
	500 KCMIL	-	-	4	-	-	6	-	-	4
	750 KCMIL	-	-	6	-	-	6	-	-	6
	1000 KCMIL	-	-	6	-	-	6	-	-	6
25 KV	1/0 AWG	2	3	4	2	4	4	2	3	4
	350 AWG	-	-	6	-	-	6	-	-	4
	750 KCMIL	-	-	6	-	-	6	-	-	6
	1000 KCMIL	-	-	6	-	-	6	-	-	6
35 KV	1/0 AWG	2	4	4	2	4	6	2	4	4
	750 KCMIL	-	-	6	-	-	6	-	-	6

*A SINGLE 15KV, 1/0 AWG CABLE MAY BE PULLED INTO EXISTING 1-1/2" SPARE CONDUITS IN DUKE ENERGY FLORIDA IF THE CONDUIT AND ANY BENDS ARE IN GOOD CONDITION AND THE PULL WILL NOT PASS THROUGH EXCESSIVE ANGULAR DEFLECTION.

MINIMUM CONDUIT INSIDE DIAMETER			
CONDUIT SIZE	PVC OR STEEL	HIGH DENSITY POLYETHYLENE	FIBERGLASS
1-1/2"	1.558	-	-
2"	2.015	2.002	2.235
3"	3.001	-	3.360
4"	3.920	3.794	4.320
6"	5.947	5.585	6.435

NOTES:

1. CABLE DIAMETERS WERE ESTABLISHED ASSUMING CABLE DIAMETERS WERE 1.05% THE MANUFACTURER'S PUBLISHED NOMINAL DIAMETERS.

2. USE THE NEXT LARGER SIZE OF CONDUIT IF THE ONE SHOWN ON THIS TABLE IS NOT AVAILABLE IN YOUR AREA.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

RECOMMENDED CONDUIT FILL

PRIMARY CABLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

22.07-106

AVAILABLE PULLING LUBRICANTS			
REGION	PACKAGE	COMPATIBLE UNIT	ITEM NUMBER
DEC	5 GAL PAIL	-	1412519
DEM	5 GAL PAIL	-	1412519
DEP	QUART PACK 1-3/4"D X 24" L	-	4030534 - SEE NOTE 1
	HALF GALLON PACK 3"D X 14"L	-	4030530 - SEE NOTE 2
DEF	-	-	-

NOTES:

1. FOR USE IN 2" AND 3" CONDUIT.

2. FOR USE IN 4" AND 6" CONDUIT.

REQUIRED LUBRICANT IN GALLONS (G) - WHEN USING PAILS					
PULL LENGTH IN FEET (L)	CONDUIT I.D. IN INCHES (D)				
	2"	3	4"	5"	6"
100	0.30	0.45	0.60	0.75	0.90
500	1.50	2.25	3.00	3.75	4.50
1000	3.00	4.50	6.00	7.50	9.00

G = L X D X 0.0015

* AVERAGE NUMBER OF LUBRICANT PACKS RECOMMENDED				
PULL LENGTH	CONDUIT SIZE (PACK SIZE)			
	2" (QUART PACK)	3" (QUART PACK)	4" (1/2 GAL. PACK)	6" (1/2 GAL. PACK)
100 FT.	2	3	2	3
200 FT.	4	6	4	6
300 FT.	6	9	6	9
400 FT.	8	12	8	12
500 FT.	10	15	10	15

* PULL LENGTHS AND QUANTITIES ARE ADDITIVE FOR PULL LENGTHS ABOVE 500 FT. QUANTITIES MAY VARY DEPENDING ON LENGTH OF PULL.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	8/7/17	FLETCHER	EANES	ADCOCK

CABLE PULLING LUBRICANTS

DEC	DEM	DEP	DEF
X	X	X	X

22.07-108

TYPICAL PULLING GRIP

PULLING GRIP					
WORKING DIAMETER	REGION	ITEM NUMBER	WORKING LOAD (LBS)	PRIMARY CABLE	SECONDARY CABLE
0.25" TO 0.50"	DEC	656579	6,800	-	-
	DEM	656579	6,800	-	-
	DEP	-	-	-	-
	DEF	656579	6,800	-	-
0.75" TO 0.99"	DEC	105301	-	-	-
	DEM	651286	2,800	-	-
	DEP	4022853	1,360	-	1-350 KCMIL AL 1-500 KCMIL AL
	DEF	-	-	-	-
1.00" TO 1.25"	DEC	-	-	-	-
	DEM	656570	12,800	-	-
	DEP	4022852	1,920	1/0 AWG 25KV	1-500 KCMIL CU
1.00" TO 1.49"	DEF	4005635	-	-	-
1.50" TO 1.99"	DEC	-	-	-	-
	DEM	651280	16,400	-	-
	DEP	4022851	3,280	350 KCMIL	-
	DEF	-	-	-	-
2.00" TO 2.49"	DEC	-	-	-	-
	DEM	651283	27,200	-	-
	DEP	4000560	3,700	750 KCMIL 1000 KCMIL	-
	DEF	656573	-	-	-
2.50" TO 2.99"	DEC	-	-	-	-
	DEM	651282	33,000	-	-
	DEP	-	-	-	-
	DEF	-	-	-	-
3.00" TO 3.49"	DEC	-	-	-	-
	DEM	651285	41,000	-	-
	DEP	-	-	-	-
	DEF	651285	-	-	-
3.50" TO 3.99"	DEC	-	-	-	-
	DEM	651284	48,000	-	-
	DEP	-	-	-	-
	DEF	-	-	-	-
4.00" TO 4.50"	DEC	-	-	-	-
	DEM	-	-	-	-
	DEP	-	-	-	-
	DEF	4005633	-	-	-

NOTES:

1. SEE DWG. 22.07-112B FOR NOTES.

REVISED		BY	CHK'D	APPR.
3				
2				
1	11/13/17	FLETCHER	EANES	ADCOCK
0	8/7/17	FLETCHER	EANES	ADCOCK

PULLING GRIPS FOR UNDERGROUND CABLES

DEC	DEM	DEP	DEF
X	X	X	X

22.07-112A

NOTES:

1. DO NOT ATTEMPT TO USE ONE CABLE GRIP FOR ALL CONDUCTORS IN TRIPLEX OR QUADRUPLEX: IT WILL NOT GRIP PROPERLY. USE A SEPARATE CABLE GRIP FOR EACH CONDUCTOR. SECURE PULLING ENDS OF ALL GRIPS TOGETHER AND PULL AS A UNIT.

2. WHEN MORE THAN ONE GRIP IS USED, STAGGER THE GRIPS AT LEAST ONE (1) FOOT.

3. WHEN PULL IS COMPLETE, CUT OFF AND SCRAP CABLE DIRECTLY UNDER THE GRIP AND AT LEAST THREE (3) FEET BEHIND THE GRIP.

3				
2				
1				
0	12/31/15	FLETCHER	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

PULLING GRIPS FOR UNDERGROUND CABLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

22.07-112B

CABLE PULLING CALCULATIONS ARE TO BE MADE USING THE DSTAR CABLE PULLING ASSISTANT (CPA) SOFTWARE. THIS SOFTWARE IS AVAILABLE FOR DOWNLOAD FROM THE DAE. INSTRUCTIONS FOR USING THE SOFTWARE ARE PROVIDED ON THE DISTRIBUTION STANDARDS SHARE POINT IN THE JOB AID SECTION.

THE CPA ALLOWS THE USER TO MODEL MOST ANY INSTALLATION THAT MIGHT BE ENCOUNTERED. ALL DUKE ENERGY CABLES, PRIMARY AND SECONDARY, ARE MODELED WITHIN THE SOFTWARE DATABASE ALONG WITH PVC, HIGH DENSITY POLYETHYLENE (HDPE), FIBERGLASS, AND STEEL CONDUIT. A ROTATABLE, THREE-DIMENSION DRAWING IS PROVIDED BY THE SOFTWARE FOR EACH SCENARIO TO ALLOW THE USER TO VERIFY THAT THE LAYOUT ENTERED ACCURATELY REFLECTS THE DESIRED LAYOUT. RESULTS ARE PROVIDED FOR PULLS BEING MADE IN BOTH DIRECTIONS.

QUESTIONS OR NEEDS FOR ADDITIONAL OPTIONS WITHIN THE CPA SOFTWARE SHOULD BE DIRECTED TO DISTRIBUTION STANDARDS.

23.00 GENERAL INFORMATION

23.01 PRIMARY CABLE

23.02 600V ALUMINUM CABLE

23.03 600V COPPER CABLE

23.05 CABLE HANDLING AND STORAGE

THE MAJORITY OF DUKE ENERGY'S PRIMARY CABLE IS RECEIVED ON WOOD REELS. FOR CERTAIN SIZES, OR POSSIBLY FOR SPECIALLY ORDERED CABLES, STEEL REELS ARE UTILIZED DUE TO THE SIZE AND WEIGHT OF THE CABLE. IT IS SIGNIFICANT TO NOTE THAT THESE REELS ARE NOT THE PROPERTY OF DUKE ENERGY (THEIR COST IS NOT INCLUDED IN THE COST OF THE CABLE) AND MUST BE RETURNED TO THE CABLE MANUFACTURER IN A TIMELY MANNER.

DEPENDING UPON THE MANUFACTURER, STEEL REELS NOT RETURNED TO A SITE DESIGNATED BY THE MANUFACTURER WITHIN 12 MONTHS OF THE SHIPMENT DATE WILL HAVE A DEPOSIT INVOICED FOR THE REEL. ONCE THE DEPOSIT IS CHARGED, IF THE REEL IS NOT RETURNED WITHIN AN ADDITIONAL 12 MONTHS (24 MONTHS TOTAL FROM THE DATE OF SHIPMENT), THE COMPANY WILL BE CHARGED THE ENTIRE COST OF THE REEL. THIS REPRESENTS A SIGNIFICANT EXPENSE FOR DUKE ENERGY.

GIVEN THESE POLICIES, EVERY EFFORT SHOULD BE MADE TO RETURN STEEL REELS WITHIN 12 MONTHS TO AVOID ANY DEPOSIT CHARGES. CONTACT INFORMATION FOR DUKE ENERGY'S CABLE MANUFACTURERS IS PROVIDED BELOW.

GENERAL CABLE

- CALL 1-800-325-3025 TO SCHEDULE PICK-UP OF REELS WITH GENERAL CABLE'S TRANSPORTATION PROVIDER.
- REELS RETURNED 'COLLECT' VIA ANY OTHER CARRIER WILL NOT BE ACCEPTED.
- REELS RETURNED WITH NO LABEL OR AN ILLEGIBLE LABEL WILL NOT BE ELIGIBLE FOR A DEPOSIT REFUND.

SOUTHWIRE CABLE

- CALL 1-866-797-3357 TO SCHEDULE PICK-UP OF REELS.
- REEL PICK-UP CAN ALSO BE SCHEDULED VIA THE FOLLOWING LINK: HTTP://WWW.SOUTHWIRE.COM/ORDERING/REELRETURNS.HTM
- REEL SERIAL NUMBERS WILL BE NEEDED TO COMPLETE THE ON-LINE INFORMATION FORM.

ADDITIONALLY, PROPER HANDLING AND CARE OF REELS SHOULD BE MAINTAINED AT ALL TIMES. STEEL REELS THAT ARE RETURNED WITH DAMAGED FLANGES OR DRUMS CAN BE ASSESSED CHARGES IN MUCH THE SAME MANNER AS REELS THAT ARE NOT RETURNED AT ALL.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

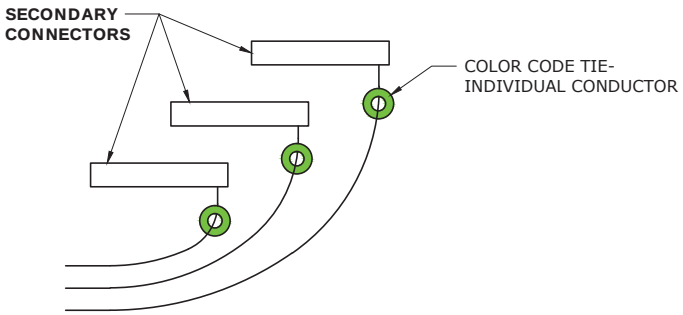
PRIMARY CABLE STEEL REEL RETURN PROCESS

DEC	DEM	DEP	DEF
X	X	X	X

23.00-105

SECONDARY AND SERVICE CABLE IDENTIFICATION - COLOR CODING

- AFTER CABLES ARE PROPERLY IDENTIFIED, MARK BOTH ENDS OF CABLE WITH COLOR CODING TIES OF SAME COLOR
- COLOR CODE TIES SHALL BE PLACED ON EACH INDIVIDUAL CONDUCTOR
- COLOR CODE TIES SHALL BE TIGHTENED TO REMAIN SECURE ON CONDUCTOR



- COLOR CODES MUST NOT BE DUPLICATED WITHIN THE SAME COMPARTMENT OF A TRANSFORMER, PEDESTAL OR SECONDARY ENCLOSURE.
- ON THREE-PHASE CIRCUITS, RESERVE RED, WHITE AND BLUE COLOR TIES FOR PHASE IDENTIFICATION. PHASE IDENTIFICATION TIES ARE INSTALLED IN ADDITION TO THE INDIVIDUAL AND CIRCUIT COLOR CODE TIES DESCRIBED ABOVE. MARK PHASES AS FOLLOWS:

    1. A PHASE- RED TIE
    2. B PHASE - WHITE TIE
    3. C PHASE - BLUE TIE (ALSO HIGH LEG)

SECONDARY CABLE IDENTIFICATION - CABLE TAGGING

- IN PEDESTALS AND SECONDARY ENCLOSURES, ATTACH WHITE CABLE ID TAG TO EACH SECONDARY CABLE. INFORMATION MUST CONTAIN "EQUIPMENT IDENTIFIER" OF SOURCE FEED.
- EQUIPMENT IDENTIFIER IS THE ASSOCIATED PREFIX OF THE EQUIPMENT (SEE DWG. 23.00-107C, TABLE 1) ALONG WITH EITHER THE LAST 3 DIGITS OF THE EQUIPMENT ID NUMBER OR THE LAST 2 NUMBERS OF EACH GRID COORDINATE NUMBER. SEE EXAMPLE BELOW.

FROM PM 685

- ATTACH WHITE CABLE ID TAG TO CABLE USING TIE COLOR CONSISTANT WITH EXISTING COLOR CODE OF CABLE.
- ATTACH WHITE CABLE ID TAG AT A PLACE ON THE CONDUCTOR THAT IS FURTHEST DISTANCE FROM THE GROUND.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

STANDARD IDENTIFICATION AND TAGGING METHODS FOR CABLE

DEC	DEM	DEP	DEF
			X

23.00-107A

ROTATION - SERVICE CABLE

- ON NEW THREE-PHASE INSTALLATIONS, CLOCKWISE ROTATION AT THE METER BASE IS PREFERRED.

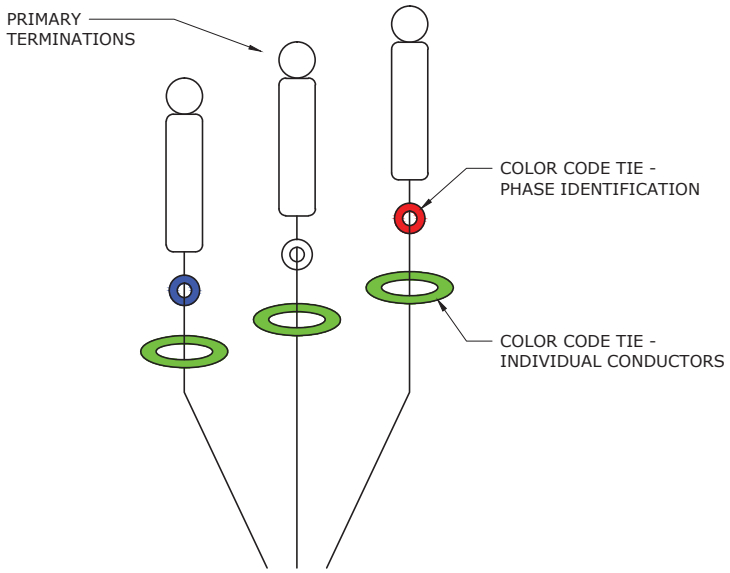
    1. THREE-PHASE ROTATION STICKERS ARE TO BE INSTALLED BOTH INSIDE THE METER BASE AND BELOW THE GLASS ON THE OUTSIDE OF THE METER BASE.

    2. THREE-PHASE ROTATION STICKERS ARE TO BE INSTALLED AT CUSTOMERS POINT OF SERVICE (CUSTOMER PANEL, WIRING, TROUGH OR CT CABINET).

PRIMARY CABLE IDENTIFICATION FOR - COLOR CODING

ALL 200 AMP CABLE - WHICH INCLUDES TRANSFORMERS, PROTECTED WAY SWITCHGEAR TERMINATIONS AND TERMINAL POLES

- AFTER CABLES ARE PROPERLY IDENTIFIED, CABLE CODE BOTH ENDS OF CABLE WITH SAME COLOR
- COLOR CODE TIES SHALL BE PLACED ON EACH INDIVIDUAL CONDUCTOR
- COLOR CODE TIES SHALL BE TIGHTENED TO REMAIN SECURE ON CONDUCTOR



- COLOR CODES MUST NOT BE DUPLICATED WITHIN THE SAME TRANSFORMER OR SWITCHGEAR COMPARTMENT.
- ON THREE-PHASE CIRCUITS, DO NOT USE COLORS RED, WHITE OR BLUE FOR PRIMARY CABLE COLOR CODING. RESERVE RED, WHITE AND BLUE COLOR TIES FOR PHASE IDENTIFICATION AS FOLLOWS (SEE ILLUSTRATION ABOVE).

    1. A PHASE- RED TIE
    2. B PHASE - WHITE TIE
    3. C PHASE - BLUE TIE

ALL 600 AMP CABLE INCLUDES: FEEDER CABLE TERMINATIONS, SPLICES IN PULL- BOX OR CABLE CONNECTED BETWEEN SOLID BLADE SWITCHES

ONLY COLOR CODE PHASES AS FOLLOWS:

1. A PHASE- RED TIE
2. B PHASE - WHITE TIE
3. C PHASE - BLUE TIE

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

STANDARD IDENTIFICATION AND TAGGING METHODS FOR CABLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.00-107B

PRIMARY CABLE- CABLE TAGGING

- FOR TRANSFORMER INSTALLATIONS, USE WHITE CABLE IDENTIFICATION TAG AND INCLUDE THE "EQUIPMENT IDENTIFIER" THAT THE CABLE IS FEEDING, THE DIRECTION OF THE CABLE AND THE COLOR CODE. SEE EXAMPLE BELOW.
- FOR SWITCHGEAR INSTALLATIONS ON 600 AMP SIDE OF GEAR, USE THE WHITE CABLE IDENTIFICATION TAG AND INCLUDE THE "EQUIPMENT IDENTIFIER" AND THE WAY, BAY OR COMPARTMENT NUMBER THAT THE CABLE IS FEEDING AND THE DIRECTION OF THE CABLE. IF CABLE RUNS THROUGH A CONDUIT AND PULL-BOX SYSTEM, INDICATE NUMBER OF PULL-BOXES TO NEXT TERMINATION POINT.
- FOR SWITCHGEAR INSTALLATIONS ON THE 200 AMP SIDE OF GEAR (PROTECTED WAY), USE WHITE CABLE IDENTIFICATION TAG AND INCLUDE THE "EQUIPMENT IDENTIFIER" THAT THE CABLE IS FEEDING, THE DIRECTION OF THE CABLE AND THE COLOR CODE OF THE CABLE. IF CABLE RUNS THROUGH A CONDUIT AND PULLBOX SYSTEM, INDICATE NUMBER OF PULLBOXES TO NEXT TERMINATION POINT.
- PULL-BOX INSTALLATIONS- NO TAGGING IS REQUIRED
- "EQUIPMENT IDENTIFIER" IS THE ASSOCIATED PREFIX OF THE EQUIPMENT AS SHOWN IN TABLE BELOW ALONG WITH EITHER THE LAST 3 DIGITS OF THE EQUIPMENT ID NUMBER OR THE LAST 2 NUMBERS OF EACH GRID COORDINATE NUMBER, OR THE SWITCH NUMBER AND ALSO THE COMPARTMENT OR WAY NUMBER IF APPLICABLE.
- ATTACH CABLE ID TAGS TO CABLE.

TABLE 1

EQUIPMENT PREFIX	EQUIPMENT
OHT	OVERHEAD TRANSFORMER
PED	PEDESTAL
PM	PAD-MOUNTED TRANSFORMER
SWG	SWITCHGEAR
TP	TERMINAL POLE

WHITE CABLE IDENTIFICATION TAG
TRANSFORMER EXAMPLE OR 200 AMP SIDE OF SWITCHGEAR (PROTECTED WAY)

TO: PM 395

WEST

GREEN

WHITE CABLE IDENTIFICATION TAG
SWITCHGEAR 600 AMP SIDE EXAMPLE

TO: SWG 478 WAY 2

EAST

CABLE THRU 3 PULL-BOX

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

STANDARD IDENTIFICATION AND TAGGING METHODS FOR CABLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.00-107C

EPR CABLE WARRANTY

DUKE ENERGY RECEIVES A FORTY (40) YEAR WARRANTY ON THE PRIMARY EPR CABLE, MANUFACTURED BY EITHER KERITE OR OKONITE, THAT IT HAS INSTALLED. THE MANUFACTURER WILL AT LEAST REPLACE ALL CABLE THAT FAILS UNDER THIS WARRANTY AND, IN SOME CASES, LABOR COSTS CAN BE RECOVERED AS WELL.

NOTIFICATION

BE CERTAIN TO NOTIFY THE DISTRIBUTION STANDARDS GROUP ANY TIME A FAILURE OCCURS ON EPR CABLE. AFTER NOTIFICATION, THIS GROUP CAN WORK TO DETERMINE THE CAUSE OF THE FAILURE AND ANY REMUNERATION THAT IS DUE. AS WITH EVERY OTHER CABLE FAILURE, THE MANUFACTURER'S NAME AND THE DATE OF MANUFACTURE MUST BE ENTERED INTO THE OUTAGE REPORTING SYSTEM. THIS PROVIDES THE PERMANENT RECORD NECESSARY FOR TRACKING FAILURES. IN ADDITION, THE SECTION OF DAMAGED CABLE REMOVED SHOULD BE FORWARDED TO THE DISTRIBUTION STANDARDS GROUP FOR EXAMINATION.

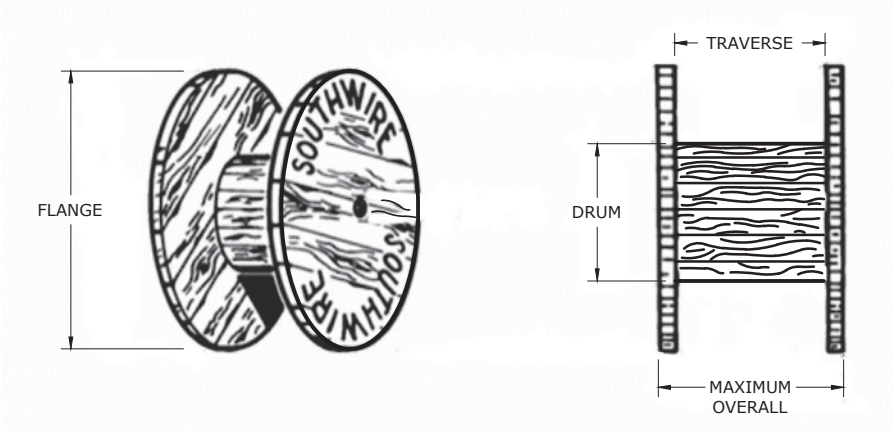
DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

EPR CABLE WARRANTY

DEC	DEM	DEP	DEF
X	X	X	X

23.00-109



DUKE ENERGY USES A VARIETY OF REELS FOR BOTH ITS UNDERGROUND AND OVERHEAD CABLE AND WIRE. THESE REELS CAN BE WOODEN, STEEL, OR COMPOSITE DEPENDING UPON THE APPLICATION, SIZE AND LENGTH OF WIRE WHICH THEY WILL SUPPORT. A BRIEF DESCRIPTION OF REEL SIZES AND HOW TO APPLY THEM IN THE FOLLOWING TABLES OF THIS DOCUMENT IS GIVEN BELOW.

REELS ARE GENERALLY CATEGORIZED AND MEASURED WITH THREE SEPARATE DIMENSIONS. THE 'FLANGE' DIMENSION CAN BE THOUGHT OF AS THE OUTSIDE DIAMETER OF THE REEL OR PERHAPS THE HEIGHT OF THE REEL IF THE REEL IS RESTING ON ITS FLANGES. THIS DIMENSION IS OFTEN THE MOST IMPORTANT WHEN DETERMINING WHETHER A REEL WILL FIT MANY OF THE CABLE TRAILERS USED THROUGHOUT THE DUKE ENERGY SYSTEM. THE 'TRAVERSE' DIMENSION IS THE INSIDE LENGTH BETWEEN THE FLANGES, AND MANY TIMES IS CONSIDERED THE WIDTH OF THE REEL. IT SHOULD BE NOTED THAT THE TRAVERSE DIMENSION IS MEASURED FROM THE INSIDE OF THE FLANGES, AND DOES NOT REPRESENT THE ENTIRE WIDTH OF THE REEL ITSELF. THE MAXIMUM OVERALL WIDTH WOULD INCLUDE THE WIDTH OF EACH FLANGE IN ADDITION TO THE TRAVERSE DIMENSION. FINALLY, THE 'DRUM' DIMENSION IS THE DIAMETER OF THE DRUM AROUND WHICH THE CABLE OR WIRE IS WOUND.

THE TABLES IN THIS SECTION THAT CONTAIN REEL DIMENSIONS WILL HAVE EITHER TWO OR THREE DIMENSIONS TO DESCRIBE THE REEL. THESE DIMENSIONS, IN ORDER, ARE FLANGE X TRAVERSE X DRUM. FOR EXAMPLE, A REEL WITH DIMENSIONS 36 X 24 X 17, ALSO SHOWN AS 36.24.17, WILL HAVE A FLANGE MEASUREMENT OF 36”, A TRAVERSE MEASUREMENT OF 24”, AND A DRUM MEASUREMENT OF 17”. FOR THOSE REELS WITH ONLY TWO DIMENSIONS, THESE WILL BE THE FLANGE AND THE TRAVERSE MEASUREMENTS.

ADDITIONALLY, SOME REEL DESCRIPTIONS ALSO CONTAIN THE ACRONYM 'NRC', WHICH IS A REFERENCE TO A NON-RETURNABLE REEL FOR COVERED CONDUCTOR. ABSENCE OF THIS ACRONYM DOES NOT MEAN THAT THE REEL IS STEEL OR MUST BE RETURNED TO THE MANUFACTURER, ONLY THAT THE FULL DESCRIPTION OF IT WAS NOT AVAILABLE.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE REEL DIMENSIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.00-111

PRIMARY CABLE DESIGN

MEDIUM VOLTAGE UNDERGROUND CABLE IS A HIGHLY ENGINEERED MATERIAL COMPRISED OF MULTIPLE LAYERS. WHILE THESE LAYERS CAN DIFFER SLIGHTLY ACROSS THE DUKE ENERGY SYSTEM BASED UPON SPECIFIC NEEDS, IN GENERAL OUR CABLE IS SIMILAR TO THAT SHOWN BELOW. GREATER DETAIL OF THE VARIOUS LAYERS IS PROVIDED IN THE FOLLOWING PARAGRAPHS.

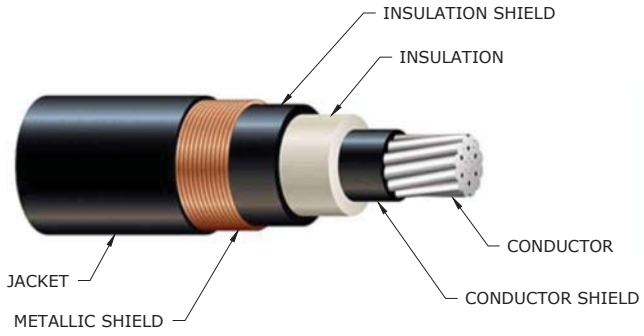


FIGURE 1

CONDUCTOR

THE MAJORITY OF DUKE ENERGY'S UNDERGROUND PRIMARY CABLES UTILIZE ALUMINUM CONDUCTORS. ALUMINUM IS TYPICALLY THE MOST COST EFFECTIVE METAL TO USE AS A CONDUCTOR, HOWEVER COPPER CONDUCTORS ARE AVAILABLE FOR USE IN SOME LARGER CABLES WHERE EITHER GREATER AMPACITY IS NEEDED OR OLDER, SMALLER DUCTS PHYSICALLY LIMIT THE SIZE OF CABLE THAT CAN BE INSTALLED.

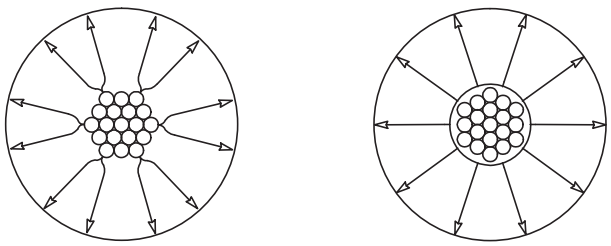
DUKE ENERGY'S 1/0 CABLE, AS WELL AS SOME OLDER #2 CABLE (NO LONGER INSTALLED), HAS A SOLID CONDUCTOR. THIS HELPS PREVENT THE MIGRATION OF WATER WHICH IS KNOWN TO BE A MAJOR CONTRIBUTOR TO THE DEGRADATION OF CABLE.

OTHER SIZE CABLES HAVE A STRANDED CONDUCTOR. THE PRIMARY BENEFIT OF A STRANDED CONDUCTOR IS IMPROVED FLEXIBILITY. THE STRANDING OF CONDUCTORS IS THE FORMATION OF SOLID INDIVIDUAL WIRE STRANDS INTO A COMPOSITE CONSTRUCTION TO ACHIEVE A SPECIFIED CROSS-SECTIONAL AREA. THE NUMBER OF STRANDS IS USUALLY BASED ON A GEOMETRIC PROGRESSION OF SINGLE STRAND LAYERS (1, 6, 12, 18 ETC). FOR EXAMPLE, A 19-STRAND CONDUCTOR WOULD BE COMPOSED OF 3 LAYERS WITH 1, 6, AND 12 STRANDS IN EACH RESPECTIVE LAYER.

STRANDED CONDUCTORS ARE REQUIRED TO HAVE A FILLER, OR BLOCKING COMPOUND, BETWEEN THE STRANDS TO PREVENT THE MIGRATION OF WATER.

CONDUCTOR SHIELD

THE CONDUCTOR SHIELD IS A LAYER OF SEMI-CONDUCTING MATERIAL WHICH IS EXTRUDED OVER THE CONDUCTOR IN ORDER TO PROVIDE A SMOOTH, SYMMETRICAL SURFACE AROUND THE CONDUCTOR. THE CONDUCTOR SHIELD EVENLY DISTRIBUTES THE ELECTRIC FIELD THROUGHOUT THE CIRCUMFERENCE OF THE INSULATION AND PREVENTS THE CONCENTRATION OF STRESS AT SPECIFIC POINTS. SEE FIGURE 2. THIS LAYER ALSO PROVIDES A SMOOTH AND COMPATIBLE SURFACE FOR THE APPLICATION OF THE INSULATION.



WITHOUT A SHIELD WITH A SHIELD

FIGURE 2

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PRIMARY CABLE DESIGN

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.01-101A

INSULATION

EXTRUDED INSULATIONS USED FOR MEDIUM VOLTAGE CABLE ARE CLASSIFIED AS EITHER THERMOPLASTIC OR THERMOSET MATERIAL. THERMOPLASTIC MATERIALS TEND TO LOSE THEIR FORM UPON HEATING, WHILE THERMOSET MATERIALS TEND TO MAINTAIN THEIR FORM. VARIOUS TYPES OF INSULATION CAN BE FOUND ON THE DUKE ENERGY SYSTEM, DESCRIBED BELOW.

PAPER-INSULATED LEAD-COVERED (PILC): THIS TYPE OF CABLE USUALLY CONTAINS A COPPER CONDUCTOR WHICH IS INSULATED WITH OIL IMPREGNATED PAPER AND COVERED WITH LEAD. THE CABLE MAY BE PROTECTED WITH A RUBBER OR POLYETHYLENE JACKET. THIS CABLE WAS USED PRIMARILY IN DOWNTOWN UNDERGROUND SYSTEMS, BUT IS NO LONGER INSTALLED. IT IS A HIGHLY RELIABLE CABLE DESIGN BUT IS HEAVY, EXPENSIVE COMPARED TO NEWER DESIGNS, AND REQUIRES A HIGH DEGREE OF SKILL TO SPLICE AND TERMINATE.

HIGH MOLECULAR WEIGHT POLYETHYLENE (HMWPE): THIS IS A THERMOPLASTIC MATERIAL USED TO FORM A SOLID DIELECTRIC INSULATION. IT WAS USED IN CABLES UNTIL THE LATE 1970S, BUT IS NO LONGER AVAILABLE.

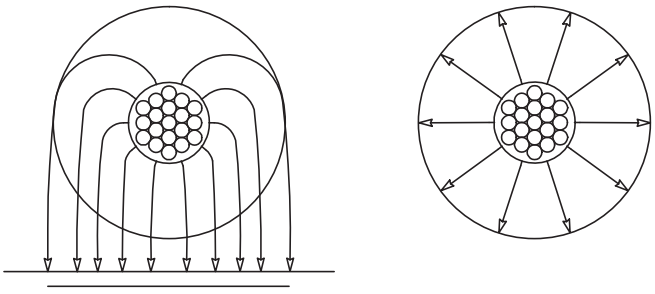
CROSS-LINKED POLYETHYLENE (XLPE): THIS IS A THERMOSET MATERIAL WHERE THE INDIVIDUAL MOLECULES OF POLYETHYLENE ARE JOINED TOGETHER THROUGH A CROSSLINKING PROCESS, FORMING AN INTERCONNECTED NETWORK. INSULATION THAT IS CROSS-LINKED IS ALSO REFERRED TO AS 'CURED' OR 'VULCANIZED'. THIS INSULATION IS NO LONGER INSTALLED AT DUKE ENERGY.

TREE-RETARDANT CROSSLINKED POLYETHYLENE (TRXLPE): THIS IS A CROSSLINKED POLYETHYLENE COMPOUND WHICH CONTAINS AN ADDITIVE THAT REDUCES THE GROWTH OF 'TREES' WITHIN THE INSULATION. INSULATION TREES ARE ACTUALLY VOIDS WHICH CHANNEL THROUGH THE INSULATION IN THE SHAPE OF A TREE AND PROVIDE A PATH FOR DISCHARGE BETWEEN ENERGIZED COMPONENTS AND GROUND. CURRENTLY, THE MAJORITY OF DUKE ENERGY'S CABLE IS MANUFACTURED WITH TRXLPE INSULATION.

ETHYLENE-PROPYLENE RUBBER (EPR): EPR IS A THERMOSET MATERIAL WHICH IS FORMED FROM ETHYLENE, PROPYLENE, AND TYPICALLY A THIRD MONOMER. THIS IS A RUBBERY MATERIAL THAT IS MORE FLEXIBLE THAN TRXLPE. WITHIN THE DUKE ENERGY SYSTEM EPR CABLE IS MOST COMMONLY USED IN DENSE, URBAN AREAS WITHIN MANHOLE AND DUCTBANK SYSTEMS THAT CAN BENEFIT FROM THE INCREASED FLEXIBILITY DUE TO SPACE CONSTRICTIONS.

INSULATION SHIELD

THE INSULATION SHIELD IS A LAYER OF SEMI-CONDUCTING MATERIAL WHICH IS EXTRUDED OVER THE INSULATION IN ORDER TO MAINTAIN GROUND POTENTIAL AROUND THE ENTIRE CIRCUMFERENCE OF THE INSULATION. THE INSULATION SHIELD ALLOWS THE ELECTRIC FIELD TO BE EVENLY DISTRIBUTED THROUGHOUT THE INSULATION BETWEEN THE CONDUCTOR SHIELD AND THE INSULATION SHIELD. SEE FIGURE 3.



WITHOUT A SHIELD WITH A SHIELD

FIGURE 3

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK

PRIMARY CABLE DESIGN

DEC	DEM	DEP	DEF
X	X	X	X

23.01-101B

METALLIC SHIELD

A METALLIC SHIELD IS APPLIED OVER THE INSULATION SHIELD ON ALL OF DUKE ENERGY'S UNDERGROUND PRIMARY CABLES. THIS COMPONENT SERVES AS A PART OF THE INSULATION SHIELD, AND IN MOST CASES AS THE CONDUCTOR FOR THE NEUTRAL RETURN CURRENT AND FOR FAULT CURRENT DISSIPATION. IT ALSO PROVIDES A MEANS OF CONNECTING GROUND POTENTIAL TO THE INSULATION SHIELD. SEVERAL TYPES OF METALLIC SHIELD ARE INCORPORATED WITHIN DUKE ENERGY'S DIFFERENT CABLES.

CONCENTRIC NEUTRAL WIRES ARE CURRENTLY USED ON ALL 35KV CABLES AS WELL AS ALL 4/0 CABLES, AND UNTIL 2015 WERE STILL THE STANDARD FOR SMALLER SIZES IN THE DEP AND DEF AREAS. VERY EARLY ITERATIONS OF CONCENTRIC NEUTRAL CABLE DID NOT UTILIZE AN OUTER JACKET, WHICH LED TO CORROSION OF THE NEUTRAL WIRES. SEE FIGURE 4 BELOW FOR AN IMAGE OF A TYPICAL CONCENTRIC NEUTRAL CABLE.

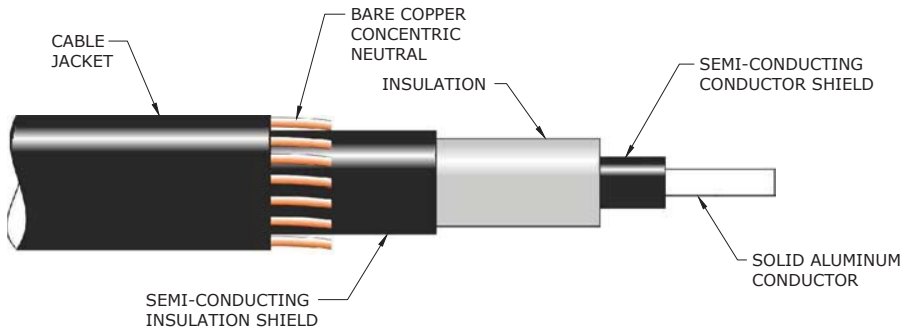


FIGURE 4

SIMILAR TO CONCENTRIC NEUTRAL WIRES IN APPEARANCE ARE CABLES USING DRAIN WIRES AS THE METALLIC SHIELD. MANY OF THESE INSTALLATIONS HAVE BEEN REPLACED, BUT SOME CAN STILL BE FOUND ON LARGER CABLE SIZES. THESE DRAIN WIRES ARE SMALLER THAN CONCENTRIC NEUTRAL WIRES AND ARE NOT DESIGNED TO CARRY NEUTRAL OR FAULT CURRENT. THEY SIMPLY SERVE TO DRAIN SMALL CHARGES FROM THE INSULATION SHIELD, AND MUST BE INSTALLED WITH SEPARATE NEUTRALS. THIS CABLE IS NO LONGER INSTALLED ON THE DUKE ENERGY SYSTEM. SEE FIGURE 5 FOR AN IMAGE.

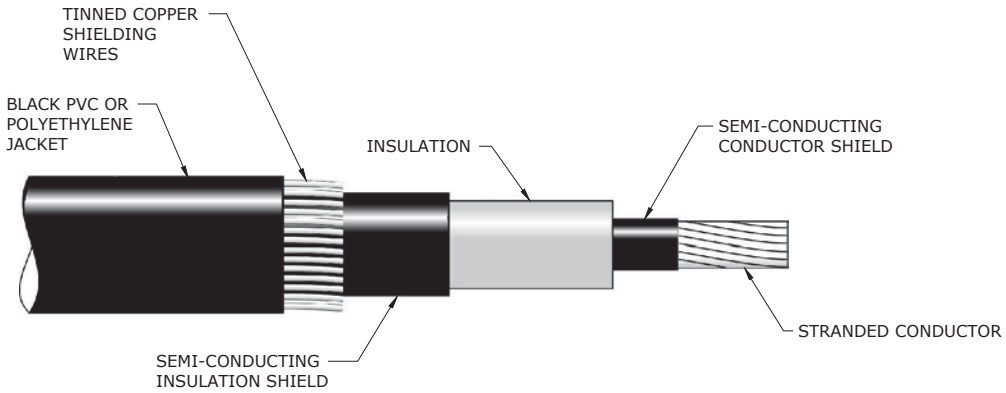


FIGURE 5

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PRIMARY CABLE DESIGN

DEC	DEM	DEP	DEF
X	X	X	X

23.01-101C

METALLIC SHIELD (CONT.)

MOST DUKE ENERGY PRIMARY CABLES UTILIZE A LONGITUDINALLY CORRUGATED (LC) COPPER SHIELD THAT IS WRAPPED AROUND THE ENTIRE CIRCUMFERENCE OF THE INSULATION SHIELD AND SEALED AT THE OVERLAP. THIS SHIELD DOES NOT HAVE A SPECIFIC THICKNESS (ALTHOUGH MOST ARE CLOSE TO 10 MILS) BUT INSTEAD IS DESIGNED TO HANDLE A MAXIMUM ANTICIPATED FAULT CURRENT FOR A CERTAIN PERIOD OF TIME. SEE FIGURE 6 BELOW.

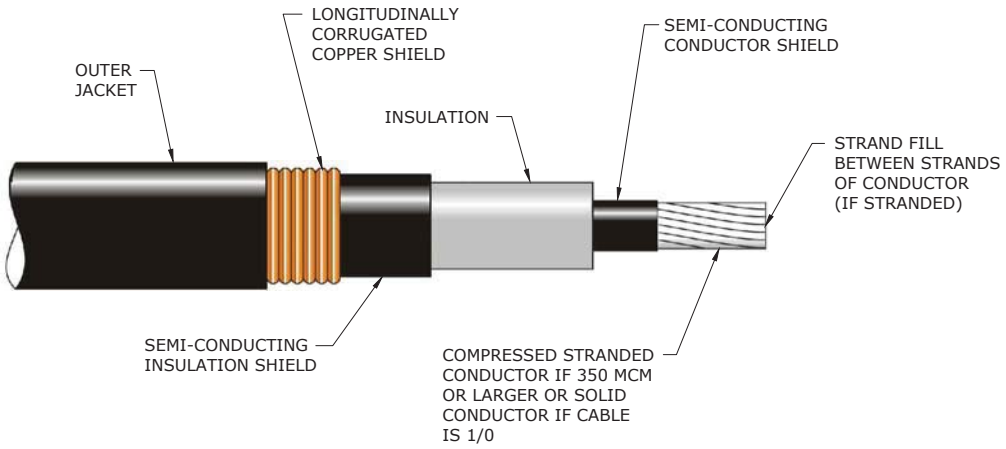


FIGURE 6

FLAT STRAP METALLIC SHIELDS ARE ALSO USED ON SOME CABLES. A FLAT STRAP DESIGN IS VERY SIMILAR TO THAT OF A CONCENTRIC NEUTRAL, BUT THE FLAT WIRES ALLOW FOR A SMALLER OVERALL CABLE DIAMETER VERSUS ROUND CONCENTRIC WIRES. FLAT STRAP CABLES ARE OFTEN USED AS A REPLACEMENT FOR PILC CABLES WHERE SMALL DUCT SPACE IS PREVALENT. SEE FIGURE 7 BELOW.

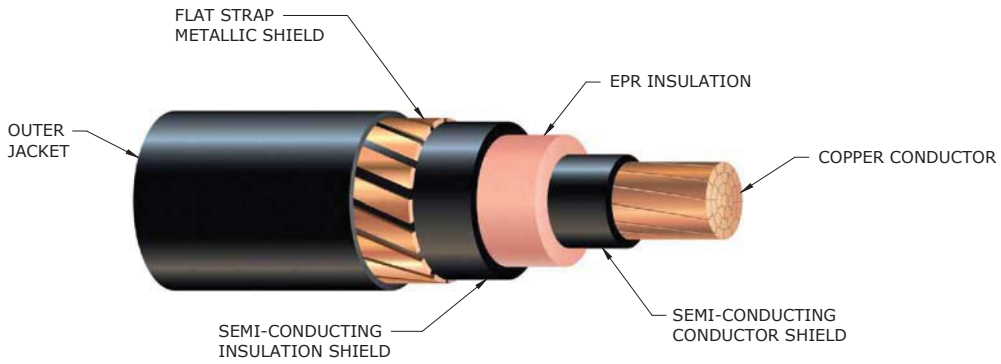


FIGURE 7

JACKET

ALL DUKE ENERGY PRIMARY CABLES UTILIZE AN EXTRUDED CABLE JACKET. JACKETS SERVE TO PROVIDE MECHANICAL PROTECTION, RESISTANCE TO MOISTURE MIGRATION, AND ION FILTERING. NEARLY ALL JACKET MATERIALS ARE A LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) INSULATING MEDIUM, ALTHOUGH IN SOME AREAS A SEMI-CONDUCTING JACKET IS INSTALLED TO IMPROVE THE GROUNDING CHARACTERISTICS IN URD INSTALLATIONS.

CONDUCTOR SIZE	ITEM NUMBER	AL OR CU	STRANDING	UNIT OF MEASURE (FT OR CK)	NUMBER OF CABLES	METALLIC SHIELD	INSULATION TYPE	JACKET MATERIAL	CABLE LENGTH (FT.)	MAXIMUM REEL DIMENSIONS
15KV MEDIUM VOLTAGE CABLE										
1/0 AWG	4205784	AL	SOLID	-	1	LC	TRXLPE	LLDPE	3000	66" X 37"
1/0 AWG	4205786	AL	SOLID	-	3	LC	TRXLPE	LLDPE	3 X 1000	66" X 37"
4/0 AWG	1545414	CU	COMPRESSED	CK	3	CN	TRXLPE	LLDPE	3000	66" X 37"
500 KCMIL	4003577	AL	COMPRESSED	FT	1	LC	TRXLPE	LLDPE	3000	96" X 60" X 42" STL
500 KCMIL	4003576	AL	COMPRESSED	FT	3	LC	TRXLPE	LLDPE	3 X 1000	96" X 60" X 42" STL
750 KCMIL	4003578	AL	COMPRESSED	CK	3	LC	TRXLPE	LLDPE	3 X 1000	84" X 55"
750 KCMIL	4157994	CU	COMPRESS ED	FT	3	LC	TRXLPE	LLDPE	3 X 1000	90" X 55"
1000 KCMIL	4003580	AL	COMPRESSED	FT	1	LC	TRXLPE	LLDPE	3000	96" X 60" X 42" STL
1000 KCMIL	4003579	AL	COMPRESSED	FT	3	LC	TRXLPE	LLDPE	3 X 1000	96" X 60" X 42" STL
1000 KCMIL	4197338	AL	COMPRESSED	FT	1	LC	EPR	LLDPE	6000	96" X 60" X 42" STL
1000 KCMIL	4193767	CU	COMPRESSED	FT	1	LC	EPR	LLDPE	PER P.O.	PER P.O.
25KV MEDIUM VOLTAGE CABLE										
1000 KCMIL	4206140	AL	COMPRESSED	FT	1	LC	TRXLPE	LLDPE	PER P.O.	PER P.O.

NOTES:

LC - LONGITUDINALLY CORRUGATED SHIELD
CN - CONCENTRIC NEUTRAL
TRXLPE - TREE-RETARDANT CROSS LINKED POLYETHYLENE
EPR - ETHYLENE-PROPYLENE RUBBER
LLDPE - LINEAR LOW-DENSITY POLYETHYLENE

DUKE ENERGY.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PRIMARY CABLE BASIC INFORMATION

DEC	DEM	DEP	DEF
			X

23.01-103

GENERAL INFORMATION					CONDUCTOR		CONDUCTOR SHIELD		INSULATION		INSULATION SHIELD		METALLIC SHIELD			JACKET		APPROX. WEIGHT (LBS/1000 FT.)	MIN. BENDING RADIUS (IN.)	MAX. TENSION (LB.) PULLING EYE	MAX. SIDEWALL BEARING PRESS (LB.)
CONDUCTOR SIZE	ITEM NUMBER	AL OR CU	NUMBER OF CABLES	METALLIC SHIELD	INSULATION TYPE	NUMBER OF STRANDS	NOMINAL DIAMETER (IN.)	NOMINAL THICKNESS (IN.)	NOMINAL DIAMETER (IN.)	NOMINAL THICKNESS (IN.)	NOMINAL DIAMETER (IN.)	NOMINAL THICKNESS (IN.)	NOMINAL DIAMETER (IN.)	CONFIGURATION	NOMINAL THICKNESS (IN.)	NOMINAL DIAMETER (IN.)				
15KV MEDIUM VOLTAGE CABLE																					
1/0 AWG	4205784	AL	1	LC	TRXLPE	1	0.325	0.018	0.361	0.175	0.711	0.030	0.771	0.010	0.867	.010" X 2.92"	0.080	1.027	512	12	630	1500
1/0 AWG	4205786	AL	3	LC	TRXLPE	1	0.325	0.018	0.361	0.175	0.711	0.030	0.771	0.010	0.867	.010" X 2.92"	0.080	1.027	1536	12	1260	1500
4/0 AWG	1545414	CU	3	CN	TRXLPE	19	0.512	0.017	0.539	0.175	0.908	0.045	0.988	0.064	1.116	.20 X #14	0.063	1.216	3882	9.7	3386	1250
500 KCMIL	4003577	AL	1	LC	TRXLPE	37	0.789	0.023	0.839	0.175	1.193	0.042	1.260	0.011	1.356	.011" X 4.94"	0.088	1.513	1240	18.2	3000	1000
500 KCMIL	4003576	AL	3	LC	TRXLPE	37	0.789	0.023	0.839	0.175	1.193	0.042	1.260	0.011	1.356	.011" X 4.94"	0.088	1.513	1240	18.2	6000	1000
750 KCMIL	4003578	AL	3	LC	TRXLPE	61	0.968	0.028	1.013	0.175	1.383	0.042	1.450	0.010	1.546	.010" X 5.5"	0.088	1.703	4728	20.4	9000	1000
750 KCMIL	4157994	CU	3	LC	TRXLPE	61	0.968	0.028	1.013	0.175	1.383	0.042	1.450	0.010	1.546	.010" X 5.5"	0.088	1.703	9550	20.4	12000	1000
1000 KCMIL	4003580	AL	1	LC	TRXLPE	61	1.117	0.028	1.177	0.175	1.530	0.042	1.600	0.009	1.696	.009" X 6.00"	0.125	1.916	1964	23	6000	1000
1000 KCMIL	4003579	AL	3	LC	TRXLPE	61	1.117	0.028	1.177	0.175	1.530	0.042	1.600	0.009	1.696	.009" X 6.00"	0.125	1.916	5892	23	12000	1000
1000 KCMIL	4197338	AL	1	LC	EPR	61	1.117	0.027	1.171	0.175	1.521	0.030	1.581	0.010	1.691	0.010" X 5.47"	0.110	1.911	2079	23	8000	1500
1000 KCMIL	4193767	CU	1	LC	EPR	61	1.117	0.028	1.162	0.175	1.530	0.042	1.600	0.009	1.776	.009" X 6.00"	0.125	2.039	4178	24.5	8000	1000
25KV MEDIUM VOLTAGE CABLE																					
1000 KCMIL	4206140	AL	1	LC	TRXLPE	61	1.760	0.028	1.162	0.260	1.693	0.042	1.760	0.009	1.856	.009" X 6.63"	0.125	2.079	2185	24.9	6000	1000

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PRIMARY CABLE PHYSICAL DATA

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.01-105

REVISED	BY	CHK'D	APPR.
0 11/13/17	FLETCHER	EANES	ADCOCK
1			
2			
3			

PRIMARY CABLE ELECTRICAL DATA

GENERAL INFORMATION						ELECTRICAL PROPERTIES					
CONDUCTOR SIZE	ITEM NUMBER	AL OR CU	NUMBER OF CABLES	METALLIC SHIELD	INSULATION TYPE	PHASE DC RESISTANCE @ 25° C (OHMS/1000 FT.)	PHASE AC RESISTANCE @ 90° C (OHMS/1000 FT.)	REACTANCE (OHMS/1000 FT.)	POSITIVE/NEGATIVE SEQUENCE IMPEDANCE (OHMS/1000 FT.)	CAPACITANCE (uFARADS/1000 FT.)	SUSCEPTANCE (uSIEMENS/1000 FT.)
15KV MEDIUM VOLTAGE CABLE											
1/0 AWG	4205784	AL	1	LC	TRXLPE	0.1670	0.2101	0.0480	0.211 + j0.048	0.0590	j22.150
1/0 AWG	4205786	AL	3	LC	TRXLPE	0.1670	0.2101	0.0480	0.211 + j0.048	0.0590	j22.150
4/0 AWG	1545414	CU	3	CN	TRXLPE	0.0510	0.064	0.0416	0.661 + j0.0407	0.0813	j30.6937
500 KCMIL	4003577	AL	1	LC	TRXLPE	0.0354	0.045	0.0366	0.0467 + j0.0362	0.1203	j45.3782
500 KCMIL	4003576	AL	3	LC	TRXLPE	0.0354	0.045	0.0366	0.0467 + j0.0362	0.1203	j45.3782
750 KCMIL	4003578	AL	3	LC	TRXLPE	0.02558	0.0329	0.0347	0.0347 + j0.0348	0.1360	j51.3069
750 KCMIL	4157994	CU	3	LC	TRXLPE	0.0144	0.0194	0.0339	0.0211 + j0.0348	0.1360	j51.3069
1000 KCMIL	4003580	AL	1	LC	TRXLPE	0.0176	0.0234	0.0338	0.0252 + j0.0334	0.1590	j59.9890
1000 KCMIL	4003579	AL	3	LC	TRXLPE	0.0176	0.0235	0.0340	0.025 + j0.034	0.1520	j57.41
1000 KCMIL	4197338	AL	1	LC	EPR	0.0176	0.0235	0.0340	0.025 + j0.034	0.1590	j59.86
1000 KCMIL	4193767	CU	1	LC	EPR	0.0108	0.0151	0.0355	0.0172 + j0.0354	0.1840	j69.4595
25KV MEDIUM VOLTAGE CABLE											
1/0 AWG	4206140	AL	1	LC	TRXLPE	0.0176	0.0233	0.0360	0.0252 + j0.0359	0.1125	j42.4432

NOTES:

1. REACTANCE AND POSITIVE/NEGATIVE SEQUENCE IMPEDANCE VALUES ARE BASED ON A THREE-PHASE, TRIFOIL ARRANGEMENT.

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.01-107

REVISED	BY	CK'D	APPR.
0 12/31/15	EANES	FLETCHER	ADCOCK
1 1/5/16	EANES	FLETCHER	ADCOCK
2			
3			

PRIMARY CABLE AMPACITY RATINGS

GENERAL INFORMATION					AMPACITY (AMPERES)											
					DIRECT BURIED				DIRECT BURIED PVC				RISER			
					SUMMER		WINTER		SUMMER		WINTER		SUMMER		WINTER	
CONDUCTOR SIZE	AL OR CU	NUMBER OF CABLES	METALLIC SHIELD	INSULATION TYPE	NORMAL	EMERGENCY	NORMAL	EMERGENCY	NORMAL	EMERGENCY	NORMAL	EMERGENCY	NORMAL	EMERGENCY	NORMAL	EMERGENCY
15KV MEDIUM VOLTAGE CABLE																
1/0 AWG	AL	1	LC	TRXLPE	223	281	251	294	166	203	177	211	133	180	155	195
1/0 AWG	AL	3	LC	TRXLPE	225	270	242	282	167	205	178	213	151	203	177	221
4/0 AWG	CU	3	CN	TRXLPE	430	516	461	539	324	399	347	416	292	398	342	432
500 KCMIL	AL	3	LC	TRXLPE	533	642	573	671	402	496	431	518	380	516	446	562
750 KCMIL	AL	3	LC	TRXLPE	662	799	711	836	522	648	559	676	480	665	569	727
750 KCMIL	CU	3	LC	TRXLPE	822	999	883	1045	648	810	694	845	595	830	705	908
1000 KCMIL	AL	3	LC	TRXLPE	763	923	819	966	605	752	648	785	562	775	660	846
1000 KCMIL	AL	3	LC	EPR	761	922	818	965	604	751	647	784	545	750	640	819
1000 KCMIL	CU	3	LC	EPR	899	1098	966	1149	723	905	774	944	669	926	786	1007
25KV MEDIUM VOLTAGE CABLE																
1000 KCMIL	AL	3	LC	TRXLPE	757	916	813	959	606	752	649	785	568	779	667	847

NOTES:

1. RATINGS ARE BASED ON THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE - NORMAL RATINGS
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE - EMERGENCY RATINGS
   - 25°C EARTH AMBIENT TEMPERATURE - SUMMER
   - 15°C EARTH AMBIENT TEMPERATURE - WINTER
   - 40°C AMBIENT AIR TEMPERATURE (FOR RISER RATINGS) - SUMMER
   - 21°C AMBIENT AIR TEMPERATURE (FOR RISER RATINGS) - WINTER
   - 2 FT/SEC WIND SPEED (FOR RISER RATINGS)
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - THREE CURRENT CARRYING CONDUCTORS, EXCEPT WHERE INDICATED FOR SMALLER SINGLE-PHASE APPLICATIONS.
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - 36" DEPTH OF INSTALLATION (TO TOP OF CABLE OR CONDUIT)
   - 6" HORIZONTAL SEPARATION FOR DIRECT BURIED CABLE AND CONDUITS

2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFETIME OF THE CABLE.

3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.

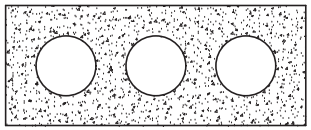
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATION INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-109

REVISED	BY	CK'D	APPR.
0 12/31/15	EAMES	FLETCHER	ADCOCK
1			
2			
3			



15 KV THREE-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	202	245	178	219	340	420	425	526	529	656	656	820	613	762	600	745	732	916
2	191	233	163	200	308	378	380	468	470	580	583	724	541	670	532	658	649	809
3	182	221	151	185	283	347	347	425	426	524	529	655	490	604	483	595	588	731

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

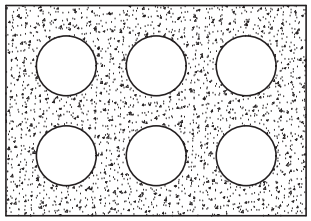
PRIMARY CABLE
AMPACITY RATINGS
DUCT BANK THREE-WAY

DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-111A

REVISED	BY	CK'D	APPR.
0 12/31/15	EANES	FLETCHER	ADCOCK
1			
2			
3			



15 KV SIX-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	202	245	178	219	340	419	425	525	528	655	656	819	612	761	599	744	731	915
2	191	232	163	200	308	378	380	467	469	579	582	723	540	669	531	657	648	808
3	182	221	151	185	283	346	346	424	425	523	528	653	489	602	482	594	587	730
4	174	211	141	172	263	322	320	392	392	481	487	601	450	553	444	546	542	672
5	167	203	134	163	249	303	301	368	369	451	457	564	422	518	417	512	508	629
6	161	196	128	155	236	288	285	348	349	426	432	532	398	488	394	483	481	594

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

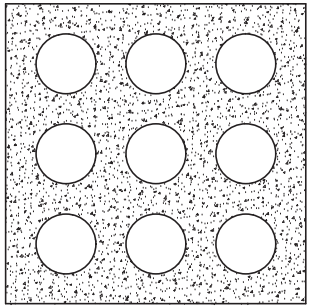
PRIMARY CABLE
AMPACITY RATINGS
DUCT BANK SIX-WAY

DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-111B

REVISED	BY	CK'D	APPR.
0 12/31/15	EAMES	FLETCHER	ADCOCK
1			
2			
3			



15 KV NINE-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	201	245	178	218	339	418	423	524	527	653	654	816	610	759	597	742	729	912
2	191	232	162	199	306	376	378	465	466	576	579	719	538	665	529	653	645	804
3	181	220	150	184	281	344	344	422	423	520	524	649	485	598	479	590	584	725
4	173	210	140	171	261	319	318	389	390	478	483	597	446	549	441	542	538	666
5	166	202	133	162	247	301	299	365	365	447	453	559	418	513	414	508	504	624
6	160	195	127	154	234	285	283	345	345	422	428	527	395	484	391	479	476	589
7	155	189	122	148	224	273	270	329	330	402	409	502	376	461	373	457	454	561
8	151	183	117	142	215	262	259	315	315	384	391	480	360	440	357	436	434	536
9	146	178	113	137	207	251	249	302	303	369	375	461	345	422	342	418	417	514

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

PRIMARY CABLE
AMPACITY RATINGS
DUCT BANK NINE-WAY

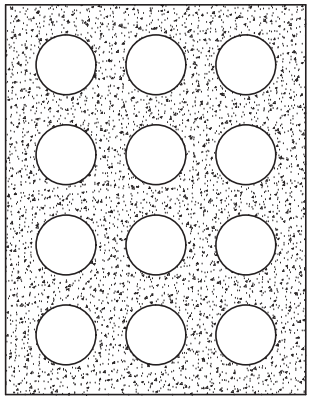
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.01-111C

REVISED	BY	CK'D	APPR.
0 12/31/15	EAMES	FLETCHER	ADCOCK
1			
2			
3			

PRIMARY CABLE AMPACITY RATINGS DUCT BANK TWELVE-WAY



15 KV TWELVE-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	201	244	177	218	338	416	422	521	524	650	650	812	607	755	595	738	726	908
2	190	231	161	198	304	374	375	462	463	571	575	714	534	660	525	648	640	797
3	180	219	149	182	279	341	341	418	419	515	519	643	481	593	474	584	578	718
4	172	209	139	170	259	316	315	385	386	472	478	590	442	543	436	536	532	659
5	165	201	132	160	244	298	295	361	361	442	448	552	413	507	409	502	498	617
6	159	193	125	152	232	282	279	341	341	417	423	520	390	477	386	473	470	581
7	154	187	120	146	221	269	266	324	325	396	403	495	371	454	367	450	447	553
8	149	181	115	140	212	259	255	310	310	378	385	472	354	433	351	429	428	528
9	145	176	111	135	204	248	245	297	298	363	369	453	339	415	337	412	410	506
10	141	171	108	131	198	240	237	288	288	351	357	438	328	401	326	398	397	489
11	138	167	105	127	192	233	230	279	279	340	346	425	318	389	316	386	385	474
12	135	164	102	124	187	227	224	271	272	330	337	413	309	377	307	375	374	461

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

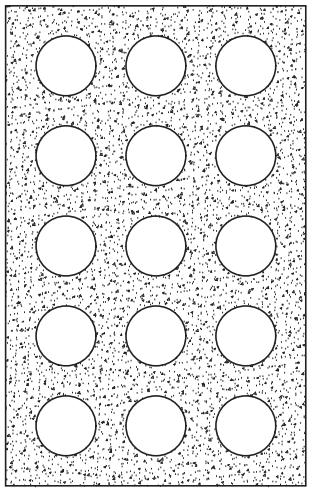
DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-111D

REVISED	BY	CK'D	APPR.
0 12/31/15	EAMES	FLETCHER	ADCOCK
1			
2			
3			

PRIMARY CABLE AMPACITY RATINGS DUCT BANK FIFTEEN-WAY



15 KV FIFTEEN-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	201	244	177	217	337	415	420	519	522	647	648	808	605	751	592	735	722	904
2	189	230	161	197	302	371	373	458	460	567	570	708	530	655	521	644	635	792
3	179	218	148	181	277	339	338	414	415	510	515	637	477	587	470	579	573	713
4	171	208	138	168	257	313	312	381	382	468	473	584	437	537	432	531	526	652
5	164	199	130	159	242	294	292	357	357	437	443	546	408	501	404	496	493	610
6	158	192	124	151	229	278	276	336	337	412	418	514	385	471	381	467	464	574
7	152	185	119	144	218	265	263	320	320	391	397	488	366	447	362	443	441	545
8	147	179	114	138	209	254	251	305	306	373	379	466	349	426	346	423	421	520
9	143	174	110	133	201	244	241	293	293	357	364	446	334	408	332	405	404	498
10	139	169	106	129	195	236	233	283	283	345	351	431	323	394	321	391	390	481
11	136	165	103	125	189	229	226	274	275	334	341	417	313	382	311	379	379	466
12	133	161	101	122	184	223	220	267	267	325	331	405	304	371	302	368	368	453
13	131	158	98	119	180	218	215	260	261	317	323	396	297	362	295	360	359	442
14	128	156	96	117	176	213	210	255	255	310	316	387	290	354	288	351	351	432
15	126	153	94	114	172	208	205	249	249	303	309	378	284	346	282	344	343	422

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

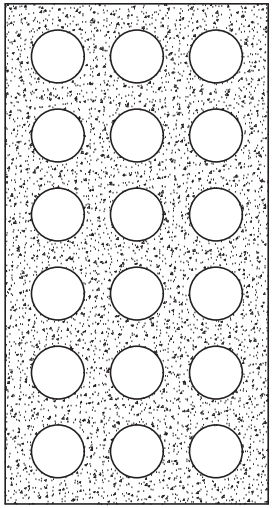
DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-111E

REVISED	BY	CK'D	APPR.
0 12/31/15	EAMES	FLETCHER	ADCOCK
1			
2			
3			

PRIMARY CABLE AMPACITY RATINGS DUCT BANK EIGHTEEN-WAY



15 KV EIGHTEEN-WAY DUCT BANK																		
CIRCUITS	1/0 AL N SINGLE CONDUCTOR	1/0 AL E SINGLE CONDUCTOR	1/0 AL N THREE CONDUCTORS	1/0 AL E THREE CONDUCTORS	4/0 CU N	4/0 CU E	500 AL N	500 AL E	750 AL N LC TRXLPE	750 AL E LC TRXLPE	750 CU N LC TRXLPE	750 CU E LC TRXLPE	1000 AL N LC TRXLPE	1000 AL E LC TRXLPE	1000 AL N LC EPR	1000 AL E LC EPR	1000 CU N LC EPR	1000 CU E LC EPR
1	200	243	176	216	335	413	418	517	520	644	645	805	602	748	589	731	719	899
2	189	229	160	196	301	369	370	455	457	563	566	703	526	650	517	639	631	786
3	178	217	147	180	275	336	335	411	412	506	511	632	472	582	466	574	568	706
4	170	207	137	167	254	310	309	377	378	463	469	578	433	532	428	526	521	646
5	163	198	129	157	239	292	289	353	354	432	438	540	404	496	400	491	487	603
6	157	190	123	149	227	276	273	333	333	407	413	508	381	466	377	462	459	567
7	151	183	117	142	216	262	260	316	316	386	392	482	361	442	358	438	436	538
8	146	177	113	136	207	251	248	301	302	368	374	459	344	421	341	417	416	513
9	142	172	108	131	199	241	238	289	289	352	359	440	330	403	327	400	398	491
10	138	167	105	127	192	233	230	279	279	340	346	424	318	388	316	386	385	474
11	135	163	102	123	186	226	223	270	271	329	336	411	308	376	306	374	373	459
12	132	159	99	120	181	219	216	262	263	319	326	399	299	365	297	363	362	446
13	129	156	97	117	177	214	211	256	256	312	318	389	292	356	290	354	353	435
14	127	154	95	115	173	210	206	250	251	304	311	380	285	347	283	345	345	425
15	124	151	93	112	169	205	202	244	245	297	303	371	278	339	277	337	337	414
16	122	148	91	110	166	201	198	239	240	291	297	364	273	332	271	330	330	406
17	120	146	89	108	163	197	194	235	235	286	292	357	267	325	266	324	324	398
18	119	144	88	106	160	194	190	231	231	280	286	350	263	320	261	318	318	391

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT (EXCEPT WHERE NOTED) WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE – NORMAL RATINGS – DESIGNATED WITH AN 'N'
   - 130°C MAXIMUM CONDUCTOR TEMPERATURE – EMERGENCY RATINGS – DESIGNATED WITH AN 'E'
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6" PVC DUCTS
2. OPERATION OF CABLES AT THE EMERGENCY RATINGS SHALL NOT EXCEED 1500 HOURS CUMULATIVE OVER THE LIFE OF THE CABLE.
3. OPERATION OF CABLES AT VALUES GREATER THAN 200A FOR 4/0 CABLE AND SMALLER, OR AT VALUES GREATER THAN 600A FOR 350 MCM AND LARGER CAN EXCEED THE RATINGS OF SPLICES, TERMINATIONS, ELBOWS, ETC AND SHOULD BE INVESTIGATED BEFORE APPLYING.
4. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

DEC	DEM	DEP	DEF
			X

DUKE ENERGY®

23.01-111F

600V UNDERGROUND ALUMINUM CABLE

600V UNDERGROUND ALUMINUM CABLES ARE COMPRISED OF TWO LAYERS, THE CONDUCTOR AND INSULATION. DUKE ENERGY RECEIVES THESE CABLES IN SINGLE CABLE FORM AS WELL AS DUPLEX, TRIPLEX, QUADRUPLEX AND CABLE IN CONDUIT FOR CERTAIN WIRE SIZES. FOR MOST TRIPLEX AND QUADRUPLEX CABLES, THE NEUTRAL WIRE IS SIZED DIFFERENTLY THAN THE LOAD WIRES, AS THE NEUTRAL'S RESPONSIBILITY IS TO CARRY ONLY THE IMBALANCE AMONG THE PHASE WIRES RATHER THAN THE FULL LOAD CURRENT. IMAGES OF THE VARIOUS TYPES OF 600V CONDUCTORS ARE SHOWN BELOW.

CONDUCTOR

THE ALUMINUM CONDUCTOR USED IN DUKE ENERGY'S 600V CABLE IS A STRANDED, RATHER THAN SOLID, CONDUCTOR. THE STRANDING OF CONDUCTORS IS THE FORMATION OF SOLID INDIVIDUAL WIRE STRANDS INTO A COMPOSITE CONSTRUCTION TO ACHIEVE A SPECIFIED CROSS-SECTIONAL AREA. THE NUMBER OF STRANDS IS USUALLY BASED ON A GEOMETRIC PROGRESSION OF SINGLE STRAND LAYERS (1, 6, 12, 18 ETC). FOR EXAMPLE, A 19-STRAND CONDUCTOR WOULD BE COMPOSED OF 3 LAYERS WITH 1, 6, AND 12 STRANDS IN EACH RESPECTIVE LAYER.

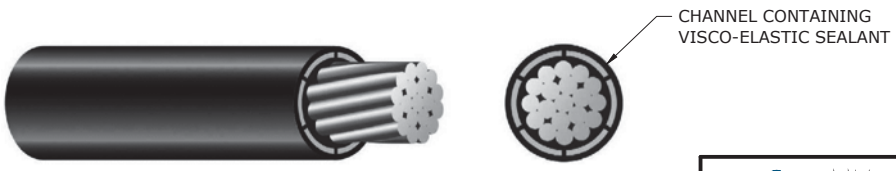
THE NUMBER OF STRANDS IN CONDUCTORS OF THE SAME SIZE CAN DIFFER, HOWEVER, DUE TO A MANUFACTURING TECHNIQUE CALLED SINGLE INPUT WIRE (SIW). THE INDIVIDUAL STRANDS WITHIN A SIW CABLE ALL HAVE THE SAME SIZE BUT CAN VARY IN SHAPE (THEY CAN BE TRAPEZOIDAL, PIE SHAPED, OR HEMISPHERES VERSUS ROUND, FOR EXAMPLE). THE NET RESULT OF THIS TECHNIQUE IS THAT USUALLY FEWER WIRES ARE NEEDED TO ACHIEVE THE SAME CROSS SECTIONAL AREA THAT IS REQUIRED.

SECONDARY ALUMINUM CONDUCTORS DO NOT HAVE THE SAME STRAND FILL COMPOUND USED IN PRIMARY CABLES.

INSULATION

THE BASIC INSULATION USED FOR THESE CABLES IS CROSS-LINKED POLYETHYLENE (XLPE). WITH THE EXCEPTION OF THE TRIPLEX CABLES IN CONDUIT, ALL ALUMINUM SECONDARY CONDUCTORS USE AN ABUSE RESISTANT INSULATION THAT IS ACTUALLY COMPOSED OF TWO LAYERS. THE INNER LAYER IS A LOW DENSITY CROSSLINKED POLYETHYLENE AND THE OUTER LAYER MATERIAL IS A HIGH DENSITY CROSSLINKED POLYETHYLENE.

SOME CABLES AS IDENTIFIED ON DWG 23.02-103 HAVE A SELF-HEALING CAPABILITY. BETWEEN THE INNER AND OUTER LAYERS OF CROSSLINKED POLYETHYLENE ARE A MINIMUM OF 6 CHANNELS CONTAINING A VISCO-ELASTIC SEALANT. THIS SEALANT, IN THE EVENT OF A NICK OR SMALL BREAK IN THE INSULATION, WILL OOZE TO THE SURFACE AND ESSENTIALLY REPAIR, OR SELF-HEAL, ITSELF. THE CHANNELS AND CONSTRUCTION OF THIS CABLE CAN BE SEEN IN THE FIGURE BELOW.



3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

600V UG ALUMINUM CABLE DESIGN

DEC	DEM	DEP	DEF
X	X	X	X

23.02-101

CONDUCTOR SIZE	ITEM NUMBER	SELF HEALING	CABLE LENGTH (FT.)	PACKAGE TYPE	MAX. REEL SIZE
SINGLE CABLE					
4/0 AWG	4003569	NO	1100′	REEL	NRC 36.24.17
DUPLEX CABLE					
#6 - #6	50124380	YES	3000′	REEL	NRC 36.24.17
TRIPLEX CABLE					
#2 - #2 - #4	4158154	NO	1100′	REEL	NRC 32.24.12
2/0 - 2/0 - #2	4022212	NO	2000′	COIL	NOT APPLICABLE
4/0 - 4/0 - 1/0	4205638	NO	1500′	COIL	NOT APPLICABLE
350 - 350 - 4/0	4022215	NO	1000′	COIL	NOT APPLICABLE
500 – 500 – 350	4158173	NO	1000′	REEL	58" X 35"

DUKE ENERGY.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

600V ALUMINUM CABLE BASIC INFORMATION

DEC	DEM	DEP	DEF
			X

23.02-103

GENERAL INFORMATION		PHASE INFORMATION					NEUTRAL INFORMATION				OVERALL BUNDLED CABLE DIAMETER (IN.)	OVERALL BUNDLED CABLE AREA (SQ. IN.)	APPROX. WEIGHT (LB./1000 FT.)	MIN. BENDING RADIUS (IN.)	MAX. TENSION (LBS.)	MAX. SIDEWALL BEARING PRESSURE (LBS.)
CONDUCTOR SIZE	ITEM NUMBER	NUMBER STRANDS	METALLIC CONDUCTOR DIAMETER (IN.)	NOMINAL INSULATION THICKNESS (IN.)	OVERALL INDIVIDUAL CABLE DIAMETER(S) (IN.)	NUMBER STRANDS	METALLIC CONDUCTOR DIAMETER (IN.)	NOMINAL INSULATION THICKNESS (IN.)	OVERALL INDIVIDUAL CABLE DIAMETER(S) (IN.)							
SINGLE CABLE																
4/0 AWG	4003569	18	0.498	0.080	0.658	NA	NA	NA	NA		NA	NA	263	2.6	1270	900
DUPLEX CABLE																
#6 - #6	50124380	7	0.178	0.080	0.338	7	0.178	0.080	0.338		0.676	0.18	104	2.7	315	750
TRIPLEX CABLE																
#2 - #2 - #4	4158154	7	0.283	0.060	0.403	7	0.255	0.060	0.375		0.870	0.37	249	3.5	796	750
2/0 - 2/0 - #2	4022212	11	0.395	0.080	0.555	7	0.283	0.080	0.443		1.199	0.64	454	6.0	1597	750
4/0 - 4/0 - 1/0	4205638	18	0.498	0.080	0.658	9	0.352	0.080	0.512		1.421	0.89	678	7.1	2539	750
350 - 350 - 4/0	4022215	30	0.641	0.095	0.831	18	0.498	0.080	0.658		1.795	1.42	1118	9.0	4200	750
500 – 500 – 350	4158173	37	0.789	0.095	0.979	30	0.641	0.095	0.831		2.115	2.05	1598	12.7	6000	750

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

600V ALUMINUM CABLE PHYSICAL DATA

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

23.02-105

GENERAL INFORMATION		ELECTRICAL PROPERTIES					
CONDUCTOR SIZE	ITEM NUMBER	PHASE DC RESISTANCE @ 20° C (OHMS/1000 FT.)	PHASE AC RESISTANCE @ 90° C (OHMS/1000 FT.)	REACTANCE (OHMS/1000 FT.)	IMPEDANCE (OHMS/1000 FT.)	CAPACITANCE (picoFARADS/FT.)	SUSCEPTANCE (SIEMENS/1000 FT.)
SINGLE CABLE							
4/0 AWG	4003569	0.0820	0.1049	0.4884	0.4952	0.3041	114.66
DUPLEX CABLE							
#6 - #6	50124380	0.6676	0.8535	0.0351	0.6685	0.1321	49.81
TRIPLEX CABLE							
#2 - #2 - #4	4158154	0.2636	0.3375	0.0314	0.2655	0.2397	90.37
2/0 - 2/0 - #2	4022212	0.1313	0.1684	0.0308	0.1349	0.2492	93.93
4/0 - 4/0 - 1/0	4205638	0.0828	0.1059	0.0288	0.0877	0.3041	114.66
350 - 350 - 4/0	4022215	0.0500	0.0641	0.0281	0.0574	0.3264	123.05
500 – 500 – 350	4158173	0.0350	0.0450	0.0270	0.0442	0.3927	148.05

DUKE ENERGY.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

600V ALUMINUM CABLE ELECTRICAL DATA

DEC	DEM	DEP	DEF
			X

23.02-107

CONDUCTOR SIZE	AMPACITY (AMPERES)										
	DIRECT BURIED			DIRECT BURIED PVC					RISER		
				ONE CKT. PER CONDUIT			MULTIPLE CKTS. PER CONDUIT				
	1 CKT.	2 CKTS.	3 CKTS.	1 CKT.	2 CKTS.	3 CKTS.	2 CKTS.	3 CKTS.	1 CKT.	2 CKTS.	3 CKTS.
SINGLE CABLE											
2/0 AWG	268	457	622	174	326	459	269	365	142	227	298
4/0 AWG	347	589	797	233	432	603	352	489	187	299	393
350 KCMIL	459	771	1040	312	572	798	491	655	259	414	544
750 KCMIL	693	1145	1532	497	896	1233	777	-	428	685	899
1000 KCMIL	803	1316	1755	577	1036	1422	-	-	511	818	1073
DUPLEX CABLE											
#6 - #6	124	-	-	79	-	-	-	-	61	-	-
TRIPLEX CABLE IN CONDUIT											
#6 - #6 - #6 IN CONDUIT	-	-	-	79	-	-	-	-	-	-	-
#4 - #4 - #4 IN CONDUIT	-	-	-	102	-	-	-	-	-	-	-
TRIPLEX CABLE											
#6 - #6 - #6	124	-	-	79	-	-	-	-	61	-	-
#2 - #2 - #4	211	-	-	132	-	-	-	-	106	-	-
2/0 - 2/0 -#2	305	530	714	200	371	525	308	404	163	-	-
4/0 - 4/0 -1/0	393	680	912	257	482	678	412	528	215	-	-
4/0 - 4/0 -2/0	393	680	912	257	482	678	412	528	215	-	-
350 -350 - 4/0	518	888	1188	351	654	913	570	737	298	-	-
500 - 500 - 350	627	1072	1431	435	805	1119	710	919	390	-	-
QUADRUPLEX CABLE											
2/0 - 2/0 - 2/0 - #1	268	457	622	174	326	459	269	365	142	227	298
4/0 - 4/0 - 4/0 - 1/0	347	589	797	233	432	603	352	489	187	299	393
4/0 - 4/0 - 4/0 - 2/0	347	589	797	233	432	603	352	489	187	299	393
350 - 350 -350 - 4/0	459	771	1040	312	572	798	491	655	259	414	544
500 - 500 - 500 - 350	558	931	1251	396	718	993	612	832	339	542	712

NOTES:

1. RATINGS ARE BASED ON THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 40°C AMBIENT AIR TEMPERATURE (FOR RISER RATINGS)
   - 2 FT/SEC WIND SPEED (FOR RISER RATINGS)
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - THREE CURRENT CARRYING CONDUCTORS FOR QUADRUPLEX CABLES, TWO CURRENT CARRYING CONDUCTORS FOR TRIPLEX CABLES
   - SINGLE CABLE RATINGS ARE BASED ON THREE CURRENT CARRYING CONDUCTORS
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 30” DEPTH OF INSTALLATION (TO TOP OF CABLE OR CONDUIT)
   - CONDUIT SIZE IS BASED ON RECOMMENDED CONDUIT FILL PER DWG. 22.07-102
   - 6” HORIZONTAL SEPARATION FOR DIRECT BURIED CABLES AND CONDUITS
   - MULTIPLE CIRCUITS FOR RISER RATINGS ARE ASSUMED TO BE IN THE SAME CONDUIT OR U-GUARD

2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

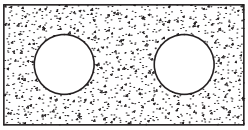
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/5/16	EANES	FLETCHER	ADCOCK
0	12/31/15	EANES	FLETCHER	ADCOCK

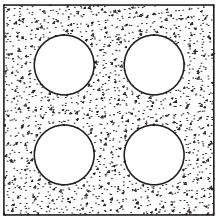
600V ALUMINUM CABLE AMPACITY RATINGS DIRECT BURIED AND RISER

DEC	DEM	DEP	DEF
X	X	X	X

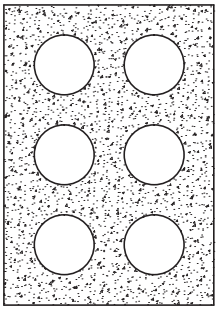
23.02-111



TWO-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	188	247	332	412	520	606
2	174	227	302	372	464	538



FOUR-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	188	247	332	412	518	604
2	173	226	301	371	463	536
3	163	211	280	343	426	492
4	153	198	261	318	394	453



SIX-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	188	246	330	410	516	601
2	172	225	299	368	460	532
3	161	208	275	337	418	483
4	152	196	258	315	389	448
5	144	186	244	297	366	421
6	138	177	232	282	347	398

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6” PVC DUCTS

2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

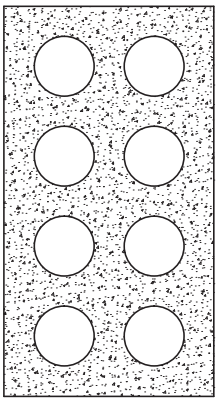
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK

600V ALUMINUM CABLE
AMPACITY RATINGS
DUCTBANK

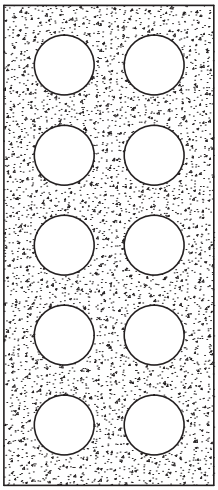
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.02-113A



EIGHT-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	187	245	329	408	514	598
2	171	223	297	365	456	528
3	159	206	273	334	414	478
4	150	194	255	311	385	443
5	143	184	241	293	361	415
6	136	175	229	278	342	392
7	131	168	220	266	327	375
8	127	163	212	257	315	360



TEN-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	186	244	328	406	511	595
2	171	222	295	363	453	524
3	158	205	271	331	410	473
4	149	192	253	308	381	438
5	141	181	238	289	356	409
6	134	173	226	274	337	386
7	129	166	217	262	322	369
8	125	160	209	252	310	354
9	121	155	203	245	300	343
10	118	151	197	237	291	332

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6” PVC DUCTS

2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

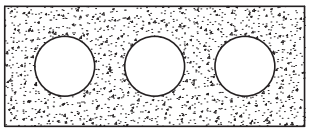
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

600V ALUMINUM CABLE
AMPACITY RATINGS
DUCTBANK

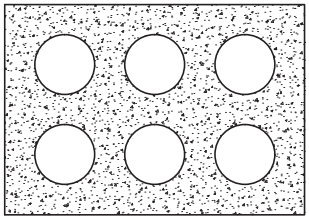
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.02-113B



THREE-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	189	248	333	413	520	607
2	174	227	303	373	466	540
3	163	211	279	342	425	491



SIX-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	189	247	332	412	520	606
2	174	222	302	372	465	539
3	162	211	279	342	424	490
4	153	198	261	318	393	453
5	146	188	247	300	370	426
6	139	179	235	285	351	403

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6” PVC DUCTS

2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

600V ALUMINUM CABLE
AMPACITY RATINGS
DUCTBANK

DEC	DEM	DEP	DEF
X		X	X

23.02-113C

CONDUCTOR SIZE	AMPACITY (AMPERES)										
	DIRECT BURIED			DIRECT BURIED PVC					RISER		
				ONE CKT. PER CONDUIT			MULTIPLE CKTS. PER CONDUIT				
	1 CKT.	2 CKTS.	3 CKTS.	1 CKT.	2 CKTS.	3 CKTS.	2 CKTS.	3 CKTS.	1 CKT.	2 CKTS.	3 CKTS.
SINGLE CABLE											
#10 AWG	85	152	207	53	-	-	-	-	36	58	76
#8 AWG	110	192	261	69	-	-	-	-	49	78	103
#6 AWG	140	244	330	89	-	-	-	-	65	104	137
#2 AWG	235	404	540	149	-	-	-	-	117	187	246
2/0 AWG	345	586	783	224	418	588	338	470	183	293	384
4/0 AWG	447	752	999	300	542	774	454	630	241	386	506
350 KCMIL	586	976	1293	400	734	1023	636	840	336	538	706
500 KCMIL	705	1168	1542	499	886	1254	780	1048	417	667	876
750 KCMIL	860	1412	1857	616	1112	1530	982	1294	531	850	1115
1000 KCMIL	976	1590	2088	702	1260	1728	1143	1474	621	994	1304
THREE CABLES PARALLELED											
350 - 350 - 4/0	661	1136	1521	453	842	1199	736	1087	386	-	-
500 - 500 - 350	801	1370	1830	556	1029	1460	898	1334	480	-	-
750 - 750 -500	987	1682	2241	717	1314	1855	1118	1721	611	-	-
1000 - 1000 - 750	1143	1940	2577	840	1531	2155	1286	2016	714	-	-
FOUR CABLES PARALLELED											
350 - 350 - 350 - 4/0	586	976	1293	400	734	1023	636	840	336	538	706
500 - 500 - 500 - 350	705	1168	1542	499	886	1254	780	1048	417	667	876
750 - 750 - 750 -500	860	1412	1857	616	1112	1530	982	1294	531	850	1115
1000 - 1000 - 1000 - 750	976	1590	2088	702	1260	1728	1143	1474	621	994	1304

NOTES:

1. RATINGS ARE BASED ON THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 40°C AMBIENT AIR TEMPERATURE (FOR RISER RATINGS)
   - 2 FT/SEC WIND SPEED (FOR RISER RATINGS)
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - THREE CURRENT CARRYING CONDUCTORS FOR QUADRUPLEX CABLES, TWO CURRENT CARRYING CONDUCTORS FOR TRIPLEX CABLES
   - SINGLE CABLE RATINGS ARE BASED ON THREE CURRENT CARRYING CONDUCTORS
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 30" DEPTH OF INSTALLATION (TO TOP OF CABLE OR CONDUIT)
   - CONDUIT SIZE IS BASED ON RECOMMENDED CONDUIT FILL PER DWG. 22.07-102
   - 6" HORIZONTAL SEPARATION FOR DIRECT BURIED CABLES AND CONDUITS
   - MULTIPLE CIRCUITS FOR RISER RATINGS ARE ASSUMED TO BE IN THE SAME CONDUIT OR U-GUARD
2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

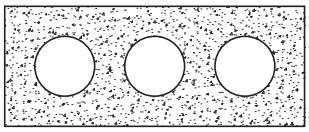
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/5/16	EANES	FLETCHER	ADCOCK
0	12/31/15	EANES	FLETCHER	ADCOCK

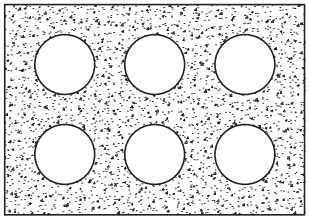
600V COPPER CABLE
AMPACITY RATINGS
DIRECT BURIED AND RISER

DEC	DEM	DEP	DEF
X	X		X

23.03-111



THREE-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	243	318	427	521	645	738
2	224	292	389	471	578	657
3	209	271	358	432	528	597



SIX-WAY DUCT BANK						
CIRCUITS	2/0 AWG NORMAL	4/0 AWG NORMAL	350 MCM NORMAL	500 MCM NORMAL	750 MCM NORMAL	1000 MCM NORMAL
1	243	318	427	521	645	737
2	224	291	388	470	577	656
3	209	270	358	431	526	596
4	196	254	334	401	488	551
5	187	241	316	379	459	518
6	179	230	301	360	435	490

NOTES:

1. RATINGS ARE BASED ON 3 CURRENT-CARRYING CABLES PER DUCT WITH THE FOLLOWING ASSUMPTIONS:
   - 90°C MAXIMUM CONDUCTOR TEMPERATURE
   - 25°C EARTH AMBIENT TEMPERATURE
   - 0.9 °C-M/WATT EARTH THERMAL RESISTIVITY
   - 0.6 °C-M/WATT CONCRETE THERMAL RESISTIVITY
   - CABLES EQUALLY LOADED
   - 75% LOAD FACTOR
   - NO CURRENT IN NEUTRAL
   - 3' DEPTH OF DUCT BANK
   - 6” PVC DUCTS

2. THE NUMBERS IN THE ABOVE TABLES ARE FOR PLANNING PURPOSES. FOR SPECIFIC INSTALLATIONS INVOLVING DIFFERENT CONDUCTORS OR DIFFERENT LOADING LEVELS, THE CYMCAP SOFTWARE SHOULD BE USED TO OBTAIN A MORE REPRESENTATIVE RESULT.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

600V COPPER CABLE
AMPACITY RATINGS
DUCTBANK

DEC	DEM	DEP	DEF
X	X		X

23.03-113

CABLE END SEALS

MOISTURE ENTERING PRIMARY AND SECONDARY CABLES DAMAGES CONDUCTORS AND CAUSES A DECREASE IN LIFE EXPECTANCY. ALL CABLE ENDS MUST BE SEALED ON UNDERGROUND CABLES IN EACH OF THE FOLLOWING SITUATIONS.

- CABLE LEFT ON TRUCKS OR TRAILERS OVERNIGHT.
- PARTIAL REELS LOCATED AT DISTRICTS, OPERATING CENTERS, OR DISTRIBUTION CENTERS.
- INSTALLED CABLE THAT IS NOT IMMEDIATELY TERMINATED.

CREWS SHOULD STOCK ALL APPLICABLE END SEALS ON THEIR VEHICLE. A LIST OF UNDERGROUND CABLES AND THE APPROPRIATE END SEAL FOR THEM IS PROVIDED BELOW. IF AN END SEAL IS NOT IMMEDIATELY AVAILABLE, AN ALTERNATE METHOD OF SEALING CABLE ENDS IS TO APPLY A SQUARE SECTION OF VINYL PLASTIC SEAL DIRECTLY OVER THE EXPOSED END OF THE CABLE AND PRESS THE EDGES DOWN AROUND THE END. NEXT, APPLY VINYL ELECTRICAL TAPE ACROSS THE END OF THE CABLE AND THEN AROUND THE CABLE, COMPLETELY COVERING THE VINYL PLASTIC SEAL.

CABLE SIZE AND TYPE 600 VOLT UNDERGROUND (AL OR CU) UNLESS NOTED	END SEAL ITEM NUMBER			
	DEC	DEM	DEP	DEF
#10 AWG	NA	NA	-	-
#8 AWG	NA	NA	-	4005870
#6 AWG	341734	341734	-	4005870
#2 AWG	47306	47306	-	4005871
#1 AWG	47306	47306	-	-
#1/0 AWG	47306	47306	-	4005872
#2/0 AWG	47307	47307	-	-
#2/0 AWG CU NETWORK	47308	47308	-	-
#4/0 AWG	47308	47308	-	4005873
350 MCM	47309	47309	-	-
500 MCM AL	47309	47309	-	4005874
500 MCM CU	932165	932165	-	-
750 MCM CU	47311	47311	-	-
1000 MCM	1469775	1469775	-	-
1000 MCM CU NETWORK	47313	47313	-	-

CABLE SIZE AND TYPE MEDIUM VOLTAGE UNDERGROUND (AL OR CU)	END SEAL ITEM NUMBER			
	DEC	DEM	DEP	DEF
15KV #10 AWG	932165	932165	-	4005875
15KV #8 AWG	47311	47311	-	4005876
15KV #6 AWG	NA	NA	-	4005877
15KV #2 AWG	1469702	1469702	-	-
15KV #1 AWG	47315	47315	-	-
25KV #1/0 AWG	47311	-	-	-
25KV 350 MCM	47313	-	-	-
25KV 750 MCM	1469702	-	-	-
25KV 1000 MCM	47315	-	-	-
35KV #1/0 AWG	47313	47313	-	-
35KV 750 MCM	1469715	1469715	-	-

DUKE ENERGY.

3				
2				
1				
0	11/13/17	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

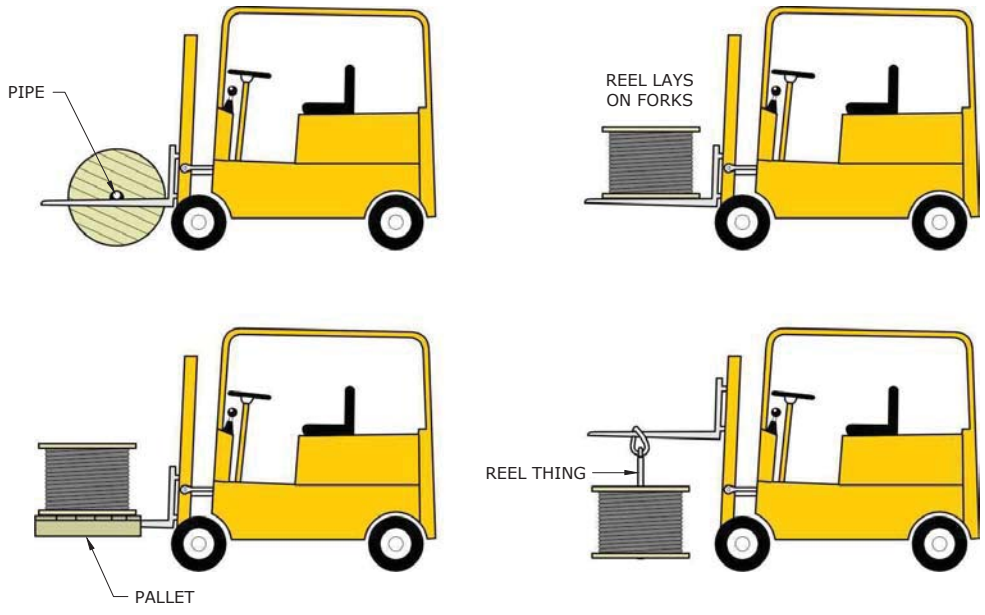
CABLE END SEALS

DEC	DEM	DEP	DEF
X	X	X	X

23.05-101

PROPER HANDLING OF CABLE ON REELS

- WHEN REELS ARE LAID ON ONE FLANGE, THE ATTACHED SPACERS (2X4'S) SHALL BE ON THE BOTTOM.
- NEVER ALLOW THE FORKS OF A LIFT OR ANY OTHER LIFTING DEVICE TO COME INTO CONTACT WITH WIRE OR CABLE ON A REEL.
- NEVER ALLOW THE FLANGES OF ONE REEL TO COME INTO CONTACT WITH WIRE OR CABLE ON ANOTHER REEL. THIS COULD OCCUR WHEN REELS ARE PLACED SIDE-BY-SIDE OR WHEN ONE REEL ROLLS INTO ANOTHER.
- NEVER PICK UP WIRE OR CABLE REELS THAT ARE LAYING ON ONE FLANGE IN A PANCAKED POSITION WITH A FORKLIFT BY PLACING THE FORKS INSIDE THE REEL FLANGES OR BY TOUCHING THE WIRE OR CABLE IN ANY MANNER. INSTEAD LIFT THE REELS BY PLACING THE FORKS OF THE LIFT UNDER THE BOTTOM FLANGE OR BY PLACING A DEVICE, SUCH AS A REEL THING, INSIDE THE ARBOR HOLE OF THE TOP FLANGE.
- NEVER PICK UP WIRE OR CABLE REELS THAT ARE STANDING ON THE EDGE OF THE FLANGES BY PLACING THE FORKS OF THE LIFT IN BETWEEN THE REEL FLANGES AND AGAINST THE WIRE OR CABLE.
- NEVER PICK UP WIRE OR CABLE REELS THAT ARE STANDING ON THE EDGE OF THE FLANGES BY PLACING A SLING AROUND THE WIRE OR CABLE ON THE REEL.
- ALWAYS LIFT REELS STANDING ON THE EDGE OF THE FLANGES BY:
  1. PLACING A REEL RACK BAR THROUGH THE ARBOR HOLES OF THE REEL AND ATTACHING A SLING TO THE BAR.
  2. PLACING THE FORKS OF A LIFT UNDER BOTH FLANGES WHEN FACING THE SIDE OF THE REEL.
  3. SQUEEZING THE OUTSIDE OF THE FLANGES WITH THE FORKS ON THE LIFT.
- NEVER ROLL A REEL OFF A TRUCK OR TRAILER. THE WEIGHT OF A LOADED REEL IS SUFFICIENT TO DAMAGE A WOODEN OR STEEL REEL.



3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

EXAMPLES OF APPROVED
FORKLIFT HANDLING METHODS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.05-103

PROPER STORAGE OF CABLE ON REELS

THE PREFERRED METHOD OF STORING REELS IS WITH THE FLANGES UPRIGHT AND CAPTIVE ARRANGEMENTS TO KEEP THE REELS FROM ROLLING. THIS METHOD SHOULD BE USED WHEN SPACE ALLOWS. WHEN STORAGE IS NOT SUFFICIENT TO PERMIT THE USE OF THIS METHOD, STACKING REELS MAY BE PRACTICED PROVIDED THE FOLLOWING CONDITIONS ARE MET:

- SPACERS MUST BE USED BETWEEN REELS AND BETWEEN THE BOTTOM REEL AND THE GROUND. THIS KEEPS THE REELS FROM CONTINUOUSLY STANDING IN CONTACT WITH WATER OR DIRT AND PROVIDES SPACE UNDER THE REELS FOR LIFTING WITH FORKLIFTS.
- REELS MUST NOT BE STACKED EXCESSIVELY HIGH SUCH THAT THEY CREATE SAFETY HAZARDS.
- ADEQUATE SPACE MUST BE MAINTAINED BETWEEN STACKS OF REELS. REELS IN ADJACENT STACKS MUST NOT TOUCH.
- KEEP END SEALS ON CABLE AT ALL TIMES.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PROPER STORAGE OF CABLE ON REELS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.05-104

THE FOLLOWING PROCESSES MUST BE FOLLOWED WHEN HANDLING AND STORING REEL-LESS 600V CABLE COILS.

- NEVER CUT THE BANDS THAT HOLD REEL-LESS CABLE PACKAGES TOGETHER PRIOR TO PLACING THE COIL ONTO A PLASTIC REEL OR METAL STEM.
- NEVER ALLOW THE TEETH OF AN EXCAVATING BUCKET TO COME INTO CONTACT WITH A METAL STEM.
- REEL-LESS CABLE PACKAGES MUST BE LOADED ONTO STEMS OR PLASTIC REELS ACCORDING TO THE INFORMATION PROVIDED ON DWGS. 23.05-107 AND 23.05-109, RESPECTIVELY.
- SLINGS AND CHAINS USED TO LIFT LOADED STEMS AND REELS MUST BE RATED FOR AT LEAST TWICE THE WEIGHT THEY WILL HAVE TO SUPPORT. SLINGS AND CHAINS MUST BE LABELED WITH THEIR RATING. EXAMINE SLINGS FOR DAMAGE PRIOR TO USE.
- NEVER ALLOW LIFTING EQUIPMENT (SLINGS, FORKLIFTS, ETC) TO COME INTO CONTACT WITH THE CABLE.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PROPER HANDLING AND STORAGE OF
REEL-LESS CABLE COILS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

23.05-105

LOADING REEL-LESS CABLE COILS ONTO A METAL STEM

THE FOLLOWING PROCESS MUST BE FOLLOWED WHEN LOADING REEL-LESS PACKAGES ONTO A METAL STEM.

- PLACE THE REEL-LESS PACKAGE ON ASPHALT, CONCRETE, OR A SMOOTH, PROTECTIVE SURFACE IN A STANDING POSITION.
- PLACE AN EMPTY METAL STEM (SEE FIGURE 1) NEAR THE REEL-LESS PACKAGE TO BE LOADED.
- PLACE PROTECTIVE COVERS OVER BOTH FORKS OF A LIFT.
- USING THE PROTECTED ENDS OF THE FORKS, PUSH THE REEL-LESS PACKAGE ONTO ITS SIDE IN A PANCAKED POSITION.
- USING THE PROTECTED FORKS, SQUEEZE THE REEL-LESS PACKAGE AND LIFT IT OFF THE GROUND.
- CENTER THE REEL-LESS PACKAGE OVER THE METAL STEM AND GENTLY LOWER IT INTO POSITION.
- REMOVE THE PROTECTIVE COVERS FROM THE FORKS AND RETURN THEM TO WHERE THEY ARE STORED.
- REMOVE THE BANDS HOLDING THE REEL-LESS PACKAGE TOGETHER AND THE PROTECTIVE WRAP ONLY WHEN IT IS TIME TO USE THE CABLE.
- ONCE THE CABLE IS PLACED ON THE STEM, A SWIVEL CAN BE PLACED IN THE TOP OF THE STEM FOR TRANSPORT AND CABLE PAYOFF (SEE FIGURE 2).

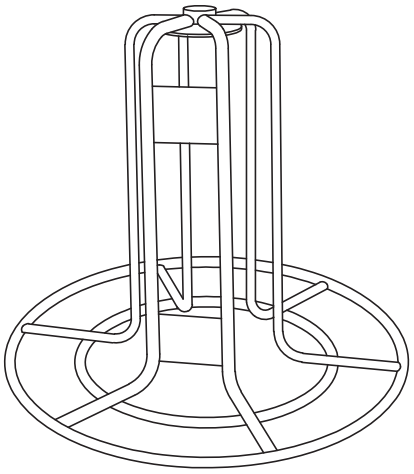


FIGURE 1
REEL-LESS COIL STEM

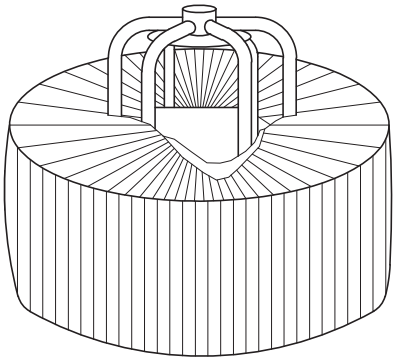


FIGURE 2
REEL-LESS CABLE COILS MOUNTED ON A STEM

						DEC	DEM	DEP	DEF
3					LOADING REEL-LESS CABLE COILS ONTO A METAL STEM				
2									
1						X	X	X	X
0	12/31/15	EANES	FLETCHER	ADCOCK		23.05-107			
REVISED		BY	CK'D	APPR.					

LOADING REEL-LESS PACKAGES ONTO A PLASTIC REEL

THE FOLLOWING PROCESS MUST BE FOLLOWED WHEN LOADING REEL-LESS PACKAGES ONTO A PLASTIC REEL.

- PLACE A PROTECTIVE COVER OVER ONE OF THE FORKS OF A LIFT.
- INSERT THE PROTECTED FORK INTO THE CENTER OF A REEL-LESS CABLE PACKAGE.
- LIFT THE REEL-LESS PACKAGE AND SET IT ON A FLAT SURFACE AT LEAST 12 INCHES ABOVE GROUND AND SLIGHTLY NARROWER THAN THE COIL. ALTERNATIVELY, IN THE DEC AND DEM AREAS UTILIZE ITEM # 1479058, A SECURE BASE THAT IS APPROXIMATELY 12 INCHES TALL AND SLIGHTLY LARGER THAN THE AREA OF THE REEL-LESS PACKAGE.
- UNSCREW THE REMOVABLE FLANGE FROM A PLASTIC REEL.
- PICK UP THE PLASTIC REEL AND SLIDE THE CORE OF THE REEL INTO THE HOLE OF THE REEL-LESS PACKAGE, BEING CAREFUL NOT TO DAMAGE THE CABLE.
- TO KEEP THE PLASTIC REEL IN POSITION WHILE INSTALLING THE REMOVABLE FLANGE, GENTLY PLACE THE FORKS OF A LIFT AGAINST THE PLASTIC REEL OR HAVE A PERSON TO HOLD THE PLASTIC REEL.
- SCREW THE REMOVABLE FLANGE BACK ONTO THE PLASTIC REEL.
- ALL APPROVED METHODS FOR HANDLING WOOD REELS, SEE DWG. 23.05-103, CAN ALSO BE USED WITH PLASTIC REELS EXCEPT FOR THE USE OF A 'REEL THING' OR 'REEL JIG' INSERTED INTO THE ARBOR HOLE TO LIFT THE REEL.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

LOADING REEL-LESS CABLE COILS
ONTO A PLASTIC REEL

DEC	DEM	DEP	DEF
X	X	X	X

23.05-109

LOADING REELS ONTO A TRUCK OR TRAILER RACK

- VERIFY THAT THE LIFTING EQUIPMENT AND SLINGS CAN SAFELY HANDLE TWICE THE WEIGHT OF THE REEL.
- STAND THE REEL ON THE EDGE OF THE FLANGES.
- REMOVE THE REEL RACK BAR FROM THE TRUCK OR TRAILER.
- INSERT THE RACK BAR THROUGH THE ARBOR HOLES OF THE REEL.
- INSPECT SLINGS FOR DETERIORATION OR DAMAGE.
- PLACE THE SLINGS AROUND THE RACK BAR ON EACH SIDE OF THE REEL AND OVER THE HOOK ON THE LIFTING EQUIPMENT. NEVER PLACE THE SLINGS AROUND THE WIRE OR CABLE ON THE REEL.
- KEEP EVERYONE CLEAR AS THE REEL IS LIFTED AND MOVED INTO POSITION ON THE TRUCK OR TRAILER.
- CAREFULLY LOWER THE REEL UNTIL THE BAR IS SUPPORTED BY THE RACK.
- SECURE THE BAR IN THE RACK WITH THE APPROPRIATE LOCKING PIN.

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

LOADING REELS ONTO A TRUCK OR TRAILER RACK

DEC	DEM	DEP	DEF
X	X	X	X

23.05-111

24.00 GENERAL INFORMATION

24.01 TRANSFORMERS

24.03 CAPACITORS, PRIMARY METERS, AND SECONDARY ENCLOSURES

24.05 SWITCHGEAR

24.07 PULL BOXES

DUKE ENERGY.

3					DEC	DEM	DEP	DEF
2								
1								X
0	1/31/19	KATIGBAK	EANES	ADCOCK				
REVISED		BY	CHK'D	APPR.				

SECTION 24 - PADS AND FOUNDATIONS

TABLE OF CONTENTS

SECTION 24 CONTAINS SPECIFICATIONS FOR PADS AND FOUNDATIONS THAT SUPPORT SURFACE-MOUNTED DISTRIBUTION EQUIPMENT, INCLUDING TRANSFORMERS, SWITCHGEAR, SECTIONALIZING MODULES, PRIMARY METERING, CAPACITORS, RECLOSERS AND SECONDARY BUS ENCLOSURES.

PADS FOR THREE-PHASE TRANSFORMERS

PADS FOR THREE-PHASE TRANSFORMERS ARE NOW STANDARDIZED THROUGHOUT THE ENTERPRISE FOR DUKE ENERGY:

THE "PIT PAD" SHALL BE USED FOR ALL THREE-PHASE PAD-MOUNTED TRANSFORMER INSTALLATIONS IN THE DUKE ENERGY CAROLINAS WEST (DEC), DUKE ENERGY MIDWEST (DEM) AND THE NON-COASTAL DUKE ENERGY CAROLINAS EAST (DEP) TERRITORIES. IN THE DUKE ENERGY FLORIDA (DEF) AND COASTAL DEP TERRITORIES, A "FLAT-PAD" SHALL BE USED.

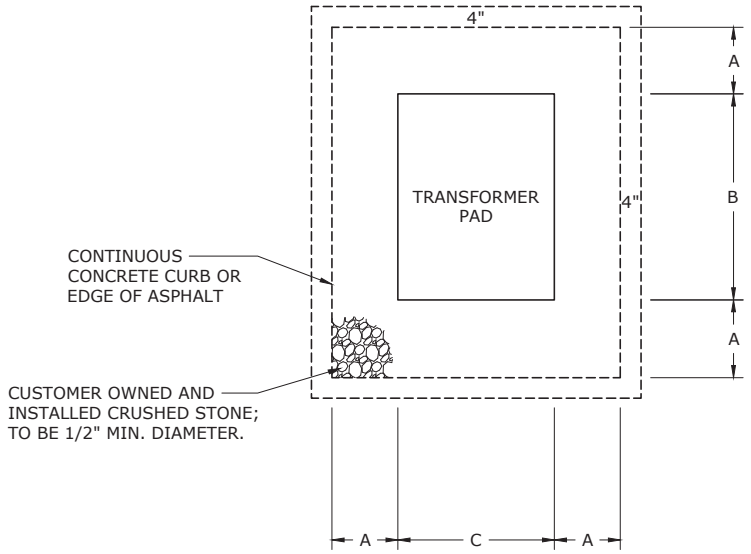
THE "SMALL" PAD SHALL BE USED FOR TRANSFORMERS RATED 300 KVA AND BELOW, AND THE "LARGE" PAD SHALL BE USED FOR TRANSFORMERS RATED 500 KVA AND ABOVE.

THE CUSTOMER IS RESPONSIBLE FOR PROVIDING AND INSTALLING THE CONCRETE THREE-PHASE PAD-MOUNTED TRANSFORMER PAD ACCORDING TO THE SPECIFICATIONS OUTLINED IN THE SERVICE REQUIREMENTS HANDBOOK. THE CUSTOMER MAY CHOOSE TO CONSTRUCT (FORM AND POUR) THE PAD ON SITE OR PURCHASE AND INSTALL A PRE-FABRICATED PAD FROM AN APPROVED SUPPLIER. THE CUSTOMER MUST PROVIDE AND INSTALL THE PRIMARY AND SECONDARY CONDUITS INTO WINDOW OPENING OF THE PAD ACCORDING TO THE SPECIFICATIONS OUTLINED IN THIS DOCUMENT.

THE CUSTOMER IS RESPONSIBLE FOR CONTACTING A DUKE ENERGY REPRESENTATIVE TO INSPECT AND APPROVE THE PAD TO BE USED. IF USING A PRE-CAST PAD, CONTACT THE DUKE ENERGY REPRESENTATIVE AFTER INSTALLATION SO THAT THE CORRECT PAD CAN BE CONFIRMED AND VERIFIED THAT IT IS IN THE CORRECT LOCATION AND LEVEL. IF CONSTRUCTING THE PAD ONSITE, THE DUKE ENERGY REPRESENTATIVE MUST BE CONTACTED TO INSPECT THE FORM OF THE PAD, INCLUDING REBAR, PRIOR TO POURING THE CONCRETE.

DUKE ENERGY RESPONSIBILITIES

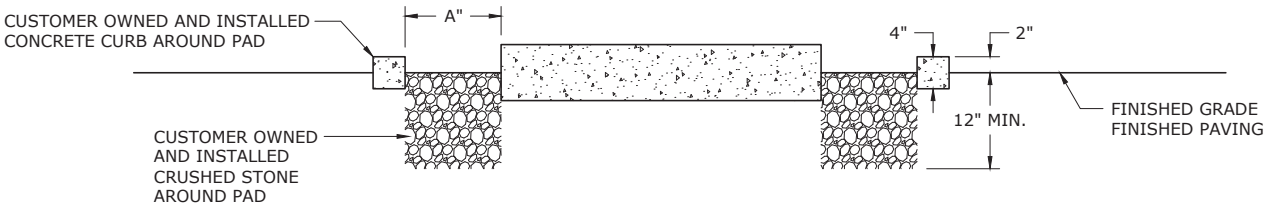
- PROVIDE AND INSTALL THE GROUND ROD(S) PRIOR TO THE INSTALLATION OF THE PAD-MOUNTED TRANSFORMER.
- PROVIDE AND INSTALL THE PAD-MOUNTED TRANSFORMER.
- PROVIDE AND INSTALL THE CONNECTORS TO TERMINATE THE PRIMARY AND SECONDARY CONDUCTORS TO THE TRANSFORMER TERMINALS.
- METERING



PLAN VIEW

PHASE	TRANSFORMER KVA	A	B	C
1Ø	ALL	12"	SEE NOTE 1	SEE NOTE 1
3Ø	75-300	18"	66"	82"
3Ø	500-5000	28"	104"	98"

CURBING AND ABSORPTION BEDS CAN BE USED TO CONTAIN OIL LEAKS AROUND TRANSFORMERS THAT ARE DEFINED AS A "CRITICAL FACILITY" (PER THE ENVIRONMENTAL HANDBOOK) OR ARE LOCATED IN OR IMMEDIATELY ADJACENT TO PAVED AREAS THAT CONTAIN STORM DRAINS. CONSULT THE ENVIRONMENTAL GROUP FOR PROPER APPLICATION OF THIS STANDARD.



NOTES:

1. REFERENCE THE APPROPRIATE DRAWING IN SECTION 24 FOR SPECIFIC SINGLE-PHASE TRANSFORMER PAD DIMENSIONS.

2. TRAFFIC BARRIERS ARE TO BE USED WHEN TRANSFORMER IS EXPOSED TO VEHICLE TRAFFIC. SEE DWG. 36.01-105 FOR TRAFFIC BARRIER DETAILS.

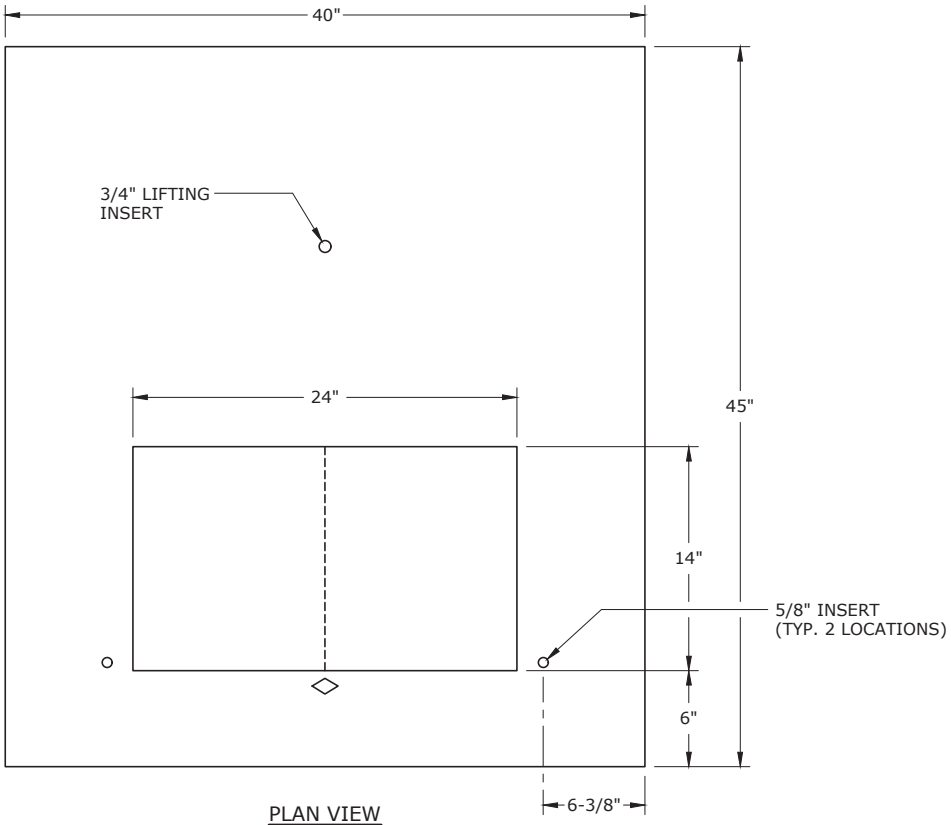
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK

ABSORPTION BEDS FOR TRANSFORMER PADS

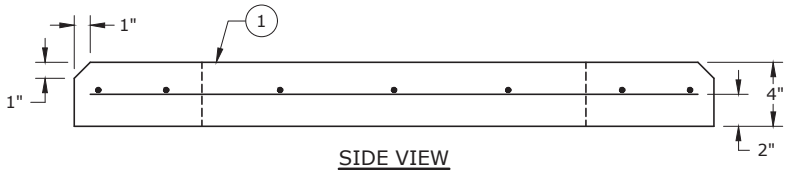
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

24.01-102



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	STRUCT-PAD-TF-CTE-SM-1P-F	1	4004768	1	PAD, CONCRETE, TRANSFORMER, 40" X 45" X 4"

NOTES:

1. SEE DWG. 24.01-102 TO DETERMINE IF CURBING AND ABSORPTION BED IS REQUIRED.
2. PROTECTIVE POLES ARE REQUIRED WHEN TRANSFORMERS ARE EXPOSED TO VEHICLE TRAFFIC. SEE DWG. 36.01-105 FOR PROTECTIVE POLE DETAILS.
3. SEE SECTION 36 FOR ALL TRANSFORMER CLEARANCES.
4. INSTALL PAD ON TOP OF FINAL GRADE.
5. THE SURFACE OF THE PAD MUST BE LEVEL WITHIN 1" ACROSS THE PAD IN ALL DIRECTIONS.
6. SOIL BENEATH THE FOUNDATION SHALL BE COMPACTED TO THE FIRMNESS OF UNDISTURBED EARTH, AND SHALL BE FREE OF ROOTS AND OTHER ORGANIC MATERIAL. BACKFILL AND TAMP THE SOIL AROUND THE PAD SUFFICIENTLY TO PREVENT WASHING. SOD MAY BE REQUIRED AROUND PAD TO PREVENT EROSION.
7. USE FIRE ANT CONTROL IN PAD OPENINGS.
8. FINAL GRADE SHOULD SLOPE AWAY FROM PAD TO ALLOW PROPER WATER RUN-OFF. IF PAD LOCATION IS CUT INTO A HILL, ENSURE MINIMUM THREE (3) FEET OF SPACE IS AVAILABLE BETWEEN PAD AND RETAINING WALLS OR BOTTOM OF THE HILL SLOPE.
9. THE CENTERLINE OF THE PAD SHOULD BE PLACED ON THE PROPERTY LINE UNLESS OTHERWISE SPECIFIED.
10. SECURE TRANSFORMER TO FOUNDATION WITH HOLD DOWN CLAMPS SUPPLIED BY TRANSFORMER MANUFACTURER. SEE SECTION 27 FOR MOUNTING DETAILS.
11. FOR CABLE AND CONDUIT ENTRANCE ZONES, SEE DWG. 27.02-108.
12. CUT AND CAP ALL CONDUITS FLUSH WITH THE TOP OF THE PAD.
13. OTHER UTILITIES SHALL NOT BE INSTALLED UNDER TRANSFORMER PAD. SEE SECTION 36 FOR MINIMUM CABLE CLEARANCES.
14. SEE SECTION 27 OF THIS MANUAL FOR GROUND ROD AND GROUND BUS DETAILS.

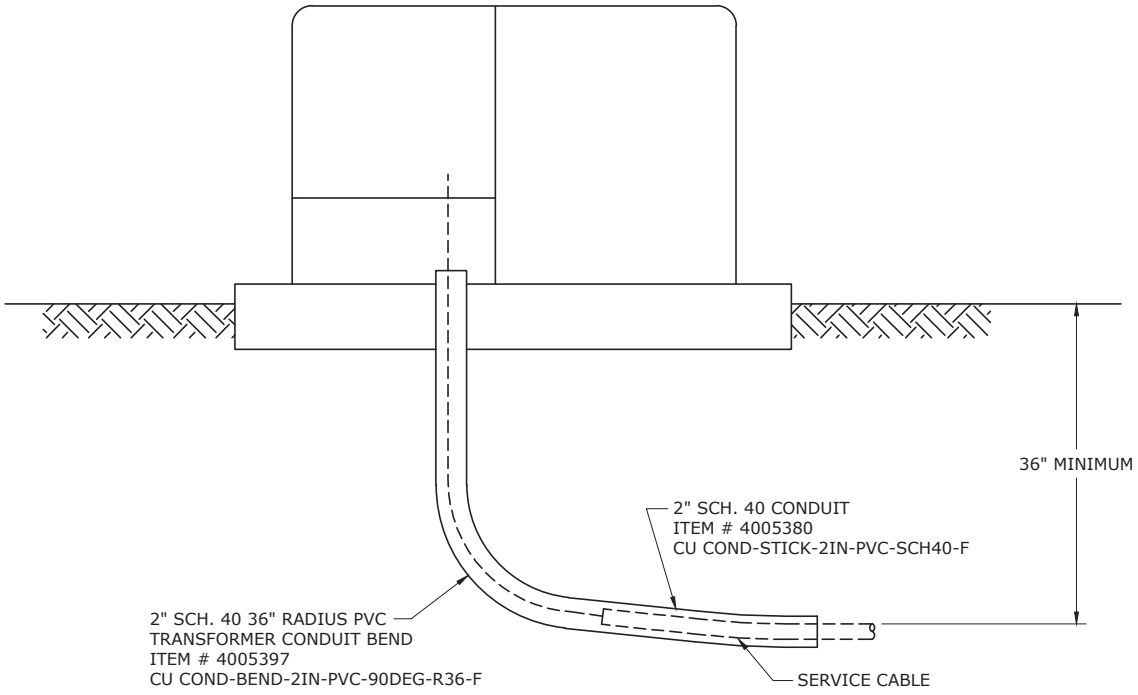
DUKE ENERGY.

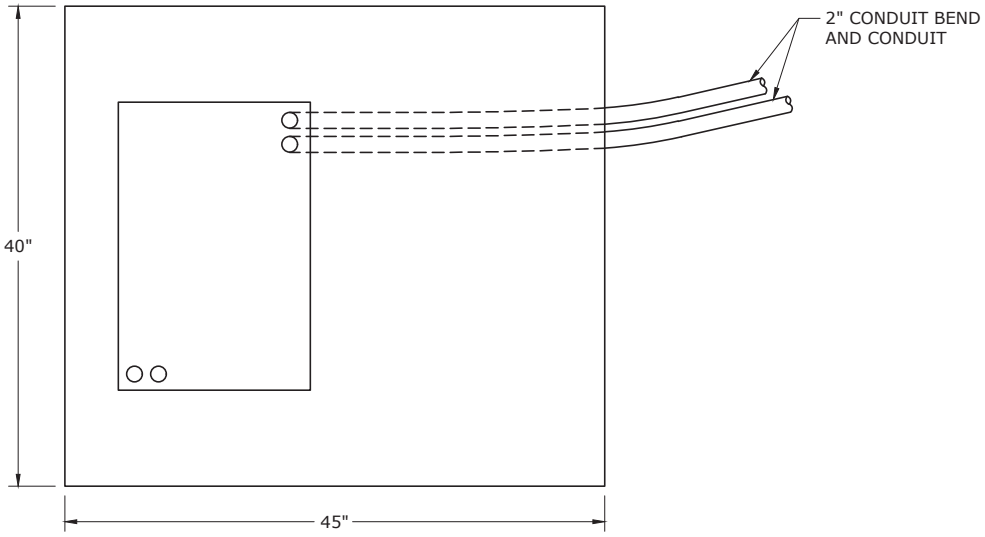
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK

FLAT PAD FOR SINGLE-PHASE PAD-MOUNTED TRANSFORMERS 25 - 167 KVA

DEC	DEM	DEP	DEF
			X

24.01-110





NOTES:

1. INSTALL CONDUIT BEND AND CONDUIT FOR SERVICES TO ADJACENT LOTS TO AVOID DIGGING UNDER TRANSFORMERS.
2. INSTALL CONDUIT CAPS ON EACH END OF CONDUIT TO KEEP SAND OUT OF CONDUIT PRIOR TO INSTALLING SERVICE.
3. CONDUIT SHOULD BE PLACED IN FRONT OF DIRECT BURIED SERVICES.
4. CONDUIT SHOULD EXTEND PAST BACK EDGE OF TRANSFORMER PAD.

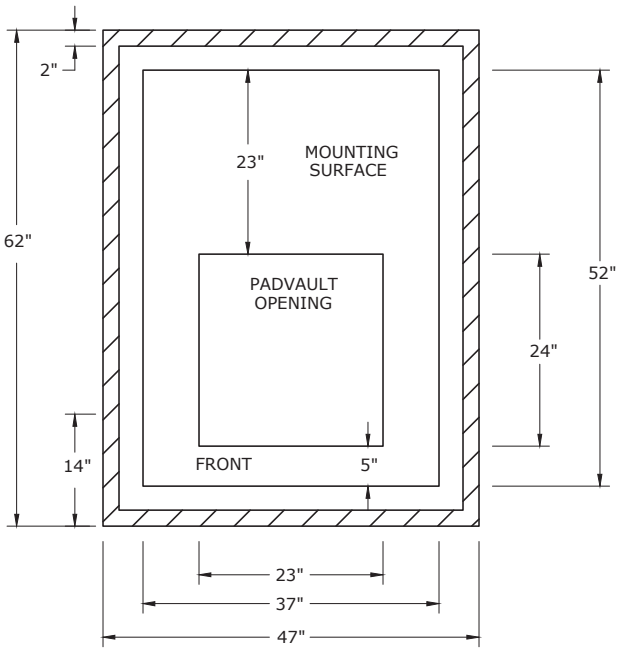
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONDUIT BEND PLACEMENT FOR TRANSFORMER PAD FOR 25 TO 167 KVA SINGLE-PHASE

DUKE ENERGY.

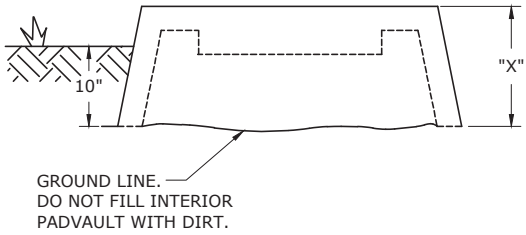
DEC	DEM	DEP	DEF
			X

24.01-111

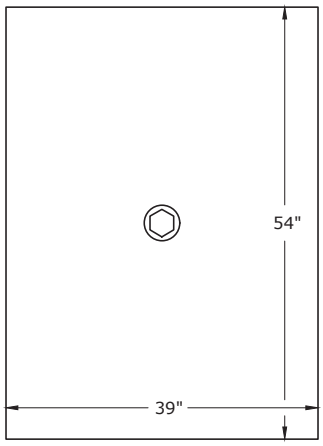


TOP VIEW

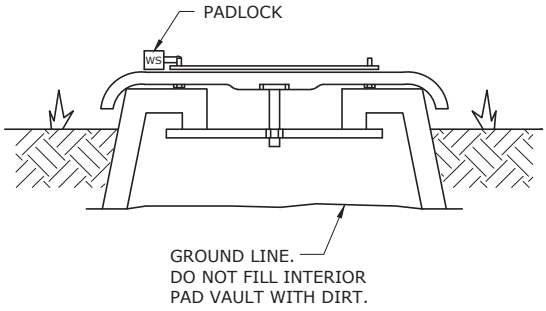
COMPATIBLE UNIT	ITEM NUMBER	"X" (INCHES)
STRUCT-PADVLT-TF-FG-SM-1P-P	4022988	15
STRUCT-PADVLT-TF-FG-SM-1P-F		
STRUCT-PADVLT-TF-FG-LG-1P-P	4173624	30
STRUCT-PADVLT-TF-FG-LG-1P-F		



SIDE VIEW



COVER TOP VIEW
ITEM # 4027882
STRUCT-COVER-PADVLT-TF-FG-1P-P
STRUCT-COVER-PADVLT-TF-FG-1P-F



SIDE VIEW

NOTES:

1. PADVAULT IS TO BE MOUNTED 10" IN THE GROUND. SOIL AROUND PADVAULT TO BE FREE OF ROOTS, TRASH, AND OTHER ORGANIC MATERIALS, AND COMPACTED TO THAT OF UNDISTURBED EARTH.
2. SECURE TRANSFORMER TO FOUNDATION WITH HOLD DOWN CLAMPS SUPPLIED BY THE TRANSFORMER MANUFACTURER. SEE SECTION 27 FOR MOUNTING DETAILS.
3. OLDER TRANSFORMERS WILL NEED TO HAVE 9/16" HOLES DRILLED IN THE SIDE FLANGES FOR BOLTING TO THE PADVAULT. DRILL 9/16" HOLES IN THE SIDE FLANGES 14" FROM THE FRONT OF THE TRANSFORMER, THEN DRILL 9/16" HOLES IN THE PADVAULT. USE 1/2" X 4" HEX HEAD STAINLESS STEEL BOLTS. FILE-DEBURR, AND USE TOUCH-UP PAINT (ITEM # 30246300) ON THE HOLES.
4. INSTALL COVER WHEN TRANSFORMER INSTALLATIONS ARE TO BE DELAYED. USE 1/2" X 8" HEX HEAD STAINLESS STEEL BOLT WITH CAPTIVE THREADS TO SECURE COVER TO PADVAULT AND APPLY PADLOCK.
5. UNIT CAN BE USED FOR A LOOP COVER BOX WITH LOCKED COVER INSTALLED.
6. FOR DEP, SINGLE-PHASE FIBERGLASS PADVAULTS (ITEM # 4022988 AND ITEM # 4173624) ARE ONLY TO BE USED IN WESTERN REGION IN LOCATIONS WHICH HAVE SEVERE SLOPE. FIBERGLASS PADVAULTS ARE ONLY TO BE USED IN EASTERN REGION IN LOCATIONS WHICH HAVE SHIFTING SOILS OR TIDAL WATERS CAUSED BY WINDS AND/OR WATER. NO OTHERS SHALL INSTALL PADVAULTS UNLESS EITHER OF THE ABOVE CONDITIONS ARE ENCOUNTERED OR WHEN USED TO DELAY TRANSFORMER INSTALLATION.
7. FOR DEF, THESE PADVAULTS ARE USED ONLY AT 'THE VILLAGES' DEVELOPMENT.
8. OTHER UTILITIES ARE NOT TO BE INSTALLED UNDER THE TRANSFORMER PAD. SEE SECTION 36 FOR MINIMUM CABLE CLEARANCES.
9. THERE SHALL BE NO ABOVEGROUND OBSTRUCTIONS WITHIN 10' OF FRONT OF THE TRANSFORMER OR WITHIN 3' OF THE SIDES OR BACK. REFER TO THE CLEARANCE SECTION OF THIS MANUAL FOR ADDITIONAL REQUIREMENTS.
10. USE FIRE ANT CONTROL IN PAD OPENINGS.
11. SEE SECTION 27 OF THIS MANUAL FOR GROUND ROD AND GROUND BUS DETAILS.

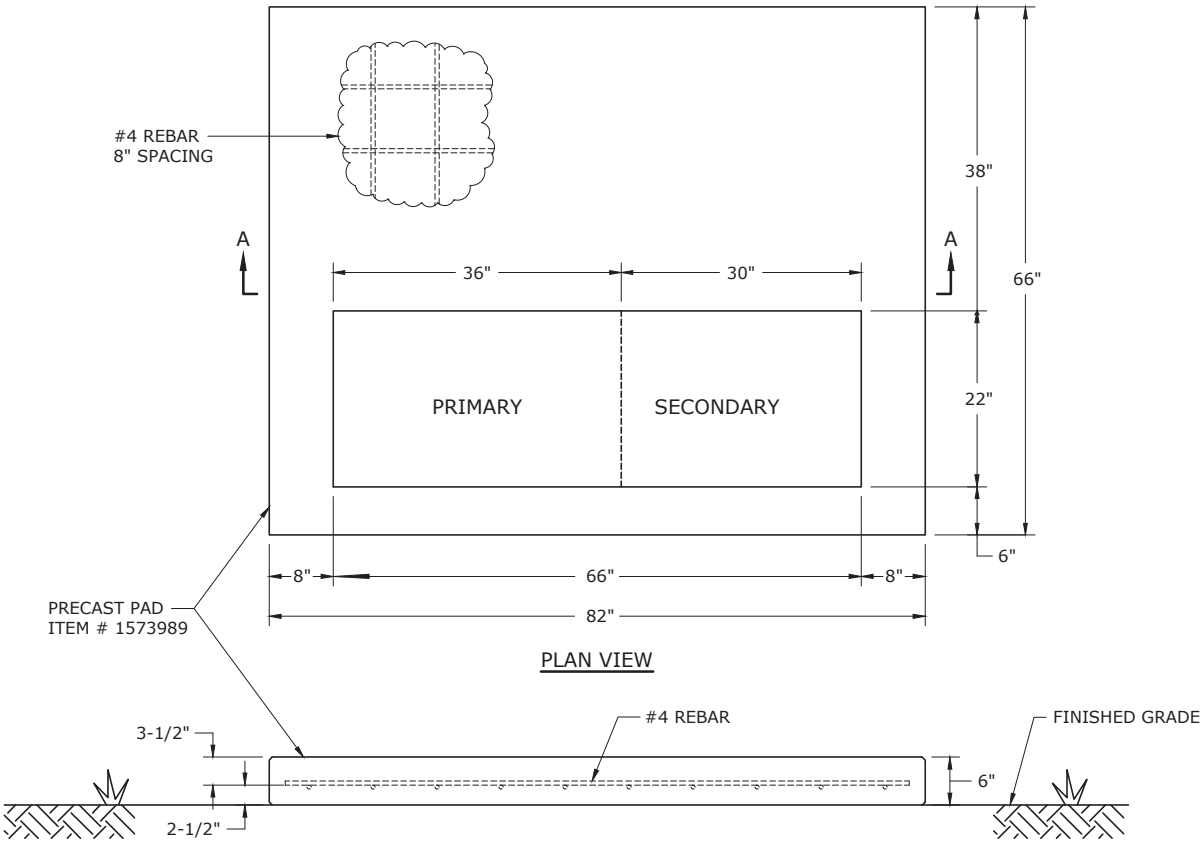
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK

PADVAULT FOR SINGLE-PHASE PAD-MOUNTED TRANSFORMERS

DEC	DEM	DEP	DEF
		X	X

24.01-114



NOTES:

1. THIS STANDARD APPLIES TO THE DEF REGION, AND THE COASTAL AREAS IN THE DEP REGION.
2. THE COMPANY RESERVES THE RIGHT TO REFUSE SERVICE TO NEW INSTALLATIONS THAT DO NOT MEET DUKE ENERGY REQUIREMENTS.
3. REFERENCE DWG. 24.01-102 TO DETERMINE IF CURBING AND ABSORPTION BED IS REQUIRED.
4. PROTECTIVE POLES ARE REQUIRED WHEN TRANSFORMERS ARE EXPOSED TO VEHICLE TRAFFIC. SEE DWG. 36.01-105 FOR PROTECTIVE POLE DETAILS.
5. THERE SHALL BE MINIMUM CLEARANCES OF 10' IN FRONT OF THE TRANSFORMER AND 3' ON ALL OTHER SIDES OF THE TRANSFORMER. SEE DWGS. 36.01-101 AND 36.01-103 FOR MORE DETAILS ON CLEARANCES.
6. TRANSFORMER MUST BE LOCATED IN AN AREA THAT ALLOWS SAFE ACCESS BY DUKE ENERGY CONSTRUCTION AND MAINTENANCE EQUIPMENT IN WET OR DRY WEATHER.
7. CONSIDER FROST ACTION, DRAINAGE, AND LOCAL SOIL CONDITIONS WHEN PREPARING SITE FOR PAD. SOIL UNDERNEATH PADS SHALL BE LEVELED AND COMPACTED. SOIL SHALL ALSO BE FREE OF ROOTS AND OTHER ORGANIC MATERIALS TO PREVENT SETTLING AND EROSION. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
8. USE FIRE ANT CONTROL IN PAD OPENINGS.
9. ALL CONDUITS SHALL BE CUT SO THAT THE TOP OF THE CONDUIT IS FLUSH WITH THE TOP OF THE PAD.
10. CUSTOMER SHALL INSTALL THE CONDUIT FOR THE PRIMARY CONDUCTORS AS CLOSE TO THE CENTER OF THE PRIMARY AREA AS PRACTICAL. THE SECONDARY CONDUITS SHALL BE INSTALLED TO THE RIGHT INSIDE THE SECONDARY AREA. SEE SERVICE GUIDE FOR PAD INSTALLATION DETAILS AND SPECIFICATIONS.
11. OTHER UTILITIES SHALL NOT BE INSTALLED UNDER TRANSFORMER PAD. SEE SECTION 36 FOR MINIMUM CABLE CLEARANCES.
12. SEE SECTION 27 OF THIS MANUAL FOR GROUND ROD AND GROUND BUS DETAILS.

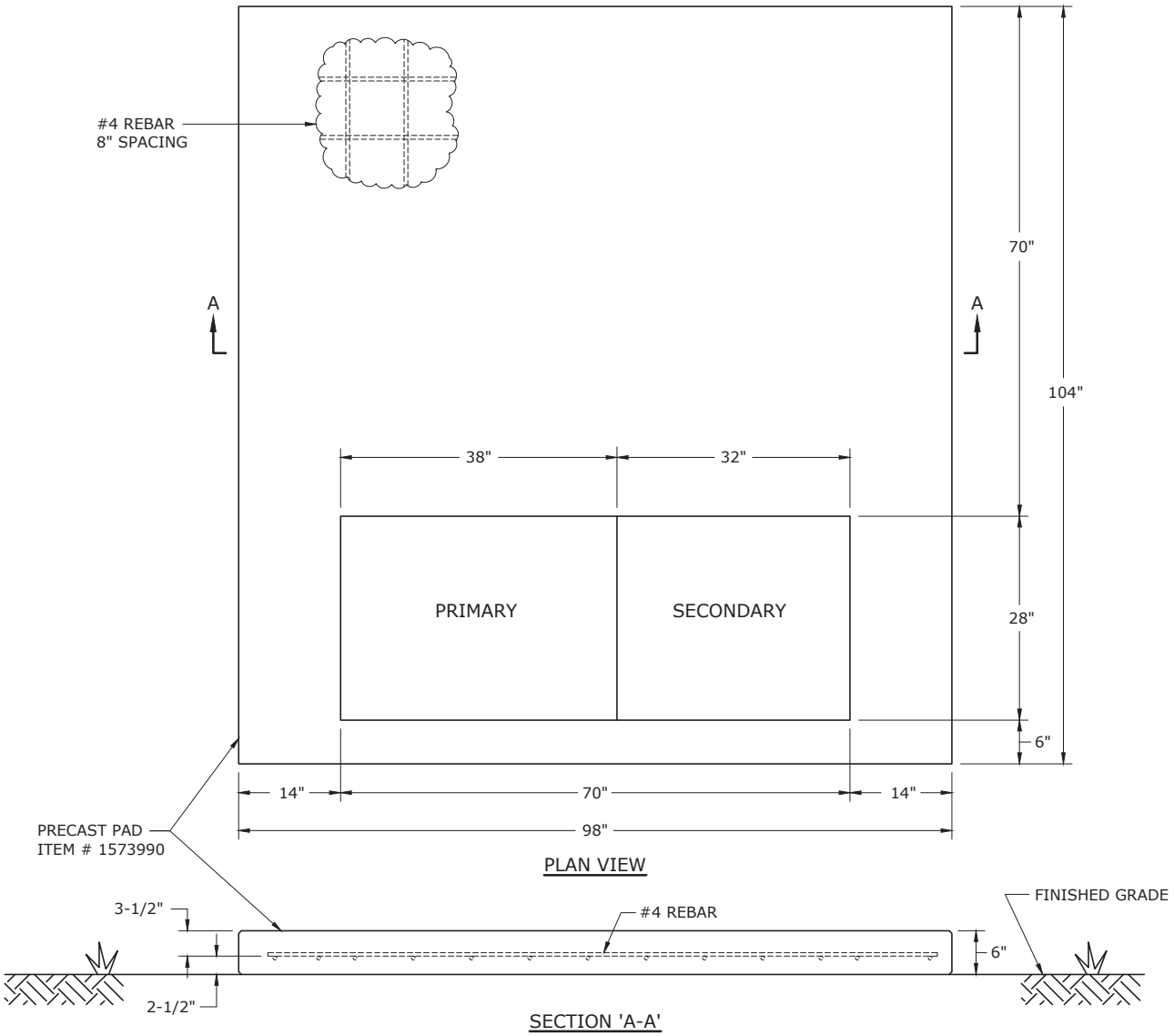
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

FLAT PADS FOR THREE-PHASE PAD-MOUNTED TRANSFORMERS 75 KVA - 300 KVA

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

24.01-116



NOTES:

1. THIS STANDARD APPLIES TO THE DEF REGION, AND THE COASTAL AREAS IN THE DEP REGION.
2. THE COMPANY RESERVES THE RIGHT TO REFUSE SERVICE TO NEW INSTALLATIONS THAT DO NOT MEET DUKE ENERGY REQUIREMENTS.
3. REFERENCE DWG. 24.01-102 TO DETERMINE IF CURBING AND ABSORPTION BED IS REQUIRED.
4. PROTECTIVE POLES ARE REQUIRED WHEN TRANSFORMERS ARE EXPOSED TO VEHICLE TRAFFIC. SEE DWG. 36.01-105 FOR PROTECTIVE POLE DETAILS.
5. THERE SHALL BE MINIMUM CLEARANCES OF 10' IN FRONT OF THE TRANSFORMER AND 3' ON ALL OTHER SIDES OF THE TRANSFORMER. SEE DWGS. 36.01-101 AND 36.01-103 FOR MORE DETAILS ON CLEARANCES.
6. TRANSFORMER MUST BE LOCATED IN AN AREA THAT ALLOWS SAFE ACCESS BY DUKE ENERGY CONSTRUCTION AND MAINTENANCE EQUIPMENT IN WET OR DRY WEATHER.
7. CONSIDER FROST ACTION, DRAINAGE, AND LOCAL SOIL CONDITIONS WHEN PREPARING SITE FOR PAD. SOIL UNDERNEATH PADS SHALL BE LEVELED AND COMPACTED. SOIL SHALL ALSO BE FREE OF ROOTS AND OTHER ORGANIC MATERIALS TO PREVENT SETTLING AND EROSION. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
8. USE FIRE ANT CONTROL IN PAD OPENINGS.
9. ALL CONDUITS SHALL BE CUT SO THAT THE TOP OF THE CONDUIT IS FLUSH WITH THE TOP OF THE PAD.
10. CUSTOMER SHALL INSTALL THE CONDUIT FOR THE PRIMARY CONDUCTORS AS CLOSE TO THE CENTER OF THE PRIMARY AREA AS PRACTICAL. THE SECONDARY CONDUITS SHALL BE INSTALLED TO THE RIGHT INSIDE THE SECONDARY AREA. SEE SERVICE GUIDE FOR PAD INSTALLATION DETAILS AND SPECIFICATIONS.
11. OTHER UTILITIES SHALL NOT BE INSTALLED UNDER TRANSFORMER PAD. SEE SECTION 36 FOR MINIMUM CABLE CLEARANCES.
12. SEE SECTION 27 OF THIS MANUAL FOR GROUND ROD AND GROUND BUS DETAILS.

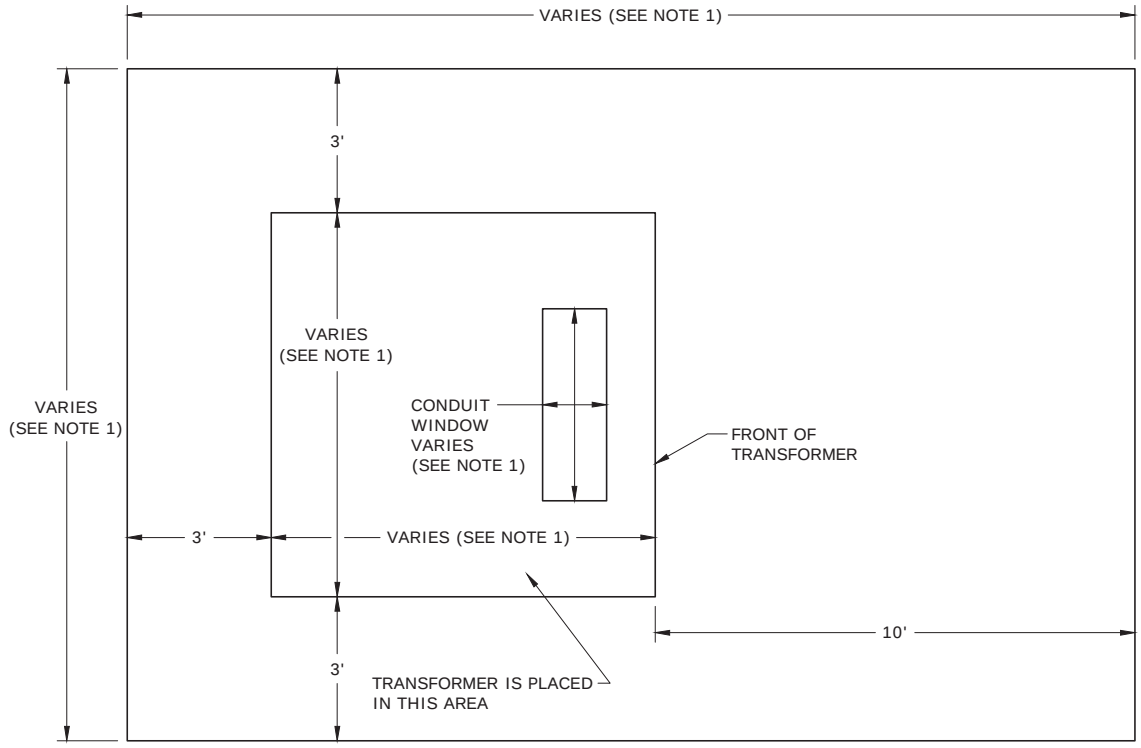
DUKE ENERGY.

3				
2				
1				
0	1/31/19	FLETCHER	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

FLAT PADS FOR THREE-PHASE PAD-MOUNTED TRANSFORMERS 500 KVA- 5000 KVA

DEC	DEM	DEP	DEF
		X	X

24.01-118



PLAN VIEW

NOTE: PROVIDE ACCESS STAIRWAY AND GUARDRAIL PER OSHA REQUIREMENTS IF PAD ELEVATION IS 4 FT OR HIGHER ABOVE GRADE.

NOTES:

1. THE PAD SIZE VARIES BASED ON THE SIZE OF THE TRANSFORMER. SEE DWGS. 24.01-116 THROUGH 24.01-122 FOR THE APPROPRIATE THREE-PHASE PAD-MOUNTED TRANSFORMER PAD AND CONDUIT WINDOW DIMENSIONS.

2. SEE DWG. 24.01-123B FOR ADDITIONAL NOTES.

3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CUSTOMER-INSTALLED ELEVATED PADS FOR THREE-PHASE PAD-MOUNTED TRANSFORMER 75 - 5000 KVA

DEC	DEM	DEP	DEF
X	X	X	X

24.01-123A

NOTES:

1. SCOPE: THIS STANDARD APPLIES TO CUSTOMER-INSTALLED ELEVATED PAD STRUCTURES FOR THREE-PHASE PAD-MOUNTED TRANSFORMERS INSTALLED AT ELEVATIONS HIGHER THAN 24 INCHES ABOVE FINAL GRADE. ELEVATED PADS ARE TYPICALLY REQUIRED WHEN PAD-MOUNTED TRANSFORMERS MUST BE PLACED IN A FLOOD PLAIN.

2. ACCEPTANCE: THE COMPANY RESERVES THE RIGHT TO REFUSE SERVICE TO NEW INSTALLATIONS THAT DO NOT MEET DUKE ENERGY REQUIREMENTS AND MAY ELECT TO REMOVE EXISTING FACILITIES IF THE CUSTOMER FAILS TO PROVIDE ADEQUATE MAINTENANCE TO CUSTOMER OWNED FACILITIES.

3. LOCATION: DUKE ENERGY SHALL BE RESPONSIBLE FOR DETERMINING THE FINAL LOCATION FOR THE TRANSFORMER PAD STRUCTURE. THE CUSTOMER SHALL PROVIDE A LEVEL LOCATION FOR A PAD-MOUNTED TRANSFORMER INSTALLATION AS DIRECTED BY THE COMPANY. THE ELEVATED PAD STRUCTURE MUST BE LOCATED ADJACENT TO AND WITHIN 10 FEET OF A DRIVEWAY OR OTHER AREA ACCESSIBLE TO DUKE ENERGY CONSTRUCTION AND MAINTENANCE EQUIPMENT. NO PART OF THE TRANSFORMER PAD MAY BE WITHIN 12 FEET FROM ANY COMBUSTIBLE WALL, WINDOW, OR VENTILATION OPENING AND 20 FEET FROM ANY DOORWAY IN A BUILDING. THE ELEVATED PAD SURFACE FOOTPRINT IS SPECIFIED SO THAT 3 FEET OF CLEARANCE IS MAINTAINED AROUND THE SIDES AND BACK OF THE TRANSFORMER, AND 10 FEET OF CLEARANCE IS PROVIDED TO THE FRONT OF THE TRANSFORMER. SEE SECTION 36 OF THIS MANUAL FOR ANY ADDITIONAL CLEARANCE REQUIREMENTS FOR OIL-FILLED, PAD-MOUNTED EQUIPMENT.

4. DESIGN: THE CUSTOMER IS RESPONSIBLE FOR THE DESIGN AND CONSTRUCTION OF AN ELEVATED TRANSFORMER PAD STRUCTURE IN ACCORDANCE WITH DUKE ENERGY REQUIREMENTS FOR THE LARGEST TRANSFORMER THAT MAY BE REQUIRED. THE ELEVATED PAD STRUCTURE SHALL BE DESIGNED IN ACCORDANCE WITH SOUND CIVIL AND STRUCTURAL ENGINEERING PRACTICES, LOCAL CODES AND REQUIREMENTS, AND, WHERE APPLICABLE, OSHA REQUIREMENTS FOR GUARDRAILS AND ACCESS STAIRWAYS. FOR STRUCTURES WITH TOP SURFACE DESIGNED AT 4 FEET OR HIGHER ABOVE FINISHED GRADE, THE CUSTOMER MUST PROVIDE CONSTRUCTION DRAWINGS STAMPED AND SEALED BY A LICENSED PROFESSIONAL ENGINEER FOR REVIEW BY DUKE ENERGY. THE ELEVATED STRUCTURE MAY BE SOLID CONCRETE, FILLED RETAINING WALL STRUCTURE, STRUCTURAL STEEL ELEVATED PLATFORM, OR OTHER DESIGN MUTUALLY AGREED UPON BY THE CUSTOMER AND DUKE ENERGY. IF A STEEL STRUCTURE IS EMPLOYED, IT MUST BE BONDED TO THE TRANSFORMER GROUND. IN ALL CASES, THE TRANSFORMER SHALL BE PLACED ON A CONCRETE SURFACE THAT IS FLAT, SMOOTH, AND LEVEL WITHIN 1 INCH IN ALL DIRECTIONS. SEE DWG. 24.01-123A FOR THE PLAN VIEW DIMENSIONS OF THE ELEVATED PAD SURFACE.

5. MATERIALS AND LABOR: THE CUSTOMER SHALL PROVIDE ALL MATERIALS AND LABOR NECESSARY TO INSTALL THE ELEVATED PAD STRUCTURE. THIS INCLUDES: EXCAVATION, BACKFILLING, INSTALLATION OF CONDUIT AND CONDUIT ACCESSORIES, BUILDING FORMS, POURING AND FINISHING CONCRETE, ETC.

6. CONDUIT: THE CUSTOMER SHALL INSTALL, OWN, AND MAINTAIN THE CONDUIT SYSTEM INCLUDING DUCT, MANHOLES, CABLE PITS, AND TRANSFORMER FOUNDATIONS, ETC. CONDUIT SHALL BE INSTALLED IN ACCORDANCE WITH DUKE ENERGY STANDARDS. THE CONDUIT SHALL BE SCHEDULE 40 PVC SUITABLE FOR USE WITH UNDERGROUND ELECTRIC DISTRIBUTION CABLES RATED AT 90°C. ALL CONDUITS SHALL HAVE A UL LISTING AND A SCHEDULE 40 (SCH 40) RATING CLEARLY PRINTED ON THE EXTERIOR SURFACE. DUKE ENERGY WILL SPECIFY THE INSIDE DIAMETER SIZE OF THE PRIMARY CABLE CONDUITS. ALL BENDS SHALL BE 90° "SWEEP" BENDS WITH A MINIMUM RADIUS OF 36". CONDUIT MAY BE DIRECT BURIED IF LOCAL PERMITTING AUTHORITIES ALLOW DIRECT BURIED CONDUIT SYSTEMS. VERTICAL RUNS OF CONDUIT UP TO THE ELEVATED PLATFORM MUST BE IN A CONCRETE-ENCASED, REINFORCED, AND SUPPORTED DUCT BANK. ALL CONDUITS SHALL HAVE A PULL STRING INSTALLED. ALL CONDUITS SHALL BE CAPPED TO PREVENT DEBRIS FROM ENTERING THE CONDUIT.

7. THE MAXIMUM NUMBER OF SERVICE CONDUITS ENTERING INTO THE SECONDARY AREA OF THE PAD OPENING SHALL BE 12 (4" DIA.) UNLESS SPECIFICALLY APPROVED BY ENGINEERING AND CONSTRUCTION PLANNING.

8. UNLESS THE METER IS MOUNTED DIRECTLY ON THE SIDE OF THE TRANSFORMER, CUSTOMER MUST PROVIDE A 2" SCHEDULE 40 PVC CONDUIT FROM THE SECONDARY AREA OF THE PAD OPENING AND STUB UP AND CAP AT THE METER LOCATION. THE CUSTOMER MUST PROVIDE ACCESS TO DUKE ENERGY'S METER IF THE METER IS LOCATED ON TOP OF THE ELEVATED STRUCTURE.

9. THE CUSTOMER MUST PROVIDE A 1" SCHEDULE 40 PVC CONDUIT FOR A GROUND WIRE FROM THE PRIMARY AREA OF THE PAD OPENING AND STUB AND CAP AT A LOCATION 8" BELOW FINAL GRADE OUTSIDE OF THE ELEVATED STRUCTURE FOOTPRINT WHERE DUKE ENERGY WILL INSTALL A GROUND ROD.

10. FOR TRANSFORMERS LARGER THAN 2500 KVA, CONTACT DISTRIBUTION STANDARDS FOR ELEVATED SURFACE DIMENSIONS.

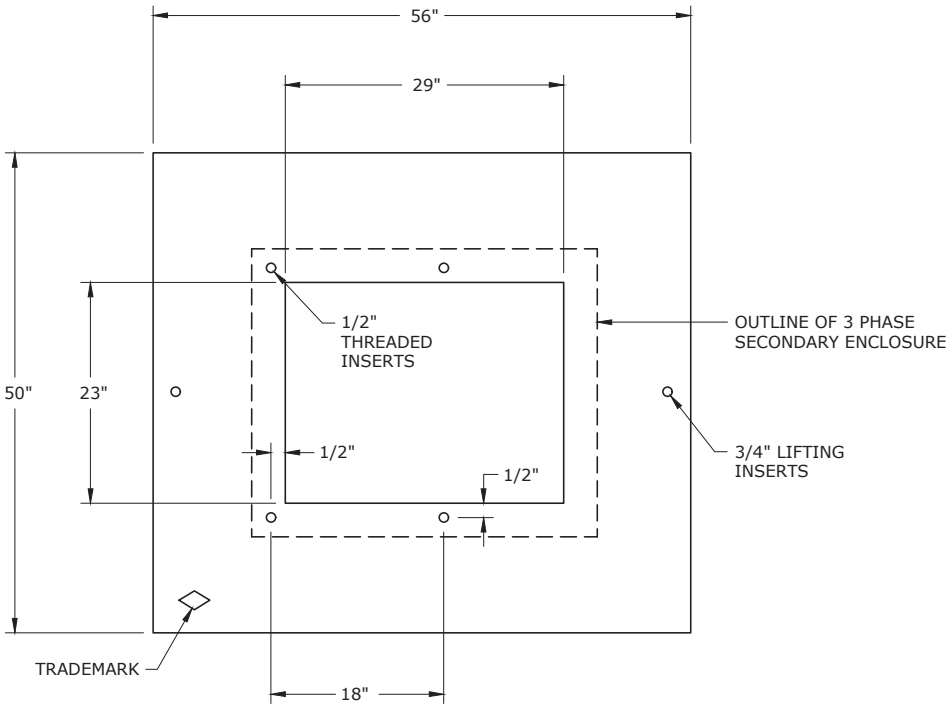
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK

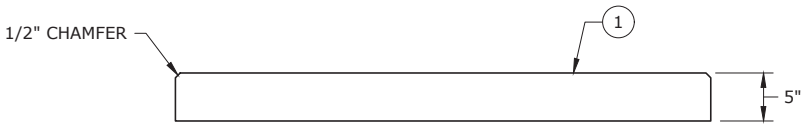
CUSTOMER-INSTALLED ELEVATED PADS
FOR THREE-PHASE PAD-MOUNTED TRANSFORMER
75 - 5000 KVA

DEC	DEM	DEP	DEF
X	X	X	X

24.01-123B



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADS50X56CF	1	327704	1	50" X 56" SECONDARY ENCLOSURE PAD

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 8' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS FLUSH WITH TOP OF PAD AND CAP CONDUIT.
5. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.

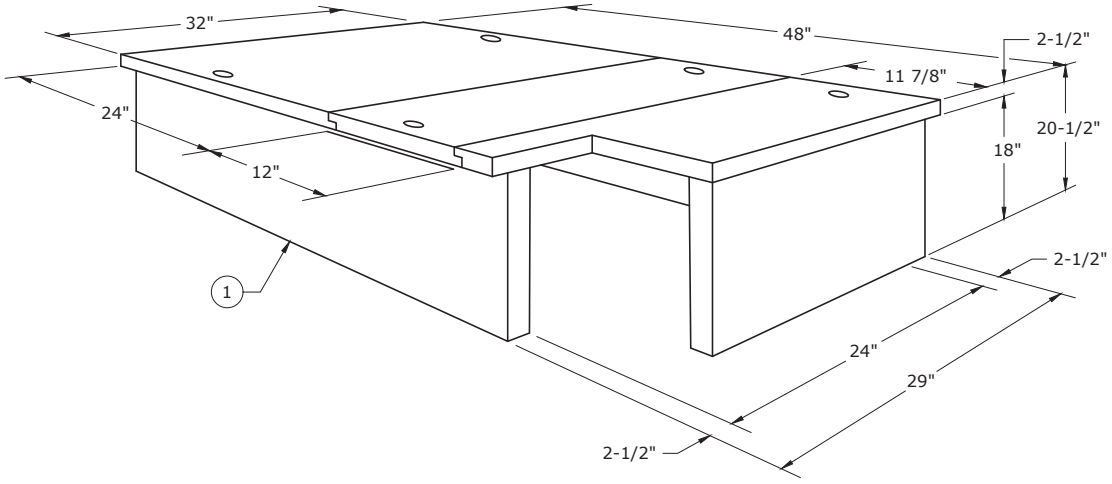
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

DUKE ENERGY.

THREE-PHASE SECONDARY ENCLOSURE PAD

DEC	DEM	DEP	DEF
			X

24.03-01



BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADTMT48X32CF	1	320154	1	BOX
			320162	1	12.875" X 32" LID
			320166	1	24" X 32" LID

NOTES:

1. BELOW GRADE INSTALLATION REQUIRES ELECTRONIC POWER MARKER.
2. WHEN USED AS A SPLICE BOX, USE 1/0 PRIMARY CONDUCTOR MAXIMUM.
3. CAN BE USED AS THREE-PHASE SECONDARY ENCLOSURE MOUNTING BOX. SEE DWG. 25.03-01.
4. CAN BE USED AS A SINGLE-PHASE TRANSFORMER MOUNTING BOX.
5. CUT OFF CONDUITS (IF PRESENT) 6" ABOVE BOTTOM OF BOX AND CAP.
6. DO NOT FILL INTERIOR OF BOX WITH SOIL.
7. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.

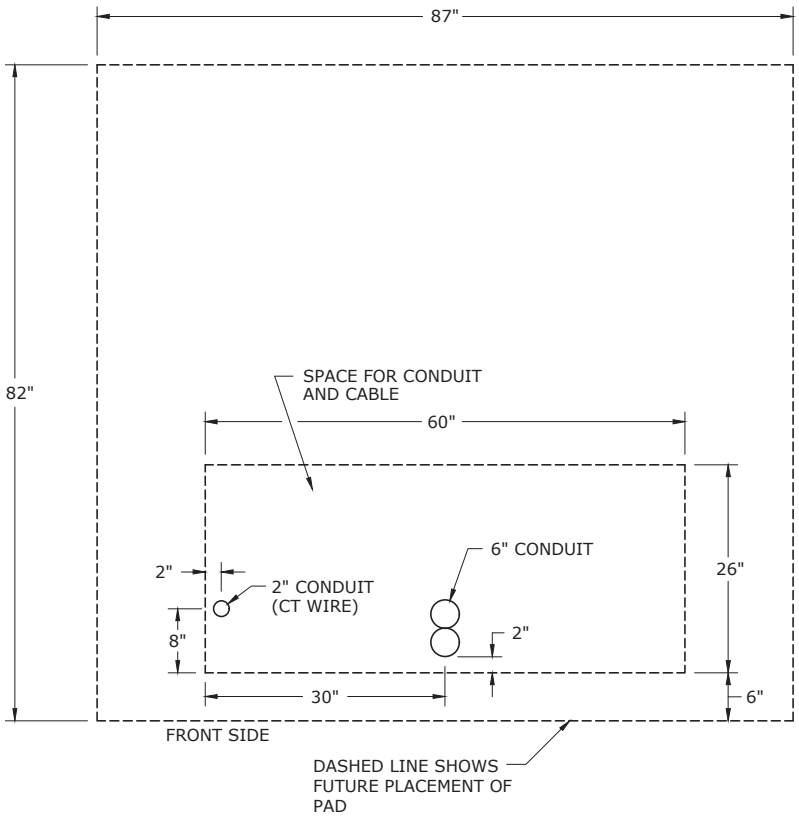
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	8/10/10	DANNA	GUINN	ELKINS

THREE-PHASE SECONDARY ENCLOSURE MOUNTING BOX (SMALL SPLICE BOX) (24" X 43" X 18")

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

24.03-03



CU PAD3P82X87CF
ITEM # 327712
APPROX. WEIGHT: 3350 LBS.

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. THE PAD IS SHOWN AS A REFERENCE AND IS INSTALLED AFTER CABLE AND CONDUIT IS INSTALLED.
3. CUT ALL CONDUITS OFF FLUSH WITH TOP OF PAD AND CAP CONDUIT.
4. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SAND EROSION.
5. USE GENEROUS AMOUNT OF FIRE ANT KILLER UNDER TRANSFORMER PAD.
6. MAINTAIN A 10 FOOT CLEARANCE ON FRONT AND REAR OF CABINET. ALL SIDES TO HAVE 3 FOOT MINIMUM CLEARANCE.
7. SEE DWG. 24.03-112 IF DIRECT BURIED CABLE.

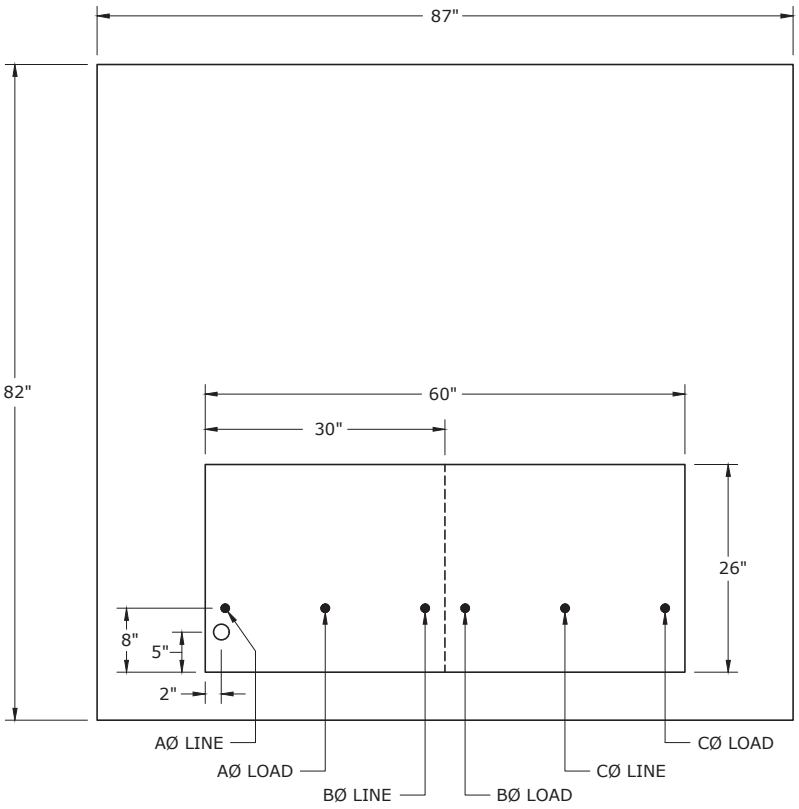
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

CABLE AND CONDUIT PLACEMENT FOR
PAD-MOUNTED METER ENCLOSURE

DEC	DEM	DEP	DEF
			X

24.03-110



NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. THE PAD IS SHOWN AS A REFERENCE AND IS INSTALLED AFTER CABLE AND CONDUIT IS INSTALLED.
3. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SAND EROSION.
4. USE GENEROUS AMOUNT OF FIRE ANT KILLER UNDER TRANSFORMER PAD.

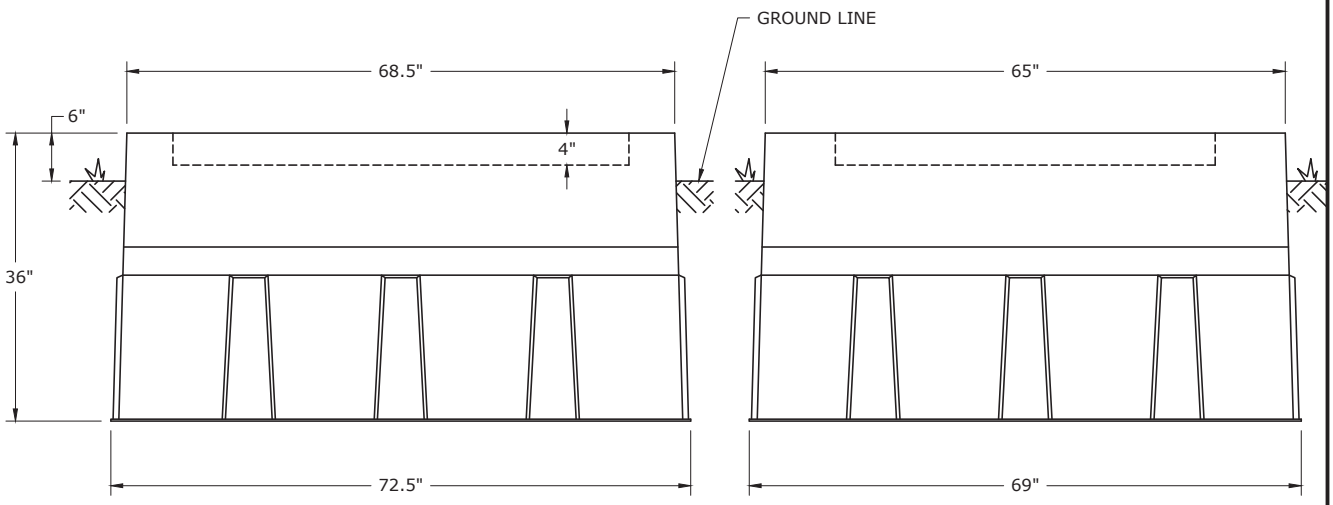
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE AND CONDUIT PLACEMENT FOR
PAD-MOUNTED METER ENCLOSURE

DUKE ENERGY.

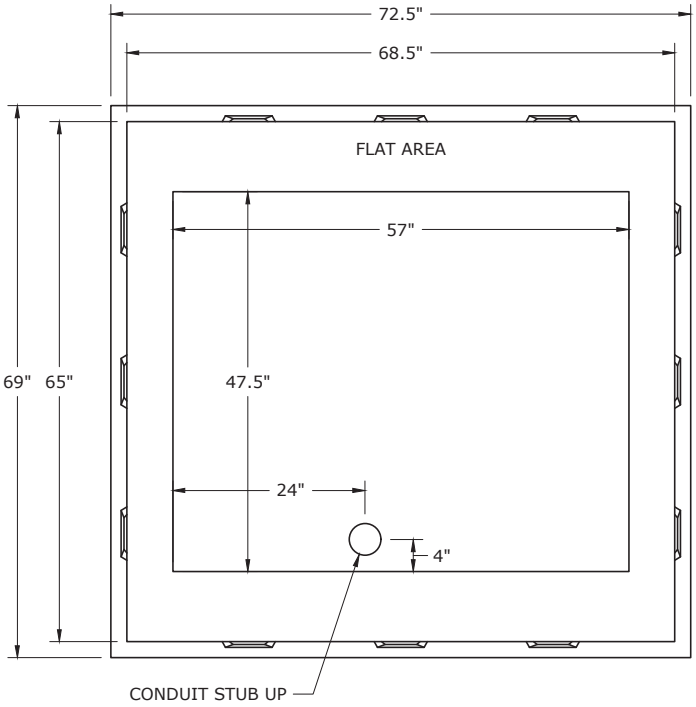
DEC	DEM	DEP	DEF
			X

24.03-112



FRONT VIEW

SIDE VIEW



PLAN VIEW

REGION	ITEM NUMBER	COMPATIBLE UNIT
DEC	836361	STRUCT-PAD-CAP-FG-MD-C
DEM	836361	STRUCT-PAD-CAP-FG-MD-M
DEP	836361	STRUCT-PAD-CAP-FG-MD-P
DEF	836361	STRUCT-PAD-CAP-FG-MD-F

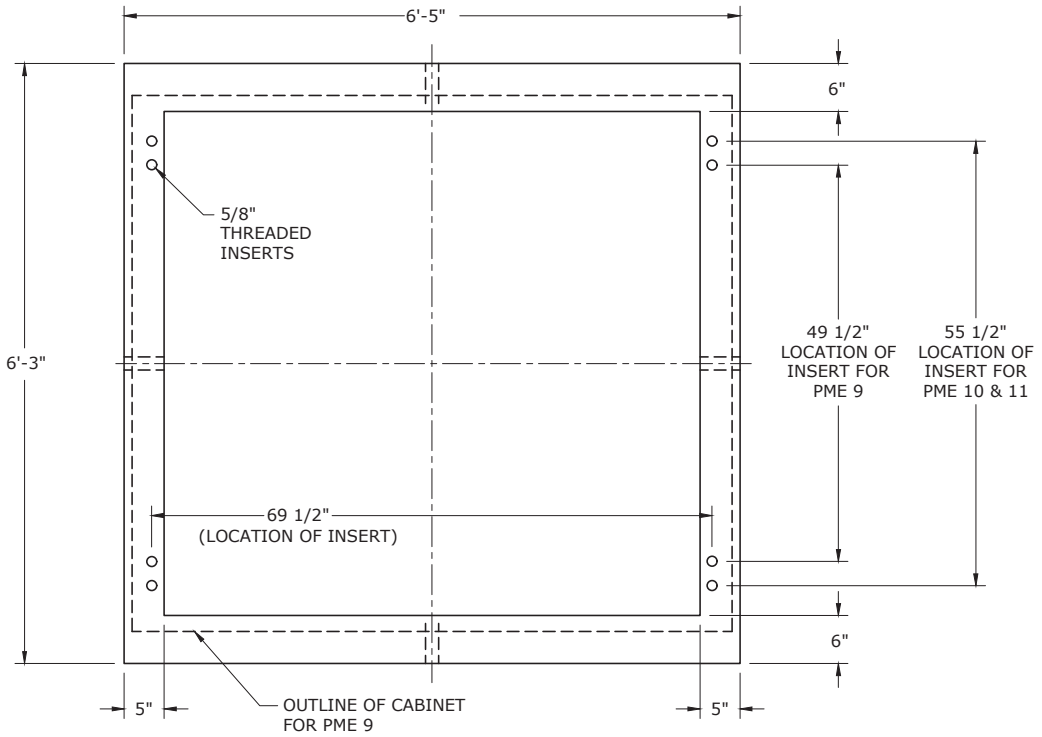
3				
2				
1				
0	1/31/19	GORLEY	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

BOX PAD FOR 15KV
PAD-MOUNTED CAPACITOR

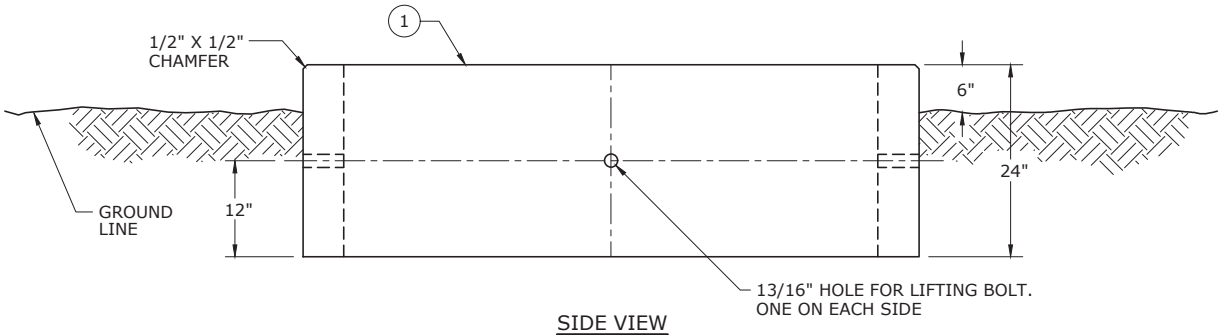
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

24.03-140



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADSWGCPME9F	1	327723	1	BOX, FOR MOUNTING PME GEAR

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
7. TO DEFER SWITCH INSTALLATION, USE LID (ITEM # 327375).

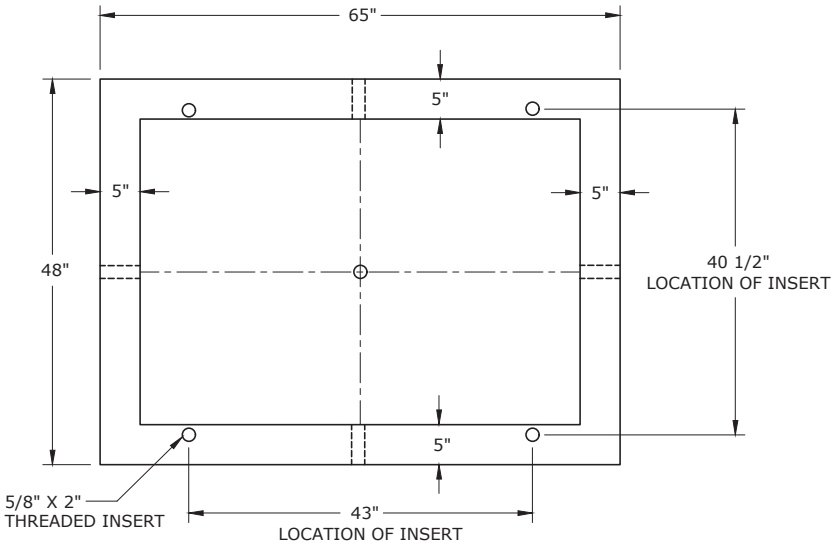
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

DUKE ENERGY.

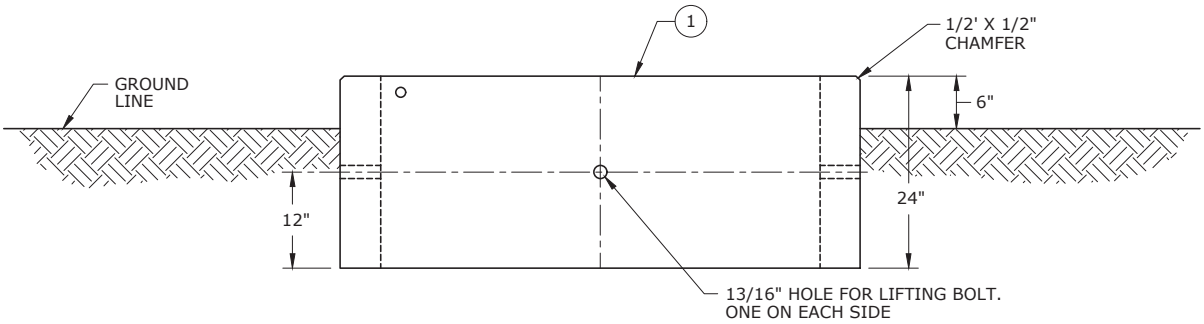
MOUNTING BOX FOR PME 9, 10, 11
& AUTO TRANSFER

DEC	DEM	DEP	DEF
			X

24.05-01



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADSWGCPME4F	1	327724	1	BOX, MOUNTING ALL PME-4

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.

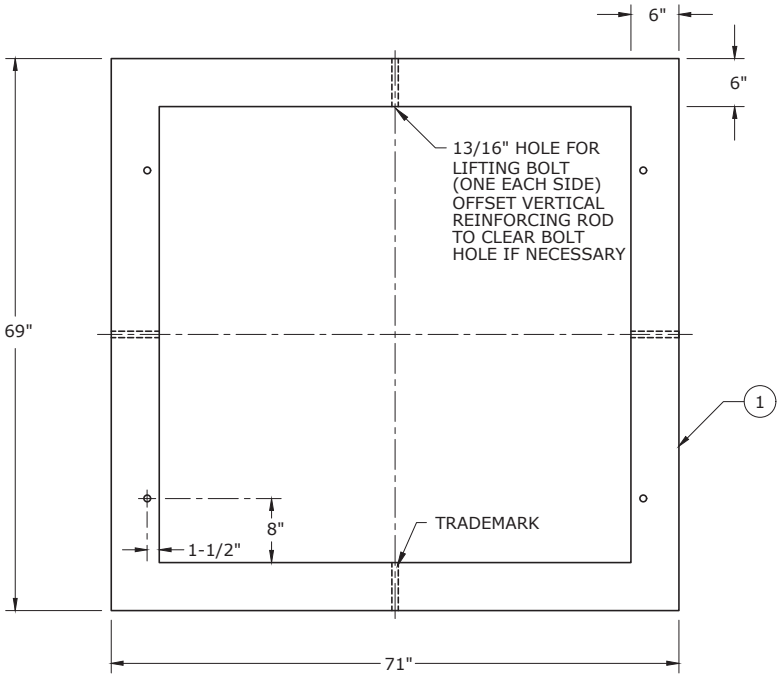
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	EANES	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

DUKE ENERGY.

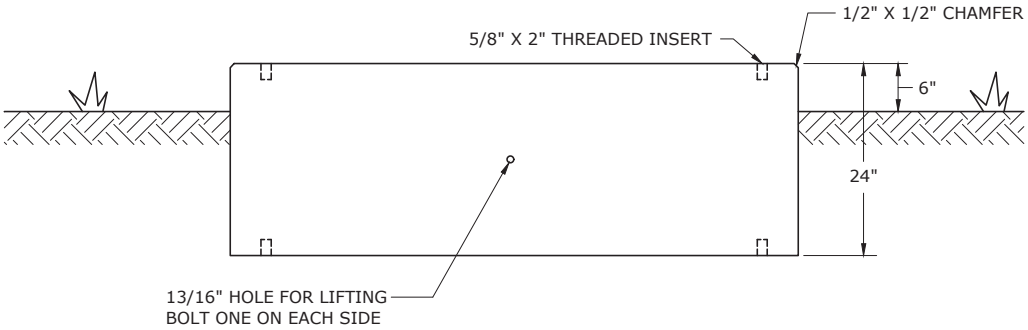
MOUNTING BOX FOR PME 4 (200 & 600 AMP)

DEC	DEM	DEP	DEF
			X

24.05-03



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADSWGCPMHF	1	152199	1	BOX, MOUNTING PMH SWITCHGEAR

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
7. TO DEFER SWITCH INSTALLATION, USE LID (ITEM # 327381).
8. OLD 70" X 62" PADS MAY BE USED.
9. APPROXIMATE WEIGHT IS 3150 LBS.

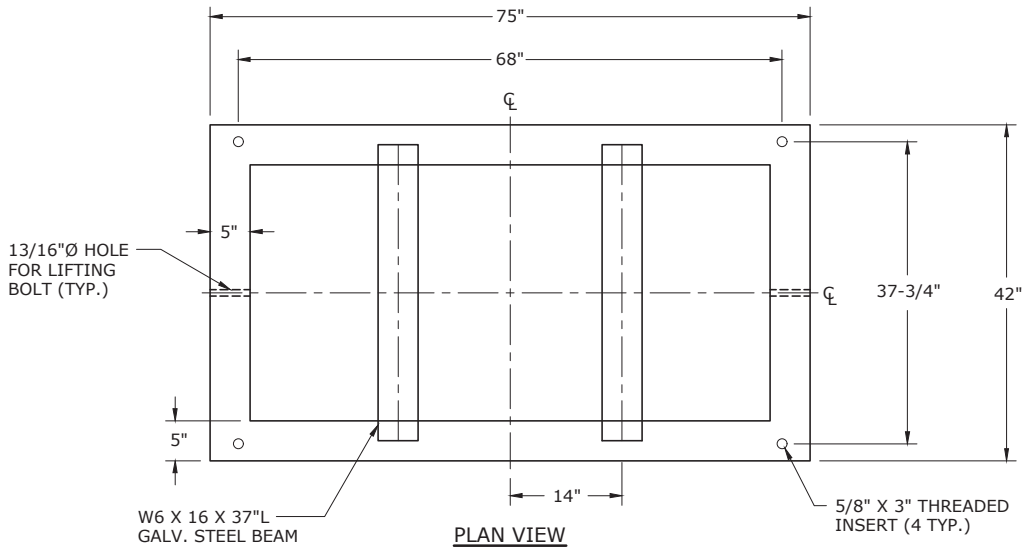
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

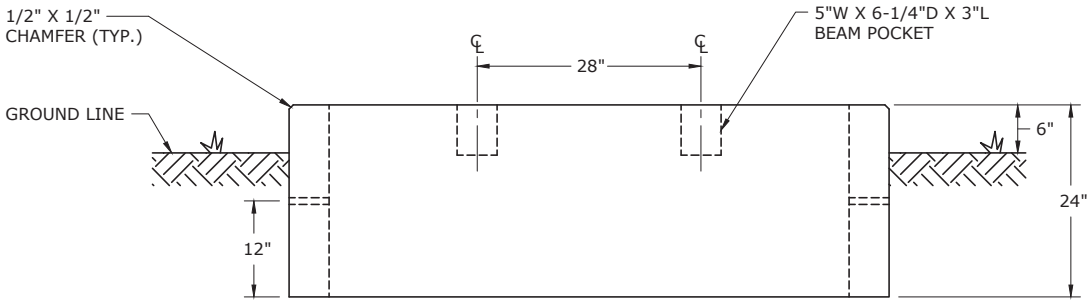
MOUNTING BOX PMH 9, 10 & 11,
AUTO TRANSFER & TRAYER 9, 10 & 11

DEC	DEM	DEP	DEF
			X

24.05-05



PLAN VIEW



FRONT VIEW

BILL OF MATERIALS				
BUBBLE NO.	COMPATIBLE UNIT	ITEM NUMBER	QUANTITY	DESCRIPTION
1	PADSWGCVFIF	9220109880	1	MOUNTING BOX

NOTES:

1. THE GROUND SHALL BE LEVELED AND COMPACTED TO THAT OF UNDISTURBED EARTH BEFORE MOUNTING BOX IS INSTALLED. SOIL AROUND THE MOUNTING BOX IS TO BE FREE OF ROOTS AND CONSTRUCTION DEBRIS TO PREVENT SETTLING.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 8' CLEARANCE FROM THE FRONT AND REAR DOORS AND 3' FROM THE SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE THE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF THE BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND THE PAD TO PREVENT SOIL EROSION.
7. OTHER UTILITIES ARE NOT TO BE INSTALLED UNDER THE BOX PAD.
8. APPROXIMATE WEIGHT IS 2275 LBS.
9. SEE SECTION 28 FOR COOPER 15KV VFI-5.

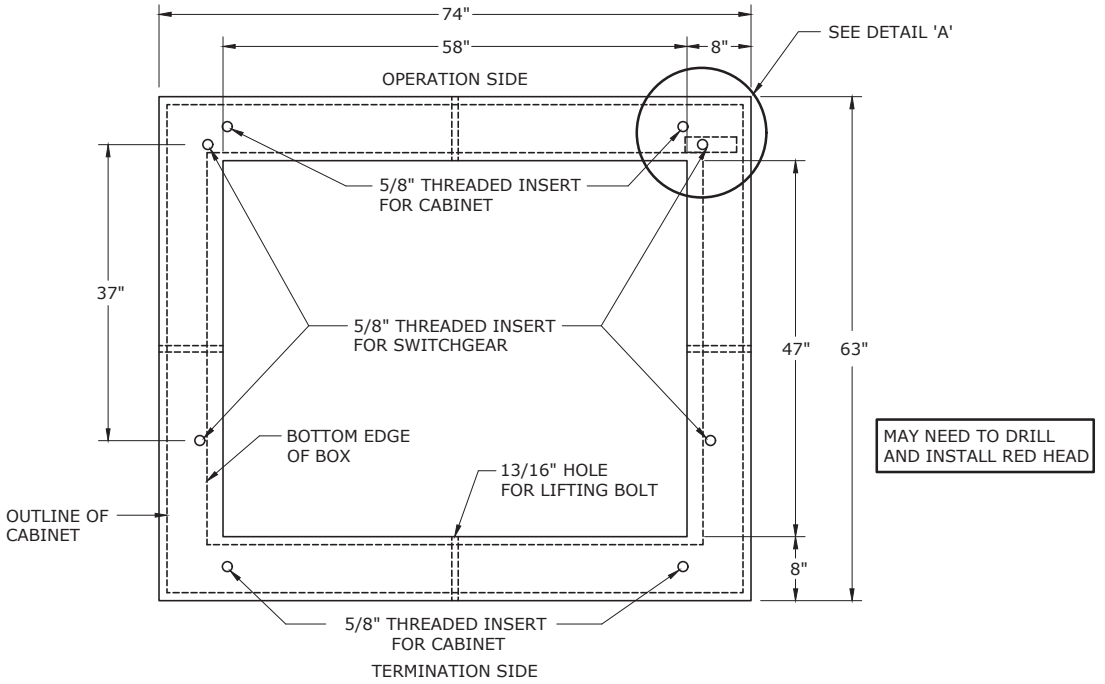
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

MOUNTING BOX FOR
COOPER 15KV VFI-5

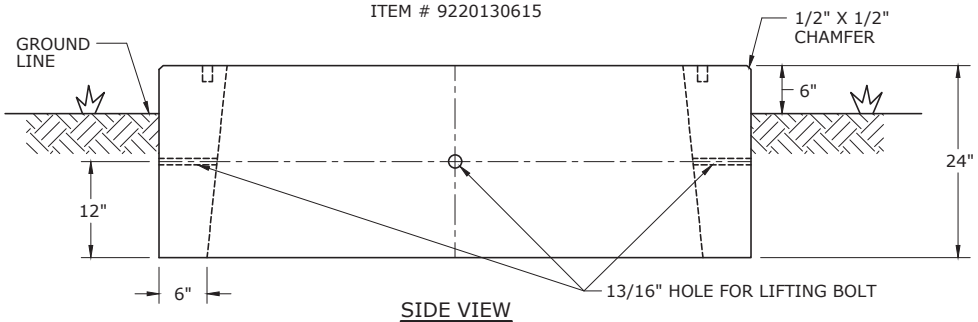
DEC	DEM	DEP	DEF
			X

24.05-07

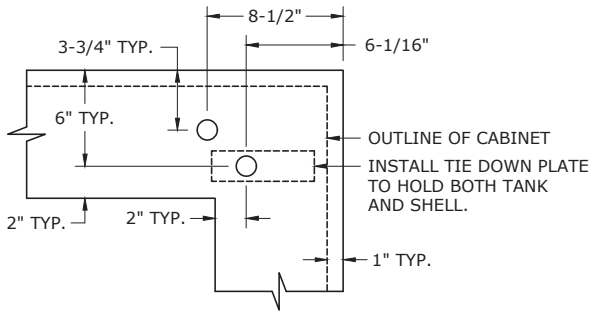


PLAN VIEW

CU PADSWGCVISTAF
ITEM # 9220130615



SIDE VIEW



DETAIL 'A'

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE BOX IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
7. WEIGHT IS APPROXIMATELY 3500 LBS.

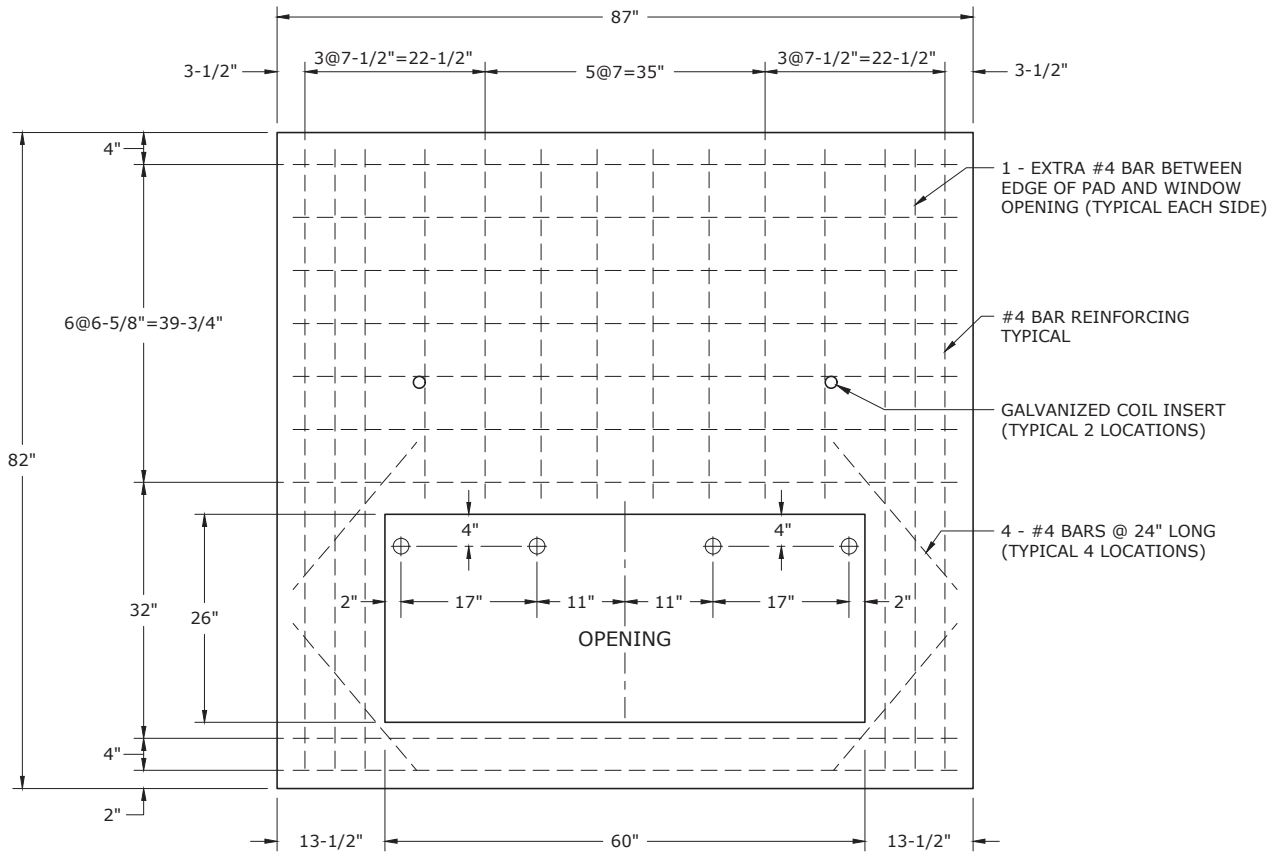
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

MOUNTING BOX FOR 15 KV, 12.5 KA,
VISTA AND NEXT GENERATION VISTA

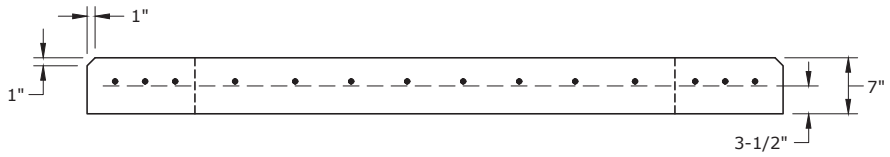
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

24.05-09



PLAN VIEW



SIDE VIEW

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.

3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	5/24/12	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

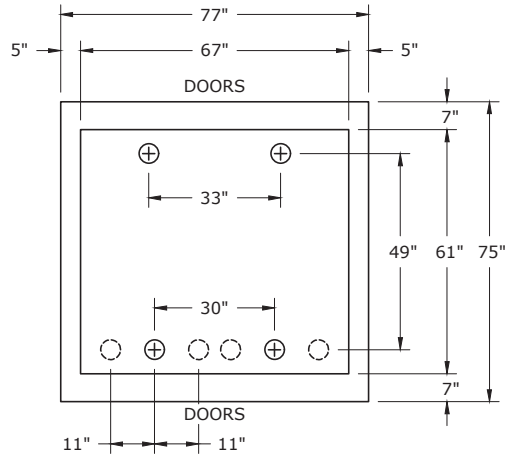
DUKE ENERGY.

CABLE AND CONDUIT PLACEMENT FOR TRAYER ATS VFI

DEC	DEM	DEP	DEF
			X

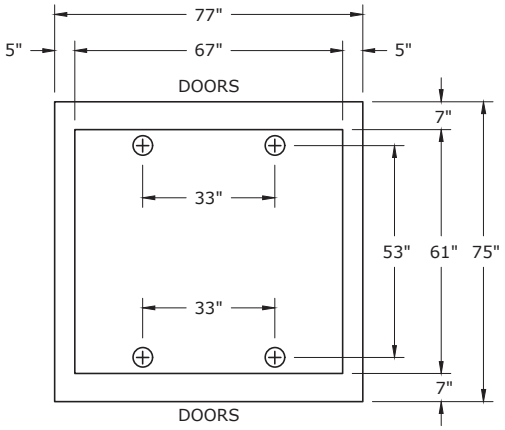
24.05-11

PME 9
ITEM # 327723



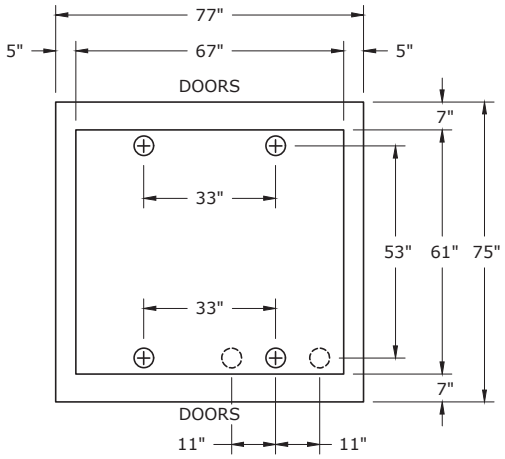
SWITCH GEAR OUTSIDE DIMENSION 75" x 67"

PME 10
ITEM # 327723



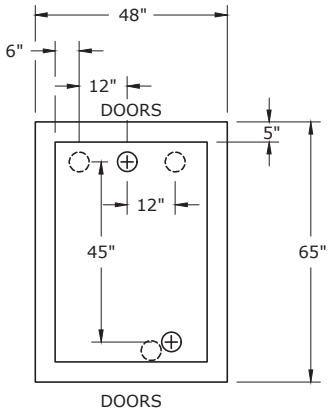
SWITCH GEAR OUTSIDE DIMENSIONS 75" x 73"

PME 11
ITEM # 327723



SWITCH GEAR OUTSIDE DIMENSION 75" x 73"

PME 4 (600A) & (200A)
ITEM # 327724



SWITCH GEAR OUTSIDE DIMENSIONS 46" x 62"

NOTES:

1. ALL 90° SWEEPS MUST NOT BE CUT OFF.

2. CONCRETE MUST BE PLACED ON INSIDE OF BENDS.

3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

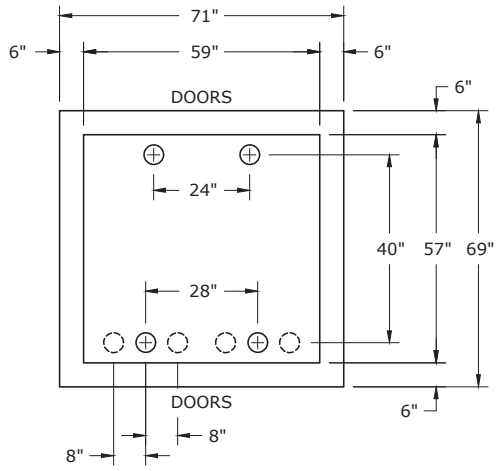
CABLE AND CONDUIT PLACEMENT FOR
S&C PME SWITCHGEAR

DUKE ENERGY.

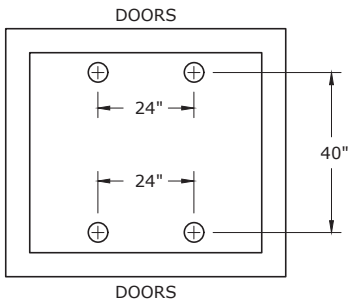
DEC	DEM	DEP	DEF
			X

24.05-120

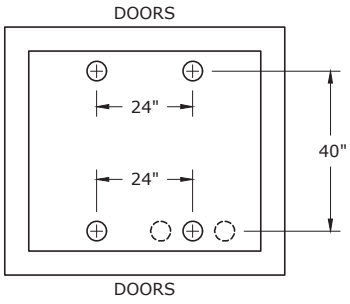
9
ITEM # 152199



10



11



TRAYER SWITCHGEAR

NOTES:

1. SEE DWG. 24.06-126 FOR CONCRETE BAG PLACEMENT AND BUILDING CLEARANCES.
2. ALL CONDUIT DIMENSIONS ARE CENTER-TO-CENTER.
3. BOXES PURCHASED PRIOR TO 2004 WERE 70" X 62".

3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

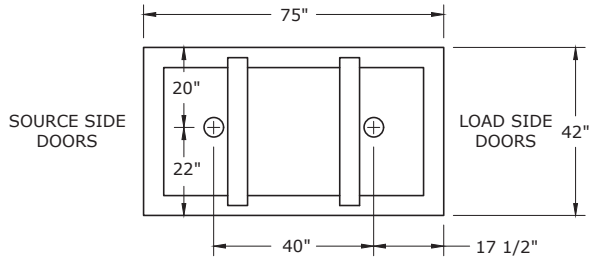
CABLE AND CONDUIT PLACEMENT FOR TRAYER SWITCHGEAR

DUKE ENERGY.

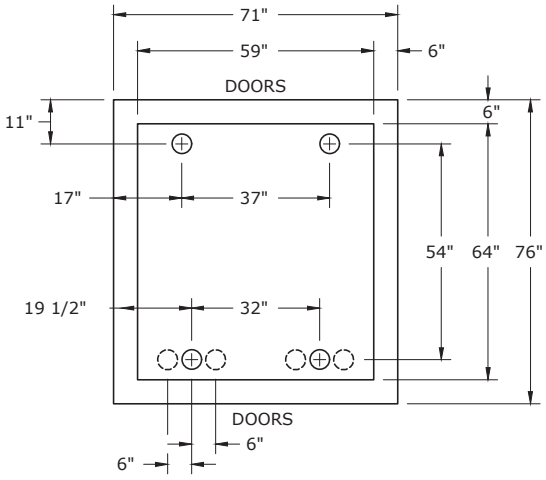
DEC	DEM	DEP	DEF
			X

24.05-122

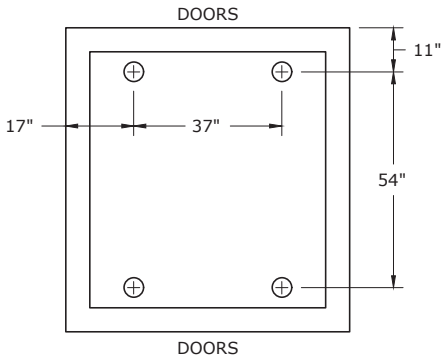
VFI 5



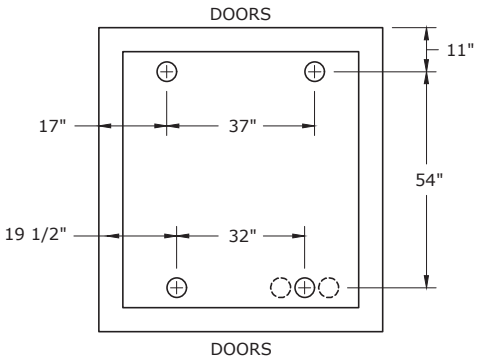
VFI 9



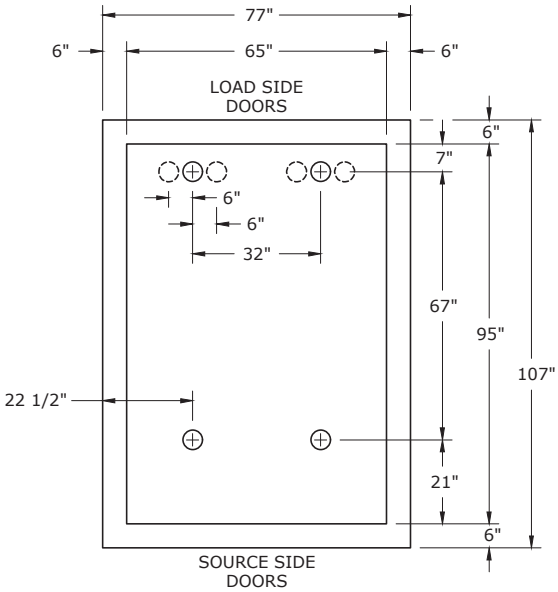
VFI 10



VFI 11



PST AUTO TRANSFER



NOTES:

1. REFER TO DWG. 24.05-126 FOR CONCRETE BAG PLACEMENT AND BUILDING CLEARANCES.

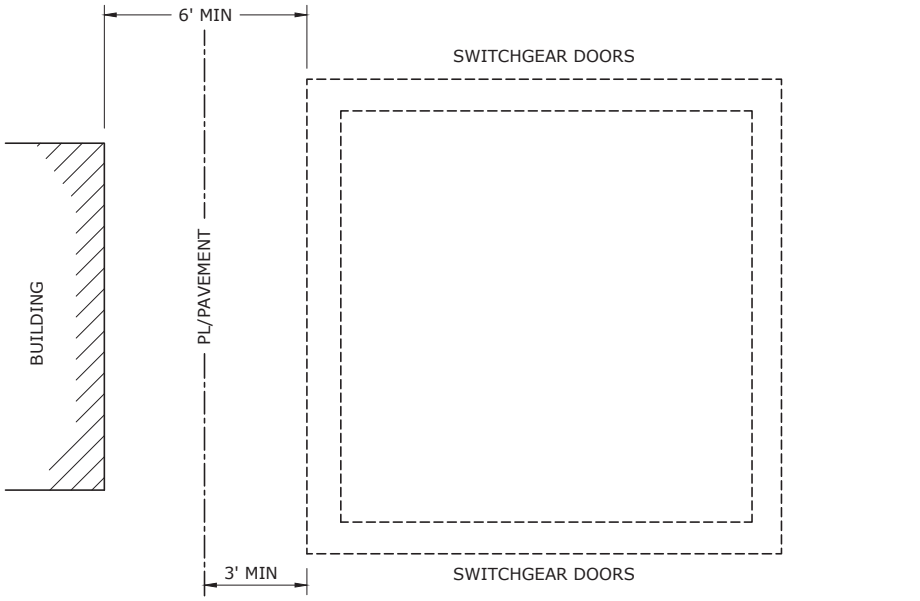
DUKE ENERGY.

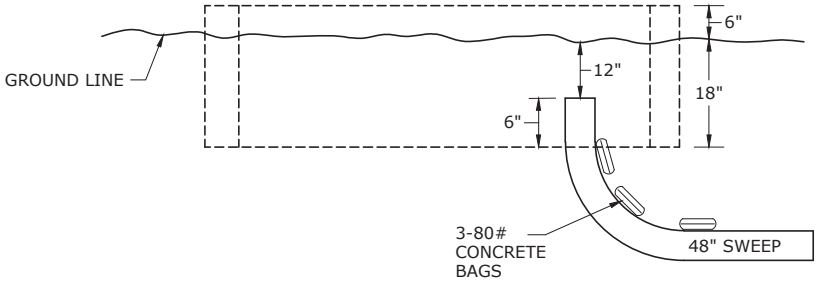
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE AND CONDUIT PLACEMENT FOR VFI SWITCHGEAR

DEC	DEM	DEP	DEF
			X

24.05-124





CAUTION:

REFER TO ACCIDENT PREVENTION MANUAL FOR PROPER LIFTING TECHNIQUES WHEN HANDLING CONCRETE BAGS.

NOTES:

1. ALL 90° SWEEPS MUST NOT BE CUT OFF.
2. CONCRETE MUST BE PLACED ON INSIDE OF BENDS.
3. THE MOUNTING BOX IS SHOWN AS A REFERENCE AND IS INSTALLED AFTER CABLE AND CONDUIT.

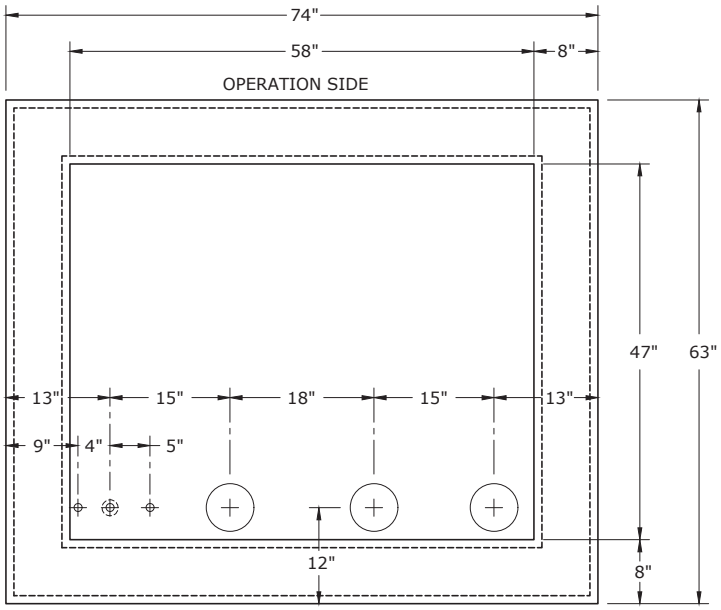
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

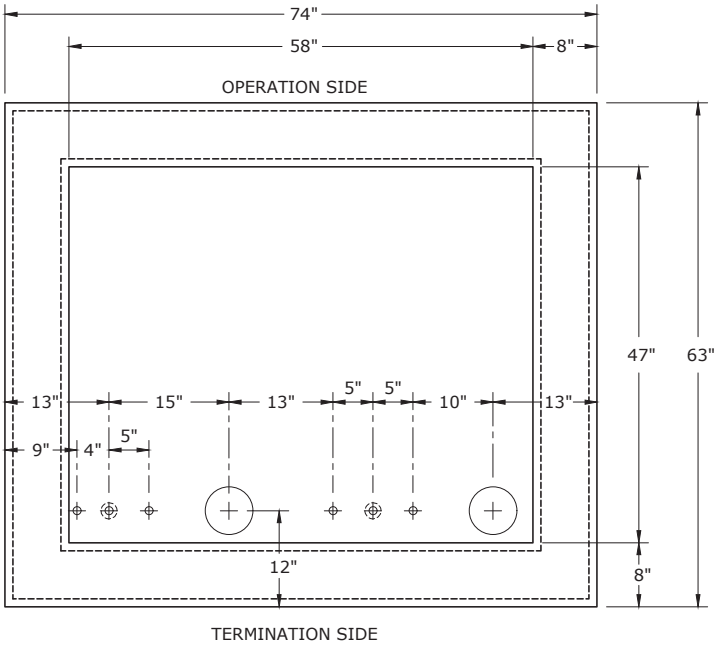
CABLE AND CONDUIT PLACEMENT FOR PAD-MOUNTED SWITCHGEAR

DEC	DEM	DEP	DEF
			X

24.05-126



PLAN VIEW
VISTA 431
ITEM # 9220130615



PLAN VIEW
VISTA 422
ITEM # 9220130615

NOTES:

1. SEE DWG. 24.05-126 FOR CONCRETE BAG PLACEMENT AND BUILDING CLEARANCES.

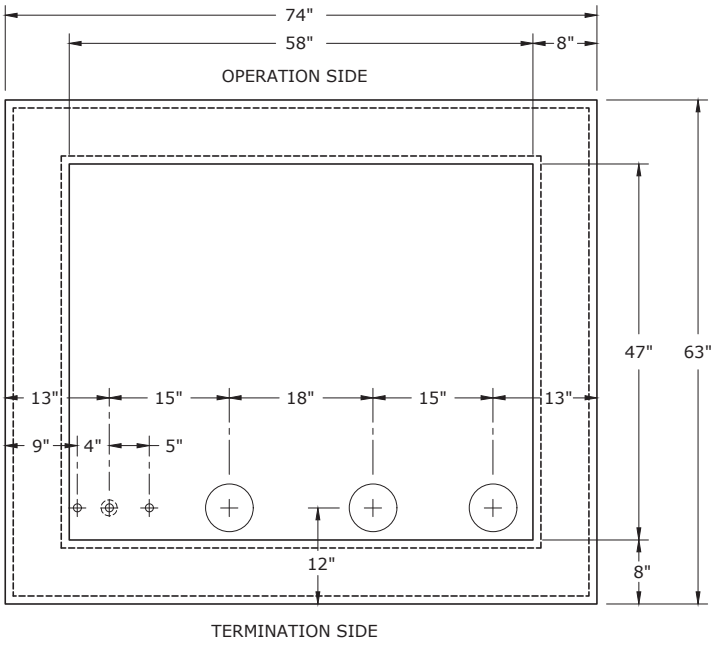
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE AND CONDUIT PLACEMENT FOR
VISTA SWITCHGEAR

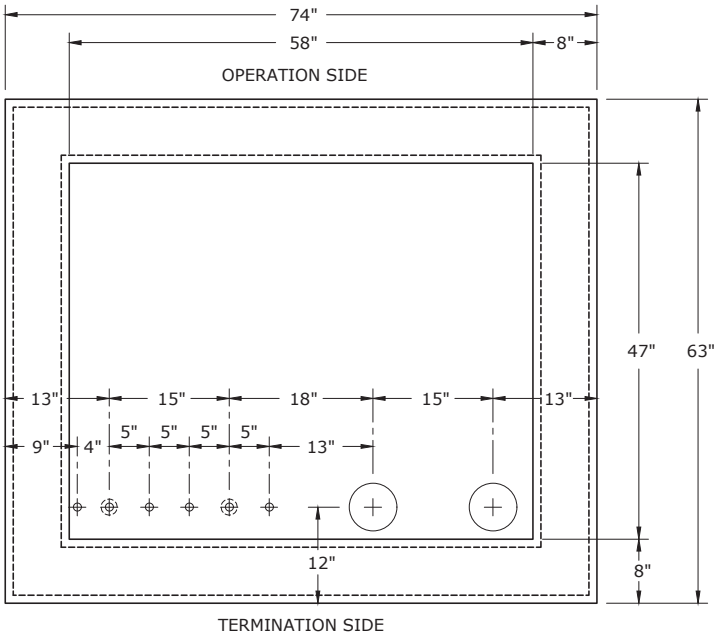
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

24.05-128



PLAN VIEW
VISTA (NEXT GENERATION) 431
ITEM # 9220130615



PLAN VIEW
VISTA (NEXT GENERATION) 422
ITEM # 9220130615

NOTES:

1. SEE DWG. 24.05-126 FOR CONCRETE BAG PLACEMENT AND BUILDING CLEARANCES.

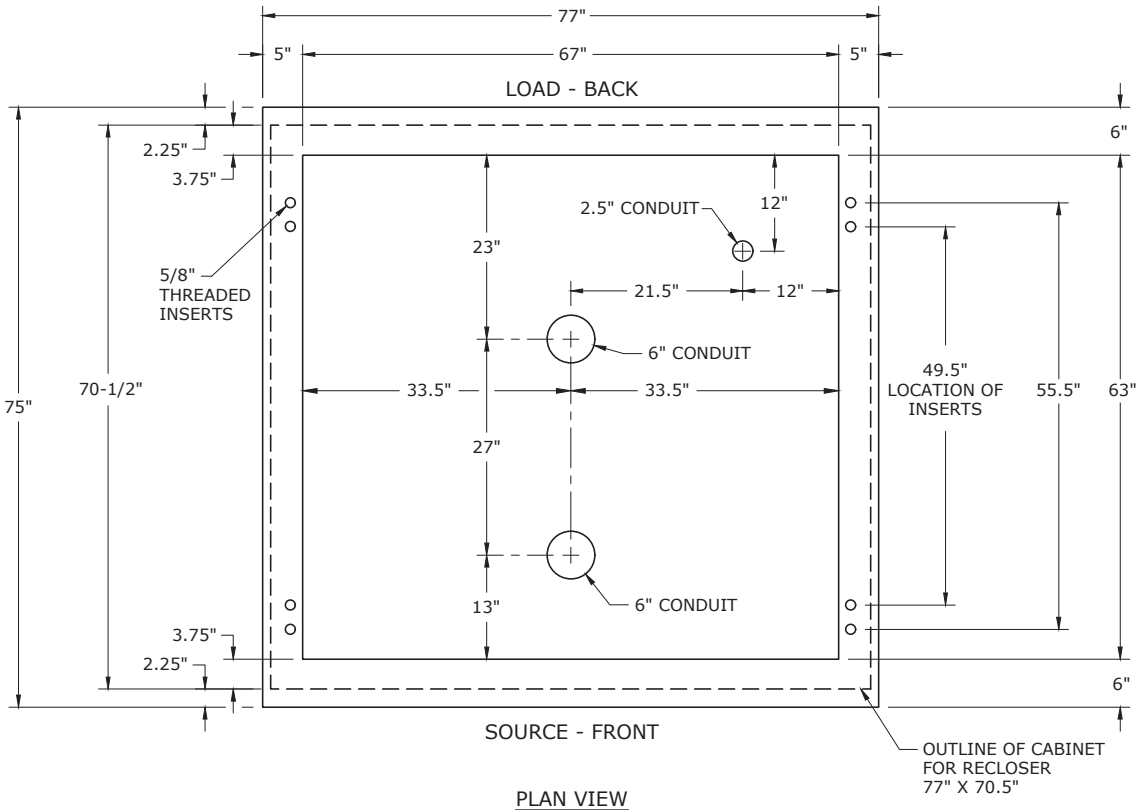
3				
2				
1				
0	12/9/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE AND CONDUIT PLACEMENT FOR
VISTA NEXT GENERATION SWITCHGEAR

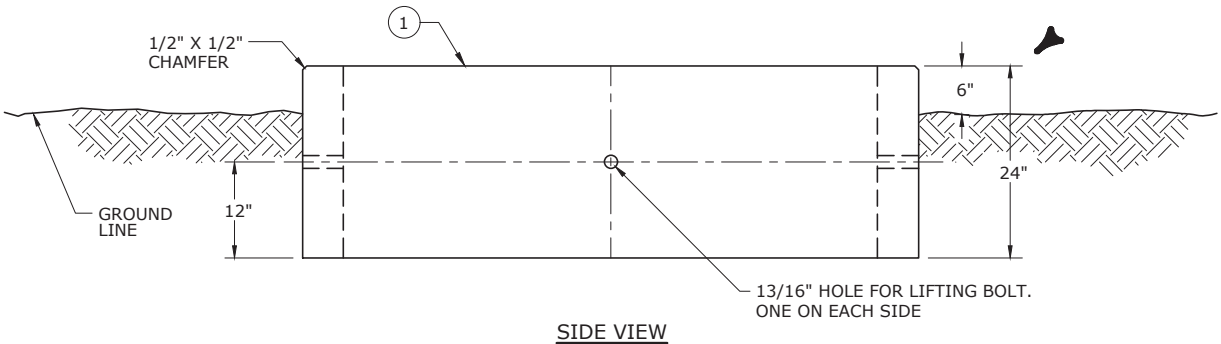
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

24.05-130



PLAN VIEW



SIDE VIEW

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	PADSWGCPME9F	1	327723	1	BOX, FOR MOUNTING PME GEAR

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. MAINTAIN 10' CLEARANCE FROM FRONT AND REAR DOORS AND 3' FROM SIDES.
4. CUT OFF ALL CONDUITS 6" ABOVE BOTTOM OF BOX AND CAP.
5. DO NOT FILL INTERIOR OF BOX WITH SOIL.
6. SOD MAY BE REQUIRED AROUND PAD TO PREVENT SOIL EROSION.
7. TO DEFER SWITCH INSTALLATION, USE LID (ITEM # 327375).

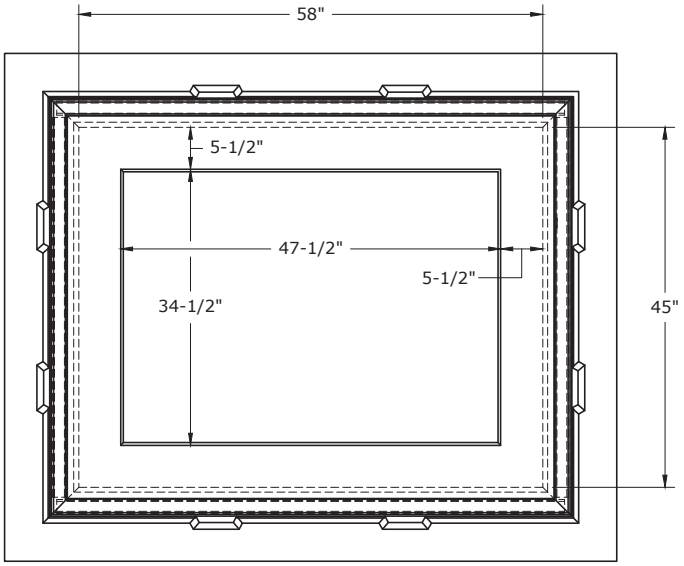
REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	3/31/17	BRAVO	EANES	ADCOCK

DUKE ENERGY.

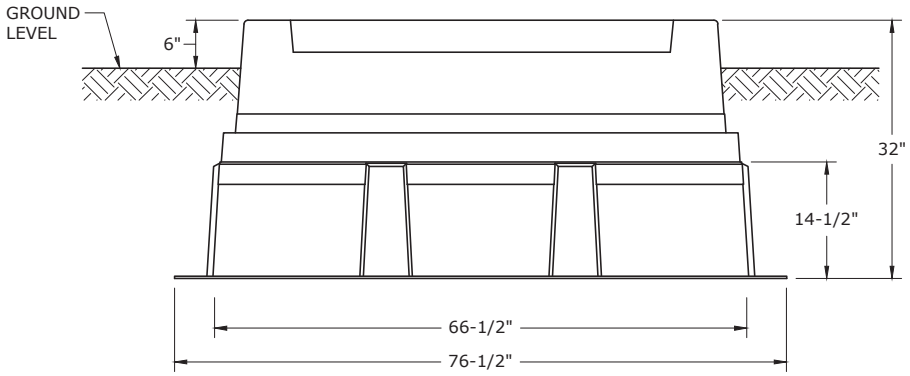
BOX PAD AND CONDUIT LAYOUT FOR PAD-MOUNTED RECLOSERS

DEC	DEM	DEP	DEF
			X

24.05-150



PLAN VIEW



FRONT VIEW
CU STRUCT-PAD-SG-FG-1P-GW-*
ITEM # 1572029

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. SEE DWG. 28.04-121 FOR SINGLE-PHASE G&W SWITCHGEAR DETAIL.
4. APPLY THE PROPER REGION SUFFIX TO THE CU: DEC - C; DEM - M; DEP - P; DEF - F.

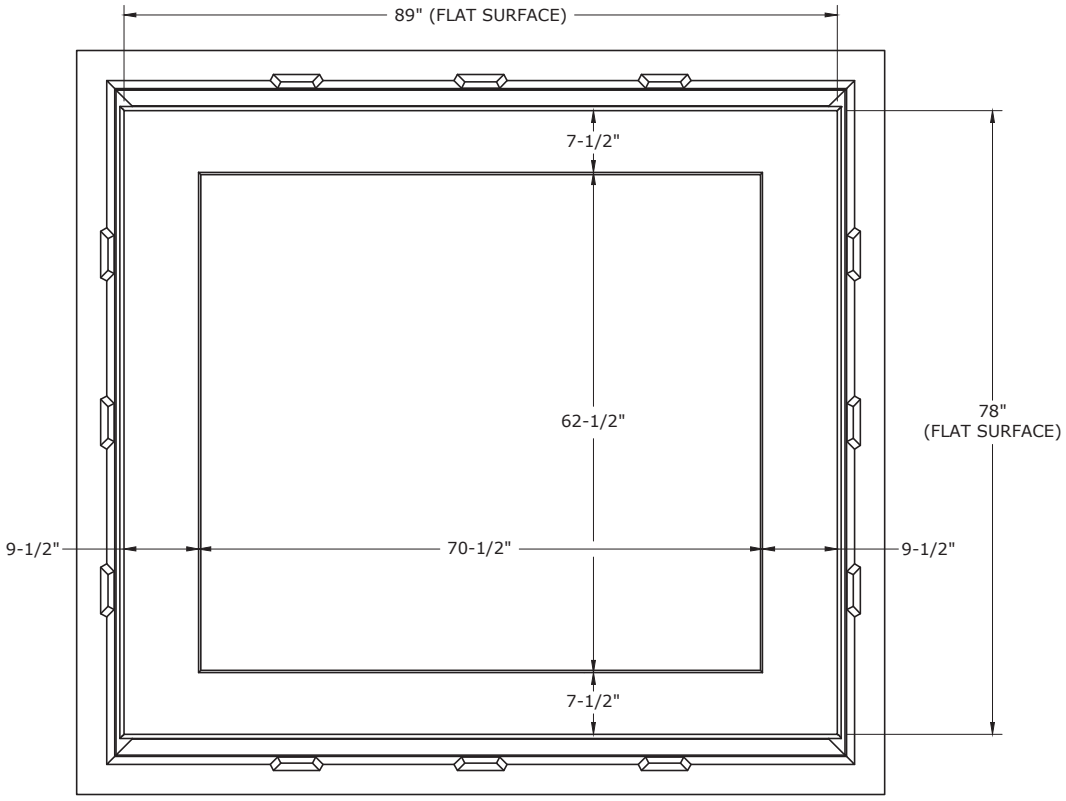
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

BOX PAD FOR 15/25KV FAULT INTERRUPTER
SINGLE-PHASE PAD-MOUNTED SWITCHGEAR

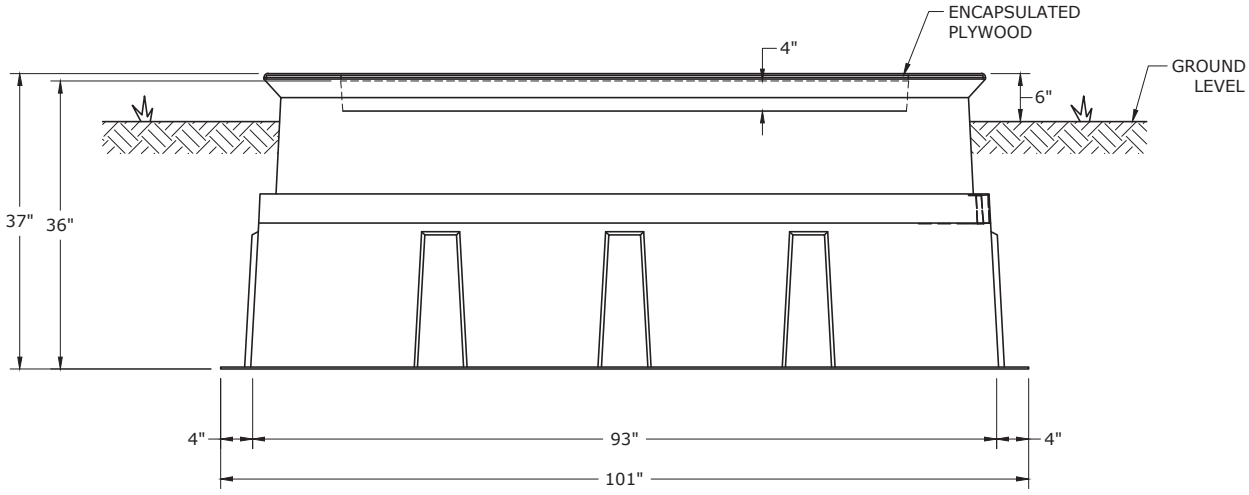
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

24.05-153



PLAN VIEW



FRONT VIEW
CU STRUCT-PAD-SG-FG-LG-GW-15KV-SD-SUB-*
ITEM # 1573083

NOTES:

1. THE GROUND SHALL BE LEVELED AND THOROUGHLY COMPACTED BEFORE PAD IS INSTALLED.
2. USE FIRE ANT CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
3. SEE DWGS. 28.04-113, 28.04-115 AND 28.04-117 FOR SWITCHGEAR DETAIL.
4. APPLY THE PROPER REGION SUFFIX TO THE CU: DEC - C; DEM - M; DEP - P; DEF - F.

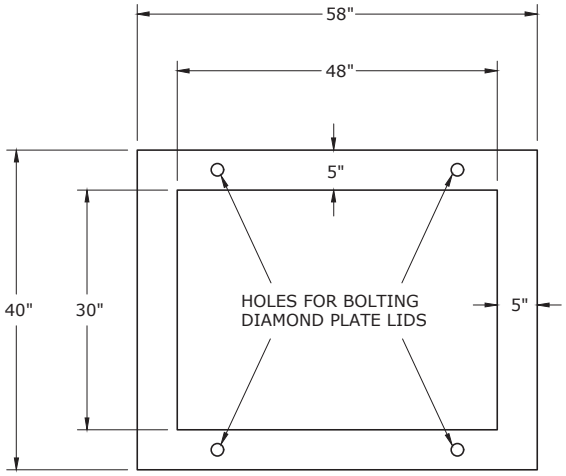
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

BOX PAD FOR G&W 15KV FAULT INTERRUPTER PAD-MOUNTED SOLID DIELECTRIC FOUR WAY SUBMERSIBLE GEAR - PME9, 10 AND 11 VERSIONS

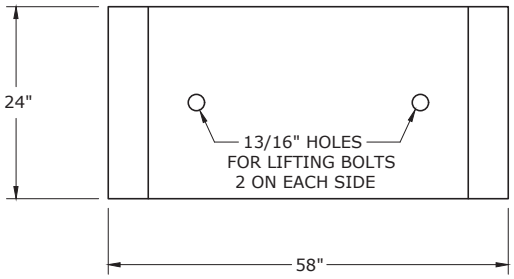
DEC	DEM	DEP	DEF
X	X	X	X

24.05-155



TOP VIEW

ITEM # 320185
APPROXIMATE WEIGHT - 1,780 LBS.
PBSPSMNOLID



SIDE VIEW

NOTES:

1. LIDS ARE DIAMOND PLATE (ITEM # 320189) OR CONCRETE (ITEM # 320188).
2. USE 1/0 PRIMARY - THREE-PHASE CONDUCTOR MAXIMUM.
3. NO PULLING EYES.
4. NO BOTTOM.
5. FOUR (4) HOLES (2 ON EACH SIDE) FOR LIFTING BOX.
6. BELOW GRADE INSTALLATION REQUIRES ELECTRONIC POWER MARKER.
7. SEE DWG. 24.07-03 FOR LIDS.
8. DO NOT FILL INTERIOR OF BOX.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	8/10/10	DANNA	GUINN	ELKINS

SMALL PULL & SPLICE BOX
(30" X 48" X 24")

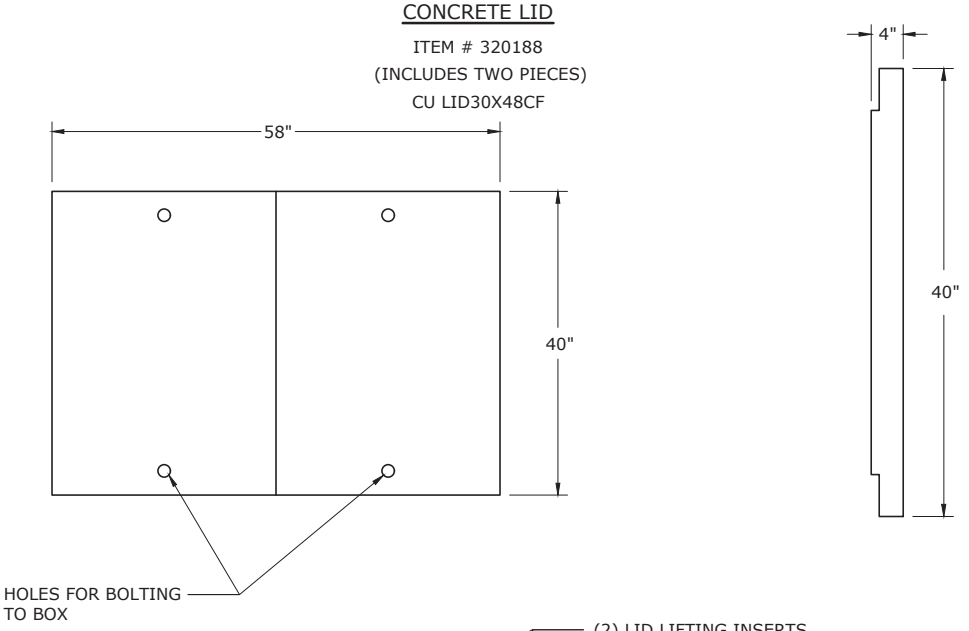
DUKE ENERGY.

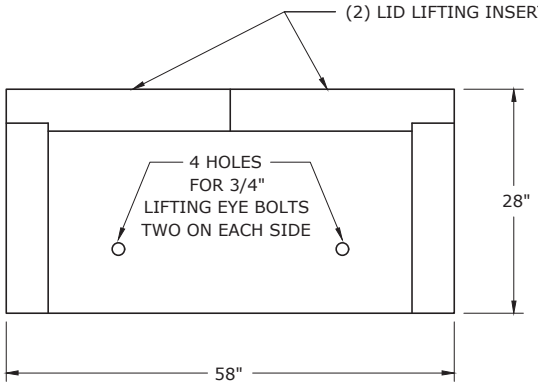
DEC	DEM	DEP	DEF
			X

24.07-01

CONCRETE LID

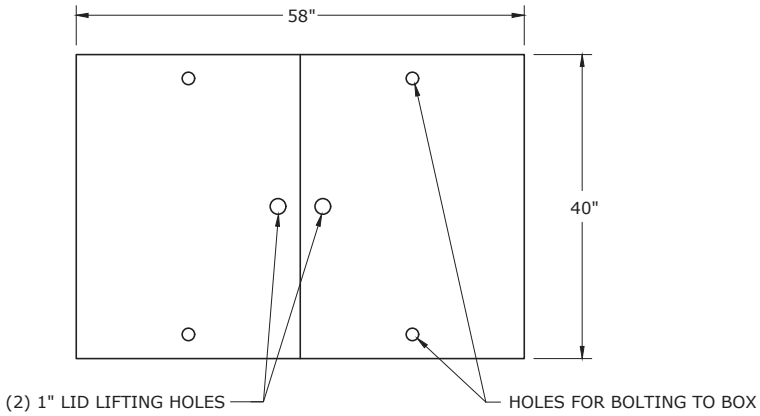
ITEM # 320188
(INCLUDES TWO PIECES)
CU LID30X48CF





GALVANIZED LID

ITEM # 320189
(INCLUDES TWO PIECES)
CU LID30X48SF



NOTES:

1. LID MUST BE SECURED TO BOX USING 1/2" X 1" STAINLESS STEEL BOLTS.

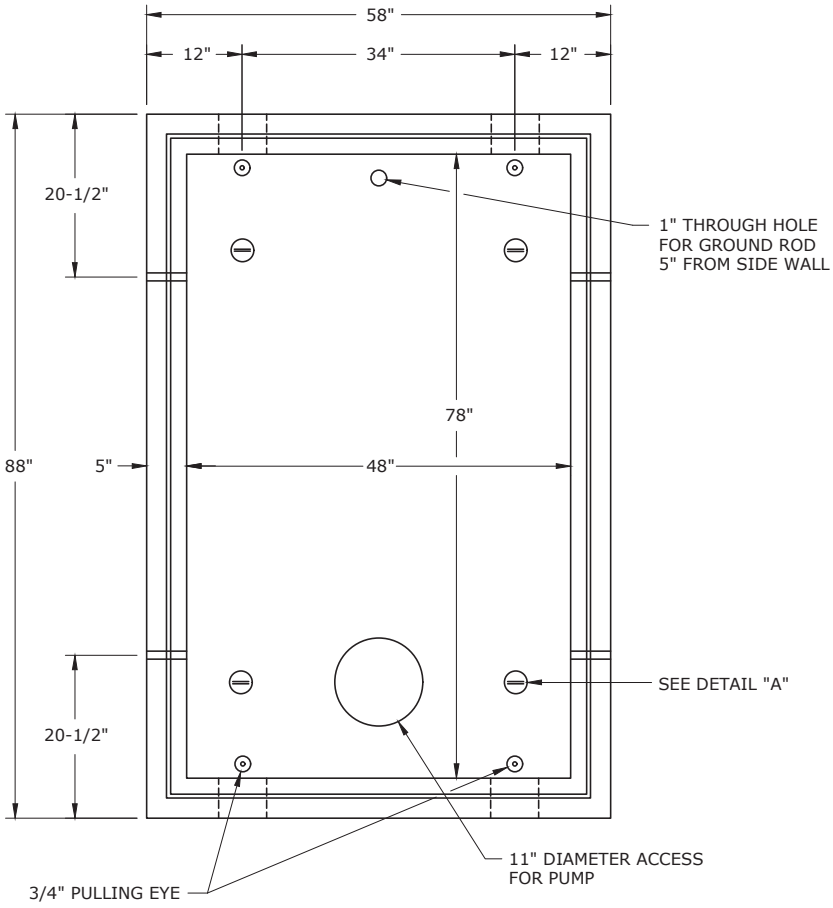
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

LIDS FOR SMALL PULL & SPLICE BOX

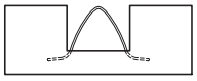
DEC	DEM	DEP	DEF
			X

24.07-03

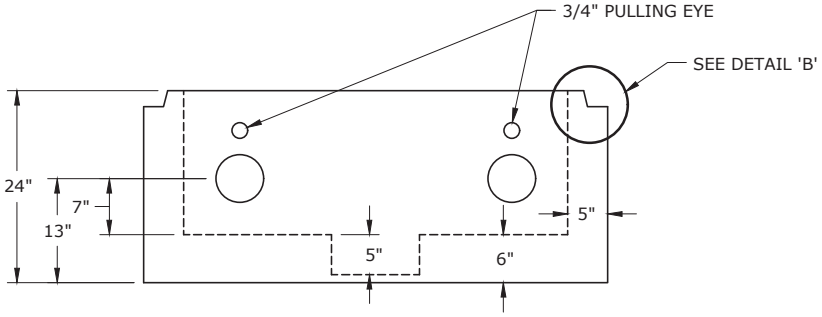


PLAN VIEW

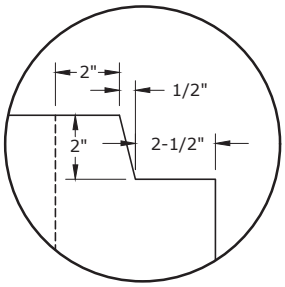
ITEM # 320181
CU BOXSP6X4CBTMF



DETAIL "A"
LIFTING EYE



SIDE VIEW



DETAIL 'B'
SHIPLAP GROOVE

NOTES:

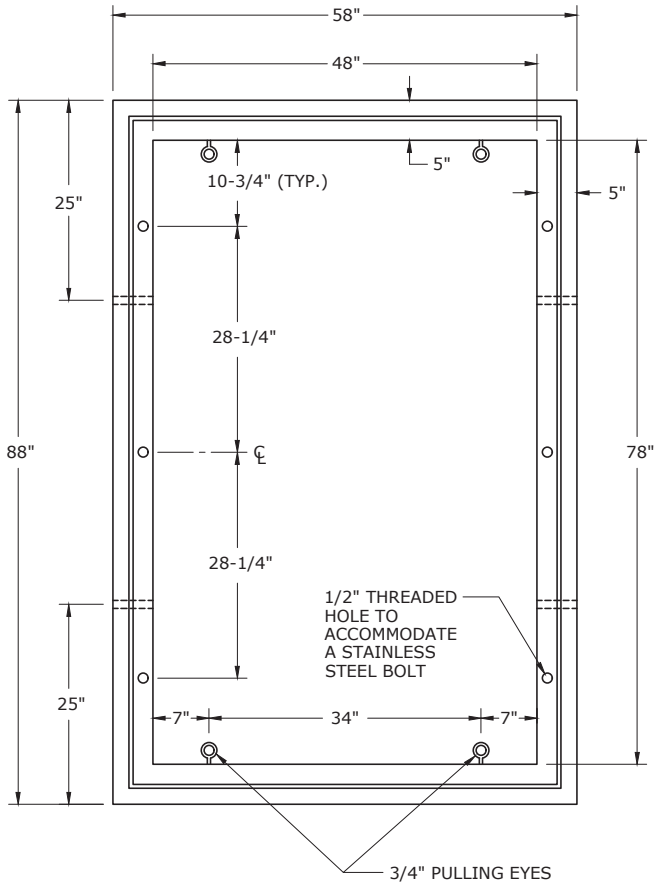
1. FOR ASSEMBLY, SEE DWG. 24.07-15.

3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

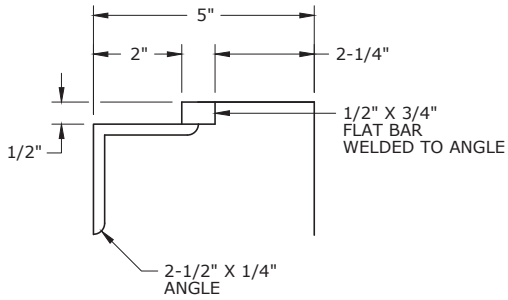
LARGE PULL BOX, BOTTOM HALF
(6.5' X 4' X 2')

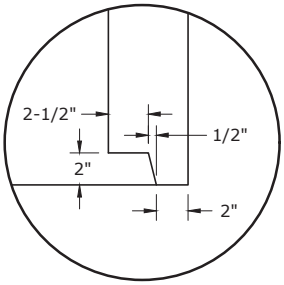
DEC	DEM	DEP	DEF
			X

24.07-07

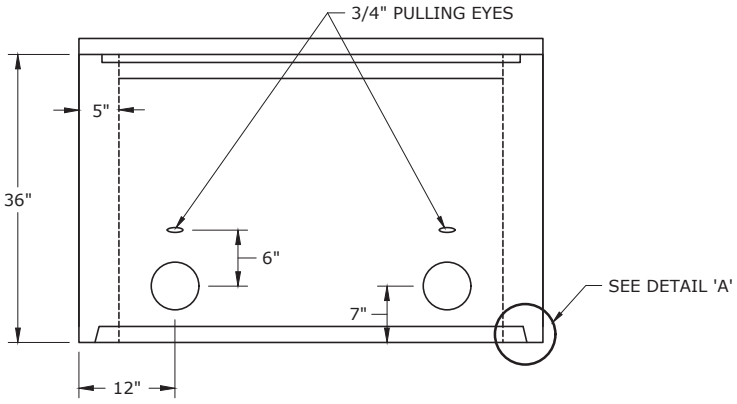


PLAN VIEW
ITEM # 320182
CU BOXSP6X4CTOPF





DETAIL 'A'
SHIPLAP GROOVE



SIDE VIEW

NOTES:

1. FOR ASSEMBLY, SEE DWG. 24.07-15.

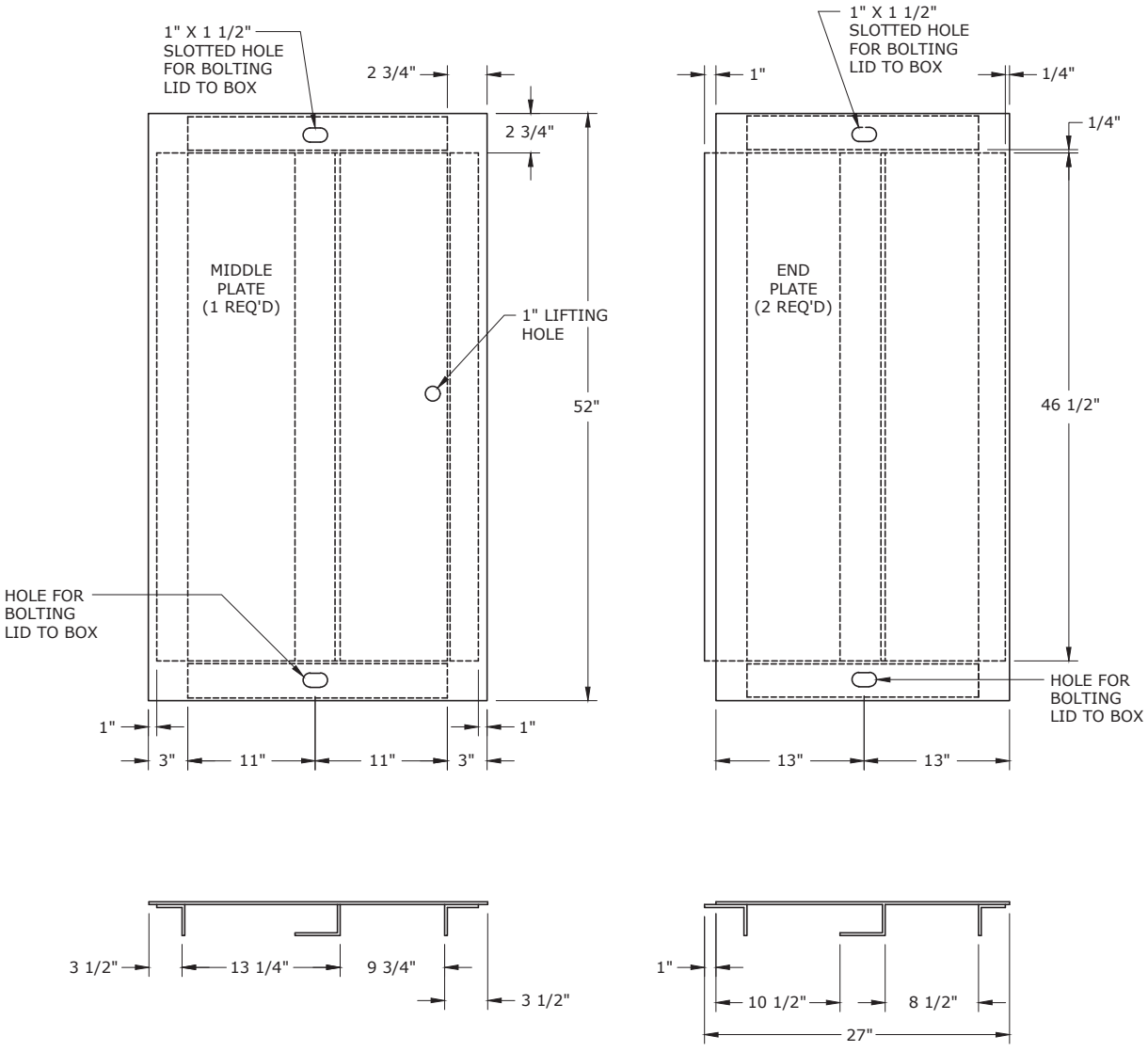
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LARGE PULL BOX, TOP HALF
(6.5' X 4' X 3')

DEC	DEM	DEP	DEF
			X

24.07-09

ITEM # 320186
CU LID6X4SF



NOTES:

1. LID MUST BE SECURED TO BOX USING 1/2" X 1" STAINLESS STEEL BOLTS.

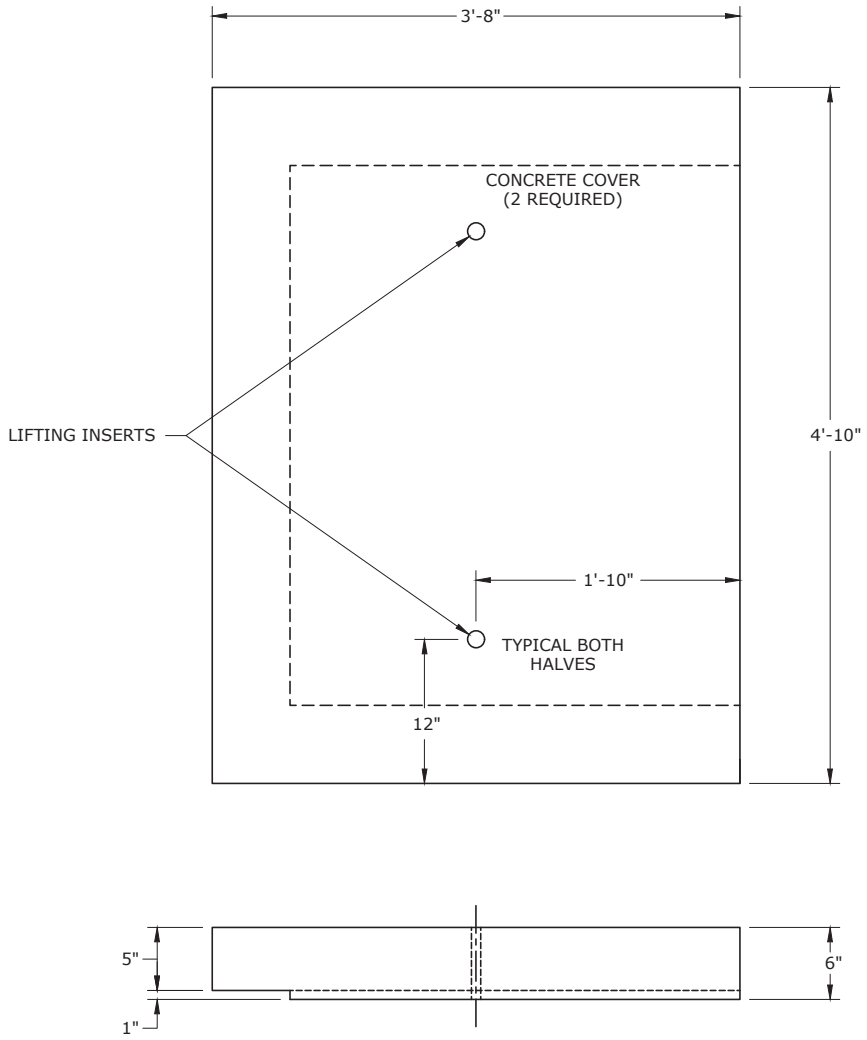
3				
2				
1	1/31/19	GORLEY	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

STEEL LIDS FOR LARGE PULL BOX

DEC	DEM	DEP	DEF
			X

24.07-11

ITEM # 320187
CU LID6X4CF



REVISED	BY	CK'D	APPR.
3			
2			
1	1/31/19	GORLEY	EANES	ADCOCK
0	8/10/10	DANNA	GUINN	ELKINS

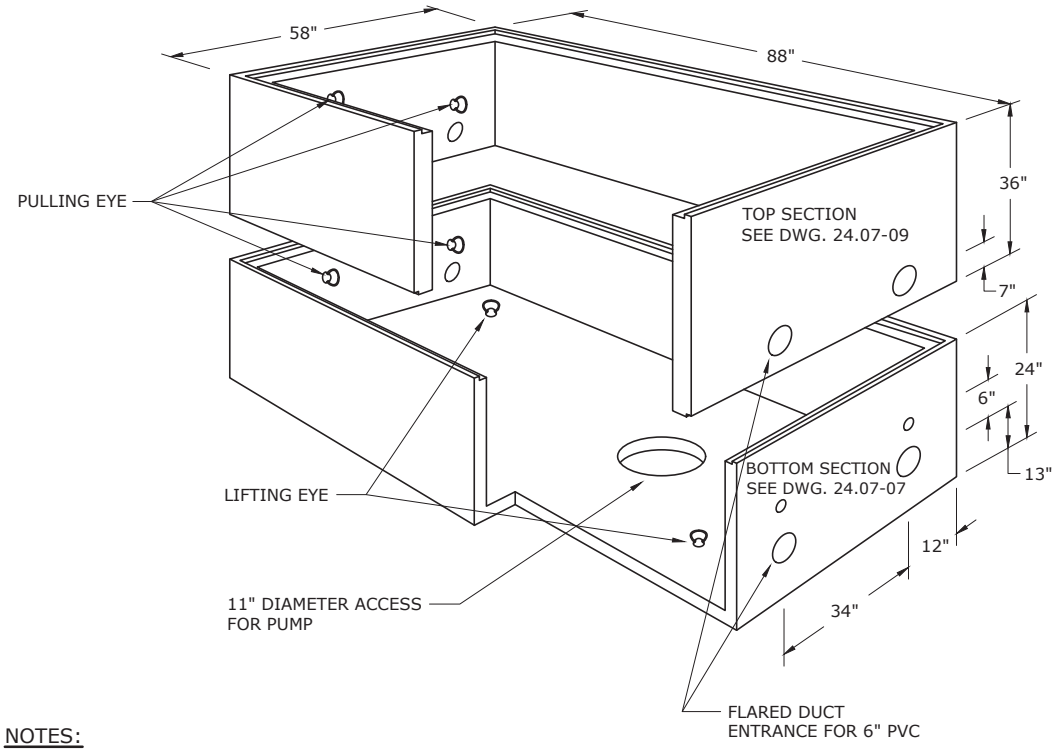
CONCRETE LIDS FOR LARGE PULL BOX

DEC	DEM	DEP	DEF
			X

24.07-13

TOP HALF WEIGHT - 4100 LBS.

BOTTOM HALF WEIGHT - 5000 LBS.



NOTES:

1. BOTTOM OF PULL BOX SHOULD BE LIFTED USING LIFTING EYES THAT ARE LOCATED ON THE FLOOR OF THE BOTTOM SECTION.
2. WHEN SETTING TOP SECTION, INSTALL LIFTING EYES INTO INSERTS ON OUTSIDE WALLS OF PULLBOX SECTION.
3. LISTED BELOW ARE OPTIONS REGARDING LID TYPES. THE 6.5 FT. X 4 FT. PULLBOX HAS THREE AVAILABLE LID OPTIONS.
   - 3 - PIECE STEEL LID USED FOR NON-TRAFFIC RATED APPLICATION (ITEM # 320186). FOR USE WITH STANDARD TOP SECTION (ITEM # 320182) AND BOTTOM SECTION (ITEM # 320181).
   - 3 - PIECE HEAVY DUTY NON-IMPACT TRAFFIC RATED STEEL LID (ITEM # 300406), WHICH MUST BE USED WITH TOP SECTION (ITEM # 320180) AND STANDARD BOTTOM SECTION (ITEM # 320181).
   - 2 - PIECE HEAVY DUTY NON-IMPACT TRAFFIC RATED CONCRETE LID (ITEM # 320187). THIS LID HAS A BRUSHED CONCRETE FINISH AND CAN BE USED IN SIDEWALK APPLICATIONS. FOR USE WITH STANDARD TOP SECTION (ITEM # 320182) AND BOTTOM SECTION (ITEM # 320181).
4. NON-IMPACT TRAFFIC RATED IS FOR APPLICATIONS WHERE BOX AND LID WILL BE IN AREAS OF INCIDENTAL TRAFFIC ONLY (I.E. DRIVEWAYS, PARKING LOTS). IT IS NOT RATED FOR INSTALLATION IN ROADWAYS.
5. BELOW GRADE INSTALLATION REQUIRES ELECTRONIC POWER MARKER.
6. THE TOP AND BOTTOM SECTIONS SHALL BE INSTALLED FOR ALL INSTALLATIONS. THIS IS TO ENSURE THAT THE INSTALLATION MEETS ALL TRAFFIC RATINGS, CONDUIT IS AT STANDARD DEPTH AND PULLING EYES ON BOTTOM SECTION CAN BE USED FOR CABLE PULLING APPLICATIONS.

   EXCEPTION: TOP SECTIONS ONLY WITH LIDS CAN BE INSTALLED FOR NON-TRAFFIC RATED INSTALLATIONS WHERE PHYSICAL CONSTRAINTS DO NOT ALLOW FOR THE ADDITIONAL SPACE OF THE BOTTOM SECTION.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	1/31/19	DANNA	EANES	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

LARGE PULL BOX ASSEMBLY

DEC	DEM	DEP	DEF
			X

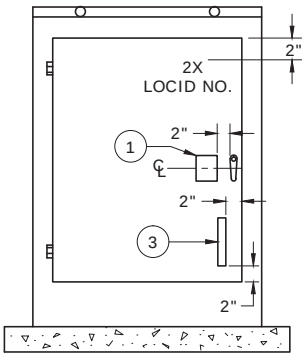
24.07-15

REVISED	BY	CHK'D	APPR.
3 7/31/17	KATIGBAK	BURLISON	ADCOCK
2 3/8/13	KATIGBAK	GUINN	ADCOCK
1 8/16/11	CECCONI	BURLISON	ELKINS
0 10/4/10	CECCONI	GUINN	ELKINS

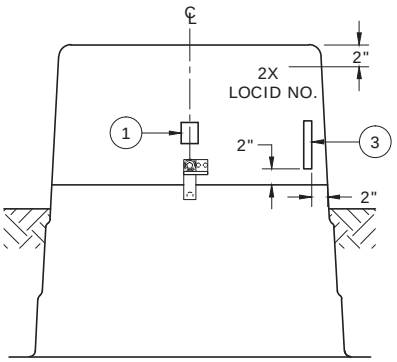
SECTION 25 - ENCLOSURES, PEDESTALS

TABLE OF CONTENTS

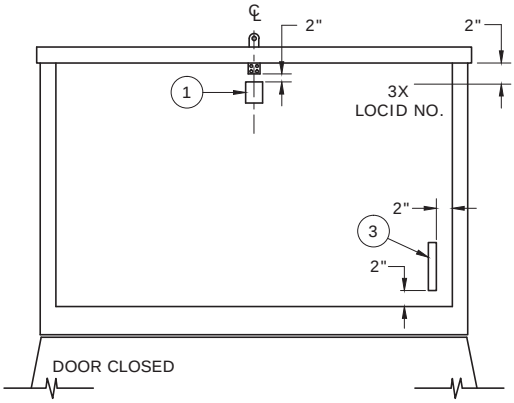
DEC	DEM	DEP	DEF
			X



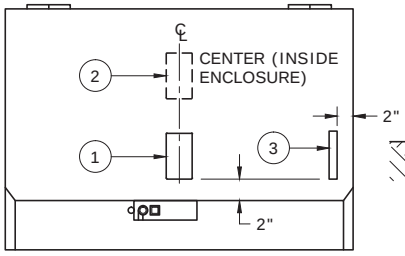
FUSED TAP ENCLOSURE AND CABLE LOOP COVER BOX
DOOR CLOSED
(FOR MAINTENANCE ONLY)



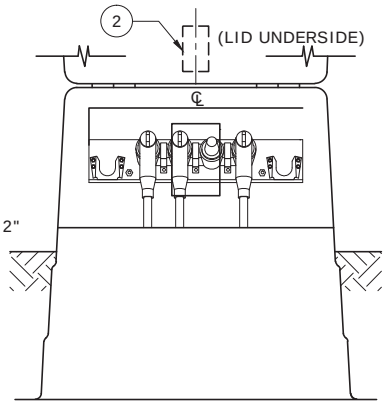
1Ø - 3Ø JUNCTION ENCLOSURE
DOOR CLOSED



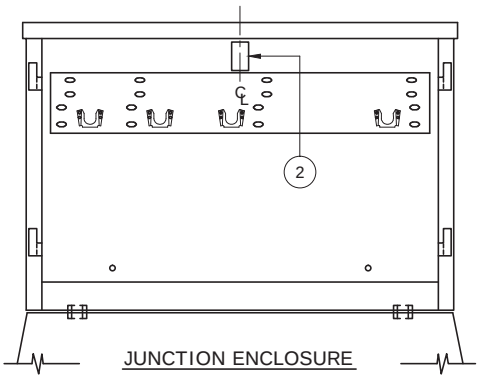
JUNCTION ENCLOSURE
DOOR CLOSED (FMO)
(FOR MAINTENANCE ONLY)



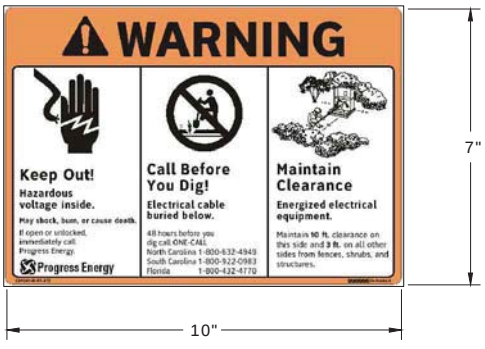
1Ø PRIMARY TERMINATION ENCLOSURE
DOOR CLOSED
"DANGER" LABEL SHALL BE LOCATED ON INSIDE OF DOOR (VISIBLE WHEN OPEN)

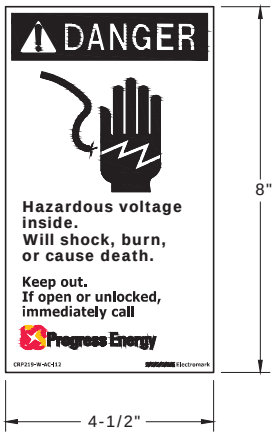


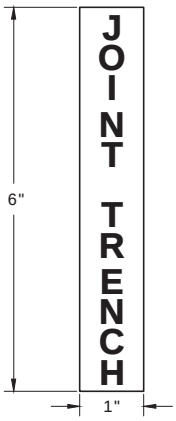
1Ø - 3Ø JUNCTION ENCLOSURE
DOOR OPEN
"DANGER" LABEL SHALL BE LOCATED ON INSIDE OF DOOR (VISIBLE WHEN OPEN)



JUNCTION ENCLOSURE
DOOR OPEN
"DANGER" LABEL SHALL BE LOCATED ON THE INSIDE OF ENCLOSURE AS SHOWN, CN 9220097951.







1 WARNING LABEL CN 9220111316
EXTERIOR MOUNTING ONLY

2 DANGER LABEL CN 9220097951
INTERIOR MOUNTING ONLY

3 'JOINT TRENCH' STICKER CN 9220120922
EXTERIOR MOUNTING ONLY

NOTES:

1. "WARNING" LABEL SHALL BE LOCATED ON THE OUTSIDE OF FUSE TAP ENCLOSURES (BOTH DOORS), PADMOUNTED SWITCHGEAR, LOOP COVER BOXES AND C.T. METERING CABINETS ON CENTER LINE OF DOOR HANDLE OR LOCKING DEVICE AS SHOWN (CN 9220111316).
2. SURFACE TEMPERATURE SHOULD NOT BE BELOW 50°F WHEN LABEL IS APPLIED
3. WIPE METAL SURFACES WITH CABLE CLEANER (CN 30525000) AND A CLEAN CLOTH BEFORE APPLYING LABEL.
4. LABELS MUST BE APPLIED CAREFULLY. ONCE THIS MATERIAL IS APPLIED, IT CANNOT BE MOVED.
5. SPACE LOCID LABELING LINES 1/2" APART.

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

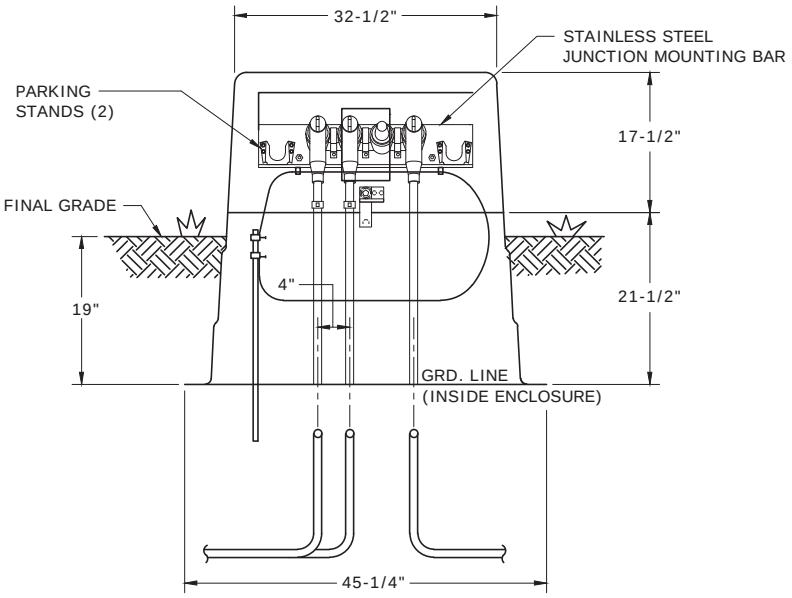
LOCATION OF LABELS FOR PRIMARY ENCLOSURES

Duke Energy

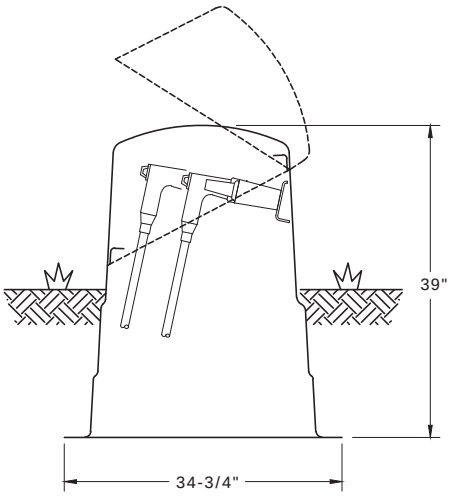
FLA

DWG. 25.01-01

SINGLE-PHASE JUNCTION ENCLOSURE



FRONT VIEW



SIDE VIEW

NOTES:

1. ENCLOSURE IS A ONE PIECE FIBERGLASS UNIT WITH A SWING UP, HINGED REMOVABLE TOP.
2. ENCLOSURE CAN BE USED FOR THE FOLLOWING:
   A. SINGLE-PHASE TAPS LONGER THAN 450 FT. IN LENGTH, USE WILL BE FOR LARGE ACREAGE LOT SUBDIVISIONS. FOR DISTANCES LESS THAT 450 FT., THE TRANSFORMER SHOULD BE INSTALLED DIRECTLY IN THE LOOP BY SPLICING-IN TWO SEPARATE RUNS OF OF PRIMARY CABLE.
   B. TEMPORARILY ENDING PRIMARY CABLE RUNS ON THE LAST PROPERTY LINES IN SUBDIVISION SECTIONS BEING DEVELOPED. THE FIBERGLASS ENCLOSURE SHOULD BE REMOVED ONCE CONSTRUCTION OF THE NEXT PHASE OF DEVELOPMENT BEGINS. FOR DISTANCES LESS THAN 170 FT., IT IS MORE ECONOMICAL TO INSTALL CONDUIT AND PULL CABLE THROUGH AT A LATER DATE.
3. ENCLOSURE WILL ACCEPT 3-WAY PRIMARY JUNCTION OR A 4-WAY PRIMARY JUNCTION. SEE DWG. 25.01-11 FOR PRIMARY JUNCTION MOUNTING DETAILS. DO NOT INSTALL PRIMARY JUNCTIONS WITH STAINLESS STEEL UNIVERSAL MOUNTING BRACKETS AS SHOWN ON DWG. 29.08-01.
4. DO NOT FILL INSIDE OF ENCLOSURE WITH BACKFILL.
5. GROUND MOUNTING BAR AT BOTH GROUND LUGS WITH #4 BC.
6. INSTALL FAULT INDICATORS ON LOAD SIDE CABLES.
7. CABLES/CONDUITS SHALL BE ROUTED SO THAT ALL LOADBREAK ELBOWS AND CABLES MAY BE OPERATED FROM FEED THROUGHS ON PARKING STANDS OR 3/4 WAY JUNCTIONS. SEE DWG. 25.01-11.
8. REPLACEMENT "U" STRAPS WITH HARDWARE ARE INCLUDED IN CN 672.
9. ENCLOSURE SHALL BE ORIENTED/INSTALLED TO FACILITATE OPERATION OF EQUIPMENT.
10. NO ABOVE GROUND OBSTRUCTIONS WITHIN 3' OF SIDES/BACK AND 10' OF FRONT.
11. SEE DWG. 25.01-03B FOR BILL OF MATERIALS.

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

ENCLOSURE, SINGLE-PHASE PRIMARY JUNCTION

Duke Energy®

FLA

DWG. 25.01-03A

BILL OF MATERIALS (SINGLE-PHASE UNIT)						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCP45X34X39FGF	1	22276604	1	ENCLOSURE, CAB, JNT, FBG, 1 PH
				9220111316	1	SIGN, WARNING, EXTERIOR, 10" W X 7"H
				9220069244	5	WIRE, #4 SD, BC
				434337	1	PADLOCK
				9220097951	1	DANGER LABEL, INTERIOR MOUNTING ONLY
	2	GUAR2F	1	9220192319	2	ROD, 5/8" X 5' COPPER CLAD
				060136	1	COUPLING, 5/8" THREADLESS
	3	GUP1E4F	1	160182	1	CONNECTOR, GROUND, EYEBOLT
				162206	3	CONNECTOR, VISE TYPE, 1/0
				9220069244	1	WINE, TIE, #4 SLD CU
				160123	1	CONNECTOR, GND, 5/8" ROD, #2 CU
	4 *	FDTHR154WF	1	9220151419	1	CONNECTOR, LBK, JNT, 4-WAY, 200 AMP
	5 *	FDTHR153WF	1	9220151439	1	CONNECTOR, LBK, JNT, 3-WAY, 200 AMP
	6	FCIURT2N1PTF	1	323455	1 **	INDICATOR FAULT, CABLE, 200 AMP

* USE ITEM 4 OR 5
** ONE PER LOAD SIDE CABLE

NOTES:

1. SEE DWG. 25.01-03A FOR DESIGN SPECIFICATIONS.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/7/12	KATIGBAK	BURLISON	ELKINS
0	8/10/10	DANNA	GUINN	ELKINS

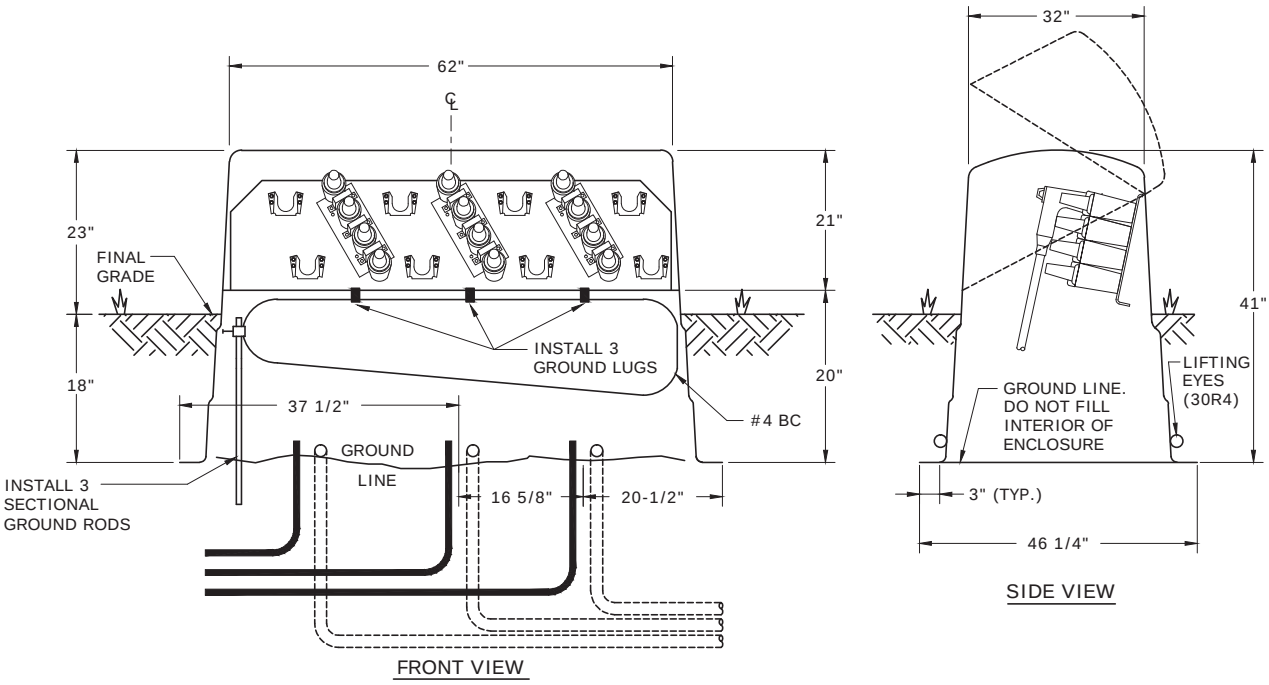
ENCLOSURE, SINGLE-PHASE PRIMARY JUNCTION

Duke Energy®

FLA

DWG. 25.01-03B

THREE-PHASE JUNCTION ENCLOSURE



FRONT VIEW

SIDE VIEW

NOTES:

1. ENCLOSURE IS A ONE PIECE FIBERGLASS UNIT WITH SWING-UP TOP.
2. ENCLOSURE CAN BE USED FOR THE FOLLOWING:

   A. USE TO CUT IN A PERMANENT, RADIAL, THREE-PHASE FEED TO A SINGLE TRANSFORMER FED OFF AN UNDERGROUND LOOP. THIS APPLICATION IS COST EFFECTIVE FOR DISTANCES GREATER THAT 475 FT. (EXISTING CABLE TO TRANSFORMER LOCATION). FOR DISTANCES LESS THAN 475 FT., THE TRANSFORMER SHOULD BE INSTALLED DIRECTLY IN THE LOOP BY SPLICING IN TWO SEPARATE RUNS OF PRIMARY CABLE.

   B. USE TO TERMINATE CABLE FOR USE IN A FUTURE PHASE OF A DEVELOPMENT WHERE THE DISTANCE FROM THE LAST TRANSFORMER TO THE END OF THE FIRST PHASE OF DEVELOPMENT IS GREATER THAT 170 FT. THE FIBERGLASS ENCLOSURE IS TO BE REMOVED AND CABLE SPLICED ONCE THE NEXT PHASE OF DEVELOPMENT BEGINS. FOR DISTANCES LESS THAN 170 FT., IT IS MORE ECONOMICAL TO INSTALL CONDUIT AND PULL CABLE THROUGH AT A LATER DATE.

3. ENCLOSURE WILL ACCEPT THREE, 3-WAY PRIMARY JUNCTIONS (CN 9220151439, CU FDTHR153WF) OR THREE, 4-WAY PRIMARY JUNCTION (CN 9220151419, CU FDTHR154WF) SEE DWG. 25.01-11 FOR PRIMARY JUNCTION MOUNTING DETAILS. **DO NOT** INSTALL PRIMARY JUNCTIONS WITH WALL MOUNTING BRACKETS AS SHOWN ON DWG. 29.08-01.
4. CABLES/CONDUITS SHALL BE ROUTED SO THAT ALL LOADBREAK ELBOWS AND CABLES MAY BE OPERATED FROM FEED THRUS ON PARKING STANDS OR 3-WAY OR 4-WAY JUNCTIONS.
5. INCOMING CABLES MUST BE PROPERLY PHASED AND LABELED BEFORE THEY ARE POSITIONED AS SHOWN ABOVE.
6. DO NOT FILL INSIDE OF ENCLOSURE WITH BACKFILL.
7. GROUND MOUNTING BAR AT LUGS WITH #4 BC.
8. ENCLOSURE SHALL BE ORIENTED/INSTALLED TO FACILITATE OPERATION OF EQUIPMENT.
9. NO ABOVE GROUND OBSTRUCTIONS SHOULD BE WITHIN 3' OF SIDES/BACK AND 10' OF FRONT.
10. SEE DWG. 25.01-10B FOR BILL OF MATERIALS.

3				
2				
1	6/26/12	KATIGBAK	BURLISON	ELKINS
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ENCLOSURE, THREE-PHASE PRIMARY JUNCTION

Progress Energy

FLA

DWG. 25.01-10A

BILL OF MATERIALS (THREE-PHASE UNIT)						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCP62X46X41FGF	1	22276810	1	ENCLOSURE, CAB, JNT, FBG, 3 PH
				9220111316	1	SIGN, WARNING, EXTERIOR, 10" W X 7"H
				9220069244	5	WIRE, #4 SD, BC
				434337	1	PADLOCK
				9220097951	1	DANGER LABEL, INTERIOR MOUNTING ONLY
	2	GUAR2F	1	9220192319	2	ROD, 5/8" X 5', COPPER CLAD
				060136	1	COUPLING, 5/8", THREADLESS
	3	GUP3E4F	1	160123	1	CONNECTOR, GROUND, 5/8" ROD, #2 CU
				160182	1	CONNECTOR, GROUND, EYE BOLT
				162206	3	CONNECTOR, VISE TYPE, 1/0
				9220069244	20	WIRE, TIE, #4 SLD CU
	4 *	FDTHR154WF	3	9220151419	1	CONNECTOR, LBK, JNT, 4-WAY, 200 AMP
	5 *	FDTHR153WF	3	9220015139	1	CONNECTOR, LBK, JNT, 3-WAY, 200 AMP
	6	FCIURT2N1PTF	1	323455	1 **	INDICATOR FAULT, CABLE, 200 AMP

* USE ITEM 4 OR 5
** ONE PER LOAD SIDE CABLE

NOTES:

1. SEE DWG. 25.01-10A FOR DESIGN SPECIFICATIONS.

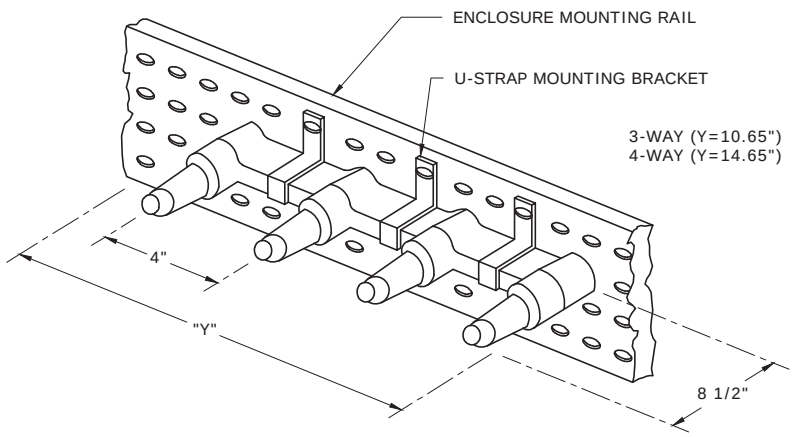
DUKE ENERGY.

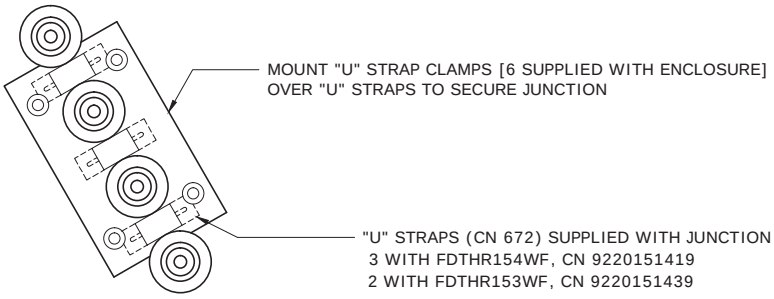
REVISED	BY	CK'D	APPR.
3 8/26/15	DANNA	EANES	ADCOCK
2 9/7/12	KATIGBAK	BURLISON	ELKINS
1 6/26/12	KATIGBAK	BURLISON	ELKINS
0 8/10/10	DANNA	GUINN	ELKINS

ENCLOSURE, THREE-PHASE PRIMARY JUNCTION

DEC	DEM	DEP	DEF
			X

25.01-10B





JUNCTION MOUNTING DETAIL
FOR POWER DESIGN MODEL

NOTES:

1. LOOSEN OR REMOVE ENCLOSURE MOUNTING RAIL TO ALLOW ACCESS TO BACK OF MOUNTING RAIL.
2. SLIDE SHORT U-STRAPS IN GROOVES BETWEEN BUSHING INTERFACES.
3. PLACE PRIMARY JUNCTION AGAINST ENCLOSURE MOUNTING RAIL IN THE DESIRED LOCATION AND BOLT USING STAINLESS STEEL BOLTS AND NUTS WITH JUNCTION. TIGHTEN ALL BOLTS SECURELY TO PREVENT MOVEMENT DURING OPERATION.
4. SEE DWGS. 25.01-03A AND 25.01-03B FOR MOUNTING DETAILS OF SINGLE-PHASE ENCLOSURES. SEE DWGS. 25.01-10A AND 25.01-10B FOR MOUNTING DETAILS OF THREE-PHASE ENCLOSURES.
5. REMOVE PROTECTIVE CAPS, CLEAN, AND LUBRICATE ENTIRE BUSHING INTERFACE WITH SILICONE GREASE. LUBRICATE ENTIRE ELBOW OR RECEPTACLE INTERFACE DURING INSTALLATION. PUSH ELBOW OR RECEPTACLE ON AND PULL OFF ONCE OR TWICE TO MAKE SURE THE SILICONE LUBRICANT COVERS AND IS EMBODIED IN ALL INTERFACE AREAS. ADD SILICONE LUBRICANT (CONTAINED IN KIT) AS NEEDED.
6. FOR METAL UNITS ONLY, DO NOT INSTALL ELBOWS WITHIN 4" OF A GROUNDED WALL.
7. REPLACEMENT "U" STRAPS WITH HARDWARE CAN BE ORDERED FROM THE WAREHOUSE (CN 672).
8. IF ELBOW IS CLOSED INTO A FAULT, REPLACE THE ELBOW AND PRIMARY JUNCTION.

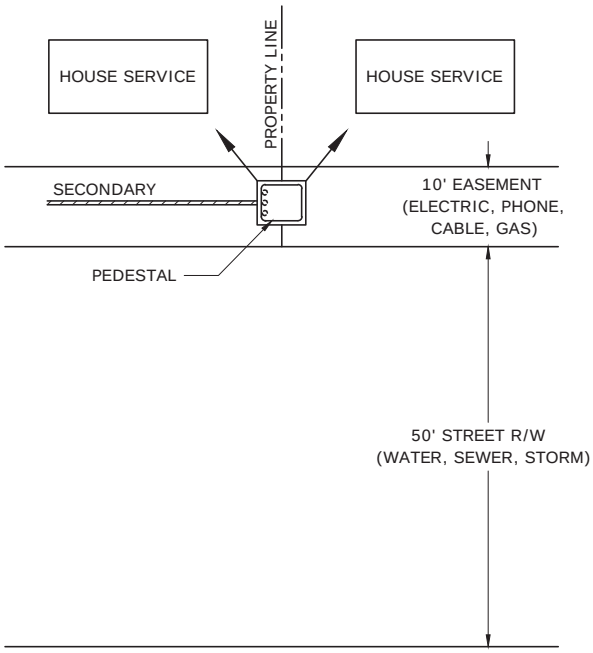
3				
2				
1				
O	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOADBREAK 3-WAY AND 4-WAY JUNCTIONS
ENCLOSURE MOUNTED

Duke Energy

FLA

DWG. 25.01-11



NOTES:

1. SOIL BENEATH PEDESTAL BASE SHALL BE COMPACTED TO THE FIRMNESS OF UNDISTURBED EARTH AND SHALL BE FREE OF ROOTS AND OTHER ORGANIC MATERIALS.
2. SECONDARY AND SERVICES SHALL ENTER APPROXIMATELY 4" INSIDE LEFT SIDE OF BASE.
3. TRAIN CABLE TO FINAL ASSEMBLED POSITION. STAGGER HEIGHT OF NEUTRAL AND HOT LEG CONDUCTORS TO MINIMIZE RISK OF ACCIDENTAL CONTACT. SECURE PLASTIC CONNECTOR COVER OVER BLOCK CONNECTOR USING ELECTRICAL TAPE OR TIE WRAPS.
4. PEDESTAL LOCKING MECHANISM SHALL BE INSTALLED A MINIMUM OF 2" ABOVE FINAL GRADE.
5. PEDESTAL BASE SHALL HAVE A MINIMUM OF 12" OF BACKFILL.
6. DO NOT FILL INSIDE OF PEDESTAL WITH BACKFILL.
7. FOR CABLE LOCATING PURPOSES, ATTACH A 3' PIECE OF #6 (SD) COPPER TO THE NEUTRAL CONNECTOR AND EXTEND OUTSIDE THE TEMPORARY SERVICE ACCESS DOOR. COIL EXCESS #6 THAT EXTENDS OUTSIDE OF TEMPORARY ACCESS DOOR BELOW GRADE.
8. REMOVE #6 WHEN THE FIRST SERVICE IS ESTABLISHED AT PEDESTAL.
9. TEMPORARY SERVICE ACCESS DOOR LOCATED ON FRONT RIGHT SIDE IS TO BE USED FOR TEMPORARY SERVICE CONSTRUCTION ONLY (EXCEPT #6 BC). REMOVE ALL TEMPORARY CONDUCTORS AND CLOSE ACCESS DOOR UPON CONNECTING PERMANENT SERVICE.
10. NO ABOVE GROUND OBSTRUCTION (EXCEPT TEMP BOARDS) SHALL BE PLACED WITHIN 3' OF PEDESTAL.
11. SEE DWG 25.02-03 FOR CONNECTOR APPLICATION.
12. SECURE PEDESTAL WITH PENTA-BOLT AND PADLOCK (ITEM # 434337).
13. CONDUIT SHALL BE CUT OFF 6" BELOW FINAL GRADE PRIOR TO INSTALLING PEDESTAL.
14. CONDUIT SHALL BE CAPPED AFTER CUTTING TO LENGTH TO PREVENT FOREIGN MATTER FROM ENTERING DUCT. (SEE DWG. 22.04-03).
15. INSTALL WARNING LABEL CENTERED 1" ABOVE LOCKING MECHANISM.
16. CONDUCTORS SHALL BE LABELED. (DWGS. 23.04-03A, 23.04-03B AND 23.04-03C).

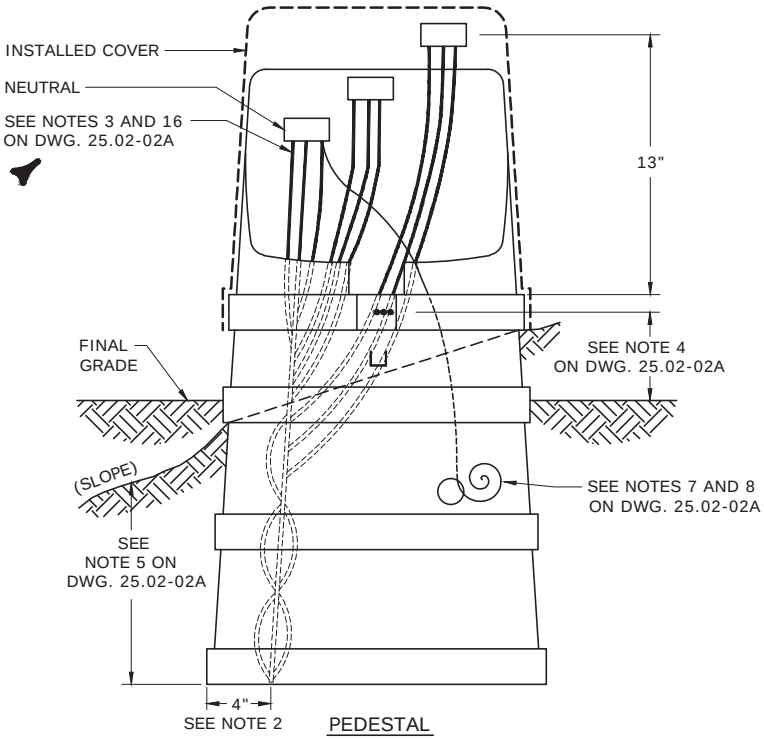
DUKE ENERGY.

3				
2	7/24/15	EANES	BURLISON	ADCOCK
1	11/14/12	DANNA	DANNA	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

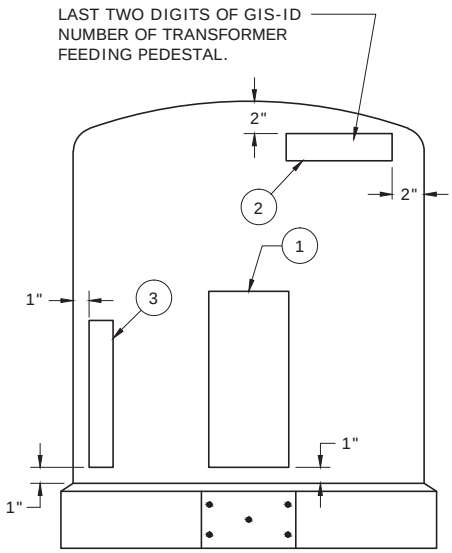
PEDESTAL INSTALLATION AND LOCATION

DEC	DEM	DEP	DEF
			X

25.02-02A

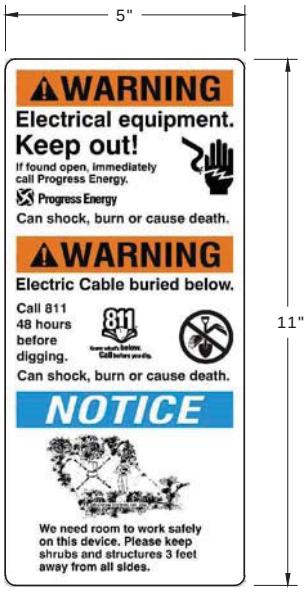


PEDESTAL



COVER

ABOVE GRADE SECONDARY PEDESTAL					
DESCRIPTION	COMP. UNIT	ITEM NUMBER	MAXIMUM CONDUCTORS		APPLICATION
			SINGLE-PHASE	THREE-PHASE	
6"x6"	PEDUR6X6PF	325531	4 - 2 #6 AL	-	LIMITED IN NUMBER AND SIZE OF CONDUCTORS
10"x14"	PEDUR9X14PF	325533	6 - 350 TPX OR 4 - 500 TPX	-	
12"x20"	PEDUR12X20PF	325535	2 - 500 TPX & 4 - 250 TPX	2 - 500 QPX & 4 - #4/0 QPX	
20"x22"	PEDUR20X22PF	325537	8 - 750 TPX	8 - 750 QPX	
①WARNING		9220118950			ALL PEDESTALS EXCEPT PEDUR6X6PF
②GIS		44323_			ALL PEDESTALS
③ JOINT USE					JOINT TRENCH



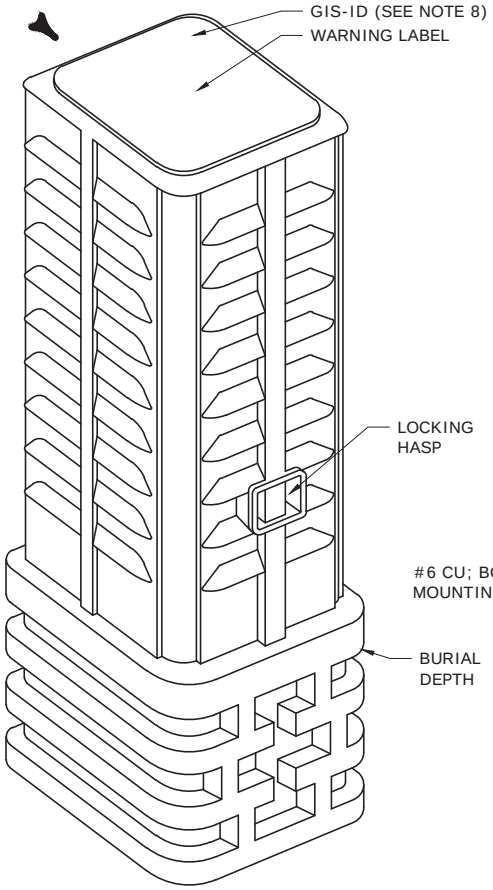
WARNING LABEL
ITEM # 9220118950

REVISED	BY	CK'D	APPR.
3			
2			
1	7/24/15	EANES	BURLISON	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

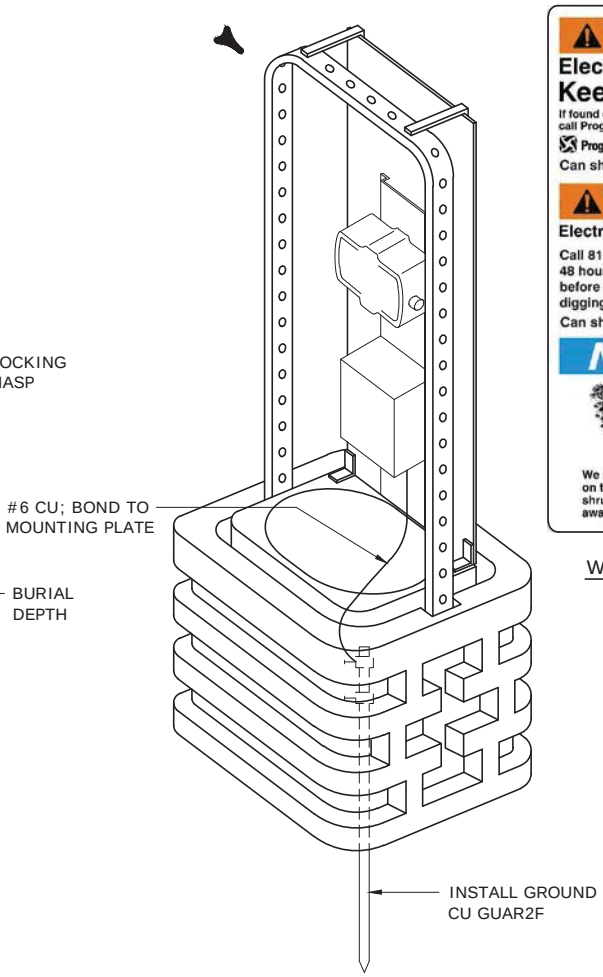
PEDESTAL INSTALLATION AND LOCATION

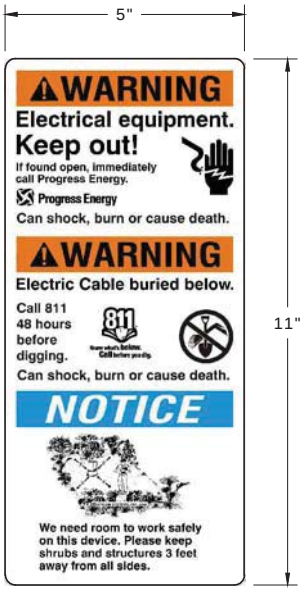
DEC	DEM	DEP	DEF
			X

25.02-02B



PEDESTAL
CN 9220239984
CU PEDNAN12X18FGF





WARNING LABEL
CN 9220118950

NOTES:

1. TO KEEP COSTS AT A MINIMUM AND TO REDUCE RIGHT-OF-WAY ISSUES, NAN ANTENNA PEDESTALS SHOULD BE INSTALLED WITHIN 2-4 FT. OF EXISTING TRANSFORMER OR POWER PEDESTAL. INSTALL NAN POWER CABLE IN A SHORT PIECE OF CONDUIT FROM THE TRANSFORMER/POWER PEDESTAL TO THE NAN PEDESTAL. WHERE THIS IS NOT POSSIBLE, SECONDARY CABLE MUST BE RAN FROM THE TRANSFORMER/POWER PEDESTAL TO THE NAN ANTENNA PEDESTAL.
2. SOIL UNDERNEATH THE PEDESTAL SHALL BE COMPACTED TO THE FIRMNESS OF UNDISTURBED EARTH AND SHALL BE FREE OF ROOTS AND OTHER ORGANIC MATERIALS.
3. SECONDARY SHALL ENTER APPROXIMATELY 4" INSIDE LEFT SIDE OF BASE.
4. PEDESTAL BASE SHALL HAVE A MINIMUM OF 12" OF BACKFILL.
5. DO NOT FILL INSIDE OF PEDESTAL WITH BACKFILL.
6. SECURE PEDESTAL WITH COMPANY PADLOCK (CN 434337).
7. INSTALL WARNING LABELS AS SHOWN.
8. INSTALL GIS-ID NUMBER AS SHOWN ON DWG. 25.02-02B.
9. WHEN PEDESTAL IS INSTALLED WITHIN 2-4' OF TRANSFORMER, BOND ANTENNA PLATE TO TRANSFORMER GROUND WITH #6 CU. ELSE, INSTALL 10' GROUND AND BOND ANTENNA PLATE TO GROUND WITH #6 CU.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/20/13	BURLISON	GUINN	ADCOCK
0	3/8/13	BURLISON	GUINN	ADCOCK

PEDESTAL - PGN NAN ANTENNA

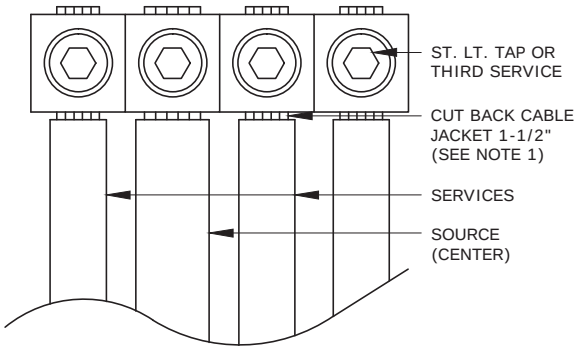
DUKE ENERGY.

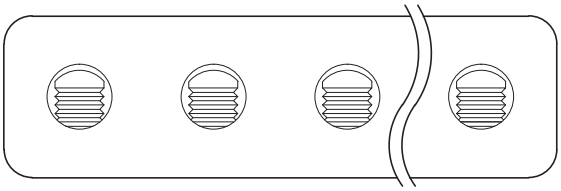
FLA

DWG. 25.02-02C

TYPICAL

4-HOLE CONNECTOR





TYPICAL 4, 6, AND 8 HOLE STRAIGHT CONNECTOR

FOLLOW SAFETY GUIDELINES WHILE WORKING
ON ENERGIZED CONDUCTORS.

ABOVE GRADE SECONDARY CONNECTORS						
DESCRIPTION	RANGE	COMPATIBLE UNIT	CN	TORQUE	USE	COVER
4 HOLE	#6-4/0	KP4W40F	320951	25 FT.-LBS	PREFERRED	* 320941
6 HOLE	#6-4/0	KP6W40F	320953	25 FT.-LBS		* 320942
8 HOLE	#6-4/0	KP8W40F	327843	25 FT.-LBS		* 320944
4 HOLE	#6-350	KP4H35N10F	11197902	25 FT.-LBS		**
6 HOLE	#6-350	KP6H35N10F	9220197885	25 FT.-LBS		**
6 HOLE	1/0-750	KP6W75F	327847	45 FT.-LBS		* 323238
8 HOLE	1/0-750	KP8W75F	327848	45 FT.-LBS		* 327374
HD COVER	1/0-750					327379
INHIBITOR			403108			

* COVER SUPPLIED WITH CONNECTOR IN COMPATIBLE UNIT

** COVER IS INCLUDED WITH CONNECTOR

NOTES:

1. **IMPORTANT:** THESE CONNECTORS ARE FOR ABOVE GRADE INSTALLATIONS ONLY. (NOT TO BE USED IN FLUSHMOUNT OR BELOW GRADE APPLICATIONS).
2. WIRE BRUSH CONDUCTORS.
3. FOR ALUMINUM CONDUCTOR INSTALLATIONS APPLY GRIT INHIBITOR (CN 403108).
4. FOR COPPER CONDUCTOR INSTALLATIONS APPLY NO GRIT INHIBITOR.
5. INSULATING COVERS MUST BE INSTALLED ON CONNECTORS ANYTIME PEDESTAL IS CLOSED. WHEN WORKING WITH ENERGIZED CONDUCTORS/CONNECTORS, FOLLOW RULES SPECIFIED IN APM.
6. CONDUCTORS SHALL BE LABELED. SEE DWGS. 23.04-03A, 23.04-03B AND 24.04-03C.
7. INSTALL SOURCE CONDUCTOR AS CLOSE AS POSSIBLE TO CENTER OF CONNECTOR.
8. SEE DWGS. 25.02-02A AND 25.02-02B FOR ABOVE GRADE PEDESTAL INSTALLATIONS.

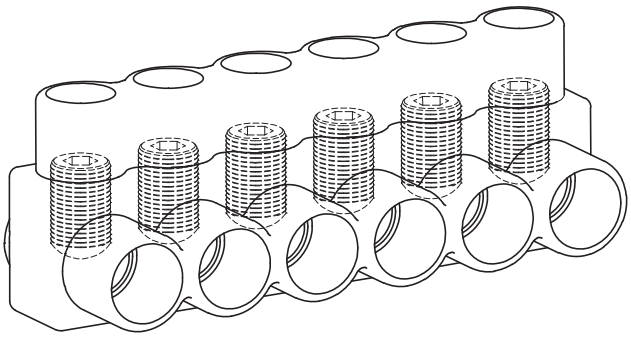
3				
2				
1	11/14/12	DANNA	DANNA	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

PEDESTAL SECONDARY CABLE CONNECTIONS

Duke Energy®

FLA

DWG. 25.02-03



ABOVE GRADE INSULATED SECONDARY PEDESTAL CONNECTORS					
NUMBER OF OUTLETS	RANGE	COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION	TORQUE (FT-LBS)
4	#6 - 250	CONN-UG-PED-AG-INSL-4POS-SM-F	9220285953	CONNECTOR, INSULATED, ELECTRICAL, PEDESTAL, 6 AWG - 250 MCM, BI-METAL, 4 POSITION	25
6	#6 - 250	CONN-UG-PED-AG-INSL-6POS-SM-F	9220285956	CONNECTOR, PEDESTAL, ELECTRICAL, INSULATED, 6 AWG - 250 MCM, BI-METAL, 6 POSITION	25
8	#6 - 250	CONN-UG-PED-AG-INSL-8POS-SM-F	9220285959	CONNECTOR, PEDESTAL, ELECTRICAL, INSULATED, 6 AWG - 250 MCM, BI-METAL, 8 POSITION	25
4	#12 - 350	CONN-UG-PED-AG-INSL-4POS-MD-F	9220285957	CONNECTOR, PEDESTAL, ELECTRICAL, INSULATED, 12 AWG - 350 MCM, BI-METAL, 4 POSITION	25
6	#12 - 350	CONN-UG-PED-AG-INSL-6POS-MD-F	9220285960	CONNECTOR, PEDESTAL, ELECTRICAL, INSULATED, 12 AWG - 350 MCM, BI-METAL, 6 POSITION	25
6	1/0 - 750	CONN-UG-PED-AG-INSL-6POS-XL-F	9220285952	CONNECTOR, INSULATED, ELECTRICAL, PEDESTAL, 1/0 AWG - 750 MCM, BI-METAL, 6 POSITION	45
8	1/0 - 750	CONN-UG-PED-AG-INSL-8POS-XL-F	9220285961	CONNECTOR, PEDESTAL, ELECTRICAL, INSULATED, 1/0 AWG - 750 MCM, BI-METAL, 8 POSITION	45

NOTES:

1. THESE CONNECTORS ARE FOR ABOVE GRADE INSTALLATIONS ONLY. THEY ARE INSULATED, BUT ARE NOT WATERPROOF AND ARE NOT TO BE USED IN FLUSHMOUNT OR BELOW GRADE APPLICATIONS.
2. THESE CONNECTORS ARE TO BE USED ONLY WITHIN ENCLOSURES. THE INSULATING COMPOUND DOES NOT CONTAIN UV PROTECTION SO THEY CANNOT BE USED IN OVERHEAD APPLICATIONS WITH EXPOSURE TO SUNLIGHT.
3. CONNECTORS ARE SUPPLIED WITH INHIBITOR. THIS ENSURES THE CORRECT INHIBITOR FOR THE APPLICATION IS USED AND IT SHOULD NOT BE REMOVED PRIOR TO INSTALLATION.
4. SEE DWG. 25.02-104B FOR PROPER INSTALLATION OF THE SOURCE AND LOAD CONDUCTORS RELATIVE TO EACH OTHER. IMPROPER LOCATION OF THE SOURCE OR LOAD CONDUCTORS CAN, IN SOME INSTANCES, LEAD TO OVERHEATING AND PREMATURE FAILURE OF THE CONNECTION AND IS TO BE AVOIDED.
5. CONDUCTORS SHALL BE LABELED PER THE APPLICABLE STANDARD OR PRACTICE IN EACH INDIVIDUAL JURISDICTION.
6. TRAIN CABLE ENDS TO THE PEDESTAL CONNECTOR MAKING SURE THE CABLES ARE STRAIGHT AS THEY APPROACH THE CONNECTOR.
7. CLEAN THE CABLES FOR A DISTANCE OF 12" FROM THE CUT ENDS WITH CABLE CLEANING FLUID AND A CLEAN CLOTH. MAKE SURE THE CABLES ARE FREE OF DIRT AND MOISTURE.
8. REMOVE INSULATION FROM THE CABLES TO THE PROPER DISTANCE FOR THE CONDUCTOR TO FULLY EXTEND INTO THE SET-SCREW. ALWAYS USE AN APPROVED METHOD THAT WILL NOT DAMAGE THE CONDUCTOR WHEN REMOVING THE CABLE INSULATION.
9. BRUSH THE CONDUCTOR WELL AND IMMEDIATELY INSTALL THE CONDUCTOR INTO THE CONNECTOR.
10. TIGHTEN THE SET SCREWS USING THE APPROPRIATE SIZE ALLEN WRENCH AND WIPE AWAY ANY EXCESS INHIBITOR FROM THE CONNECTOR AND CABLE.

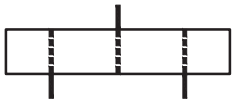
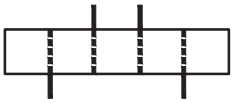
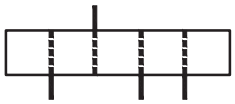
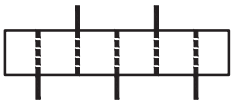
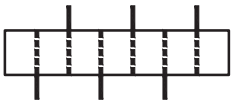
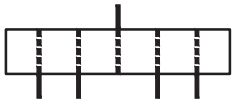
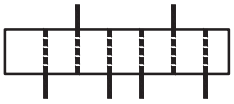
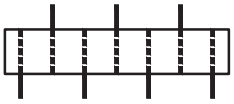
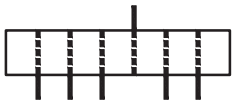
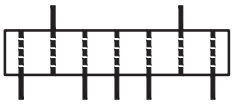
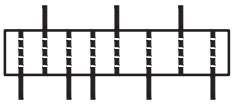
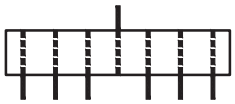
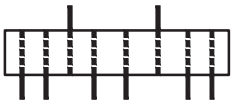
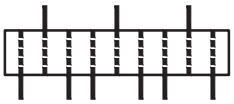
DUKE ENERGY.

3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

INSULATED SECONDARY PEDESTAL CONNECTORS

DEC	DEM	DEP	DEF
			X

25.02-104A

NUMBER OF CUSTOMER CONDUCTORS PER PHASE	NUMBER OF COMPANY CONDUCTORS PER PHASE		
	1	2	3
1		N/A	N/A
2			N/A
3			
4			
5			
6			

LEGEND:

CUSTOMER OWNED CONDUCTORS	COMPANY OWNED CONDUCTORS

NOTES:

1. IMPROPER LOCATION OF THE SOURCE OR LOAD CONDUCTORS CAN, IN SOME INSTANCES, LEAD TO OVERHEATING AND PREMATURE FAILURE OF THE CONNECTION AND IS TO BE AVOIDED.
2. PARALLEL SOURCE CONDUCTORS SHOULD NOT BE GROUPED AT ONE END OF THE CONNECTOR.
3. REFERENCE THE TABLE ABOVE FOR THE IDEAL CONFIGURATION BASED ON THE NUMBER OF SOURCE AND LOAD CONDUCTORS PRESENT.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK

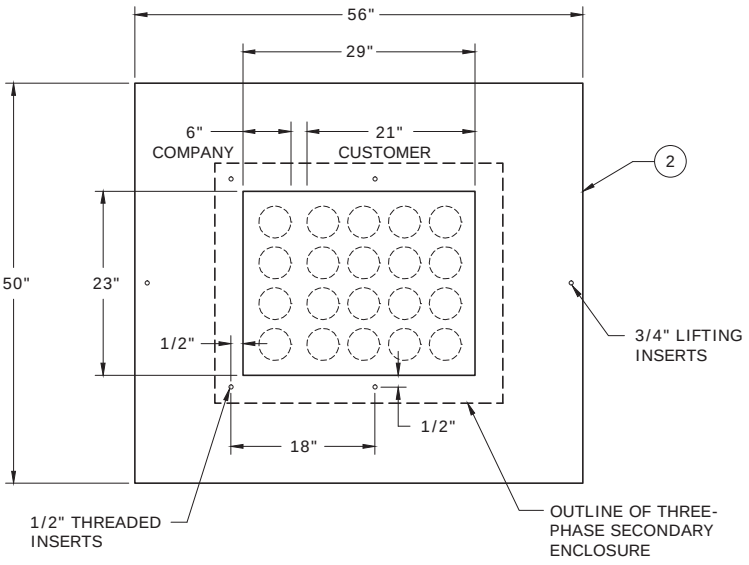
TYPICAL CONNECTOR BLOCK CONDUCTOR LOCATIONS

DUKE ENERGY.

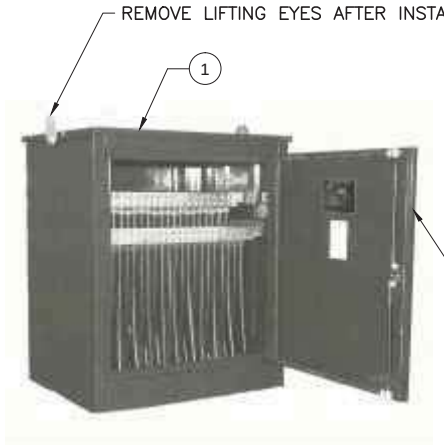
DEC	DEM	DEP	DEF
X	X	X	X

25.02-104B

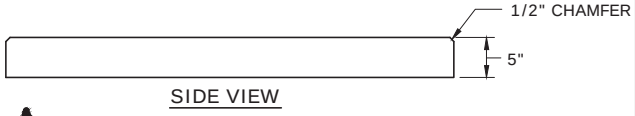
WARNING LABEL
CN 9220118950



PLAN VIEW
CN 327704



SECONDARY TERMINATION ENCLOSURE
36"W X 30"D X 44"H



SIDE VIEW

"CAUTION"
POSSIBLE PARALLEL FEED

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCS36X30X44SF	1	327454	1	ENCLOSURE, PAD-MOUNTED SECONDARY
				160123	1	CONNECTOR, GND, 5/8, ROD, 2 CU
				162204	1	CONNECTOR, VISE TYPE, 4 CU
				434337	1	PADLOCK, ROTARY, HASP
				9220118950	2	WARNING LABEL
				9220069244	5	WIRE, 4-SLD, CU, SDW, #4 AWG
	2	PADS50X56CF	1	327704	1	PAD, SECONDARY ENCLOSURE

NOTES:

1. CIAC REQUIRED WHEN SECONDARY TERMINATION ENCLOSURE IS INSTALLED BY COMPANY.
2. ENCLOSURE TO BE BONDED TO DRIVEN GROUND RODS (ISSUED SEPARATELY).
3. REFER TO DWG. 24.03-01 FOR PAD INSTALLATION.
4. USE FIRE ANT KILLER CONTROL UNDER ENTIRE PAD INCLUDING PAD OPENINGS.
5. SET SCREW CONNECTORS (INCLUDED) WILL ACCEPT 22 CONDUCTORS, #2-750, CU OR AL.

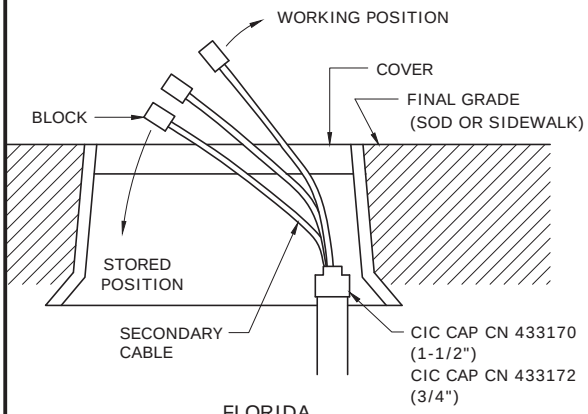
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	3/24/15	DANNA	EANES	ADCOCK
1	2/10/14	McCONNELL	DANNA	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

SECONDARY TERMINATION ENCLOSURE

DEC	DEM	DEP	DEF
			X

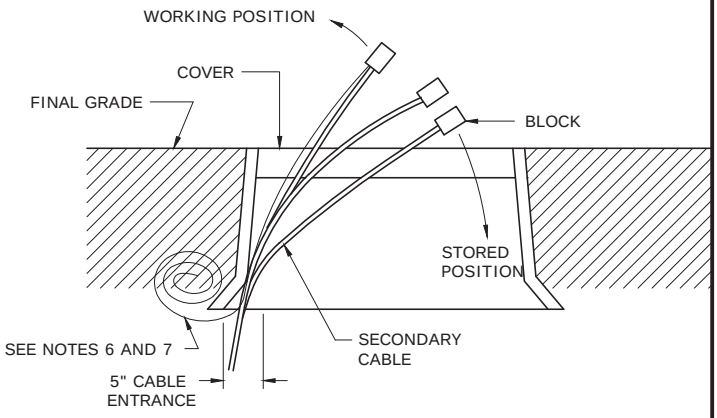
25.03-01



FLORIDA
FOR MAINTENANCE ONLY

NOTES:

1. EMPTY CONDUIT INSTALLED IN PEDESTAL MUST BE CAPPED UNTIL SUCH TIME CABLE IS PULLED IN.
2. CIC CONDUIT SHOULD BE CUT OFF 2" ABOVE BOTTOM OF PEDESTAL PRIOR TO INSTALLING PEDESTAL.
3. CIC MUST BE CAPPED WITH CIC CAP AFTER CUTTING TO LENGTH TO PREVENT FOREIGN MATTER FROM ENTERING DUCT.



PREFERRED
SIDE VIEW

FLUSH MOUNT HANDHOLE WITH ELECTRONIC MARKER			
DESCRIPTION	COMPATIBLE UNIT	CATALOG NUMBER	MAXIMUM MULTIPLEX CABLES
9" X 14" X 12"	PEDFM9X14PF	320173	2 #4/0 & 1 #6
			4 #2
12" X 20" X 17"	PEDFM12X20PF	320174	1 - 500, 2 #4/0 & 1 #6
			4 #4/0 & 1 #6
			6 #2/0
11" X 15" X 18"	PEDFM11X15X18PF	381612	SIDEWALKS, PAVED PEDESTRIAN AREAS (INCIDENTAL LIGHT TRAFFIC)
10" ROUND X 10"	PEDFM10X10RDPF	9220184254	2 #2 & 1 #6
9" X 14" REPLACEMENT LID	-	9220203005	-

NOTES:

1. SOIL BENEATH PEDESTAL BASE SHALL BE COMPACTED TO THE FIRMNESS OF UNDISTURBED EARTH AND SHALL BE FREE OF ROOTS AND OTHER ORGANIC MATERIAL.
2. **IMPORTANT:** IN ORDER TO MINIMIZE SIDEWALL DEFORMATION, INSTALL COVER BEFORE BACKFILLING AND TAMPING.
3. SECONDARY AND SERVICES SHALL ENTER WITHIN 5" OF END OF BASE.
4. TRAIN CABLE TO POSITION SHOWN. ALL CABLES SHALL ENTER THE PEDESTAL AT ONE END. VERIFY THAT THE CABLE MAY BE BENT OVER TO A POSITION BENEATH THE PEDESTAL COVER, BUT STILL TO AN UPRIGHT POSITION.
5. DO NOT FILL INSIDE WITH BACKFILL.
6. FOR CABLE LOCATING PURPOSES ATTACH A 3' PIECE OF #6 (SD) COPPER TO THE NEUTRAL CONNECTOR AND EXTEND OUTSIDE THE BOTTOM OF THE HANDHOLE EXITING THE END WHERE COVER BOLTING MECHANISM IS LOCATED. COIL EXCESS #6 BELOW GRADE.
7. REMOVE #6 BC WHEN THE FIRST SERVICE IS ESTABLISHED AT PEDESTAL.
8. ALL CONNECTORS IN FLUSH MOUNT OR BELOW GRADE APPLICATIONS MUST BE WATERPROOF TYPE.
9. ELECTRONIC MARKER IN LID.

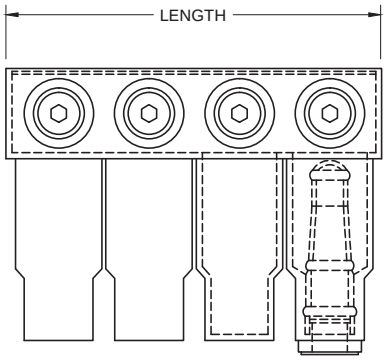
REVISED		BY	CK'D	APPR.
3				
2				
1	6/21/13	DANNA	DANNA	ADCOCK
0	10/4/10	DANNA	GUINN	ELKINS

FLUSH MOUNT SECONDARY JUNCTION BOX

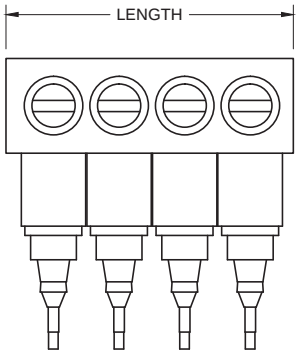
DUKE ENERGY.

FLA

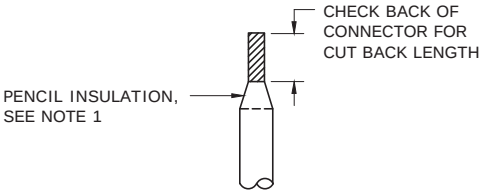
DWG. 25.04-05



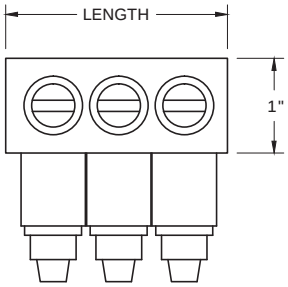
CMC ELASTIMOLD UTILCO



HOMAC



DETAIL 'A'



HOMAC
CU KPW3W10N12F
CN 327852

SUBMERSIBLE CONNECTORS				
COMPATIBLE UNIT	CATALOG NUMBER	RANGE	WAYS	MAXIMUM LENGTH
KPW3W40F	327844	#10CU - 350AL	3	4-13/16"
KPW4W40F	327845	#10CU - 350AL	4	6-3/16"
KPW6W35F	327850	#10CU - 350AL	6	9-5/16
KPW6W50F	327851	#10CU - 500AL	6	10-1/2"
KPW3W10N12F	327852	#12CU - 1/0AL	3	2-9/16"

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. TO BE USED IN VAULT, HAND HOLE, FLUSH MOUNT, AND TROUGH INSTALLATIONS.
14. ALUMINUM OR COPPER CAN BE USED IN CONNECTORS.
15. 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.
16. 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.
17. USE CN 327852 FOR LIGHTING CIRCUIT CONNECTIONS IN LIGHTING PEDESTAL.

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

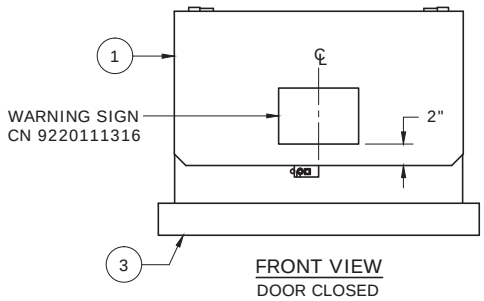
SINGLE SET SCREW

SUBMERSIBLE CONNECTORS - 600 VOLTS

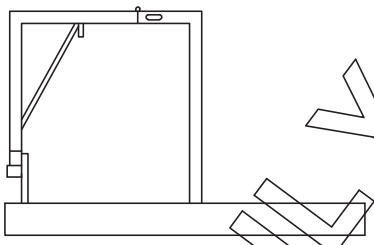
Duke Energy®

FLA

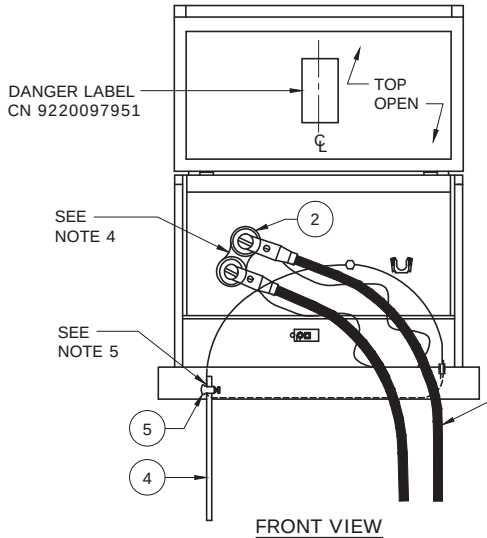
DWG. 25.04-06



FRONT VIEW
DOOR CLOSED



SIDE VIEW



FRONT VIEW
DOOR OPEN

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCP34X24X24SF	1	9220111316	1	SIGN, WARNING, EXTERIOR, 10" WIDE X 7" HIGH
				9220097951	1	LABEL, DANGER, INTERIOR, 4.5" WIDE X 8" HIGH
				327453	1	ENCLOSURE, PAD MOUNTED
				9220069244	5	WIRE #4 SD BC
				443333	2	TAG, PLASTIC
				160123	1	CONN CW 5/8" ROD 2 STR
				162204	1	CONN VICE TYPE 4 CU
				434337	1	PADLOCK
	2	TUAFDTHR152WF	1	326222	1	BUSHING, 2 WAY FEED THRU
	3	PAD1P20X45CF	1	327703	1	XFMR PAD, SINGLE PHASE
	4	GUAR2F	1	9220192319	2	ROD, 5/8" X 5' COPPER CLAD
				060136	1	COUPLING, 5/8" THREADLESS
	5	GUP1E4F	1	160182	1	CONNECTOR, GROUND, EYEBOLT
				162206	3	CONNECTOR, VISE TYPE, 1/0
				9220069244	1	WINE, TIE, #4 SLD CU
				160123	1	CONNECTOR, GND, 5/8" ROD, #2 CU

NOTES:

1. ENCLOSURE IS ONE PIECE ALUMINUM UNIT WITH A SWING UP, HINGED TOP.
2. APPLICATIONS:
   (A) TERMINATE PRIMARY CABLE RUN ON THE LAST PROPERTY LINE OF SUBDIVISION SECTION.
   (B) DELAY SINGLE PHASE TRANSFORMER INSTALLATION
3. CABLES/CONDUITS SHALL BE ROUTED THROUGH SINGLE-PHASE PADS PER DWG. 22.06-02A.
4. TRAIN CABLE ON FEED THRU TO PARKING STAND TO ALLOW FUTURE SWITCHING TO SINGLE-PHASE PAD-MOUNTED TRANSFORMER WITHOUT HAVING TO RE-TERMINATE OR SPLICE CABLE.
5. GROUND ENCLOSURE PER DWG. 27.01-03.
6. LABEL CABLES PER DWGS. 23.04-03A, 23.04-03B AND 23.04-03C.

REVISED	BY	CK'D	APPR.
4 11/14/12	DANNA	DANNA	ADCOCK
3 9/7/12	KATIGBAK	BURLISON	ELKINS
2 5/24/12	DANNA	BURLISON	ELKINS
0 8/10/10	DANNA	GUINN	ELKINS

SINGLE-PHASE
PRIMARY TERMINATION ENCLOSURE (FMO)

Duke Energy®

FLA

DWG. 25.03-03

26.00 GENERAL

26.02 - 200 AMP LOADBREAK ELBOWS AND COMPONENTS

26.04 - 200 AMP DEADBREAK ELBOWS AND COMPONENTS

26.06 - 600 AMP ELBOW CONNECTORS (T-BODIES)

26.08 SECONDARY SPLICES (600 VOLT)

26.10 PRIMARY SPLICES

26.12 TERMINATIONS

26.14 GROUNDING DEVICES AND SUBMERSIBLE APPLICATIONS

26.18 ELBOW ARRESTERS

26.20 FAULT INDICATORS

CABLE PREPARATION TECHNIQUES

THE RELIABILITY OF CABLE ACCESSORIES SUCH AS SPLICES, ELBOWS, AND TERMINATIONS DEPENDS IN LARGE PART ON THE QUALITY OF THE CABLE PREPARATION. INSTALLATION OF THESE ACCESSORIES SHOULD BE PERFORMED ONLY BY TRAINED PERSONNEL FAMILIAR WITH THE MATERIAL AND PROPER TOOLS NEEDED FOR THE TASK. THE FOLLOWING PARAGRAPHS OFFER GENERAL INFORMATION AND TIPS NEEDED IN ANY INSTALLATION OF CABLE ACCESSORIES BUT ARE NOT CONSIDERED ADEQUATE IN LIEU OF THE PROPER HANDS-ON TRAINING CLASSES.

TERMINATING REQUIREMENTS

- USE ONLY THE APPROVED TOOLS FOR TERMINATING UNDERGROUND PRIMARY CABLE. THIS INCLUDES THE REMOVAL OF THE OUTER JACKET, METALLIC SHIELD, SEMI-CON (INSULATION SHIELD) AND INSULATION. SKINNING OR SCORING WITH KNIVES IS STRICTLY PROHIBITED. TOOLS THAT DO NOT ALLOW FOR PROPER DEPTH ADJUSTMENT ARE ALSO PROHIBITED.
- TOOL BLADE DEPTH SHOULD BE ADJUSTED BEFORE THE TOOL IS USED ON A CABLE BEING TERMINATED. VERIFY TOOL IS CUTTING CORRECTLY AND THE BLADE IS NOT CUTTING TOO DEEP OR TOO SHALLOW USING A PIECE OF EXCESS CABLE CUT FROM THE END OF THE CABLE BEING TERMINATED. THE TOOL USED TO SCORE THE SEMICON MUST ALSO BE PROPERLY ADJUSTED SO THAT IT WILL MAKE A CONSISTENT AND PERFECTLY STRAIGHT RING CUT /SQUARE CUT ON THE SEMI-CON.
- USE ONLY APPROVED SOLVENTS AND LINT FREE CLOTHS OR WIPES FOR CABLE CLEANING. ALWAYS CLEAN THE CABLE INSULATION FROM THE CABLE END TOWARDS THE SEMI-CON. HOWEVER, ONCE THE CLOTH HAS TOUCHED THE SEMI-CON, DO NOT LET THAT PORTION OF THE TOWEL TOUCH THE INSULATION. NEVER CLEAN FROM THE SEMI-CON TOWARDS THE CABLE END. THIS TYPICALLY PULLS SEMI-CONDUCTING PARTICLES ONTO THE SURFACE OF THE INSUALTION WHICH CAN CAUSE TRACKING AND PREMATURE FAILURES. MINOR CONTACT OF APPROVED CABLE CLEANING FLUID WILL NOT DAMAGE THE SEMI-CON AND IT WILL DRY PRIOR TO INSTALLATION OF THE CABLE ACCESSORY.
- CERTAIN GREASES AND COMPOUNDS INCLUDED IN THE ACCESSORY KITS ARE SPECIFICALLY DESIGNED AND MANUFACTURED FOR VERY SPECIFIC PURPOSES. USE ONLY THE TYPE AND AMOUNT INCLUDED IN THE KIT. SUBSTITUTING OTHER GREASES/COMPOUNDS OR INCREASING THE AMOUNT USED, RATHER THAN IMPROVING THE INSTALLATION, CAN SHORTEN THE LIFE OF THE ACCESSORY.
- PRIOR TO MAKING CUTS OF ANY KIND, PROPERLY STRAIGHTEN, TRAIN AND ALIGN THE CABLE INTO ITS FINAL LOCATION. IN MOST CASES, IT WILL BE DIFFICULT AND MAYBE IMPOSSIBLE TO STRAIGHTEN THE CABLE AFTER IT IS CUT. IF THE CABLE IS NOT STRAIGHT, IT WILL BE IMPOSSIBLE TO MAKE A STRAIGHT RING CUT ON THE SEMI-CON AND THE DEPTH OF CUTS WILL VARY AROUND THE CABLE. THIS COULD LEAD TO A PREMATURE FAILURE OF THE CABLE.
- WHEN POSSIBLE, CUT THE CABLE WITH A HACKSAW, A BATTERY POWERED BAND SAW, OR OTHER TOOL THAT DOES NOT COMPRESS THE LAYERS OF THE CABLE AS IT IS CUTTING. MAKE CUTS EVEN AND STRAIGHT.
- REMOVAL OF THE SEMI-CON (INSULATION SHIELD) IS THE MOST CRITICAL ASPECT OF TERMINATING CABLE. THE RING CUT ON THE SEMI-CON MUST BE STRAIGHT AND SMOOTH. ITS BEGINNING POINT AND ENDING POINT MUST MATCH EXACTLY. ANY RESIDUE OR "PICS" LEFT ON THE INSULATION SHJOULD BE WIPED OFF WITH A LINT-FREE TOWEL MOISTENED WITH APPROVED CABLE CLEANING FLUID.
- VERIFY PROPER DEPTH OF THE SCORING TOOL BY RUBBING YOUR FINGER ACROSS THE INSULATION. ANY NICKS OR CUTS IN THE INSULATION SHOULD BE SANDED OUT WITH 240 GRIT ALUMINUM OXIDE CLOTH. DO NOT USE ANYTHING COURSER THAN 240 GRIT. HOWEVER, WHEN YOU FIND THE TOOL MAKES A CUT SOMEWHERE ALONG THE INSULATION DUE TO THE BLADE DEPTH BEING INCORRECTLY SET OR THE CABLE NOT BEING PROPERLY STRAIGHTENED BEFORE SCORING, THIS IS A CLEAR INDICATION THERE IS A CUT IN THE INSULATION AT THE RING CUT. THESE CUTS CANNOT BE SANDED OUT. THIS REQUIRES THE CABLE TO BE CUT OFF AT A POINT WHERE THE DAMAGED INSULATION WILL NOT BE USED AND RE-TERMINATED.
- DO NOT AUTOMATICALLY SAND THE INSULATION IF NO NICKS OR CUTS ARE DETECTED.
- NEVER SAND CABLE INSULATION LONGITUDINALLY (IN THE SAME DIRECTION AS THE CONDUCTOR). SAND RADIALLY (PERPENDICULAR TO THE DIRECTION OF THE CONDUCTOR).

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK

CABLE PREPARATION

DEC	DEM	DEP	DEF
X	X	X	X

26.00-105A

TERMINATING REQUIREMENTS (CONT.)

- WHEN INSTALLING MOLDED RUBBER CABLE ACCESSORIES, USE A LINT FREE TOWEL TO APPLY A THIN EVEN COAT OF SILICONE GREASE OVER THE ENTIRE SURFACE OF THE EXPOSED INSULATION. ALSO APPLY A BEAD OF GREASE AROUND THE ENTIRE CIRCUMFERENCE OF THE RING CUT. DO NOT DO NOT CONFUSE SILICONE GREASE WITH THE "VOID-FILLING" GREASE INCLUDED WITH SOME SILICONE ACCESSORIES. THEY ARE NOT THE SAME AND IF USED INTERCHANGEABILITY WILL SHORTEN THE LIFE OF THE ACCESSORY. DO NOT OVER GREASE THE CABLE.

- ALL CUTBACK DIMENSIONS MUST BE WITHIN 1/8" OF THE VALUES LISTED IN THE ACCESSORY INSTALLATION INSTRUCTIONS. VERIFY ALL DIMENSIONS AND RE-TERMINATE THE CABLE WHEN ANY CUTBACK DIMENSION DOES NOT MEET THIS REQUIREMENT.

- THE RING CUT OF THE SEMI-CON (INSULATION SHIELD) MUST BE SMOOTH AND STRAIGHT ALL THE WAY AROUND THE CABLE. THE BEGINNING POINT AND ENDING POINT MUST MATCH EXACTLY. ANY JAGGED EDGES OR SPIKES SHALL BE CAREFULLY REMOVED BY PLACING THE CUTTING EDGE OF A VERY SHARP KNIFE ON THE JAGGED EDGE/SPIKE AND GENTLY ROCKING IT BACK AND FORTH TO PREVENT CUTTING/SCARRING THE INSULATION. NEVER ROTATE THE KNIFE IN A "CUTTING" OR "SAWING" MOTION. THIS TYPICALLY CAUSES DAMAGE TO THE INSULATION. ANY TOOL THAT DOES NOT MAKE A PERFECTLY STRAIGHT RING CUT SHALL BE REMOVED FROM SERVICE AND CALIBRATED TO CORRECT THIS ISSUE PRIOR TO BEING USED TO MAKE ANOTHER RING CUT.

- WHEN REMOVING EXCESS OXIDE INHIBITOR AFTER CRIMPING THE CONNECTOR, ALWAYS WIPE FROM THE INSULATION ONTO THE CONNECTOR. BE CERTAIN TO REMOVE ALL EXCESS INHIBITOR.

- UTILIZE AN APPROVED METHOD FOR LC SHIELD REMOVAL WHEN LC SHIELDED CABLE IS BEING USED.

- DO NOT TAP DOWN THE EDGE OF THE LC SHIELD IN SUCH A MANNER THAT WILL CAUSE THE SHARP EDGE OF THE LC SHIELD TO CUT OR PUNCTURE THE SEMI-CON LAYER OF THE CABLE OR DAMAGE THE ACCESSORY BEING INSTALLED. USE A HAND TOOL (CHANNEL LOCKS OR SIDE CUTTERS) THAT HAS A SMOOTH EDGE TO GENTLY "ROLL" THE SHARP EDGE OF THE LC SHIELD BACK ONTO ITSELF.

- ALWAYS USE THE FOLLOWING CONNECTOR CRIMPING TECHNIQUES:

  A. VERIFY THE CONNECTOR IS THE PROPER SIZE AND TYPE FOR THE CONDUCTOR AND APPLICATION.
  B. VERIFY THE PROPER TOOL AND DIE IS BEING USED.
  C. VERIFY THE TOOL IS PROPERLY CALIBRATED.
  D. ALWAYS WIRE BRUSH THE CONDUCTOR AND IMMEDIATELY PUSH THE CONNECTOR ONTO IT.
  E. DO NOT REMOVE ANY OXIDE INHIBITOR FROM THE CONNECTOR PRIOR TO PUSHING IT ONTO THE CONDUCTOR.
  F. MAKE CRIMPS IN THE PROPER ORDER. START AT THE TOP CRIMP LINE FOR ELBOW AND TERMINATION CONNECTORS AND MID-CENTER LINES FOR SPLICE CONNECTORS. MANUFACTURERS CLEARLY MARK THESE LINES ON EACH CONNECTOR. STARTING CRIMPS AT THE WRONG LOCATION WEAKENS THE CONNECTION AND CAN LEAD TO OVER-HEATING AND FAILURE.
  G. MAKE THE PROPER NUMBER OF CRIMPS.
  H. DO NOT OVERLAP CRIMPS.
  I. ROTATE THE CRIMPING TOOL 90 DEGREES AFTER EACH CRIMP TO ELIMINATE CONNECTOR BOWING.
  J. FILE ANY SHARP FLASHING THAT MIGHT EXIST ON THE CONNECTOR AFTER CRIMPING.
  K. PROPERLY REMOVE ALL EXCESS OXIDE INHIBITOR AS DESCRIBED ABOVE.

- FOR SHEAR BOLT CONNECTIONS:

  A. DO NOT BACK THE BOLTS COMPLETELY OUT OF THE CONNECTOR. THIS CAN LEAD TO CROSS THREADING AS THEY ARE REINSERTED AND SHEARING AT AN IMPROPER TORQUE VALUE.
  B. HAND TIGHTEN ALL OF THE BOLTS TO SECURE THE CONNECTOR IN PLACE.
  C. ALTERNATELY TIGHTEN THE BOLTS ON EACH SIDE UNTIL THEY SHEAR OFF, BEGINNING WITH THE OUTSIDE BOLTS CLOSEST TO THE END AND FINISHING WITH THOSE CLOSEST TO THE SOLID PORTION OF THE CONNECTOR. THIS IS OPPOSITE THE ORDER IN WHICH COMPRESSION LUGS OR SLEEVES ARE CRIMPED.

DUKE ENERGY.

3					
2					
1					
0	7/31/17	EANES	FLETCHER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

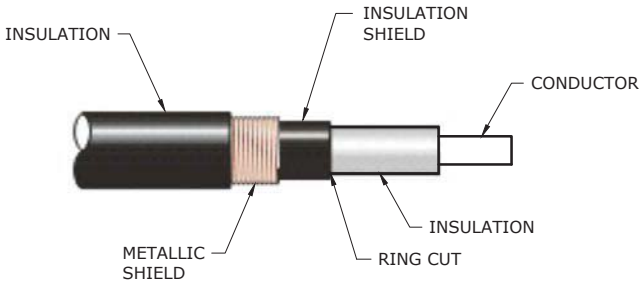
CABLE PREPARATION

DEC	DEM	DEP	DEF
X	X	X	X

26.00-105B

TERMINATING REQUIREMENTS (CONT.)

- WHEN BEVELING CABLE IS NECESSARY, BEVEL NO MORE THAN THE LAST ¼" WITH THE PROPER BEVELING TOOL.
- AFTER INSTALLING A CONSTANT TENSION SPRING TO HOLD A GROUND BRAID TO THE LC SHIELD OF A CABLE, GRAB THE SPRING AND TWIST UNTIL IT BECOMES TIGHT. THEN APPLY TWO LAYERS OF STRETCHED VINYL TAPE OVER THE SPRING TO HELP ENSURE IT WILL STAY TIGHT. APPLY THE TAPE IN THE SAME DIRECTION AS THE SPRING WAS INSTALLED. FAILURE TO DO SO WILL LOOSEN THE SPRING AND MAKE A POOR CONNECTION BETWEEN THE GROUND BRAID AND THE LC SHIELD.



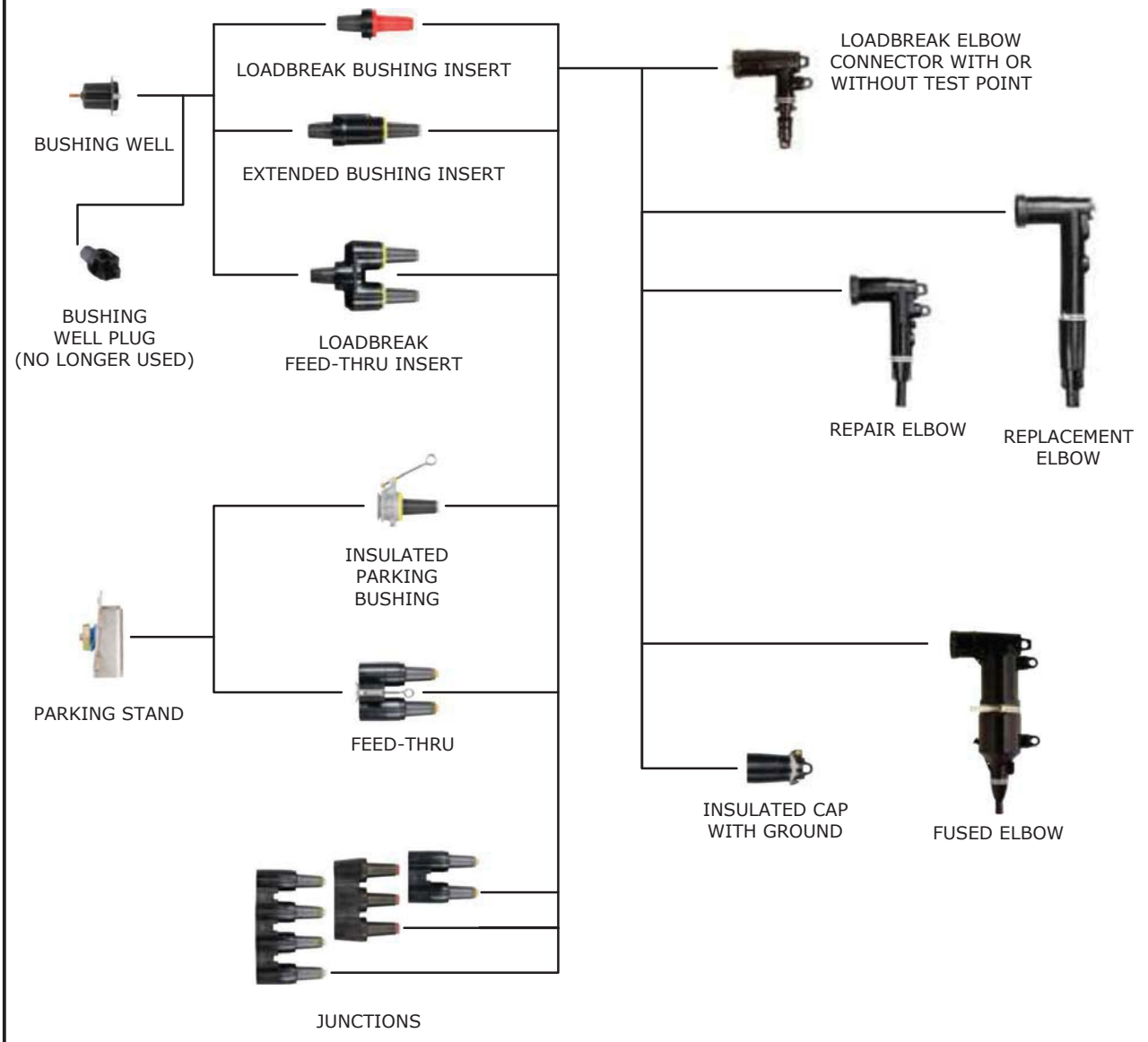
3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

CABLE PREPARATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.00-105C



3				
2				
1				
0	6/30/18	EANES	FLETCHER	EANES
REVISED		BY	CHK'D	APPR.

200 AMP LOADBREAK SEPARABLE CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.02-101

LOADBREAK ELBOW

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW 2 AL 200A 15KV LOADBREAK	ELBOW-2-AL-200A-15KV-LB-F	1	836830	1	CONNECTOR, ELECT, COMP, ELBOW, LOADBREAK, 2 AWG CU/ALUM COND
			4004699	1	CONNECTOR, ELECT, LOADBRK ELBOW, 1/0 AWG ALUM COND, 15KV 200A
ELBOW 1/0 AL 200A 15KV LOADBREAK	ELBOW-1/0-AL-200A-15KV-LB-F	1	4004699	1	CONNECTOR, ELECT, LOADBRK ELBOW, 1/0 AWG ALUM COND, 15KV 200A
			50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP
ELBOW 4/0 AL 200A 15KV LOADBREAK	ELBOW-4/0-AL-200A-15KV-LB-F	1	4004700	1	CONNECTOR, ELECTRICAL, LOADBREAK ELBOW, 4/0 AWG ALUM COND
			836834	1	CONTACT, COMP, 200A, 14.4KV, F/ ELBOWS, F/ 4/0 AL OR CU
ELBOW 1/0 AL 200A 25KV LOADBREAK	ELBOW-1/0-AL-200A-25KV-LB-F	1	50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP
			4022837	1	CONNECTOR, ELECT, LOADBREAK ELBOW, 1/0 AWG SOL ALUM COND

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. SEE DWGS. 26.02-141A THROUGH 26.02-141G FOR INSTALLATION INSTRUCTIONS.
3. WHEN INSTALLED IN SUBMERSIBLE LOCATIONS, SEE DWG. 26.14-101 FOR WATERPROOFING MATERIALS.
4. ELBOWS SHOULD ONLY BE OPERATED WITH AN APPROVED ELBOW PULLING TOOL, NEVER BY HAND.
5. IF AN ELBOW IS CLOSED INTO A FAULT, REPLACE BOTH THE ELBOW AND BUSHING INSERT.

DUKE ENERGY.

3					
2					
1					
0	6/30/18	EANES	FLETCHER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

STANDARD 200 AMP LOADBREAK ELBOWS

DEC	DEM	DEP	DEF
			X

26.02-103

REPAIR ELBOW

ADDS APPROXIMATELY 3-1/4" MORE
THAN THE STANDARD ELBOW

BILL OF MATERIALS - REPAIR ELBOWS

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW 1/0 AL 200A 15KV LOADBREAK REPAIR	ELBOW-1/0-AL-200A-15KV-LB-REPR-F	1	50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP, DRAIN WIRE, F/ GROUNDING F/ ELBOW
			4004682	1	CONNECTOR, ELECTRICAL LOADBREAK ELBOW 2-4/0 AWG STR ALUM CONDUCTOR, REPAIR, BODY 200 A 15 KV W/ CONTACT
			4002967	1	CONNECTOR, ELECTRICAL, LOADBREAK, REPAIR ELBOW 1/0 AWG SOL ALUM CONDUCTOR, CU CONNECTOR
ELBOW 2 AL 200A 15KV LOADBREAK REPAIR	ELBOW-2-AL-200A-15KV-LB-REPR-F	1	4004682	1	CONNECTOR, ELECTRICAL LOADBREAK ELBOW 2-4/0 AWG STR ALUM CONDUCTOR, REPAIR, BODY 200 A 15 KV W/ CONTACT
			4004691	1	CONNECTOR, ELECTRICAL, TERMINAL, LUG BI-METAL, 2 AWG STR ALUM CONDUCTOR, COMP CONDUCTOR CONNECTION

NOTES:

1. DO NOT USE REPAIR OR REPLACEMENT ELBOWS ON NEW INSTALLATIONS.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. WHEN INSTALLED IN SUBMERSIBLE LOCATIONS, SEE DWG. 26.14-101 FOR WATERPROOFING INSTRUCTIONS.
4. ELBOWS SHOULD ONLY BE OPERATED WITH AN APPROVED ELBOW PULLING TOOL, NEVER BY HAND.
5. IF AN ELBOW IS CLOSED INTO A FAULT, REPLACE BOTH THE ELBOW AND BUSHING INSERT.

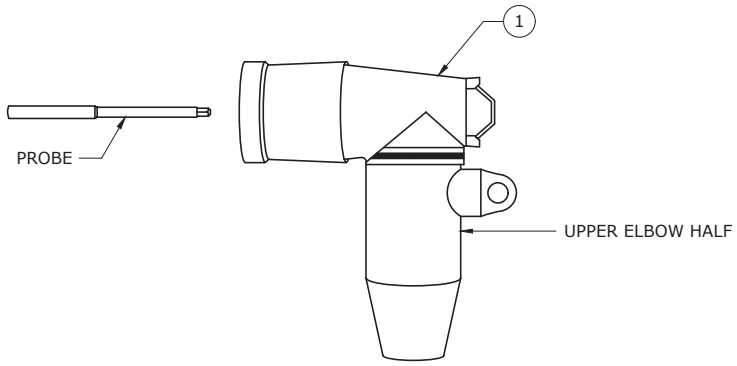
DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

200 AMP LOADBREAK ELBOWS
REPAIR AND REPLACEMENT

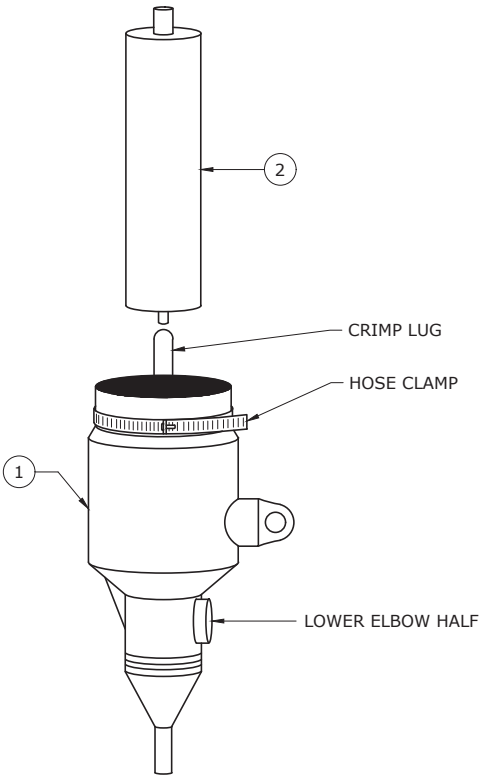
DEC	DEM	DEP	DEF
			X

26.02-105



APPLICATION:

THE FUSED ELBOW IS APPLICABLE FOR RADIALLY FED SINGLE-PHASE TRANSFORMERS, SINGLE-PHASE LOADS ONLY. IT INSTALLS ON A 200 AMP ADAPTER ON A 600 AMP ELBOW.



NOTES:

1. FOLLOW INSTRUCTIONS IN PACKAGE TO ASSEMBLE AND INSTALL THE FUSED ELBOW.
2. THE ONLY FUSE SIZE STOCKED IS 40 AMPS. TO PROPERLY COORDINATE, THE SOURCE SIDE FUSE MUST BE AT LEAST 65K OR 65E.
3. THE FUSE IS RATED FOR 15KV USE ONLY.

BILL OF MATERIALS

BUBBLE NUMBER	COMPATIBLE UNIT	QTY REQ'D	ITEM NUMBER	QTY PER CU	DESCRIPTION
1	ELBOW-1/0-AL-200A-15KV-LB-FUSE-F	1	4173497	1	CONNECTOR, ELECTRICAL, FUSED LOADBREAK ELBOW, 1/0 AWG SOL ALUM CONDUCTOR, 15KV, SUBMERSIBLE, W/ TEST PT
2	FUSE-LINK-40-CL-15KV-ELBOW-F	1	4173496	1	FUSE, CURRENT LIMITING FULL RANGE, 40A, 8.3KV LOAD BREAK ELBOW FUSE

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	10/26/18	EANES	FLETCHER	ADCOCK
0	6/30/18	EANES	FLETCHER	ADCOCK

FUSED 200 AMP LOADBREAK ELBOWS

DEC	DEM	DEP	DEF
			X

26.02-109

STANDARD
BUSHING INSERT

EXTENDED LENGTH
BUSHING INSERT

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
STANDARD 15 KV LOADBREAK INSERT	ELBOW-INS-AL-200A-15KV-LB-F	1	831048	1	BUSHING, ELECTRICAL CONDUCTOR, TRANSFORMER, 15KV, 200A, LOADBREAK, INSERT, W/ FAULT CLOSE
EXTENDED LENGTH 15 KV LOADBREAK INSERT	ELBOW-INS-AL-200A-15KV-LB-EXT-F	1	597641	1	BUSHING, ELECTRICAL CONDUCTOR, INSERT, 8.3/14.4KV, 200A, EXTENDED LENGTH, LOADBREAK
STANDARD 25 KV LOADBREAK INSERT-	ELBOW-INS-AL-200A-25KV-LB-F	1	4157056	1	INSERT, LOADBREAK, BUSHING 25KV

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE APPARATUS BUSHING WELLS MUST BE DE-ENERGIZED BEFORE INSTALLING OR REMOVING BUSHING INSERTS.
4. IF THE BUSHING INSERT IS NOT GOING TO BE IMMEDIATELY MATED WITH AN ELBOW, AN INSULATING RECEPTACLE MUST BE USED. **DO NOT** ENERGIZE THE INSERT WITH THE SHIPPING CAPS IN PLACE. THEY ARE ONLY INTENDED TO KEEP THE BUSHING SURFACE CLEAN DURING HANDLING AND INSTALLATION AND ARE NOT INSULATED.
5. EXTENDED LENGTH BUSHING INSERTS SHOULD BE USED WHERE EXTRA LENGTH IS NEEDED TO CLEAR SECONDARY CONDUCTORS THAT INTERFERE WITH THE PROPER OPERATION OF THE ELBOW.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

BUSHING INSERTS

DEC	DEM	DEP	DEF
			X

26.02-121

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
15 KV FEED-THRU BUSHING INSERT	ELBOW-FTB-4/0-AL-200A-15KV-LB-ROT-F	1	4004689	1	BUSHING, ELECTRICAL CONDUCTOR, FEED THRU, 15KV, 2 WAY, INSERT, 8.3/14.4 KV PER IEEE 386
25 KV FEED-THRU BUSHING INSERT	ELBOW-FTB-4/0-AL-200A-25KV-LB-ROT-F	1	4157432	1	BUSHING, FEED THRU INSERT, MATERIAL IS TO BE USED IN THE HOLYPAW AREA

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE APPARATUS BUSHING WELLS MUST BE DE-ENERGIZED BEFORE INSTALLING OR REMOVING FEED-THRU BUSHING INSERTS.
4. IF THE FEED-THRU BUSHING INSERT IS NOT GOING TO BE IMMEDIATELY MATED WITH AN ELBOW, INSULATING RECEPTACLES MUST BE USED. **DO NOT** ENERGIZE THE INSERT WITH THE SHIPPING CAPS IN PLACE. THEY ARE ONLY INTENDED TO KEEP THE BUSHING SURFACE CLEAN DURING HANDLING AND INSTALLATION AND ARE NOT INSULATED.
5. FEED-THRU'S ARE ROTATABLE, MEANING THEY CAN BE INSTALLED IN EITHER A VERTICAL OR HORIZONTAL POSITION DEPENDING UPON THE NEEDS OF THE SPECIFIC SITUATION. THIS ADJUSTMENT IS MADE AFTER THE FEED-THRU HAS BEEN PROPERLY SEATED IN THE BUSHING WELL, AND THE METHOD OF ADJUSTMENT DIFFERS BETWEEN MANUFACTURERS. REFER TO THE SPECIFIC MANUFACTURER'S INSTRUCTIONS FOR PROPER ADJUSTMENT STEPS.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

FEED-THRU BUSHING INSERTS

DEC	DEM	DEP	DEF
			X

26.02-123

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
15 KV DEAD-END / INSULATING RECEPTACLE	ELBOW-COV-INSL-200A-15KV-F	1	4004688	1	COVER, INSULATING, F/ 15 KV LOADBREAK BUSHING INSERT, W/ 42 INCH GROUNDING LEAD.
25 KV DEAD-END / INSULATING RECEPTACLE	ELBOW-COV-INSL-200A-25KV-F	1	4022839	1	RECEPTACLE, ELECTRICAL, LOADBREAK DEADEND, 25KV, 25 KV ROD & BORE TYPE, 125 KV BIL

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE DEAD-END OR INSULATING RECEPTACLE CAN ALSO BE REFERRED TO AS A PROTECTIVE CAP. SOME AREAS ALSO REFER TO IT AS A 'DUST COVER', ALTHOUGH THIS IS NOT TO BE CONFUSED WITH THE PLASTIC COVERS THAT ARE SHIPPED WITH BUSHING INSERTS IN MOST OF OUR TRANSFORMERS, SWITCHGEAR, ETC.
4. THE RECEPTACLE IS USED TO COVER AND INSULATE AN UNUSED INSERT IN A PAD-MOUNTED TRANSFORMER OR OTHER APPARATUS.
5. MOST RECEPTACLES ARE SHIPPED WITH A 3' STATIC WIRE THAT IS ATTACHED TO THE GROUND SYSTEM IN THE TRANSFORMER OR OTHER APPARATUS. IF THIS IS NOT PRESENT FOR ANY REASON, LOOP A SINGLE STRAND OF BARE COPPER WIRE THROUGH THE GROUNDING EYE ON THE RECEPTACLE, WRAP TIGHTLY WHILE NOT DAMAGING THE GROUNDING EYE, AND ATTACH TO THE SYSTEM GROUND.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

DEAD-END/INSULATING RECEPTACLES

DEC	DEM	DEP	DEF
			X

26.02-127

STAND-OFF PLUG OR
PARKING BUSHING

FEED-THRU

BILL OF MATERIALS

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
15 KV STAND-OFF BUSHING	-	-	-	-	-
25 KV STAND-OFF BUSHING	-	-	4022840	1	PLUG, ELECTRICAL, LOADBREAK INSULATED STAND-OFF, 25KV, ROD & BORE TYPE, 125KV BIL, USED TO INSULATE & ISOLATE
15 KV PORTABLE FEED-THRU	ELBOW-FTB-4/0-AL-200A-15KV-LB-2POS-F	1	830016	1	CONNECTOR, ELECTRICAL, PORTABLE FEED THRU, (1) 2-4/0 AWG STR ALUM COND, 15KV POLY CONC, HORZ MOUNTED, 200A
	ELBOW-FTB-4/0-AL-200A-15KV-LB-F	1	830016	1	CONNECTOR, ELECTRICAL, PORTABLE FEED THRU, (1) 2-4/0 AWG STR ALUM COND, 15KV POLY CONC, HORZ MOUNTED, 200A
15 KV PORTABLE FEED-THRU (VERTICAL MOUNT)	-	-	4199004	1	BUSHING, ELECTRICAL CONDUCTOR, FEED THRU, 2-PLG VERT MOUNT
25 KV PORTABLE FEED-THRU	-	-	4157104	1	BUSHING, ELECTRICAL CONDUCTOR, FEED THRU, 25KV, PARKING STAND

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. PORTABLE STANDOFF BUSHINGS SHOULD BE CONSIDERED TOOLS WHICH CAN BE USED TIME AND TIME AGAIN. WHEN NOT IN USE, THEY SHOULD BE COVERED WITH THE PROPER INSULATING OR DEAD-END RECEPTACLE (SEE DWG. 26.02-127).
4. WHILE THESE DEVICES MAY BE INSTALLED BY HAND USING PROPER PROTECTIVE EQUIPMENT IF THERE ARE NO EXPOSED BUSHINGS OR EXPOSED PRIMARY TERMINALS, A HOTSTICK TOOL MUST BE USED WHEN CONNECTING AN ELBOW TO THE DEVICE.
5. GROUND THE BUSHINGS WITH A COPPER LEAD OR CONCENTRIC NEUTRAL STRAND CONNECTED TO THE GROUNDING LUG ON THE BUSHING AND THE GROUND SYSTEM WITHIN THE APPARATUS. LEAVE ENOUGH SLACK TO OPERATE THE STANDOFF WITH A HOTSTICK TOOL.

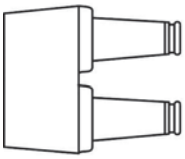
DUKE ENERGY.

3					
2					
1					
0	6/30/18	EANES	FLETCHER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

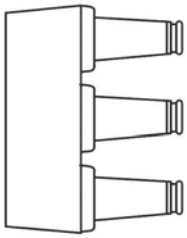
PORTABLE FEED-THRUS AND PARKING BUSHINGS

DEC	DEM	DEP	DEF
			X

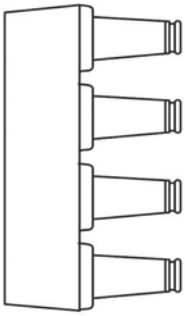
26.02-129



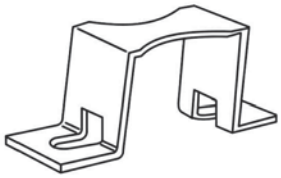
2 POINT JUNCTION



3 POINT JUNCTION



4 POINT JUNCTION



"U" STRAP

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
15 KV 3 POINT JUNCTION W/ STAINLESS STEEL BKT	CONN-UG-CAB-1P-15KV-200A-3POS-BKT-F	1	4004680	1	BUSHING, ELECTRICAL CONDUCTOR, FEED THRU, 3-PLUG, 3 WAY LOADBREAK
15 KV 4 POINT JUNCTION W/ STAINLESS STEEL BKT	CONN-UG-CAB-1P-15KV-200A-4POS-BKT-F	1	4004681	1	BUSHING, ELECTRICAL CONDUCTOR, FEED THRU, 4-PLUG, 4 WAY LOADBREAK
15 KV 3 POINT JUNCTION WITH U STRAPS	CONN-UG-CAB-1P-15KV-200A-3POS-F	1	4169990	1	JUNCTION, LOADBREAK, 15KV 200A, 3 RECEPTACLES
15 KV 4 POINT JUNCTION WITH U STRAPS	CONN-UG-CAB-1P-15KV-200A-4POS-F	1	1003225	1	JUNCTION, LOADBREAK, 15KV 200A, 4 RECEPTACLES, W/ U-STRAP
"U" STRAP ASSEMBLY	-	-	4000272	1	STRAP, MOUNTING, SS, PRIMARY JCT U STRAP, F/ MOUNTING 3 OR 4 WAY 200 A LBK JUNCTIONS

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE JUNCTION WITH THE STAINLESS STEEL BRACKET CAN BE USED TO PROVIDE A TAP POINT WITHIN A PRIMARY VAULT OR MANHOLE. SEE DWGS. 29.08-01 AND 29.08-03.
4. THESE JUNCTIONS MAY ALSO BE MOUNTED WITHIN PAD-MOUNTED JUNCTION CABINETS IN ORDER TO PROVIDE A TAP POINT FOR UNDERGROUND PRIMARY CABLE. THE JUNCTIONS ARE MOUNTED TO THE CABINET WITH THE USE OF STAINLESS STEEL "U" BRACKETS AND BOLTS, PROVIDED WITH EACH JUNCTION. SEE DWG. 25.01-11 FURTHER DETAILS AND INSTRUCTIONS.
5. AS WITH BUSHING INSERTS, IF AN ELBOW IS CLOSED INTO A FAULT, REPLACE BOTH THE ELBOW AND THE JUNCTION.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

DUKE ENERGY.

LOADBREAK JUNCTIONS

DEC	DEM	DEP	DEF
			X

26.02-131

NOTES: LEAVE THE ELBOW AND INSERT IN THE PLASTIC BAG AS LONG AS POSSIBLE IN ORDER TO PREVENT CONTAMINATION.

TAKE PRECAUTION TO KEEP THE ARC TIP ON ELBOW PROBES AS CLEAN AS POSSIBLE. THIS INCLUDES ANY CONTACT WITH SKIN.

INSTALLATION INSTRUCTIONS

THE FOLLOWING ITEMS WILL BE NEEDED IN ADDITION TO THE CONTENTS OF THE ELBOW KIT.

TABLE 1

ITEM DESCRIPTION	OPERATING AREA			
	DEC	DEM	DEP	DEF
ALUMINUM OXIDE CLOTH, 240 GRIT	376	376	4030693	4206865
3/4" VINYL TAPE	211583	211583	4028095	4005478
LINT FREE TOWEL	-	-	-	-
CLEANING FLUID	378446	650182	4030532	4000498
SILICON GREASE			4005510	4005510
DRAIN WIRE	480906	480906	480906	480906

STEP 1: FOLLOW ALL SAFETY RULES AND PROCEDURES TO INSURE CONDUCTORS ARE SAFE TO HANDLE.

STEP 2: TRAIN CABLE TO THE CENTER OF THE TRANSFORMER BUSHING AS SHOWN IN **FIGURE 3**. THE CABLE MUST FORM A GRADUAL ARC FROM THE GROUND TO THE BUSHING IN ORDER TO PROVIDE ENOUGH CABLE TO REACH BOTH BUSHINGS AND THE STANDOFF BRACKET. THIS WILL ALLOW FOR FUTURE SWITCHING.

STEP 3: CUT THE CABLE SQUARELY AT THE CENTER OF THE TRANSFORMER BUSHING.

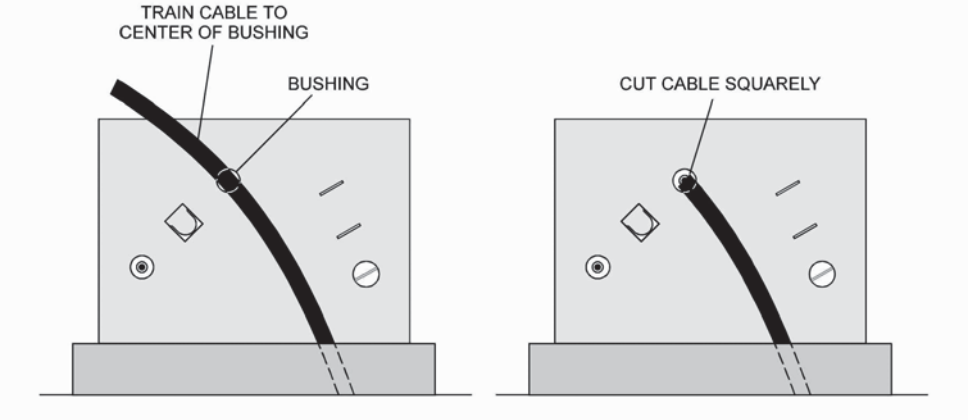


FIGURE 3
CUTTING CABLE TO PROPER LENGTH

STEP 4: REMOVE THE AMOUNT OF CABLE JACKET SHOWN IN **FIGURE 4**.

STEP 5: REMOVE THE LC SHIELD, EXCEPT FOR THE LENGTH SHOWN IN **FIGURE 4** WHICH WILL EXTEND BEYOND THE END OF THE CABLE JACKET.

THE LC SHIELD IS TO BE REMOVED BY PLACING ONE OF THE CONSTANT TENSION SPRINGS PROVIDED IN THE GROUND BRAID KIT ON THE LC SHIELD AT THE POINT WHERE THE SHIELD IS TO END, SEPARATING THE OVERLAP OF THE LC SHIELD, AND THEN TEARING OFF THE LC SHIELD AT THE CONSTANT TENSION SPRING. THE LC SHIELD OVERLAP MAY BE SEPARATED BY ROLLING THE GAP OPEN WITH CHANNEL-LOCK PLIERS, TEARING OFF THE OVERLAP BY TWISTING IT AROUND NEEDLE-NOSE PLIERS, OR BY TEARING OFF THE OVERLAP BY GRABBING THE OVERLAP WITH PLIERS AND PULLING IT STRAIGHT DOWN THE CABLE.

THE CUT BACK DIMENSIONS IN FIGURE 4 WILL LEAVE APPROXIMATELY 3" - 4" MORE EXPOSED SEMI-CONDUCTIVE INSULATION SHIELD THAN THE MANUFACTURER'S RECOMMENDED CUTBACKS. THIS IS TO ALLOW FOR THE CONVENIENT APPLICATION OF A FAULTED CIRCUIT INDICATOR (FCI) IN THE FUTURE. IT DOES NOT IMPACT THE PERFORMANCE OF THE ELBOW ITSELF.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

INSTRUCTIONS FOR INSTALLING 200 AMP ELBOWS
ON 15KV OR 25KV CABLE
IN NON-SUBMERSIBLE APPLICATIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.02-141A

STEP 6: **USE AN APPROPRIATE TOOL** AND SCORE THE SEMI-CONDUCTIVE INSULATION SHIELD SO THE LENGTH OF THE SHIELD SHOWN IN **FIGURE 4** CAN BE REMOVED; HOWEVER, **DO NOT** REMOVE THE SHIELD AT THIS TIME.

NEVER USE A KNIFE TO REMOVE THIS SHIELD.

STEP 7: REMOVE THE AMOUNT OF INSULATION SHOWN IN **FIGURE 4**.

IT IS NOT REQUIRED TO BEVEL THE EDGE OF THE CABLE INSULATION WHEN INSTALLING AN ELBOW, BUT THIS DOES ALLOW THE ELBOW TO BE MORE EASILY INSTALLED. BEVEL NO MORE THAN THE LAST 1/4" OF THE INSULATION. THIS CAN BE ACCOMPLISHED WITH A BEVELING TOOL OR KNIFE.

STEP 8: REMOVE THE PORTION OF THE SEMI-CONDUCTIVE INSULATION SHIELD SCORED IN STEP 6.

DO NOT SAND THE CABLE INSULATION EXCEPT WHEN IT IS NECESSARY.

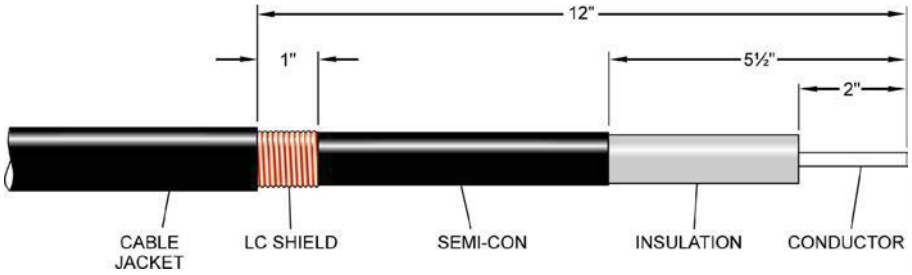


FIGURE 4
PREPARING CABLE END

STEP 9: VERIFY THAT ALL CUTBACKS HAVE BEEN MADE TO THE PROPER DIMENSION. CORRECT THE INSULATION AND SEMI-CONDUCTIVE SHIELD CUTBACKS IF THEY ARE NOT WITHIN 1/8" OF THE DIMENSIONS PROVIDED IN **FIGURE 4**.

STEP 10: VERIFY THAT THE RING CUT ON THE SEMI-CONDUCTIVE SHIELD IS STRAIGHT AND SMOOTH ALL THE WAY AROUND THE CABLE. NO POINTS OR UNEVENNESS MAY EXIST. CORRECT ANY IRREGULARITIES THAT EXIST. THESE IRREGULARITIES MAY BE REMOVED WITH A KNIFE AS LONG AS **EXTREME CAUTION** IS USED AND THAT **NO** NICKS ARE MADE INTO THE CABLE INSULATION.

STEP 11: VERIFY THAT THE INSULATION IS SMOOTH AND FREE OF ANY NICKS OR CUTS BY CAREFULLY RUBBING IT WITH YOUR FINGERS. ANY NICKS, CUTS, OR DENTS MUST BE REMOVED WITH 240 GRIT ALUMINUM OXIDE CLOTH. DO NOT USE 120 GRIT ALUMINUM OXIDE CLOTH.

IF CUTS WERE MADE INTO THE INSULATION AS A RESULT OF THE STRIPPING TOOL BEING SET TOO DEEP, THEN THE RING CUT MUST BE RELOCATED TO ALLOW THIS CUT TO BE SANDED OUT OF THE INSULATION. THIS CAN BE ACCOMPLISHED BY CUTTING AT LEAST 3/4" OFF THE CONDUCTOR AND THEN REMAKING ALL CUTBACKS FROM THAT POINT.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

INSTRUCTIONS FOR INSTALLING 200 AMP ELBOWS
ON 15KV OR 25KV CABLE
IN NON-SUBMERSIBLE APPLICATIONS

DEC	DEM	DEP	DEF
X	X	X	X

26.02-141B

STEP 12: WIRE BRUSH THE CONDUCTOR OF THE CABLE AND IMMEDIATELY PUSH IT INTO THE CONNECTOR.

- DO NOT USE OXIDE CLOTH TO BRUSH THE CONDUCTOR.
- DO NOT REMOVE ANY OF THE OXIDE INHIBITOR FROM THE CONNECTOR BEFORE PUSHING IT ONTO THE CONDUCTOR.

  POSITION THE CONNECTOR ON THE CONDUCTOR SO THAT THE FLAT SIDE FACES THE TRANSFORMERS BUSHING WHEN THE CABLE IS TRAINED INTO POSITION. BUTT THE CONNECTOR AGAINST THE CONDUCTOR AND CRIMP ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS. STARTING AT THE "TOP" OF THE CONNECTOR (THE CRIMP MARK NEAREST THE THREADED HOLE), MAKE AS MANY CRIMPS AS POSSIBLE WITH THE APPROPRIATE DIE WITHOUT OVERLAPPING THE CRIMPS. SUCCESSIVE CRIMPS WILL PROGRESS TOWARD THE CABLE INSULATION AND THE CRIMPING TOOL MUST BE ROTATED 90° BETWEEN EACH CRIMP TO PREVENT THE CONNECTOR FROM BOWING. SEE **FIGURE 5**. REMOVE ANY SHARP FLASH.

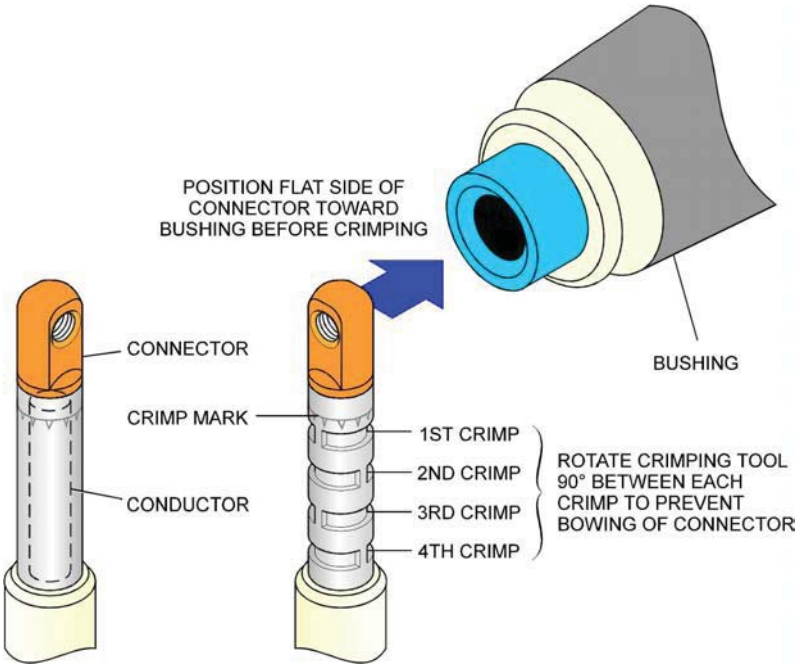


FIGURE 5
POSITIONING AND CRIMPING THE CONNECTOR TO THE CONDUCTOR

STEP 12: (ALTERNATIVE)

THIS PROCEDURE MAY BE FOLLOWED INSTEAD OF THE ONE LISTED IN STEP 12 IF THE TRANSFORMER IS DE-ENERGIZED AND ALL APPLICABLE SAFETY PROCEDURES ARE FOLLOWED.

A. INSERT THE THREADED END OF THE PROBE INTO THE EYE OF THE COMPRESSION CONNECTOR, HAND TIGHTEN, AND INSERT THE PROBE INTO THE BUSHING INSERT OR A STANDOFF INSERT IN ORDER TO POSITION THE CONNECTOR.

   TAKE PRECAUTIONS TO PREVENT TOUCHING THE ARC TIP ON THE PROBE WITH YOUR HANDS AND TO PREVENT IT FROM BECOMING CONTAMINATED. HOLD IT IN A TOWEL IF NECESSARY.

B. WIRE BRUSH THE CONDUCTOR OF THE CABLE AND IMMEDIATELY PUSH IT INTO THE CONNECTOR.

   DO NOT USE OXIDE CLOTH TO BRUSH THE CONDUCTOR.

   DO NOT REMOVE ANY OF THE OXIDE INHIBITOR FROM THE CONNECTOR BEFORE PUSHING IT ONTO THE CONDUCTOR.

C. MAKE ONE CRIMP AT THE "TOP" OF THE CONNECTOR (THE CRIMP MARK NEAREST THE THREADED HOLE) USING A 5/8" OR BG DIE.

D. REMOVE THE PROBE FROM THE BUSHING INSERT AND UNSCREW THE PROBE FROM THE CONNECTOR.

E. MAKE THE REMAINING THREE (3) CRIMPS USING A 5/8" OR BG DIE. SUCCESSIVE CRIMPS WILL PROGRESS TOWARD THE CABLE INSULATION AND THE CRIMPING TOOL SHOULD BE ROTATED 90° BETWEEN EACH CRIMP TO PREVENT THE CONNECTOR FROM BOWING. REMOVE ANY SHARP FLASH.

STEP 13: REMOVE EXCESS OXIDE INHIBITOR WITH A TOWEL. TAKE SPECIAL CARE TO PREVENT THIS EXCESS INHIBITOR FROM GETTING ONTO THE CABLE INSULATION. THIS OXIDE INHIBITOR MUST BE REMOVED BEFORE ATTEMPTING TO CLEAN THE CABLE INSULATION.

STEP 14: CLEAN THE CABLE INSULATION WITH A CLEAN TOWEL AND CABLE CLEANING FLUID TO REMOVE ANY CONTAMINATION OR PARTICLES OF THE SEMI-CONDUCTING SHIELD THAT MIGHT BE PRESENT ON THE INSULATION.

ALWAYS CLEAN FROM THE CONNECTOR TOWARDS THE SEMI-CONDUCTING SHIELD. DO NOT EVER TOUCH THE INSULATION WITH THE AREA ON A TOWEL THAT HAS TOUCHED THE SEMI-CONDUCTING SHIELD.

STEP 15: LUBRICATE THE CABLE INSULATION AND INSULATION SHIELD WITH THE SILICONE GREASE PROVIDED IN THE ELBOW KIT OR WITH GREASE FROM STOCK. BE CERTAIN TO APPLY A LIBERAL AMOUNT OF SILICONE GREASE AT THE END OF THE SEMI-CONDUCTIVE SHIELD TO ELIMINATE THE POSSIBILITY OF AIR GAPS DEVELOPING IN THIS AREA.

APPLY SILICONE GREASE WITH A CLEAN TOWEL, OR A PLASTIC BAG TURNED INSIDE OUT.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

INSTRUCTIONS FOR INSTALLING 200 AMP ELBOWS ON 15KV OR 25KV CABLE IN NON-SUBMERSIBLE APPLICATIONS

DEC	DEM	DEP	DEF
X	X	X	X

26.02-141D

STEP 16: SLIDE THE BODY OF THE ELBOW ONTO THE CABLE USING A BACK AND FORTH MOTION UNTIL THE THREADED EYE OF THE CONNECTOR IS CENTERED IN THE ELBOW CAVITY. THE LAST 1/2" OF THE RUBBER IN THE ELBOW IS KEYED TO ACCEPT THE FLAT PORTION OF THE CONNECTOR. NO ROTATION SHOULD OCCUR IN THE LAST 1/2" OF INSERTION IN ORDER TO PREVENT DAMAGE TO THE CONDUCTOR. REMOVE ALL EXCESS SILICONE GREASE.

STEP 17: INSERT THE THREADED END OF THE PROBE INTO THE EYE OF THE COMPRESSION CONNECTOR, HAND TIGHTEN A FEW TURNS TO AVOID CROSS-THREADING, AND THEN TIGHTEN WITH A PROBE INSERTION TORQUE WRENCH.

DO NOT APPLY GREASE TO THE PROBE THREADS OR ANY OTHER PART OF THE PROBE.
TAKE PRECAUTIONS TO PREVENT TOUCHING THE ARC TIP ON THE PROBE WITH YOUR HANDS AND TO PREVENT IT FROM BECOMING CONTAMINATED. HOLD IT IN A TOWEL IF NECESSARY.

SKIP TO STEP 21 IF CONCENTRIC NEUTRAL CABLE IS BEING USED.

STEP 18: RUB THE EXPOSED PORTION OF THE LC SHIELD WITH 240 GRIT ALUMINUM OXIDE CLOTH IN ORDER TO REMOVE ANY SURFACE FILM THAT MIGHT BE PRESENT. (WIRE BRUSHING COULD DAMAGE THE LC SHIELD.) POSITION THE PREFORMED GROUND BRAID, WITH THE "U" SECTION OVER THE EXPOSED LC SHIELD WITH THE FOLDS FACING OUTWARD AND THE TWO TAILS EXTENDING ALONG THE CABLE JACKET. SEE **FIGURE 6**.

STEP 19: SECURE THE BRAID TO THE LC SHIELD BY WRAPPING A CONSTANT TENSION SPRING AROUND THE PORTION OF THE BRAID THAT IS POSITIONED OVER THE LC SHIELD AS SHOWN IN **FIGURE 6**. BE CERTAIN TO TWIST THE LAST WRAP OF THE SPRING TO INSURE THAT IT IS TIGHT.

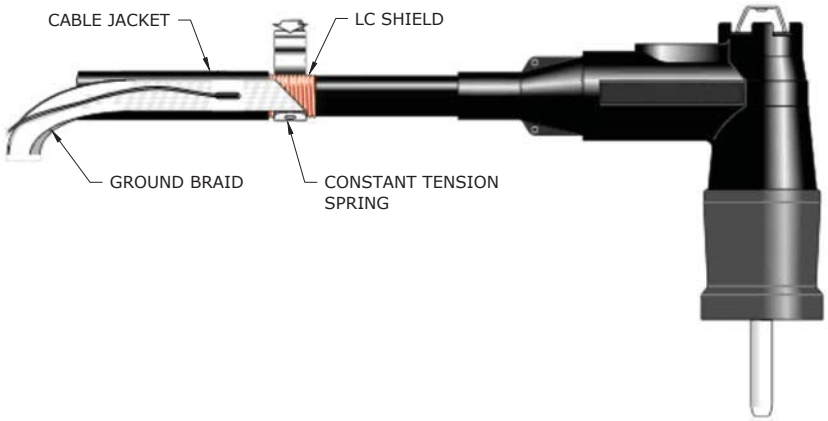


FIGURE 6
INSTALLING PREFORMED BRAID

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

INSTRUCTIONS FOR INSTALLING 200 AMP ELBOWS
ON 15KV OR 25KV CABLE
IN NON-SUBMERSIBLE APPLICATIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.02-141E

STEP 20: TIGHTLY WRAP TWO HALF-LAPPED LAYERS OF 3/4" VINYL TAPE IN THE **SAME** DIRECTION AS THE CONSTANT TENSION SPRING FROM THE **EDGE** OF THE LC SHIELD, ACROSS THE CONSTANT TENSION SPRING, AND DOWN THE CABLE JACKET TO THE POINT WHERE IT COVERS THE SOLDER CONNECTION OF THE DRAIN WIRE ON THE GROUND BRAID. SEE **FIGURE 7**.

DO NOT PLACE VINYL TAPE ON THE SEMI-CONDUCTING SHIELD.

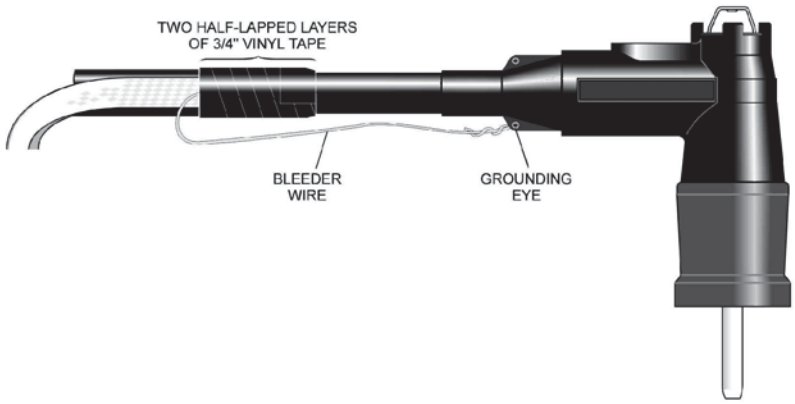


FIGURE 7
APPLYING VINYL TAPE AND ATTACHING BLEEDER WIRE

STEP 21: LOOP THE DRAIN WIRE (SINGLE WIRE ATTACHED TO THE GROUNDING BRAID), OR ONE OF THE CONCENTRIC NEUTRAL STRANDS IF USING CONCENTRIC NEUTRAL CABLE, THROUGH THE GROUNDING EYE ON THE ELBOW AND WRAP LIGHTLY AS SHOWN IN **FIGURE 7**. BE CAREFUL NOT TO DAMAGE THE GROUNDING EYE. CUT OFF ANY EXCESS LENGTHS OF THE DRAIN WIRE ON THE GROUND BRAID AND USE THIS OR STOCKED DRAIN WIRE TO GROUND THE SURFACE OF THE BUSHING INSERT.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

INSTRUCTIONS FOR INSTALLING 200 AMP ELBOWS
ON 15KV OR 25KV CABLE
IN NON-SUBMERSIBLE APPLICATIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.02-141F

STEP 22: REMOVE THE PROTECTIVE COVER FROM THE BUSHING INSERT AND THOROUGHLY COVER THE ENTIRE SURFACE OF THE BUSHING INSERT INTERFACE WITH A LIGHT COATING OF SILICONE GREASE. SEE **FIGURE 8**.

DO NOT APPLY GREASE TO THE ARC QUENCHING MATERIAL ON THE END OF THE PROBE OR ON THE THREADS OF THE PROBE.

TAKE PRECAUTIONS TO PREVENT TOUCHING THE ARC TIP ON THE PROBE WITH YOUR HANDS AND TO PREVENT IT FROM BECOMING CONTAMINATED. HOLD IT IN A TOWEL IF NECESSARY.

STEP 23: USING A HOT-STICK, PLACE THE ELBOW ON THE BUSHING INSERT BY INSERTING THE PROBE APPROXIMATELY 2" INTO THE OPENING OF THE INSERT. YOU WILL FEEL A SLIGHT RESISTANCE AT THIS POINT. MAKE SURE THE ELBOW IS LINED UP WITH THE BUSHING AND THEN PUSH THE ELBOW ONTO THE BUSHING WITH THE HOTSTICK USING A STRAIGHT, QUICK, AND STEADY FORCE. IT IS ALSO A GOOD PRACTICE TO PUSH THE ELBOW A SECOND TIME TO MAKE CERTAIN THE ELBOW WAS FULLY SEATED.

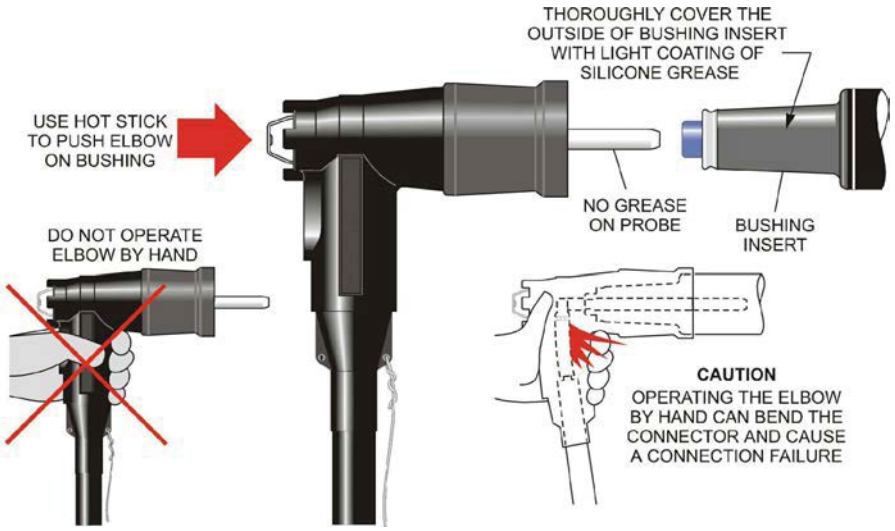


FIGURE 8
PUSHING ELBOW ONTO BUSHING USING HOT STICK

STEP 24: INSTALL A YELLOW INSTALLER ID TAG IF REQUIRED ON THE **BLACK** OUTER SURFACE OF THE ELBOW IN BETWEEN THE CUFF OF THE ELBOW (THE BLUE AREA ON 25KV ELBOWS AND A DARK GRAY AREA ON 15KV ELBOWS NEAR THE OPENING THAT FITS OVER THE INSERT) AND THE BEND OF THE ELBOW.

STEP 25: INSTALL DIRECTIONAL LABELS ON THE JACKETED PORTION OF THE CABLE (NOT ON THE SEMICON LAYER).

NOTE: ENSURE ALL CABLES ARE PROPERLY MARKED. CHECK WITH AN OHM METER IF NECESSARY.

STEP 26: REMOVE ANY TEMPORARY MARKING TAPE.

	BILL OF MATERIALS				
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW 1/0 AL 200A 15KV NON-LOAD BREAK	ELBOW-1/0-AL-200A-15KV-NLB-F	1	50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP, DRAIN WIRE
			4004701	1	CONNECTOR, ELECT, LOADBREAK BOLTED ELBOW, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, BODY

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE BOLTED ELBOW IS USED ON PAD-MOUNTED CAPACITORS, WHERE LOAD SHOULD NOT BE BROKEN PRIOR TO THE CAPACITOR BEING PROPERLY DISCHARGED.
4. THE BOLTED ELBOW FUNCTIONS IN MUCH THE SAME MANNER AS A 600 AMP T-BODY WITH A LOADBREAK REDUCING TAP WELL. THE 200 AMP INTERFACE CAN BE USED FOR PHASING OPERATIONS, GROUNDING ELBOWS, ETC, AND SHOULD BE COVERED WITH AN INSULATING CAP WHEN NOT BEING UTILIZED.

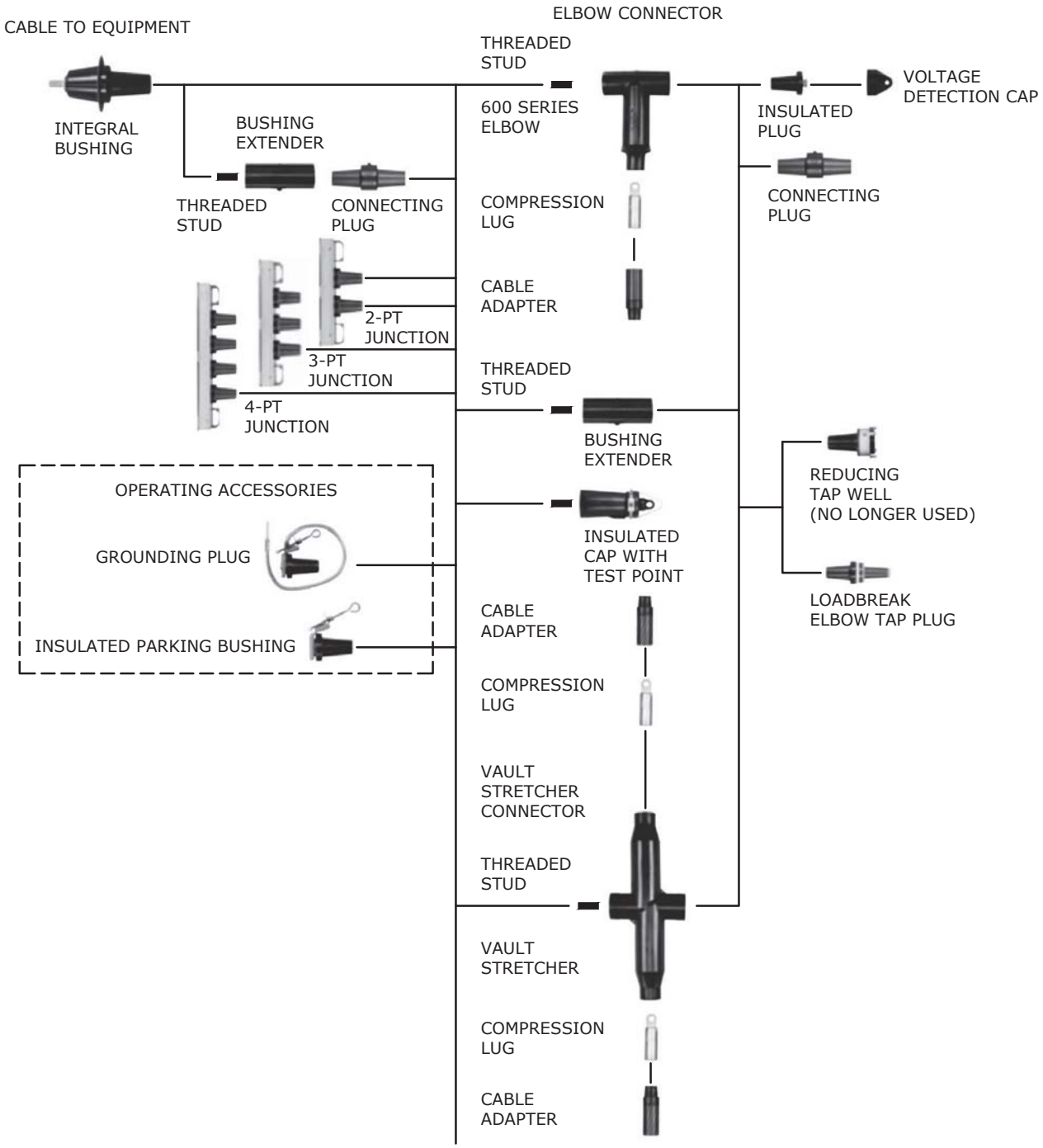
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

200 AMP BOLTED ELBOW WITH LOADBREAK TAP

DEC	DEM	DEP	DEF
			X

26.04-103



3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

600 AMP DEADBREAK SEPARABLE CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.06-101

BILL OF MATERIALS

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW T-BODY 1/0 AL 600A 15KV NON-LOAD BREAK	ELBOW-T-1/0-AL-600A-15KV-NLB-F	1	4004688	1	COVER, INSULATING, F/ 15 KV LOADBREAK BUSHING INSERT. W/ 42 INCH GROUNDING LEAD.
			4004726	1	STUD, THD, REPLACEMENT F/ ELASTIMOLD 600 A T-BODY ELBOW
			4004728	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT & T-TAP 600A SPLICE, 15KV 1/0 AL
			4004740	1	CONNECTOR, ELECTRICAL, TERMINAL, SPADE, 1/0 AWG STR CONDUCTOR, ALUM/CU CONDUCTOR, F/ T-TAPS
			111206	1	HOUSING, CABLE T, 25KV, 600A, SHIELDED, W/ GND EYE
			50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP, DRAIN WIRE, F/ GROUNDING F/ ELBOW
ELBOW T-BODY 500 AL 600A 15KV NON-LOAD BREAK	ELBOW-T-500-AL-600A-15KV-NLB-F	1	4004688	1	COVER, INSULATING, F/ 15 KV LOADBREAK BUSHING INSERT. W/ 42 INCH GROUNDING LEAD.
			1478988	1	PLUG, ELECTRICAL, ELBOW TAP, 15KV, LOADBREAK, F/ CONNECTING 200A CABLES TO 600A T-BODY
			4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A15KV, SW, 1000 F/ DEADFRONT SWITCHGEAR
			4004726	1	STUD, THD, REPLACEMENT F/ ELASTIMOLD 600 A T-BODY ELBOW
			4004731	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT SPLICE & T-TAP 600A F/ USE ON 500MCM AL
			666504	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR. CONDUCTOR
			111206	1	HOUSING, CABLE T, 25KV, 600A, SHIELDED, W/ GND EYE
			4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS, ACCOMMODATES CABLES FROM 15 TO 35 KV
ELBOW T-BODY 750 AL 600A 15KV NON-LOAD BREAK	ELBOW-T-750-AL-600A-15KV-NLB-F	1	1478988	1	PLUG, ELECTRICAL, ELBOW TAP, 15KV, LOADBREAK, F/ CONNECTING 200A CABLES TO 600A T-BODY
			111206	1	HOUSING, CABLE T, 25KV, 600A, SHIELDED, W/ GND EYE
			666494	1	CONTACT, COMP
			4004726	1	STUD, THD, REPLACEMENT F/ ELASTIMOLD 600 A T-BODY ELBOW
			4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS, ACCOMMODATES CABLES FROM 15 TO 35 KV
			4004688	1	COVER, INSULATING, F/ 15 KV LOADBREAK BUSHING INSERT. W/ 42 INCH GROUNDING LEAD.
			4004732	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT SPLICE & T-TAP 600A. F/ USE ON 750MCM AL
ELBOW T-BODY 1000 AL 600A 15KV NON-LOAD BREAK	ELBOW-T-1000-AL-600A-15KV-NLB-F	1	4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS, ACCOMMODATES CABLES FROM 15 TO 35 KV
			4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A 15KV, SW, 1000 F/ DEADFRONT SWITCHGEAR

NOTES:

1. SEE DWG. 26.06-103B FOR NOTES.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

600 AMP ELBOW HOUSING (T-BODY)

DEC	DEM	DEP	DEF
			X

26.06-103A

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.

2. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.

3. WITHIN DEF, FOR 500 MCM AND 1000 MCM CABLES THE 600 AMP ELBOW HOUSING IS PURCHASED WITH THE APPROPRIATELY SIZED CABLE ADAPTER, CONNECTOR, AND A LOADBREAK ELBOW TAP PLUG. LESSER USED SIZES SUCH AS 1/0 AWG AND 750 MCM ARE PURCHASED SEPARATELY AND PACKAGED TOGETHER WITH THE PROPER CU'S.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

600 AMP ELBOW HOUSING (T-BODY)

DEC	DEM	DEP	DEF
			X

26.06-103B

CABLE ADAPTER - ALLOWS THE 600A ELBOW HOUSING TO FIT ONTO VARIOUS CABLE SIZES.

BILL OF MATERIALS - CABLE ADAPTERS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1/0 AWG SOLID 15 KV CABLE ADAPTER	-	-	4004728	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT & T-TAP 600A SPLICE,15KV 1/0 AL
4/0 AWG 15 KV CABLE ADAPTER	-	-	4004729	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT & T-TAP 600A SPLICE, 15 KV #4/0 CU OR ALUM
500 MCM 15 KV CABLE ADAPTER	-	-	4004731	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT SPLICE & T-TAP 600A F/ USE ON 500MCM AL
750 MCM 15 KV CABLE ADAPTER	-	-	4004732	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ STRAIGHT SPLICE & T-TAP 600A. F/ USE ON 750MCM AL
1000 MCM 15 KV CABLE ADAPTER	-	-	4004733	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ USE ON 1000 MCM FULL STRANDED, AL W/ SEMI-CONDUCTING SHIELD

COMPRESSION LUG - ATTACHES THE CONDUCTOR TO THE CONNECTOR SYSTEM.

BILL OF MATERIALS - COMPRESSION LUGS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1/0 AWG SOLID COMPRESSION LUG	-	-	4004740	1	CONNECTOR, ELECTRICAL, TERMINAL, SPADE, 1/0 AWG STR CONDUCTOR, ALUM/CU CONDUCTOR, F/ T-TAPS
1/0 AWG STRANDED COMPRESSION LUG	-	-	4004739	1	CONNECTOR, ELECTRICAL, TERMINAL, SPADE, 1/0 AWG SOL CONDUCTOR, ALUM/CU CONDUCTOR, T BODY
4/0 AWG COMPRESSION LUG	-	-	666503	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 4/0AWG STR. COND.
500 MCM COMPRESSION LUG	-	-	666504	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR. COND .
750 MCM COMPRESSION LUG	-	-	666494	1	CONTACT, COMP
1000 MCM COMPRESSION LUG	-	-	4004743	1	CONNECTOR, ELECTRICAL, TERMINAL, SPADE, 1000 MCM CONDUCTOR, ALUM CONDUCTOR, F/ T-TAPS

THREADED STUD - PROVIDES THE MECHANICAL AND ELECTRICAL CONNECTION BETWEEN THE BASIC INSULATING PLUG, THE SPADE TERMINAL, AND THE DEVICE INSTALLED IN THE OTHER SIDE OF THE ELBOW HOUSING.

BILL OF MATERIALS - THREADED STUD					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
THREADED STUD	-	-	4004726	1	STUD, THD, REPLACEMENT F/ ELASTIMOLD 600 A T-BODY ELBOW

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
3. WITHIN DEF, THESE ITEMS ARE PURCHASED SEPARATELY (EXCEPT FOR THE THREADED STUD) AND COMBINED TOGETHER IN THE APPROPRIATE CU'S THAT INCLUDE THE 600 AMP T-BODY, CABLE ADAPTER, CONNECTOR, AND LOADBREAK ELBOW TAP PLUG. THE EXCEPTION TO THIS 1000 MCM WHICH IS PURCHASED IN A KIT WITH ALL OF THESE ALONG WITH AN INSULATING CAP.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

CABLE ADAPTERS AND CONNECTORS

DEC	DEM	DEP	DEF
			X

26.06-107

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW CONNECTOR PLUG	ELBOW-CONN-PLUG-F	1	153143	1	PLUG, ELECTRICAL, STRAIGHT, 600A, 25KV, DEADBREAK INSULATED BUSHING, 125KV BIL, PROCUREMENT

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
3. CONNECTING PLUGS ARE THREADED ON BOTH ENDS TO ALLOW 600 AMP ELBOW HOUSINGS TO BE JOINED.
4. CONNECTING PLUGS CURRENTLY PURCHASED HAVE A SEMICONDUCTING COVERING OVER THE WIDE CENTER PORTION OF THE PLUG. HOWEVER, UNITS PURCHASED IN THE PAST HAD A METALIZED BAND AROUND THIS AREA. WHEN SUBJECTED TO REPEATED SUBMERSION IN WATER, THE BAND MAY CORRODE AND CAUSE A FAILURE OF THE PLUG. AS THESE ARE ENCOUNTERED IN MANHOLES OR ANY WET LOCATION, THEY SHOULD BE REPLACED AS TIME AND RESOURCES ALLOW.

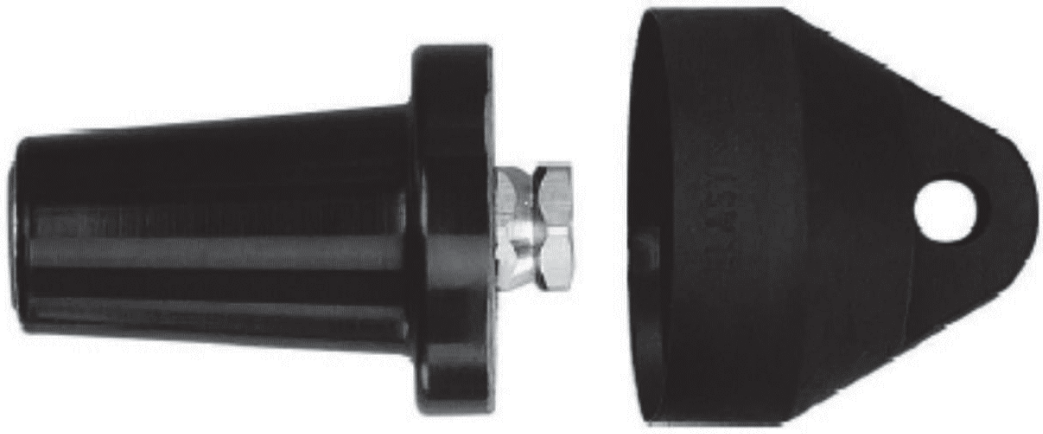
DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

CONNECTING PLUGS

DEC	DEM	DEP	DEF
			X

26.06-113



BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
BASIC INSULATING PLUG, 15KV/25KV	ELBOW-PLUG-INSL-CAP-F	1	666497	1	PLUG, ELECTRICAL, INSULATING, DEADEND, 600A, 15KV, W/ CAP

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
3. THE BASIC INSULATING PLUG IS USED TO SEAL THE UNUSED END OF A 600 AMP ELBOW HOUSING.
4. INSTEAD OF THE BASIC INSULATING PLUG, THE PREFERRED INSTALLATION IS A LOADBREAK ELBOW TAP PLUG (SEE DWG. 26.06-123), COVERED WITH AN INSULATING RECEPTACLE (SEE DWG. 26.02-127).
5. IF AN ELBOW HOUSING IS TO BE REMOVED AND RE-ENERGIZED, THE INSULATING PLUG CAN BE USED IN CONJUNCTION WITH A DEAD-END PLUG AND CAP.

REVISED		BY	CHK'D	APPR.
3				
2				
1	1/31/19	EANES	FLETCHER	ADCOCK
0	6/30/18	EANES	FLETCHER	ADCOCK

DUKE ENERGY.

BASIC INSULATING PLUG WITH CAP

DEC	DEM	DEP	DEF
			X

26.06-115

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
ELBOW PLUG 200A 15KV LOAD BREAK TAP	-	-	1478988	1	PLUG, ELECTRICAL, ELBOW TAP, 15KV, LOADBREAK F/ CONNECTING 200A CABLES TO 600A T-BODY

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.

2. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.

3. THE LOADBREAK ELBOW TAP PLUG TRANSITIONS FROM A 600 AMP INTERFACE ON ONE SIDE OF A T-BODY OR BUSHING EXTENSION TO A 200 AMP INTERFACE. THESE CAN BE USED WHEN A 200 AMP TAP IS NEEDED OR FOR THE INSTALLATION OF ELBOW ARRESTERS. THEY ARE ALSO A CONVENIENT MEANS OF PHASING WHEN USED WITH A 200 AMP DEAD-END RECEPTACLE OR COVER.

4. THE LOADBREAK ELBOW TAP PLUG WITHIN DEF IS PACKAGED TOGETHER WITH THE 600 AMP ELBOW HOUSING, CABLE ADAPTER, AND CONNECTOR FOR 1000 MCM CABLES. FOR 500 MCM AND 750 MCM CABLES, THIS SAME MATERIAL IS PURCHASED SEPARATELY AND PACKAGED TOGETHER WITH THE APPROPRIATE COMPATIBLE UNITS FOUND ON DWG. 26.06-103. IT IS THE PREFERRED INSTALLATION VERSUS THE BASIC INSULATING PLUG AND CAP FOR THE END OF THE T-BODY NOT CONNECTED TO THE APPARATUS BUSHING.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

LOADBREAK ELBOW TAP PLUG

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

26.06-123

BILL OF MATERIALS

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CONNECTOR UG SPLICE WYE 600A FOR 4/0 MCM TO 4/0 MCM	CONN-UG-SPL-WYE-4/0-F	1	153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			666503	2	CONTACT, COMP, F/ 600A. CONN, F/ 4/0AWG STR. COND.
			4004729	2	ADAPTER, CABLE, STRESS RELIEF, 15KV 4/0 CU OR ALUM
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
CONNECTOR UG SPLICE WYE 600A FOR 500 MCM TO 4/0 MCM	CONN-UG-SPL-WYE-500-4/0-F	1	666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			4004731	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 500MCM AL
			4004729	1	ADAPTER, CABLE, STRESS RELIEF, 15KV 4/0 CU OR ALUM
			666503	1	CONTACT, COMP, F/ 600A. CONN, F/ 4/0AWG STR. COND.
			666504	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR.
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
CONNECTOR UG SPLICE WYE 600A FOR 500 MCM TO 500 MCM	CONN-UG-SPL-WYE-500-F	1	111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			666504	2	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR.
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			4004731	2	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 500MCM AL
CONNECTOR UG SPLICE WYE 600A FOR 750 MCM TO 4/0 MCM	CONN-UG-SPL-WYE-750-4/0-F	1	666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			4004732	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 750MCM AL
			4004729	1	ADAPTER, CABLE, STRESS RELIEF, 15KV 4/0 CU OR ALUM
			666494	1	CONTACT, COMP
			666503	1	CONTACT, COMP, F/ 600A. CONN, F/ 4/0AWG STR. COND.
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
CONNECTOR UG SPLICE 15KV 750AL TO 500AL TAP TEE	CONN-UG-SPL-15KV-750AL-500AL-TEE-F	1	111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			4004731	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 500MCM AL
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			4004732	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 750MCM AL
			666504	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR.
			666494	1	CONTACT, COMP
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
CONNECTOR UG SPLICE WYE 600A FOR 1000 MCM TO 4/0 MCM	CONN-UG-SPL-WYE-1000-4/0-F	1	153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			4004743	1	CONNECTOR, ELECT, TERMINAL, SPADE, 1000 MCM COND.
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			4004733	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ 1000 MCM
			4004729	1	ADAPTER, CABLE, STRESS RELIEF, 15KV 4/0 CU OR ALUM
			666503	1	CONTACT, COMP, F/ 600A. CONN, F/ 4/0AWG STR. COND.
CONNECTOR UG SPLICE WYE 600A FOR 1000 MCM TO 500 MCM	CONN-UG-SPL-WYE-1000-500-F	1	4004731	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 500MCM AL
			4004733	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ 1000 MCM
			4004743	1	CONNECTOR, ELECT, TERMINAL, SPADE, 1000 MCM COND.
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			111206	1	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			153143	2	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			666504	1	CONTACT, COMP, F/ 600A. CONNECTOR, F/ 500KCMIL STR.
CONNECTOR UG SPLICE WYE 600A FOR 1000 MCM TO 750 MCM	CONN-UG-SPL-WYE-1000-750-F	1	4004732	1	ADAPTER, CABLE, STRESS RELIEF CABLE, F/ 750MCM AL
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			666494	1	CONTACT, COMP
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			4004733	1	ADAPTER, CABLE, STRESS RELIEF CABLE F/ 1000 MCM
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED
			4004743	1	CONNECTOR, ELECT, TERMINAL, SPADE, 1000 MCM COND.
600 AMP SEPARABLE SPLICE - 1000 MCM TO 1000 MCM	-	1	4004733	2	ADAPTER, CABLE, STRESS RELIEF CABLE F/ 1000 MCM
			4004743	2	CONNECTOR, ELECT, TERMINAL, SPADE, 1000 MCM COND.
			666497	2	PLUG, ELECT, INSULATING, DEADEND, 600A ,15KV, W/ CAP
			153143	1	PLUG, ELECT, STRAIGHT, 600A, 25KV, DBK INS. BUSHING
			111206	2	HOUSING, CABLE T, 25KV, 600A, SHIELDED

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THE COMPONENTS OF THE 600 AMP ELBOW SYSTEM CAN BE USED AS A MEANS OF MAKING SPLICES, JUNCTIONS, TAPS AND DEADENDS. THEY ARE ESPECIALLY USEFUL WHEN DEALING WITH TWO DIFFERENT WIRE SIZES. THE ABOVE COMPATIBLE UNITS CONTAIN THE MATERIALS NEEDED FOR THE MORE COMMON COMBINATIONS.

REVISED		BY	CHK'D	APPR.
3				
2				
1	9/24/18	EANES	FLETCHER	ADCOCK
0	6/30/18	EANES	FLETCHER	ADCOCK

SEPARABLE SPLICES WITH 600 AMP ELBOW CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

26.06-126

NOTES:

A 900 AMP CONTINUOUS RATING CAN BE ACHIEVED WITH A STANDARD 600 AMP ELBOW HOUSING OR T-BODY UNDER CERTAIN CIRCUMSTANCES. DUE TO THE INFREQUENCY WITH WHICH THIS IS NEEDED, IT IS NOT FEASIBLE TO STOCK AND MAINTAIN THE PARTS NECESSARY TO ACHIEVE THE HIGHER RATING. CONTACT DISTRIBUTION STANDARDS FOR INFORMATION REGARDING THIS, AS IT MUST BE SPECIAL ORDERED. ALLOW FOR SIGNIFICANT LEAD TIMES FOR THESE ITEMS AS WELL.

A 900 AMP RATING IS ACHIEVED WHEN THE CURRENT CARRYING PATH OF THE COMPONENTS IS ALL COPPER OR SUITABLE COPPER ALLOY. THIS INCLUDES BUT IS NOT LIMITED TO THE APPARATUS BUSHING OR JUNCTIONS, THREADED STUDS, CONNECTORS, INSULATING PLUGS OR LOADBREAK ELBOW TAP PLUGS, AND CONNECTING PLUGS.

THESE COMPONENTS CAN ONLY BE PLACED ON COPPER CONDUCTORS, AND THE CONTINUOUS RATING OF ANY SWITCHES OR DISCONNECTING DEVICES SHOULD ALSO BE 900 AMPS. PROTECTIVE DEVICES SUCH AS RELAYS OR BREAKERS SHOULD ALSO BE ADJUSTED ACCORDINGLY.

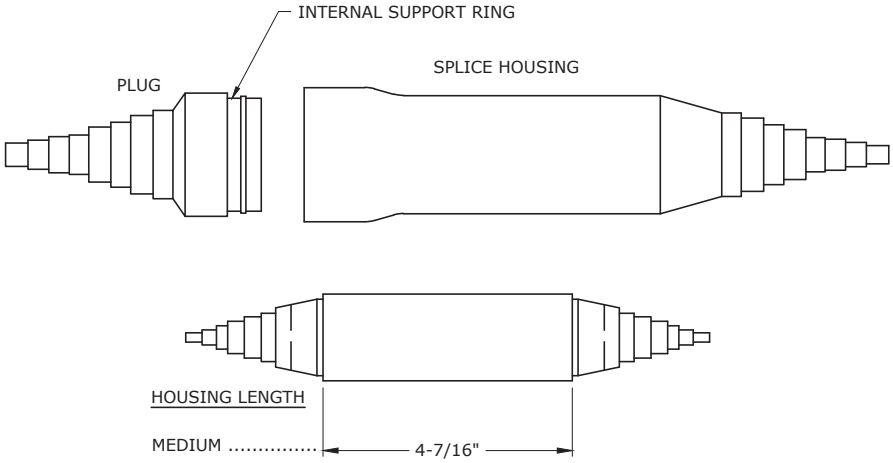
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

900 AMP DEADBREAK CONNECTORS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.06-129



NOTES:

1. SEE BELOW FOR INSTALLATION INSTRUCTIONS.
2. NEVER USE A CONNECTOR THAT CHANGES THE SHAPE OF THE FLOOD SEAL COVER. DOING SO MAY PREVENT THE COVER FROM SEALING PROPERLY OR PUNCTURE THE HOUSING.
3. NEVER REMOVE MORE INSULATION THAN NECESSARY TO FIT CONNECTOR BEING USED.
4. COMPLETED SPLICE AND CABLE MUST BE STRAIGHT TO PREVENT LEAKING.
5. THE INTERNAL SUPPORT RING IS PROVIDED TO MAINTAIN A WATERTIGHT SEAL AND SHOULD NOT BE DISCARDED.

FLOOD SEAL INSTALLATION INSTRUCTIONS:

1. BE CERTAIN THE LAST TWELVE (12) INCHES OF THE CABLES ARE STRAIGHT.
2. BE CERTAIN THE END OF THE CABLE IS CUT STRAIGHT AND AT A 90 DEGREE ANGLE TO THE CONDUCTOR.
3. CLEAN CABLES FOR A DISTANCE OF TWELVE (12) INCES FROM CUT ENDS WITH A CLEAN TOWEL AND CABLE CLEANING FLUID MAKING SURE CABLES ARE FREE OF DIRT AND MOISTURE.
4. SELECT THE PROPER RING SIZE FOR THE CABLE BEING SPLICED BY OBSERVING THE NUMBERS AND ARROWS ON THE FLOOD SEAL HOUSING AND PLUG. CUT OFF THE UN-NEEDED PORTION OF THE HOUSING AND PLUG WITH SCISSORS OR A CIRCLE CUTTER (KNIVES ARE NOT RECOMMENDED). THE CORRECT CABLE SIZE AND ITS ARROW SHOULD STILL BE VISIBLE. THIS CUT MUST ALWAYS BE STRAIGHT AND ALONG THE EDGE OF THE STEP.
5. APPLY A SMALL AMOUNT OF SILICONE GREASE TO THE END HOLES OF THE HOUSING AND PLUG, THEN SLIDE THE HOUSING AND PLUG ONTO THE CABLES.
6. USE THE PROPER TOOL TO REMOVE ONLY ENOUGH INSULATION TO ALLOW THE CONDUCTOR TO FULLY FIT INTO THE CONNECTOR AND FOR CONNECTOR ELONGATION DURING THE CRIMPING PROCESS WHEN CRIMP CONNECTORS ARE BEING INSTALLED.
7. FOR CRIMP CONNECTORS:
   - A. WIRE BRUSH ONE CONDUCTOR AND IMMEDIATELY PUSH THE CONNECTOR FULLY ONTO THE CONDUCTOR. DO NOT REMOVE ANY OXIDE INHIBITOR FROM THE CONNECTOR PRIOR TO INSTALLING IT ON THE CONDUCTOR.
   - B. VERIFY THE CRIMPING TOOL IS PROPERLY ADJUSTED, IF ADJUSTMENT MARKINGS ARE PROVIDED.
   - C. VERIFY THE CORRECT TOOL AND DIE ARE BEING USED.
   - D. PROPERLY CRIMP THE CONNECTOR BY THE FOLLOWING: MAKE FIRST CRIMP BELOW THE MARK INDICATING THE END OF THE CONDUCTOR CAVITIY AND THEN MOVE TOWARD THE END OF THE CONNECTOR, DO NO OVERLAP CRIMPS, MAKE THE PROPER NUMBER OF CRIMPS, ROTATE THE CRIMPING TOOL 90 DEGREES BETWEEN SUCCESSIVE CRIMPS, VERIFY THE CRIMP INDENTIONS IN THE CONNECTOR APPEAR CORRECT, AND REMOVE ANY SHARP FLASHING CREATED BY THE CRIMPING OPERATION.
   - E. REMOVE ALL EXCESS INHIBITOR.
   - F. REPEAT THE ABOVE ACTIONS FOR THE OTHER CONDUCTOR.
8. FOR SET SCREW CONNECTORS:
   - A. INSTALL THE SET SCREW CONNECTOR ON THE MAIN CONDUCTOR AND THEN THE TAP
   - B. TIGHTEN THE SET SCREWS UNTIL THE CONDUCTOR STRANDS ARE DISPLACED AND THE CONNECTOR CANNOT BE PULLED OFF. MINIMIZE MOVEMENT OF THE CONNECTOR AFTER DOING THIS.
   - C. REMOVE ALL EXCESS INHIBITOR.
9. SLIDE THE HOUSING OVER THE CONNECTOR UNTIL IT IS CENTERED INSIDE. APPLY A SMALL AMOUNT OF SILICONE GREASE TO THE CONNECTION SURFACES OF THE HOUSING AND PLUG, THEN SLIDE THE PLUG INTO THE HOUSING MAKING CERTAIN IT IS FULLY SEATED.

DUKE ENERGY.

3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

FLOOD SEAL COVERS AND CONNECTORS (COMPRESSION)

DEC	DEM	DEP	DEF
			X

26.08-101A

MEDIUM SPLICE COVER - ITEM # 4004757, RANGE #6 TO 350 MCM						
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION	DIE
#6 AL TO #6 AL	-	-	193057	1	SLEEVE, SE B 6ST-6ST	REFER TO SLEEVE
#4 TO #4	-	-	4022714	1	SLEEVE, CONNECTOR, SE B 4ST-4ST	REFER TO SLEEVE
#2 TO #2	-	-	4022715	1	SLEEVE, SE B 2ST-2ST	REFER TO SLEEVE
#2 TO #4	-	-	4002708	1	SLEEVE, SE B 2ST-4ST	REFER TO SLEEVE
1/0 TO #2	-	-	4002712	1	SLEEVE, SE B 1/0ST-2ST	REFER TO SLEEVE
1/0 TO 1/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
1/0 TO 2/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
2/0 TO 2/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
4/0 TO 4/0	-	-	4002717	1	SLEEVE, SE B 4/0-4/0	REFER TO SLEEVE

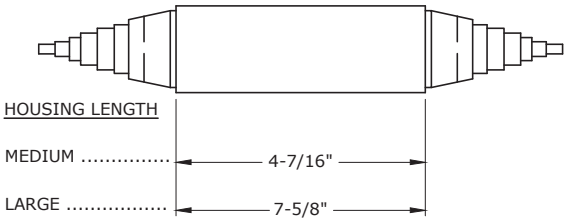
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	EANES	FLETCHER	ADCOCK
0	7/31/17	EANES	FLETCHER	ADCOCK

FLOOD SEAL COVERS AND CONNECTORS (COMPRESSION)

DEC	DEM	DEP	DEF
			X

26.08-101B



LARGE SPLICE COVER WITH MECHANICAL SET SCREW CONNECTOR					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
350 TO 350	-	-	4004694	1	SPLICE, SEC UG 2 TO 350
500 TO 500	-	-	597912	1	SPLICE, SEC UG 500KCM AL
750 TO 750	-	-	4004695	1	SPLICE, KIT, 250 TO 750MCM

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. NEVER USE A CONNECTOR THAT CHANGES THE SHAPE OF THE FLOOD SEAL COVER. DOING SO MAY PREVENT THE COVER FROM SEALING PROPERLY OR PUNCTURE THE HOUSING.
3. SELECT CORRECT RING SIZE AND CUT OFF WITH A KNIFE, LEAVING THE CORRECT CABLE SIZE SHOWING. THE CUT MUST ALWAYS BE STRAIGHT AND ALONG THE EDGE OF THE STEP.
4. NEVER REMOVE MORE INSULATION THAN NECESSARY TO FIT CONNECTOR BEING USED.
5. TIGHTEN SET SCREWS TO MANUFACTURER'S SPECIFICATIONS.
6. COMPLETED SPLICE AND CABLE MUST BE STRAIGHT TO PREVENT LEAKING.
7. THE INTERNAL SUPPORT RING IS PROVIDED TO MAINTAIN A WATERTIGHT SEAL AND SHOULD NOT BE DISCARDED.

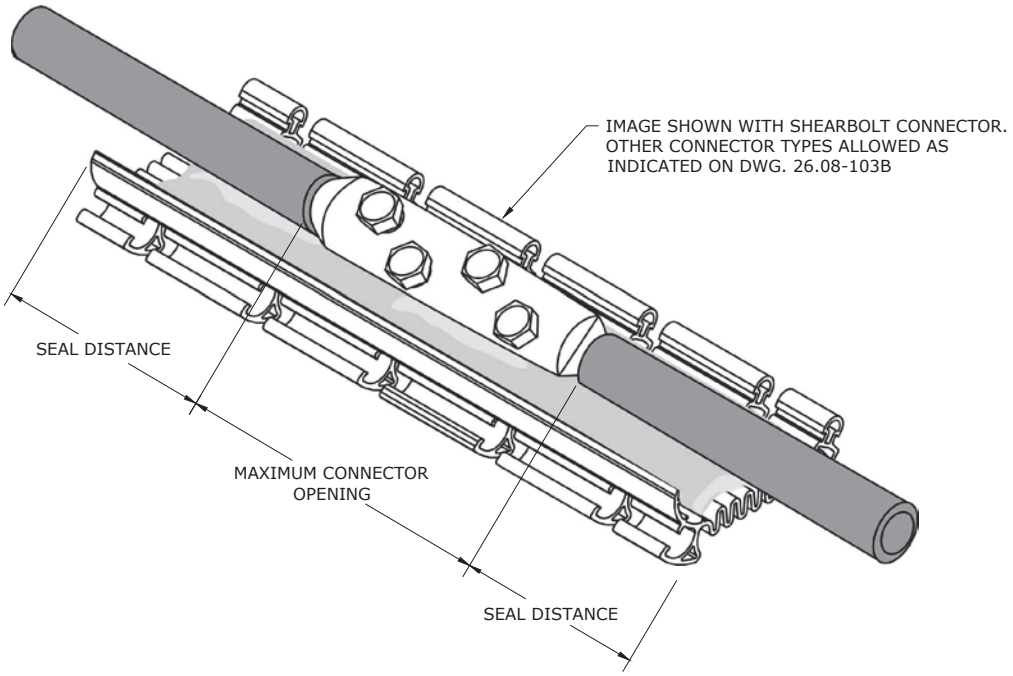
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

FLOOD SEAL COVERS AND CONNECTORS (MECHANICAL)

DEC	DEM	DEP	DEF
			X

26.08-102



NOTES:

1. UTILIZE THE INCLUDED MANUFACTURER'S INSTALLATION INSTRUCTIONS.
2. CLEAN AND STRIP THE CABLE UTILIZING APPROVED TOOLS. THEN PROPERLY INSTALL THE CONNECTOR ACCORDING TO THE TYPE OF CONNECTOR (SHEAR BOLT OR COMPRESSION) BEING USED.
3. PRESTRETCH THE SLEEVE.
4. THE CONNECTOR SHOULD BE PLACED IN THE MIDDLE OF THE WRAP. THE CRITICAL DIMENSIONS FOR THE WRAP ITSELF ARE THE 'MAXIMUM CONNECTOR OPENING', WHICH IS THE DISTANCE BETWEEN THE INSULATION CUTBACKS OF EACH CABLE, AND THE 'SEAL DISTANCE'. THIS DISTANCE IS INDICATED IN THE TABLES ON DWG. 26.08-103B AND IN THE MANUFACTURER'S INSTRUCTIONS. THE REMAINING DISTANCE ON EITHER END, THE 'SEAL DISTANCE', SHOULD BE APPROXIMATELY THE SAME ON EACH SIDE.
5. WRAP THE SLEEVE AROUND THE CABLE AND CONNECTOR. STARTING AT ONE END, COMPRESS SNAP LOCKS OVER THE ENTIRE LENGTH OF THE SLEEVE. ENSURE THAT THE FLAP SEATS UNDER THE SNAP LOCKS AS SHOWN ON THE MANUFACTURER'S INSTRUCTIONS.
6. INSTALL THE CABLE TIES AT THE OUTERMOST NOTCHES OF THE SNAP LOCK.
7. IMPORTANT - DO NOT INSTALL MORE THAN ONE CABLE OUT OF EACH END OF THE CONNECTOR (NO Y OR H CONNECTORS).
8. UTILIZE ONLY THE TIE WRAPS THAT ARE PROVIDED. DO NOT SUBSTITUTE.
9. ONCE CLOSED, THE COVER CAN BE OPENED AND THE CONNECTOR REPOSITIONED IF NEEDED. THE COVER CAN THEN BE CLOSED AGAIN WITH NO ISSUES. DESPITE THIS CAPABILITY, DO NOT REUSE THE GELWRAP COVERS FROM LOCATION TO LOCATION.
10. ANOTHER APPLICATION FOR THE GELWRAP IS FOR CABLE THAT IS NICKED, BUT NOT CUT. IN THE PAST A NICK IN THE INSULATION WOULD HAVE NECESSITATED THE WIRE BEING CUT, A CONNECTOR INSTALLED, AND A FLOOD SEAL APPLIED. THE WRAP AROUND DESIGN OF THE GELWRAPS ALLOW FOR THEM TO SIMPLY BE PLACED OVER THE INSULATION DAMAGE AND SECURED, ELIMINATING THE NEED FOR AN ENTIRE SPLICE.
11. FOR SHEAR BOLT CONNECTORS, THE PREFERRED METHOD TO SHEAR OFF THE BOLT IS A HEXAGONAL, 1/2" BATTERY OPERATED TOOL. IF THIS IS NOT AVAILABLE, A RATCHETING TOOL CAN ALSO BE USED.
12. HAND TIGHTEN ALL OF THE BOLTS TO START, THEN SHEAR OFF THE TWO OUTER BOLTS FIRST, AND THE TWO INNER BOLTS LAST. THIS IS THE OPPOSITE ORDER IN WHICH CRIMPS ARE MADE ON COMPRESSION CONNECTORS.
13. THE SHEAR BOLT PROVIDED WITH THE GELWRAP IN THESE KITS HAS BEEN PROPERLY SIZED AND ONLY NEEDS TO BE CENTERED IN THE COVER.

DUKE ENERGY.

3				
2				
1				
0	7/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

GELWRAP COVERS AND CONNECTORS

DEC	DEM	DEP	DEF
X		X	X

26.08-103A

BILL OF MATERIALS - GELWRAP SPLICE COVER - ITEM # 1537681, RANGE #6 TO 4/0 AWG MAXIMUM CONNECTOR OPENING - 5" MINIMUM SEAL DISTANCE - 1-1/2"						
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION	DIE
#6 AL TO #6 AL	-	-	193057	1	SLEEVE, SE B 6ST-6ST	REFER TO SLEEVE
#4 TO #4	-	-	4022714	1	SLEEVE, CONNECTOR, SE B 4ST-4ST	REFER TO SLEEVE
#2 TO #2	-	-	4022715	1	SLEEVE, SE B 2ST-2ST	REFER TO SLEEVE
#2 TO #4	-	-	4022708	1	SLEEVE, SE B 2ST-4ST	REFER TO SLEEVE
1/0 TO #2	-	-	4022712	1	SLEEVE, SE B 1/0ST-2ST	REFER TO SLEEVE
1/0 TO 1/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
1/0 TO 2/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
2/0 TO 2/0	-	-	50062561	1	SLEEVE, SE B 1/0ST-1/0ST	REFER TO SLEEVE
4/0 TO 4/0	-	-	4002717	1	SLEEVE, SE B 4/0-4/0	REFER TO SLEEVE

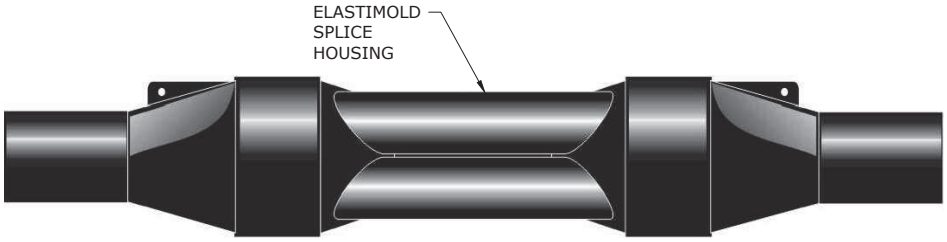
BILL OF MATERIALS - GELWRAP SPLICE COVER WITH SHEARBOLT CONNECTOR, RANGE 350 MCM TO 500 MCM					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CABLE SIZES FROM 350 MCM TO 500 MCM	-	-	1507938	1	KIT, SPLICE, 1KV, SILCONE GEL INSULATION, 350-500 AL/CU CONDUCTOR W/ SHEAR BOLT

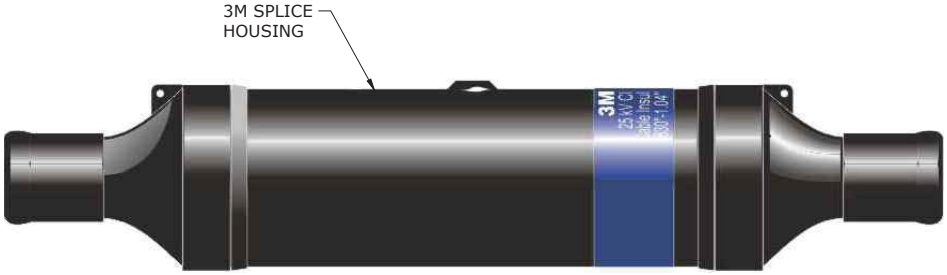
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

GELWRAP COVERS AND CONNECTORS

DEC	DEM	DEP	DEF
			X

26.08-103B





NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.

2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.

3. SPLICE KITS CONTAIN THE SPLICE BODY AND APPROPRIATE CONNECTOR. DO NOT MIX CONNECTORS FROM KIT TO KIT, AS SOME DESIGNS ARE UNIQUE TO A BRAND NAME AND MAY NOT WORK IN ANOTHER MANUFACTURER'S SPLICE.

4. THE CU'S PACKAGE TOGETHER THE APPROPRIATE SPLICE KIT, GROUND SOCK (WHERE APPLICABLE) AND RE-JACKETING/WATERPROOFING MATERIALS. THIS IS THE CASE FOR MOST HIGH VOLUME ITEMS. ITEMS USED LESS FREQUENTLY SUCH AS REPAIR AND TRANSITION SPLICES STILL REQUIRE COMPONENTS TO BE ORDERED SEPARATELY.

5. ALL SPLICES MUST BE WATERPROOFED TO PREVENT MOISTURE INGRESS AND PREMATURE FAILURE.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

200 AMP STRAIGHT SPLICES

DEC	DEM	DEP	DEF
X	X	X	X

26.10-101A

BILL OF MATERIALS - STRAIGHT SPLICES

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CONNECTOR UG SPLICE 15KV 1/0 AL TO 2AL	CONN-UG-SPL-15KV-1/0AL-2AL-F	1	4205567	1	KIT, SPLICE, CONTAIN THE SOCK & TWO CONSTANT TENSION SPRINGS CATID & PACKAGE QUANTITY IS REQUIRED ON EA
			4002712	1	SPLICE, CONDUCTOR, SERVICE ENTRANCE, 1/0 AWG-2 AWG STR CONDUCTOR, BARE CU/ALUM CONDUCTOR, YELLOW/RED
			424991	1	COVER, SPLICE, PP, TO INCLUDE INSTRUCTIONS & ALL NECESSARY SEALING MATERIAL, F/ WATERPROOFING 1/0
			301635	1	SPLICE, CONDUCTOR, UNDERGROUND, 2 AWG-1/0 AWG COND, ALUM/CU CONDUCTOR, STRAIGHT, 15-25KV 200A
CONNECTOR UG SPLICE 15KV 1/0 AL SOLID CONDUCTOR	CONN-UG-SPL-15KV-1/0ALSOL-F	1	4004712	1	SPLICE, CONDUCTOR, STRAIGHT, 1/0 AWG-1/0 AWG SOL CONDUCTOR, ALUM CONDUCTOR, CONNECTOR 15KV
			4205567	1	KIT, SPLICE, CONTAIN THE SOCK & TWO CONSTANT TENSION SPRINGS CATID & PACKAGE QUANTITY IS REQUIRED ON EA
			424991	1	COVER, SPLICE, PP, TO INCLUDE INSTRUCTIONS & ALL NECESSARY SEALING MATERIAL, F/ WATERPROOFING 1/0
			301635	1	SPLICE, CONDUCTOR, UNDERGROUND, 2 AWG-1/0 AWG COND, ALUM/CU CONDUCTOR, STRAIGHT, 15-25KV 200A
#1/0-15KV TO #1/0-15 KV	-	-	4004712	1	SPLICE, CONDUCTOR, STRAIGHT, 1/0 AWG-1/0 AWG SOL COND, ALUM COND, CONNECTOR 15KV, W/ CLEAR END CAPS
#4/0-15KV TO #4/0-15 KV	-	-	4004706	1	KIT, STRAIGHT SPLICE, 15KV, 1/C, #4/0, W/ PINK CAP ON CONNECTOR
#1/0-25KV TO #1/0-25 KV	-	-	301637	1	SPLICE,CONDUCTOR, UNDERGROUND, 1/0 AWG CONDUCTOR, SOL CONDUCTOR, STRAIGHT, 25KV, INSULATION OD RANGE
CONNECTOR - #2 AL-#2 AL (USE WITH 1/0 SPLICE BODY)	-	-	4004709	1	SPLICE,CONDUCTOR, STRAIGHT, 2-2 AWG STR CONDUCTOR ALUM CONDUCTOR, CONNECTOR 15KV W/ RED END CAPS
CONNECTOR - #2 AL-1/0 AL (USE WITH 1/0 SPLICE BODY)	-	-	4002712	1	SPLICE, CONDUCTOR, PRIMARY STRAIGHT, 2-1/0 AWG SOL CONDUCTOR, COMP CONNECTION, ALUM, SLEEVE, FOR 5451

BILL OF MATERIALS - REPAIR SPLICES

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
#1/0-15KV TO #1/0-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
		-	4004715	1	SPLICE, CONDUCTOR, REPAIR, 1/0 AWG STR CONDUCTOR, CONNECTOR 15KV, F/ USE W/ ITEM # 326455
#1/0-15KV TO #2-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
#4/0-15KV TO #1/0-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
#4/0-15KV TO #4/0-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
#4/0-15KV TO #2-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
#2-15KV TO #2-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481
		-	4004714	1	SPLICE, CONDUCTOR, REPAIR, 2-1/0 AWG SOL CONDUCTOR, CONNECTOR 15 KV F/ USE W/ P/N 326455 SPLICE HOUSING
#4-15KV TO #2-15 KV	-	-	4004704	1	KIT, SPLICE, 2-1/0 AWG STR, 1/0 AWG SOL CONDUCTOR, STRAIGHT, W/O SLEEVE, USE W/ ITEM # 326480 & 326481

DUKE ENERGY.

3					
2					
1	8/24/18	EANES	FLETCHER	ADCOCK	
0	6/30/18	EANES	FLETCHER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

200 AMP STRAIGHT SPLICES

DEC	DEM	DEP	DEF
			X

26.10-101B

BILL OF MATERIALS - TRANSITION SPLICES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CONNECTOR UG SPLICE 15KV 1/0 AL TO 2AL	CONN-UG-SPL-15KV-1/0AL-2AL-F	1	4205567	1	KIT, SPLICE, CONTAIN THE SOCK & TWO CONSTANT TENSION SPRINGS CATID & PACKAGE QUANTITY IS REQUIRED ON EA
			4002712	1	SPLICE, CONDUCTOR, SERVICE ENTRANCE, 1/0 AWG-2 AWG STR CONDUCTOR, BARE CU/ALUM CONDUCTOR, YELLOW/RED
			424991	1	COVER, SPLICE, PP, TO INCLUDE INSTRUCTIONS & ALL NECESSARY SEALING MATERIAL, F/ WATERPROOFING 1/0
			301635	1	SPLICE, CONDUCTOR, UNDERGROUND, 2 AWG-1/0 AWG COND, ALUM/CU CONDUCTOR, STRAIGHT, 15-25KV 200A
#2-15KV TO #4-15 KV	-	-	4002708	1	SPLICE, CONDUCTOR, SERVICE ENTRANCE, 2 AWG-4 AWG STR CONDUCTOR, BARE CU/ALUM CONDUCTOR, RED/ORANGE
			301635	1	SPLICE, CONDUCTOR, UNDERGROUND, 2 AWG-1/0 AWG CONDUCTOR, ALUM/CU CONDUCTOR, STRAIGHT, 15-25KV

BILL OF MATERIALS - GROUNDING / REJACKETING MATERIALS / REPLACEMENT SLEEVES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
GROUND SOCK, ALL 200 AMP SPLICES	-	-	4205567	1	KIT, SPLICE, CONTAIN THE SOCK & TWO CONSTANT TENSION SPRINGS CATID & PACKAGE QUANTITY IS REQUIRED ON EA
REJACKETING / WATERPROOFING COVER	-	-	424991	1	COVER, SPLICE, PP, TO INCLUDE INSTRUCTIONS & ALL NECESSARY SEALING MATERIAL, F/ WATERPROOFING 1/0
REPLACEMENT SLEEVE, #2 AL TO #2 AL	-	-	4004709	1	SPLICE,CONDUCTOR, STRAIGHT, 2-2 AWG STR CONDUCTOR, ALUM CONDUCTOR, CONNECTOR 15KV W/ RED END CAPS
REPLACEMENT SLEEVE, #2 AL TO 1/0 AL	-	-	4002712	1	SPLICE, CONDUCTOR, SERVICE ENTRANCE, 1/0 AWG-2 AWG STR CONDUCTOR, BARE CU/ALUM CONDUCTOR, YELLOW/RED
REPLACEMENT SLEEVE, 1/0 STR AL TO 1/0 STRAL	-	-	4004711	1	SPLICE, CONDUCTOR, STRAIGHT, 1/0 AWG SOL-1/0 AWG STR CONDUCTOR, ALUM CONDUCTOR, CONNECTOR-15KV
REPLACEMENT SLEEVE, 1/0 SOL AL TO 1/0 SOL AL	-	-	4004712	1	SPLICE, CONDUCTOR, STRAIGHT, 1/0 AWG-1/0 AWG SOL CONDUCTOR, ALUM CONDUCTOR, CONNECTOR 15KV

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

200 AMP STRAIGHT SPLICES

DEC	DEM	DEP	DEF
			X

26.10-101C

BILL OF MATERIALS - STRAIGHT SPLICES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
#2 TO 1/0 15KV/25KV	CONN-UG-SPL-PRI-1/0-#2-25KV-F	1	1568218	1	KIT, SPLICE, 2-4/0 AWG CONDUCTOR, 28KV, INLINE COLD SHRINKABLE SPLICE BODY, W/ ALUM MECHANICAL SHEARBOLT

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES. THESE INSTRUCTIONS HAVE BEEN WRITTEN AND MODIFIED SPECIFICALLY FOR THE TYPES OF CABLE DUKE ENERGY IS MOST LIKELY TO INSTALL, AND REFLECT THE CONTENTS OF THE KIT THAT WE HAVE SPECIFIED.

2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.

3. THIS DESIGN CAN ALSO BE USED AS A TRANSITION SPLICE. THE SHEAR BOLT CONNECTOR WITHIN EACH KIT CAN ACCOMMODATE THE FULL RANGE OF CABLES INDICATED.

4. THESE SPLICE KITS UTILIZE A COLD SHRINK TECHNOLOGY FOR THE SPLICE ITSELF. THE GROUND SOCK AND REJACKETING MATERIALS ARE EXTRUDED ONTO THE SPLICE BODY, AND DO NOT HAVE TO BE SLID SEPARATELY ONTO THE CABLE AS WITH OTHER DESIGNS.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

200 AMP STRAIGHT SPLICES

(ALL-IN-ONE OR INTEGRATED SPLICE KITS)

DEC	DEM	DEP	DEF
			X

26.10-102

BILL OF MATERIALS - STRAIGHT SPLICES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
500 MCM TO 500 MCM, 15KV	-	-	150132	3	CONNECTOR, COMPRESSION, COMP, NO, TABS, CU, 2-2
			160123	1	CONNECTOR, GROUND, 5/8, ROD, 2, CU
			326470	1	KIT, SPLICE, (1) 1000 MCM ALUM CONDUCTOR, 15KV, MOLDED RBR
			390124	2	TAPE, VINYL, 1-1/2"X44' VINYL
			390303	2	TAPE, ELECTRICAL, HIGH VOLTAGE SELF FUSING, 1-1/2" X 30' ROLL
			402179	1	COMPOUND, INSULATION, SEAL, PAD, 3-3/4"
			9220101218	1	SPLICE, JACKET & GROUND, JACKET & GROUND SOCK FOR 15 KV 500
			9220160118	6	CONDUCTOR, COPPER, CONDUCTOR, 2-7 STR, SDW, BR CU
			9220162221	2	CONDUCTOR, COPPER, #2 SOLID, SOFT DRAWN, BARE, ON 125' SPOOL
CONNECTOR UG SPLICE WYE 600A FOR 1000 MCM 15KV CONDUCTOR TO 1000 MCM 15 KV CONDUCTOR	CONN-UG-SPL-WYE-1000-F	1	4005478	2	TAPE, 1-1/2" X 44' ROLL, VINYL, W/ 1-1/2" CORE
			4004708	1	KIT, SPLICE, (1) 1000 MCM ALUM CONDUCTOR, 15KV, MOLDED RBR
			4005483	2	TAPE, ELECTRICAL, HIGH VOLTAGE SELF FUSING, 1-1/2" X 30' ROLL
			667629	2	TAPE, ELECTRICAL, GEN. PURPOSE, 3/4" WD X 66' LG X 0.007" THK
			4172358	6	WIRE/CABLE, ELECTRICAL, BARE, 7 STR SD, 2 AWG, CU CONDUCTOR
			4173267	2	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 2 AWG, CU CONDUCTOR
			932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8"
			4158533	1	SPLICE, CONDUCTOR, 500/750/1000 MCM, 350/750/1000 MCM COND
			4002779	3	CONNECTOR, ELECTRICAL, COMP, C-TAP, 2 AWG - 2 AWG COND

BILL OF MATERIALS - GROUNDING / REJACKETING MATERIALS / REPLACEMENT SLEEVES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
COLD SHRINK REJACKETING & GROUND SOCK ALL 600 AMP SPLICES	-	-	4158533	1	SPLICE, CONDUCTOR, 500/750/1000 MCM, 350/750/1000 MCM CONDUCTOR, JACKET & GROUND SOCK F/ 15 KV 500, 750

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THESE SPLICES UTILIZE A COLD SHRINK TECHNOLOGY FOR THE SPLICE. THE KITS INCLUDE THE SPLICE BODY AND CONNECTOR.
4. THE COMPATIBLE UNITS PACKAGE TOGETHER THE APPROPRIATE SPLICE KIT, GROUND SOCK, AND COLD SHRINK REJACKETING MATERIALS.
5. ALL SPLICES MUST BE WATERPROOFED TO PREVENT MOISTURE INGRESS AND PREMATURE FAILURE.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

DUKE ENERGY.

600 AMP STRAIGHT SPLICES

DEC	DEM	DEP	DEF
			X

26.10-103

BILL OF MATERIALS - STRAIGHT SPLICES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
4/0 TO 500 MCM, 15KV	CONN-UG-SPL-PRI-500-4/0-25KV-F	1	1540101	1	KIT, SPLICE, 4/0 AWG-500 MCM CONDUCTOR, 28KV, INLINE COLD SHRINKABLE SPLICE BODY, W/ ALUM MECHANICAL SHEARBOLT
750 MCM TO 1000 MCM, 15KV	CONN-UG-SPL-PRI-1000-750-25KV-F	1	4004705	1	KIT, SPLICE, 750-1000 MCM CONDUCTOR, 28KV, INLINE COLD SHRINKABLE SPLICE BODY, W/ ALUM MECHANICAL SHEARBOLT

BILL OF MATERIALS - GROUNDING DEVICES					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
EXTERNAL GROUND BRAID FOR ALL INTEGRATED SPLICE KITS	GND-SPL-PRI-STRAP-F	1	1543496	1	KIT, GROUNDING, CONSISTS OF EXTERNAL GROUND BRAID, (1) CONSTANT TENSION SPRING, F/ 600A SPLICES

NOTES:

1. REFER TO MANUFACTURER'S INSTRUCTIONS FOR PROPER INSTALLATION PROCEDURES. THESE INSTRUCTIONS HAVE BEEN WRITTEN AND MODIFIED SPECIFICALLY FOR THE TYPES OF CABLE DUKE ENERGY IS MOST LIKELY TO INSTALL, AND REFLECT THE CONTENTS OF THE KIT THAT WE HAVE SPECIFIED.
2. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
3. THIS DESIGN CAN ALSO BE USED AS A TRANSITION SPLICE. THE SHEAR BOLT CONNECTOR WITHIN EACH KIT CAN ACCOMMODATE THE FULL RANGE OF CABLES INDICATED.
4. THESE SPLICE KITS UTILIZE A COLD SHRINK TECHNOLOGY FOR THE SPLICE ITSELF. THE GROUND SOCK AND REJACKETING MATERIALS ARE EXTRUDED ONTO THE SPLICE BODY, AND DO NOT HAVE TO BE SLID SEPARATELY ONTO THE CABLE AS WITH OTHER DESIGNS.
5. AN EXTERNAL GROUND IS NOT NECESSARY, BUT CAN BE INSTALLED IF PREFERRED OR NEEDED IN CERTAIN SITUATIONS. THIS WOULD MOST LIKELY BE IN A MANHOLE OR VAULT APPLICATION VERSUS DIRECT BURIED. GROUND SOCK KITS INCLUDE THE BRAID AND AN ADDITIONAL SPRING CLAMP.

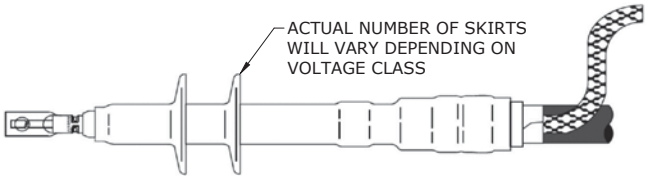
REVISED		BY	CHK'D	APPR.
3				
2				
1	6/30/18	EANES	FLETCHER	ADCOCK
0	7/31/17	EANES	FLETCHER	ADCOCK

DUKE ENERGY.

600 AMP STRAIGHT SPLICES
(ALL-IN-ONE OR INTEGRATED SPLICE KITS)

DEC	DEM	DEP	DEF
			X

26.10-105



BILL OF MATERIALS

APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
#2 AWG TERMINATION - 15 KV	TERM-2-AL-15KV-F	1	4004589	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			1535245	1	CONNECTOR, STEM, #2 - 1 AWG STR OR #1 - 1/0 SOL, F/ALUM OR CU COND
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
			4206007	1	KIT, TERMINATION, GROUND STRAP, 1/0 AWG CONDUCTOR, TERMINATOR
1/0 AWG TERMINATION - 15 KV	TERM-1/0-AL-15KV-F	1	4004589	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			1535245	1	CONNECTOR, STEM, #2 - 1 AWG STR OR #1 - 1/0 SOL, F/ALUM OR CU COND
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
			4206007	1	KIT, TERMINATION, GROUND STRAP, 1/0 AWG CONDUCTOR, TERMINATOR
4/0 AWG TERMINATION - 15 KV	TERM-4/0-AL-15KV-F	1	4004589	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			4004596	1	CONNECTOR, ELECT, TERMINAL, PIN STEM, 4/0 AWG STR CONDUCTOR
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
500 MCM TERMINATION - 15 KV	TERM-500-AL-15KV-F	1	4003029	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 500 MCM CONDUCTOR
			4004591	1	KIT, TERMINATION, CABLE, 15/25KV, 400-1000 MCM, 150KV BIL
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
750 MCM TERMINATION - 15 KV	TERM-750-AL-15KV-F	1	4004591	1	KIT, TERMINATION, CABLE, 15/25KV, 400-1000 MCM, 150KV BIL
			4003036	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 750 MCM CONDUCTOR
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
1000 MCM TERMINATION - 15 KV	TERM-1000-AL-15KV-F	1	4004591	1	KIT, TERMINATION, CABLE, 15/25KV, 400-1000 MCM, 150KV BIL
			4003034	1	CONNECTOR, ELECT, TERMINAL, LG BARREL LUG, 1000 MCM CONDUCTOR
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
#2 AWG TERMINATION - 25 KV	TERM-2-AL-25KV-F	1	4004590	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			1535245	1	CONNECTOR, STEM, #2 - 1 AWG STR OR #1 - 1/0 SOL, F/ALUM OR CU COND
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
			4206007	1	KIT, TERMINATION, GROUND STRAP, 1/0 AWG CONDUCTOR, TERMINATOR
1/0 AWG TERMINATION - 25 KV	TERM-1/0-AL-25KV-F	1	4004590	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			1535245	1	CONNECTOR, STEM, #2 - 1 AWG STR OR #1 - 1/0 SOL, F/ALUM OR CU COND
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE
			4206007	1	KIT, TERMINATION, GROUND STRAP, 1/0 AWG CONDUCTOR, TERMINATOR
4/0 AWG TERMINATION - 25 KV	TERM-4/0-AL-25KV-F	1	4004590	1	CONNECTOR, ELECTRICAL, COLD SHRINK, 2-4/0 AWG CONDUCTOR
			4004596	1	CONNECTOR, ELECT, TERMINAL, PIN STEM, 4/0 AWG STR CONDUCTOR
			908855	1	BRACKET, CABLE, AL, F/ 0.75-3" DIA CABLE, WRAP TYPE BANANA BRACKET
			395330	1	COVER, INSULATING, 7", RBR, NOTCHES TO BE PRESENT INSIDE EACH END
			1001804	1	TAPE, ELECT, HIGH VOLTAGE, 2" WD X 30' LG X 30 MIL THK, THERMAL
			4022655	4	TIE, CABLE, WEATHER RESISTANT UV RESISTANT SUNLIGHT, 4" DIA RANGE

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. FOR ALL CABLE SIZES THE APPROPRIATE CONNECTOR IS INCLUDED AS PART OF THE COMPATIBLE UNIT, SEPARATE FROM THE TERMINATION ITSELF.
3. GROUND KITS FOR 1/0 LC CABLES ARE PACKAGED SEPARATELY AND INCLUDED AS PART OF THE COMPATIBLE UNIT. SEE DWG. 26.14-101 FOR THE APPROPRIATE PART NUMBER. THE NECESSARY GROUNDING MATERIAL FOR LC SHIELDED CABLES 4/0 AND LARGER IS INCLUDED IN THE TERMINATION KIT.
4. ADDITIONAL MATERIAL NEEDED FOR RISER TERMINATIONS SUCH AS THE CABLE POSITIONER BRACKET AND WILDLIFE COVER ARE INCLUDED AS PART OF THE COMPATIBLE UNIT.

DUKE ENERGY.

3					
2					
1	1/31/19	EANES	EANES	ADCOCK	
0	6/30/18	EANES	FLETCHER	ADCOCK	
REVISED		BY	CHK'D	APPR.	

TERMINATIONS

DEC	DEM	DEP	DEF
			X

26.12-101

INSTALLATION INSTRUCTIONS:

THESE INSTALLATION INSTRUCTIONS APPLY TO 3M QTIII TERMINATION KITS SUPPLIED UNDER THE COMPATIBLE UNITS LISTED IN **TABLE 1** WHEN INSTALLED ON LC SHIELDED CABLES.

TABLE 1				
CONDUCTOR SIZE	COMPATIBLE UNIT			
	DEC	DEM	DEP	DEF
1/0	TERM-1/0-AL-15KV-C	TERM-1/0-AL-15KV-M	TERM-1/0-AL-25KV-P	TERM-1/0-AL-15KV-F
	TERM-1/0-AL-25KV-C			TERM-1/0-AL-25KV-F
350 MCM	TERM-350-AL-25KV-C	NA	TERM-350-AL-25KV-P	NA
500 MCM	NA	NA	NA	TERM-500-AL-15KV-F
750 MCM	TERM-750-AL-25KV-C	TERM-750-CU-15KV-M	TERM-750-AL-25KV-P	TERM-750-AL-15KV-F
1000 MCM	TERM-1000-AL-25KV-C	TERM-1000-AL-15KV-M	TERM-1000-AL-25KV-P	TERM-1000-AL-15KV-F

THE FOLLOWING ITEMS WILL BE NEEDED IN ADDITION TO THE CONTENTS OF THE TERMINATION CU.

TABLE 2				
ITEM	OPERATING AREA			
	DEC	DEM	DEP	DEF
ALUMINUM OXIDE CLOTH, 240 GRIT	376	376	4030693	4206865
3/4" VINYL TAPE	211583	211583	4028095	4005478
LINT FREE TOWEL	-	-	-	-
CLEANING FLUID	378446	650182	4030532	4000498

STEP 1: **FOLLOW ALL SAFETY RULES AND PROCEDURES TO ENSURE CONDUCTORS ARE SAFE TO HANDLE.**

STEP 2: REMOVE THE AMOUNT OF CABLE JACKET SHOWN IN **FIGURE 1** AND **TABLE 3**.

STEP 3: REMOVE THE LC SHIELD, EXCEPT FOR THE LENGTH SHOWN IN **FIGURE 1** AND **TABLE 3** WHICH WILL EXTEND BEYOND THE END OF THE CABLE JACKET.

THE LC SHIELD IS TO BE REMOVED BY PLACING ONE OF THE CONSTANT TENSION SPRINGS PROVIDED IN THE GROUND BRAID KIT ON THE LC SHIELD AT THE POINT WHERE THE SHIELD IS TO END, SEPARATING THE OVERLAP OF THE LC SHIELD, AND THEN TEARING OFF THE LC SHIELD AT THE CONSTANT TENSION SPRING. THE LC SHIELD OVERLAP MAY BE SEPARATED BY ROLLING THE GAP OPEN WITH CHANNEL-LOCK PLIERS, TEARING OFF THE OVERLAP BY TWISTING IT AROUND NEEDLE-NOSE PLIERS, OR BY TEARING OFF THE OVERLAP BY GRABBING THE OVERLAP WITH PLIERS AND PULLING IT STRAIGHT DOWN THE CABLE.

STEP 4: **USE AN APPROPRIATE TOOL** AND SCORE THE SEMI-CONDUCTIVE INSULATION SHIELD SO THE LENGTH OF SHIELD SHOWN IN **FIGURE 1** AND **TABLE 3** CAN BE REMOVED.

IF YOU ARE USING A SPEEDSAVER 1542 INSULATION STRIPPER, **DO NOT** REMOVE THE SEMI-CONDUCTIVE INSULATION SHIELD AT THIS TIME AND CONTINUE TO STEP 5, SKIP STEP 6 AND CONTINUE TO STEP 7.

IF YOU ARE USING A RIPLEY WS SERIES INSULATION STRIPPER, REMOVE THE PORTION OF THE SEMI-CONDUCTIVE INSULATION SHIELD SHOWN IN FIGURE 1 AND TABLE 2 AT THIS TIME AND THEN PROCEED TO STEP 5.

NEVER USE A KNIFE TO REMOVE THIS SHIELD.

STEP 5: REMOVE THE AMOUNT OF INSULATION SHOWN IN **FIGURE 1** AND **TABLE 3**.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

3M QTIII TERMINATIONS ON

15KV & 25KV LC SHIELDED CABLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.12-107A

STEP 6: REMOVE THE PORTION OF THE SEMI-CONDUCTIVE INSULATION SHIELD SCORED IN STEP 4.

DO NOT SAND THE CABLE INSULATION EXCEPT WHEN IT IS NECESSARY.

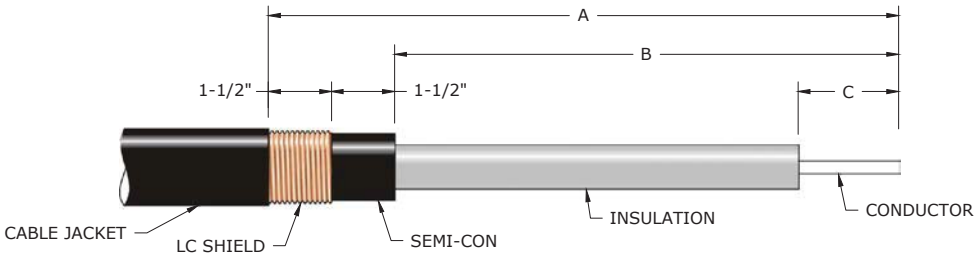


FIGURE 1
CABLE PREPARATION

TABLE 3			
CONDUCTOR SIZE	DIMENSION		
	A	B	C
1/0 (15KV)	9-1/4"	6-1/4"	2-1/4"
1/0 (25KV)	11-1/4"	8-1/4"	2-1/4"
500 MCM	12-3/8"	9-3/8"	3-3/8"
750 MCM	12-7/8"	9-7/8"	3-7/8"
1000 MCM	13-1/8"	10-1/8"	4-1/8"

STEP 7: VERIFY THAT ALL CUTBACKS HAVE BEEN MADE TO THE PROPER DIMENSION. CORRECT THE INSULATION AND SEMI-CONDUCTIVE SHIELD CUTBACKS IF THEY ARE NOT WITHIN 1/8" OF THE DIMENSIONS PROVIDED IN **TABLE 3**.

STEP 8: VERIFY THAT THE RING CUT ON THE SEMI-CONDUCTIVE SHIELD IS STRAIGHT AND SMOOTH ALL THE WAY AROUND THE CABLE. NO POINTS OR UNEVENNESS MAY EXIST. CORRECT ANY IRREGULARITIES THAT EXIST. THESE IRREGULARITIES MAY BE REMOVED WITH A KNIFE AS LONG AS **EXTREME CAUTION** IS USED AND THAT **NO** NICKS ARE MADE INTO THE CABLE INSULATION.

STEP 9: VERIFY THAT THE INSULATION IS SMOOTH AND FREE OF ANY NICKS OR CUTS BY CAREFULLY RUBBING IT WITH YOUR FINGERS. ANY NICKS, CUTS, OR DENTS MUST BE REMOVED WITH 240 GRIT ALUMINUM OXIDE CLOTH, DO NOT USE 120 GRIT ALUMINUM OXIDE CLOTH.

IF CUTS WERE MADE INTO THE INSULATION AS A RESULT OF THE STRIPPING TOOL BEING SET TOO DEEP, THEN THE RING CUT MUST BE RELOCATED TO ALLOW THIS CUT TO BE SANDED OUT OF THE INSULATION. THIS CAN BE ACCOMPLISHED BY CUTTING AT LEAST 3/4" OFF THE CONDUCTOR AND THEN REMAKING ALL CUTBACKS FROM THAT POINT.

STEP 10: CLEAN THE LAST 6 INCHES OF THE JACKET WITH CABLE CLEANING FLUID AND A CLEAN TOWEL. THEN SAND THIS AREA WITH 240 GRIT ALUMINUM OXIDE CLOTH.

STEP 11: RUB THE EXPOSED PORTION OF THE LC SHIELD WITH 240 GRIT ALUMINUM OXIDE CLOTH IN ORDER TO REMOVE ANY SURFACE FILM THAT MIGHT BE PRESENT. (WIRE BRUSHING COULD DAMAGE THE LC SHIELD.) POSITION THE GROUND BRAID WITH THE "U" SECTION OVER THE LC SHIELD DIRECTLY ADJACENT TO THE CABLE JACKET WITH THE FOLDS FACING OUTWARD. TERMINATION CUS FOR 1/0 CABLES PROVIDE THE APPROPRIATE GROUND BRAID. BRAIDS FOR CABLES 350 MCM AND LARGER ARE PROVIDED IN THE TERMINATION KITS.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

3M QTIII TERMINATIONS ON
15KV & 25KV LC SHIELDED CABLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

26.12-107B

STEP 12: SECURE THE GROUND BRAID TO THE CABLE BY WRAPPING A CONSTANT TENSION SPRING AROUND THE PORTION OF THE BRAID THAT IS POSITIONED OVER THE LC SHIELD AS SHOWN IN **FIGURE 2**. BE SURE TO PULL THE LAST WRAP OF THE SPRING TO INSURE THAT IT IS TIGHT. TIGHTLY WRAP TWO HALF-LAPPED LAYERS OF 3/4" VINYL TAPE AROUND THE CONSTANT TENSION SPRING IN ORDER TO KEEP IT TIGHT.

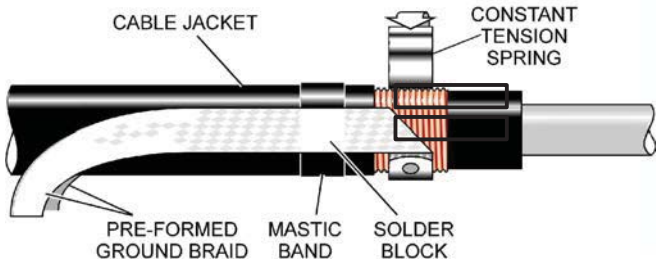


FIGURE 2
INSTALLING TWIN PRE-FORMED GROUND BRAID

STEP 13: POSITION THE TAILS OF THE PRE-FORMED GROUND BRAID ALONG THE CABLE. SELECT ONE OF THE MASTIC STRIPS (BLACK WITH WHITE RELEASE LINERS) FROM THE KIT. REMOVE THE LINER AND WRAP THE MASTIC WITH LIGHT TENSION AROUND THE CABLE DIRECTLY UNDER THE SOLDER BLOCK ON THE BRAIDS. SEE **FIGURE 2**. INSTALL **ONLY ONE** (1) LAYER OF THIS MASTIC. DISCARD ANY ACCESS.

STEP 14: WRAP A PIECE OF COLOR CODING TAPE AROUND THE CABLE AND OVER THE TWO TAILS OF THE GROUND BRAID EXACTLY 4-1/2" FROM THE END OF THE SEMI-CONDUCTIVE SHIELD. THIS WOULD ALSO MEAN THE TAPE IS 2" FROM THE END OF THE JACKET ON 1/0 CABLES AND 1-1/2" FROM THE END OF THE JACKET FOR ALL OTHER CABLE SIZES. SEE **FIGURE 3**.

CAUTION: THE LOCATION OF THE COLOR CODING TAPE IS **VERY CRITICAL** BECAUSE IT ALSO SERVES AS THE MARKER TO POSITION THE TERMINATION BODY.

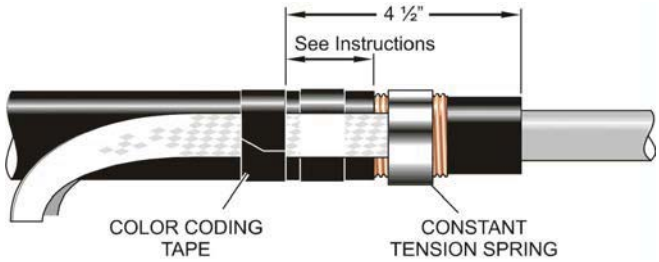


FIGURE 3
APPLYING COLOR CODING TAPE FOR MARKER

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

3M QTIII TERMINATIONS ON
15KV & 25KV LC SHIELDED CABLES

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.12-107C

STEP 15: WRAP A SECOND MASTIC STRIP, ON TOP OF THE FIRST ONE AND OVER THE SOLDER BLOCKS ON THE TAILS. INSTALL ONLY ONE (1) LAYER OF THIS MASTIC. DISCARD ANY EXCESS. MASH THIS MASTIC TIGHTLY ONTO THE FIRST MASTIC LAYER AND THE SOLDER BLOCK ON THE GROUND BRAID. SEE **FIGURE 4**.

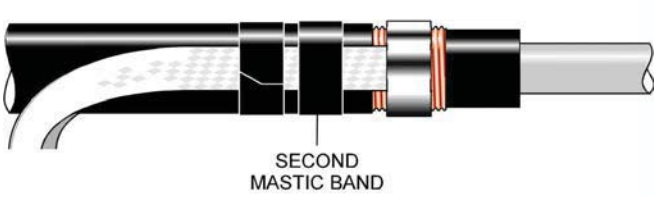


FIGURE 4
WRAPPING SECOND MASTIC BAND

STEP 16: TIGHTLY WRAP TWO HALF-LAPPED LAYERS OF 3/4" VINYL TAPE AROUND THE CONSTANT TENSION SPRING, THE EXPOSED LC SHIELD, AND THE MASTIC, TO THE EDGE OF THE COLOR CODING TAPE. SEE **FIGURE 5**.

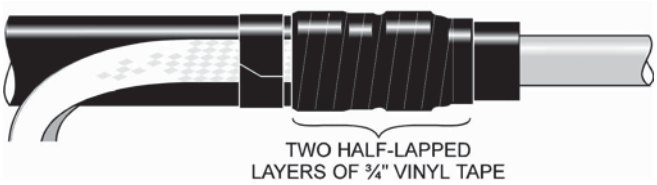


FIGURE 5
WRAPPING TWO HALF-LAPPED LAYERS OF 3/4" VINYL TAPE

STEP 17: REMOVE THE SHIPPING CORE BY PULLING THE **RED** LOOSE CORE STRAND AND UNWINDING IT IN A COUNTER-CLOCKWISE DIRECTION. THIS IS THE LOOSE CORE STRAND THAT EXTENDS OUT OF THE BOTTOM OF THE TERMINATION HOUSING. THIS CORE MUST BE REMOVED **BEFORE** THE TERMINATION HOUSING IS SLID ONTO THE CABLE.

STEP 18: CHECK TO INSURE THE TERMINATION ASSEMBLY WILL FIT OVER THE SELECTED LUG. IF THE LUG WILL NOT FIT THROUGH THE TERMINATION CORE, SLIDE THE TERMINATION ONTO THE CABLE **BEFORE** INSTALLING THE LUG. **DO NOT REMOVE THE CORE AT THIS TIME**.

STEP 19: WIRE BRUSH THE CONDUCTOR OF THE CABLE AND IMMEDIATELY PUSH THE CONNECTOR ONTO IT.

DO NOT USE OXIDE CLOTH TO BRUSH THE CONDUCTOR.

DO NOT REMOVE ANY OF THE OXIDE INHIBITOR FROM THE CONNECTOR BEFORE PUSHING IT ONTO THE CONDUCTOR.

TABLE 4

CABLE SIZE	CRIMP TOOL DIE	NUMBER OF CRIMPS
1/0 AWG	5/8, BG	4
350 MCM	1-1/8", 13A	3
500 MCM	1-5/16", U327	3
750 MCM	1-1/2", U39ART	3
1000 MCM	1-1/2", U39ART	3

STEP 20: HOLD THE CONNECTOR FIRMLY AGAINST THE END OF THE CABLE AND CRIMP IT ONTO THE CONDUCTOR USING THE APPROPRIATE DIE. BEGIN CRIMPING JUST BELOW THE CRIMP LINE AND WORK TOWARD THE CABLE INSULATION. MAKE THE APPROPRIATE NUMBER OF CRIMPS, BUT DO NOT CRIMP THE BOTTOM 1/2" OF THESE CONNECTORS. ROTATE CRIMPS TO PREVENT THE CONNECTOR FROM BOWING. SEE **FIGURE 6**. REMOVE ANY EXCESS INHIBITOR OR SHARP FLASH. CRIMPING INFORMATION IS PROVIDED IN **TABLE 4**.

BE CERTAIN CRIMP TOOLS ARE PROPERLY ADJUSTED BEFORE USING.

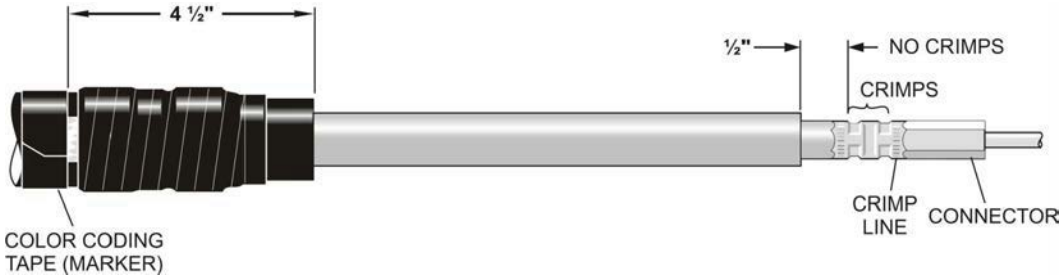


FIGURE 6
PREPARATION FOR TERMINATION BODY

STEP 21: REMOVE EXCESS OXIDE INHIBITOR WITH A TOWEL. TAKE SPECIAL CARE TO PREVENT THIS EXCESS INHIBITOR FROM GETTING ONTO THE CABLE INSULATION. THIS OXIDE INHIBITOR MUST BE REMOVED BEFORE ATTEMPTING TO CLEAN THE CABLE INSULATION.

STEP 22: CLEAN THE CABLE INSULATION WITH A CLEAN TOWEL AND CABLE CLEANING FLUID, SEE TABLE 6, T0 REMOVE ANY CONTAMINATION OR PARTICLES OF THE SEMI-CONDUCTING SHIELD THAT MIGHT BE PRESENT ON THE INSULATION.

ALWAYS CLEAN FROM THE CONNECTOR TOWARDS THE SEMI-CONDUCTING SHIELD. DO NOT EVER TOUCH THE INSULATION WITH THE AREA ON A TOWEL THAT HAS TOUCHED THE SEMI-CONDUCTING SHIELD.

STEP 23: IF NECESSARY, APPLY A SMALL AMOUNT OF SILICONE GREASE OVER THE VINYL TAPE. THIS WILL MAKE IT EASIER TO PROPERLY POSITION THE TERMINATION HOUSING AND TO REMOVE THE CORE.

STEP 24: SLIDE THE TERMINATION BODY ONTO THE CABLE TO THE EDGE OF THE TAPE MARKER AND REMOVE THE CORE BY PULLING AND UNWINDING THE LOOSE CORE STRAND EXTENDING OUT THE TOP OF THE TERMINATION HOUSING IN A COUNTER-CLOCKWISE MOTION. SEE **FIGURE 7**. AN OCCASIONAL TUG OF THE STRAND WHILE UNWINDING WILL AID IN REMOVING THE CORE.

CAUTION: MAKE SURE THE TERMINATION BODY REMAINS AT THE EDGE OF THE MARKER TAPE. SEE **FIGURE 7**. THE TERMINATION CAN PREMATURELY FAIL IF ITS BODY IS NOT PROPERLY POSITIONED.

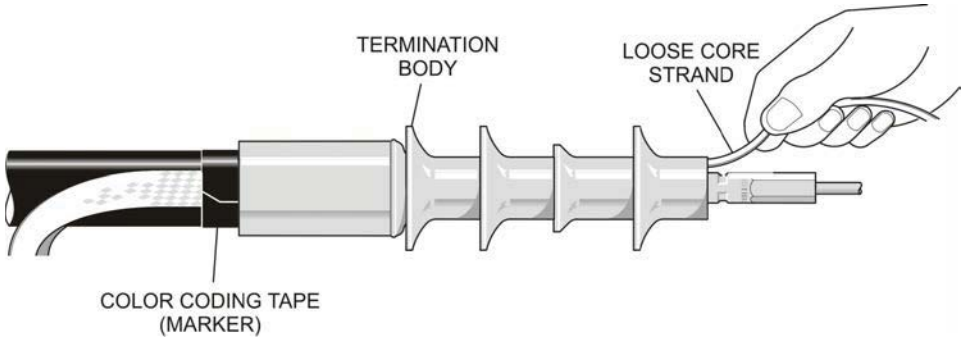


FIGURE 7
INSTALLING TERMINATION BODY

STEP 25: REMOVE THE COLOR CODE MARKING TAPE.

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
GROUND BRAID, TERMINATION, 1/0 AWG, 15KV, 25KV, OR 35KV	-	-	4206007	1	KIT, TERMINATION, GROUND STRAP, 1/0 AWG COND., TERMINATOR, F/ #1/0 LC SHIELD MED V CABLE
GROUND BRAID, NON-SUBMERSIBLE ELBOW, 1/0 AWG, 15KV, 25KV, OR 35KV	-	-	50124557	1	KIT, ACCESSORY, 15 KV CABLE SIZE 1/0, SPRING, GROUND STRAP, DRAIN WIRE, F/ GROUNDING F/ ELBOW
GROUND BRAID, SUBMERSIBLE ELBOW, 1/0 AWG, 15KV OR 25KV	-	-	-	-	-
GROUND SOCK, SPLICE, 1/0 AWG, 15KV, 25KV, OR 35KV	-	-	4205567	1	KIT, SPLICE, CONTAIN THE SOCK AND TWO CONSTANT TENSION SPRINGS, ITEM # AND QUAN IS REQUIRED ON EA

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.

2. GROUND BRAIDS ARE USED WITH LC SHIELDED CABLES TO PROVIDE A MEANS OF CONNECTING THE METALLIC SHIELD OF THE CABLE AND THE SEMI-CONDUCTING SURFACE OF THE CABLE ACCESSORY, IF PRESENT, TO GROUND.

3. GROUND BRAIDS FOR 200 AMP ACCESSORIES ARE PACKAGED SEPARATELY FROM THE ACCESSORIES THEMSELVES, BUT ARE INCLUDED AS PART OF THE ACCESSORY CU.

4 GROUND BRAIDS FOR ELBOWS INCLUDE A 'BLEEDER WIRE' SOLDERED ONTO THE BRAID THAT IS TIED INTO THE GROUNDING EYE OF THE ELBOW.

5. SUBMERSIBLE ELBOW KITS INCLUDE EITHER A COLD-SHRINK TUBE OR THE APPROPRIATE MASTIC TAPES TO WATERPROOF THE CABLE JACKET.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

GROUNDING DEVICES AND SUBMERSIBLE APPLICATIONS - 200 AMP

DEC	DEM	DEP	DEF
			X

26.14-101

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
TERMINATION, 4/0 AWG TO 1000 MCM, 15KV OR 25KV	-	-	NONE	NA	INCLUDED IN KIT FROM MANUFACTURER
600 AMP ELBOW, 4/0 AWG TO 1000 MCM, 15KV OR 25KV	-	-	4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS, ACCOMODATES CABLES FROM 15 TO 35 KV
SPLICE, 4/0 AWG TO 1000 MCM, 15KV OR 25KV	-	-	4158533	1	SPLICE, CONDUCTOR, 500/750/1000 MCM, 350/750/1000 MCM CONDUCTOR, JACKET & GROUND SOCK F/ 15 KV 500
SPLICE, 4/0 AWG TO 1000 MCM, 15KV OR 25KV	-	-	1543496	1	KIT, GROUNDING, CONSISTS OF EXTERNAL GROUND BRAID, (1) CONSTANT TENSION SPRING, F/ 600A SPLICES

NOTES:

1. SEE DWGS. 26.00-105A, 26.00-105B AND 26.00-105C FOR PROPER CABLE PREPARATION TECHNIQUES.
2. GROUND BRAIDS ARE USED WITH LC SHIELDED CABLES TO PROVIDE A MEANS OF CONNECTING THE METALLIC SHIELD OF THE CABLE AND THE SEMI-CONDUCTING SURFACE OF THE CABLE ACCESSORY, IF PRESENT, TO GROUND.
3. GROUND BRAIDS FOR 600 AMP TERMINATIONS ARE PACKAGED WITH THE TERMINATION KIT. FOR ELBOWS/T-BODIES AND SPLICES THEY ARE PACKAGED SEPARATELY FROM THE ACCESSORIES THEMSELVES.
4. GROUND BRAIDS FOR ELBOWS/T-BODIES INCLUDE A 'BLEEDER WIRE' SOLDERED ONTO THE BRAID THAT IS TIED INTO THE GROUNDING EYE.
5. ELBOW KITS INCLUDE EITHER A COLD-SHRINK TUBE OR THE APPROPRIATE MASTIC TAPES TO WATERPROOF THE CABLE JACKET.
6. GROUND SOCKS ALONG WITH REJACKETING MATERIALS ARE INTEGRATED INTO THE SPLICE BODY IN THE NEWER SPLICE DESIGNS SHOWN ON DWG. 26.10-105. ITEM # 4158533 IS FOR OLDER SPLICE DESIGNS ONLY. ITEM # 1543496 SHOULD BE USED WHENEVER EXTERNAL GROUNDING IS REQUIRED FOR A NEWER SPLICE DESIGN.

DUKE ENERGY.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

GROUNDING DEVICES AND SUBMERSIBLE APPLICATIONS - 600 AMP

DEC	DEM	DEP	DEF
			X

26.14-103

BILL OF MATERIALS									
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION	APPLICATION VOLTAGE (KV)	INTERFACE (KV)	DUTY CYCLE (KV)	MCOV (KV)
ARRESTER ELBOW 10KV	ARR-ELBOW-10KV-F	1	1000572	1	ARRESTER, ELECT, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT	12.47GY/7.2	15	10	8.4
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT				
ARRESTER ELBOW 18KV	ARR-ELBOW-18KV-F	1	4022930	1	ARRESTER, ELECTRICAL, METAL OXIDE, DISTRIBUTION, 15.3KV, 18KV, ELBOW, 18KV DUTY CYCLE	23.9GY/13.8	25	18	15.3
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT				

NOTES:

1. ELBOW ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF THE OPEN POINTS ON ALL SINGLE-PHASE AND THREE-PHASE LOOPS.

2. ELBOW ARRESTERS ARE TO BE INSTALLED ON THE LAST TRANSFORMER OF RADIAL FEEDS. ELBOW ARRESTERS ARE NOT REQUIRED ON RADIAL FEEDS TO A SINGLE TRANSFORMER THAT IS LESS THAN 300 FEET FROM THE RISER POLE.

3. IF THE NORMAL OPEN POINT FOR A LOOP IS PERMANENTLY CHANGED FOR ANY REASON, THE ELBOW ARRESTER(S) MUST BE RELOCATED TO THE NEW OPEN POINT. IT IS NOT NECESSARY TO RELOCATE ELBOW ARRESTERS WHEN THE OPEN POINT IS TEMPORARILY RELOCATED FOR A SHORT PERIOD OF TIME (TYPICALLY LESS THAN TWO WEEKS). HOWEVER, ELBOW ARRESTERS SHOULD BE RELOCATED WHEN AN OPEN POINT IS GOING TO BE MOVED FOR AN INDEFINITE PERIOD OF TIME THAT IS GREATER THAN TWO WEEKS.

4. INSTALL ELBOW ARRESTERS EVEN WHEN AN UNDER-OIL ARRESTER IS BELIEVED TO EXIST IN THE TRANSFORMER. THIS DOES NOT APPLY TO 35KV PADMOUNTS, WHICH ARE ALL PURCHASED WITH FACTORY INSTALLED UNDER-OIL ARRESTERS.

5. BE CERTAIN THE MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV) OF THE SYSTEM DOES NOT EXCEED THE MCOV OF THE ARRESTER.

6. CHECK CONTENTS OF PACKAGE FOR DAMAGE, RATINGS, AND COMPATIBILITY WITH MATING PARTS.

7. SPACE THE ARRESTER AND GROUND LEAD SO THE OPERATION OF THIS OR OTHER LOADBREAK DEVICES IS NOT RESTRICTED.

8. **CAUTION:** DO NOT HI-POT SYSTEM WITH ELBOW ARRESTERS INSTALLED. ARRESTERS ARE NOT RATED FOR HI-POT OVERVOLTAGES. IF SUBJECTED TO HI-POT OVERVOLTAGES, ARRESTERS WILL FAIL.

9. THE TYPICAL FAILURE MODE FOR ELBOW ARRESTERS IS THE BRASS CAP POPPING OFF THE BOTTOM. THIS ALLOWS GASES AND THE MOV ARRESTER BLOCKS TO VENT OUT THE BOTTOM. IF THE FAULT CURRENT RESULTING FROM A FAILURE IS VERY LOW OR A CURRENT LIMITING FUSE IS USED, THE CAP MAY STAY ON AND THE ARRESTER BLOCKS WILL CAUSE THE MIDDLE OF THE RUBBER HOUSING TO BULGE.

10. SEE SECTION 27 FOR INSTALLATION DIAGRAMS WITHIN THE PAD-MOUNTED TRANSFORMER.

DUKE ENERGY.

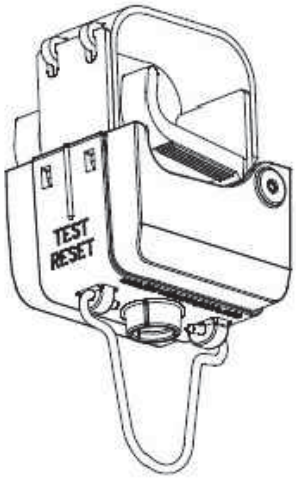
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

ELBOW ARRESTER

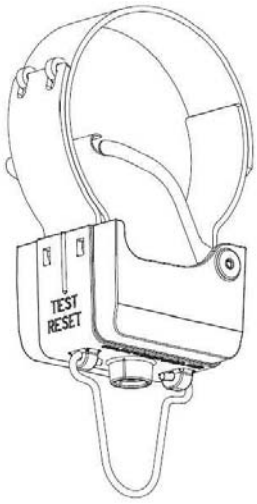
GENERAL INFORMATION

DEC	DEM	DEP	DEF
			X

26.18-101



SMALL CORE FCI



LARGE CORE FCI

BILL OF MATERIALS					
COMPATIBLE UNIT DESCRIPTION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
FAULTED CIRCUIT INDICATOR UNDERGROUND, SINGLE-PHASE 1/0 TO 350 MCM, LED	FCI-UG-1P-MD-CURR-LED-F	1	1538628	1	INDICATOR, FAULT AUTOMATIC RESET, SM CORE SELF ADJUSTING, 1/0 AWG - 350 MCM, LED INDICATION 24HR RESET
FAULTED CIRCUIT INDICATOR UNDERGROUND, SINGLE-PHASE 750 MCM TO 1000 MCM, LED	FCI-UG-1P-LG-CURR-LED-F	1	1538632	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE SELF ADJUSTING, 750 MCM - 1000 MCM, LED INDICATION 24HR RESET
-	-	1	4000055	1	MAGNET, FAULT INDICATOR RESET, HOT STICK MOUNTABLE TEST & RESET, F/ HORSTMAN AUTOMATIC RESET FAULT
FAULTED CIRCUIT INDICATOR UNDERGROUND, SINGLE-PHASE FIBER OPTIC CABLE	FCI-UG-1P-FIBER-LED-F	1	4000039	1	ASSEMBLY, FIBER OPTIC CABLE, 6' (2M) LG FIBER OPTIC CABLE REPLACEMENT, REQUIRES 5/16 INCH (8MM) MOUNTING
FAULTED CIRCUIT INDICATOR UNDERGROUND, THREE-PHASE FIBER OPTIC CABLE	FCI-UG-3P-FIBER-LED-F	1	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS WITH PDP FAULTED CIRCUIT INDICATORS

NOTES:

1. FAULTED CIRCUIT INDICATORS (FCI'S) ARE NOT RECOMMENDED FOR INSTALLATION IN NEW, UG LOOPS. THEY ARE MOST EFFECTIVE FOR USE IN EXISTING TROUBLE AREAS OR FOR THOSE INSTANCES WHEN MULTIPLE TRANSFORMERS MUST BE PLACED ON A RADIAL FEED. WITH LOCAL MANAGEMENT APPROVAL, FCI'S CAN BE USED IN NEW INSTALLATIONS WHERE SENSITIVE CUSTOMERS, CRITICAL CUSTOMERS, OR MAJOR LOAD CENTERS EXIST. DURING CABLE REPLACEMENT PROJECTS, INSTALLATION OF FCI'S IS RECOMMENDED. OUTAGE RESTORATION WORKS BEST IF ALL TRANSFORMERS ON THE LOOP OR RADIAL (WITH THE EXCEPTION OF THE LAST RADIAL TRANSFORMER) ARE EQUIPPED WITH FCI'S. THIS IS REQUIRED TO NARROW THE FAULT TO A SPECIFIC RUN OF CABLE BETWEEN TRANSFORMERS.
2. THE SAME INDICATOR CAN BE USED FOR ALL DISTRIBUTION VOLTAGE LEVELS (15/25/35).
3. UPON SEEING FAULT CURRENT, THE FCI'S LED WILL BLINK RED AT A FREQUENCY OF 30 PER MINUTE.
4. THE FCI WILL RESET ONCE LOAD CURRENT IS RESTORED (MINIMUM 5 AMPS FOR SMALL CORE UNIT AND 10 AMPS FOR LARGE CORE UNIT). IT WILL ALSO RESET AFTER 24 HOURS IF POWER IS NOT RESTORED, OR MANUALLY WITH THE TEST AND RESET TOOL.
5. THE FCI SHOULD COORDINATE WITH RISER FUSES AS SMALL AS 20K. FUSES SMALLER THAN THIS MAY OPERATE FASTER THAN THE INDICATOR IS CAPABLE OF RESPONDING.
6. THE FCI CANNOT DISTINGUISH BETWEEN MAGNETIZING INRUSH CURRENT AND FAULT CURRENT. IT INCORPORATES A LOAD TRACKING AND LOAD MEMORY FEATURE, ALONG WITH A TIME DELAYED TCC CURVE TO MINIMIZE THE LIKELIHOOD OF FALSE TRIPPING ONCE A CIRCUIT IS RE-ENERGIZED. IF A FALSE TRIP OCCURS, THE UNIT CAN BE RESET MANUALLY OR SIMPLY ALLOWED TO TIME OUT.
7. THE TOTAL INDICATING (OR BLINKING) TIME OF THE FCI'S IS APPROXIMATELY 1500 HOURS.
8. THE FCI IS POWERED WITH A LITHIUM OXIDE BATTERY. THIS BATTERY IS NON-REPLACEABLE, SO UNITS AT THE END OF THE BATTERY LIFE (ESTIMATED TO BE AT LEAST 20 YEARS FROM THE DATE OF MANUFACTURE) MUST BE REPLACED ENTIRELY. THE MANUFACTURE DATE IS CLEARLY MARKED ON EACH INDICATOR, DIRECTLY BELOW THE CATALOG NUMBER IN A MM/YY FORMAT.
9. FCI'S CAN BE BOTH APPLIED AND REMOVED WITH A HOT STICK.
10. IN THREE-PHASE TRANSFORMERS OR SWITCHGEAR, A THREE-PHASE FIBER OPTIC CABLE CAN BE USED TO MINIMIZE THE NUMBER OF HOLES PLACED IN THE EQUIPMENT FOR THE VIEWING LENS.
11. BOTH THE SMALL AND LARGE CORE FCI'S ARE PACKAGED WITH A SINGLE-PHASE FIBER OPTIC CABLE (CABLES BY THEMSELVES CAN BE ORDERED IF LOST OR DAMAGED). FOR THREE-PHASE APPLICATIONS IF IT IS DESIRABLE TO USE THE THE THREE-PHASE CABLE, IT MUST BE ORDERED SEPARATELY (ONE CABLE PER TRANSFORMER OR SWITCHGEAR).

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	8/17/18	EANES	FLETCHER	ADCOCK
0	6/30/18	EANES	FLETCHER	ADCOCK

GENERAL INFORMATION FOR
FAULTED CIRCUIT INDICATORS
AUTOMATIC RESET, LED INDICATION

DEC	DEM	DEP	DEF
			X

26.20-101

TOGGLE RESET

PUSH BUTTON RESET

BILL OF MATERIALS					
APPLICATION	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
FAULT CURRENT INDICATOR UNDERGROUND SINGLE-PHASE 200 AMPS CURRENT FLAG WITHOUT BATTERY	FCI-UG-1P-200-CURR-FLAG-F	1	4004665	1	INDICATOR, CABLE FAULT, 3 200 A TRIP CURRENT, .788" TO 1.25" CABLE DIA.

NOTES:

1. THESE MANUAL FAULTED CIRCUIT INDICATORS (FCI'S) ARE INSTALLED ONLY IN THREE-PHASE TRANSFORMERS WITHIN A LOOP SYSTEM OR ON A RADIAL SYSTEM CONTAINING MORE THAN ONE TRANSFORMER. THEY ARE NOT REQUIRED FOR A SINGLE, RADIAL FED, THREE-PHASE UNIT.

2. UPON SEEING FAULT CURRENT, ALL FCI'S FROM THE RISER POLE TO THE FAULT LOCATION WILL ROTATE FROM BLACK TO RED FOR TOGGLE UNITS OR FROM WHITE TO RED FOR PUSH BUTTON UNITS.

3. AFTER CLEARING A FAULT, ALL INDICATORS FROM THE FAULT LOCATION BACK TO THE DIP POLE MUST BE MANUALLY RESET.

4. INSTALL INDICATORS ON THE LOAD, OR OUTGOING PRIMARY SIDE CABLES OF EACH TRANSFORMER AS REQUIRED. THE EXCEPTION TO THIS WOULD BE THE LAST DEVICE ON A RADIAL FEED WITH MULTIPLE DEVICES.

5. PROPER PLACEMENT OF THE FCI ON THE PRIMARY CABLE IS CRITICAL TO ITS CORRECT INDICATION. THE TWO ACCEPTABLE LOCATIONS ARE 1) BELOW THE CABLE ACCESSORY, DIRECTLY OVER THE CABLE SEMI-CON AND ABOVE THE LC SHIELD OR CONCENTRIC NEUTRAL WIRES (THIS IS THE PREFERRED LOCATION), OR 2) IF THERE IS NOT ENOUGH ROOM FOR THIS, IT CAN BE PLACED OVER BOTH THE CABLE JACKET AND THE GROUND BRAID OR BUNDLED CONCENTRIC NEUTRAL WIRES. IT CANNOT BE PLACED OVER THE CABLE JACKET ONLY, NOR CAN IT BE PLACED DIRECTLY OVER THE LC SHIELD OR CONCENTRIC NEUTRALS. IN THIS INSTANCE THE FAULT CURRENT FLOWING IN A FORWARD DIRECTION ALONG THE PHASE CONDUCTOR IS CANCELED OUT BY THE RETURN CURRENT ON THE NEUTRAL AND THERE WILL BE NO INDICATION OF A FAULT.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

GENERAL INFORMATION FOR

FAULTED CIRCUIT INDICATORS MANUAL RESET

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

26.20-102

FAULTED CIRCUIT INDICATORS (FCI'S) HAVE BEEN USED FOR MANY YEARS TO IDENTIFY THE LOCATION OF FAULTED CABLE AND EQUIPMENT. FCI'S SENSE THE INCREASED CURRENT PRESENT DURING A FAULT CONDITION AND PROVIDE AN INDICATION THAT CAN DIRECT PERSONNEL TO THE LOCATION OF THE FAULT.

BY LOCATING THE LAST TRIPPED INDICATOR AND THE FIRST UNTRIPPED INDICATOR, THE FAULT LOCATION CAN BE ISOLATED TO A SPECIFIC SEGMENT OF THE CIRCUIT (SEE FIGURE 1 BELOW).

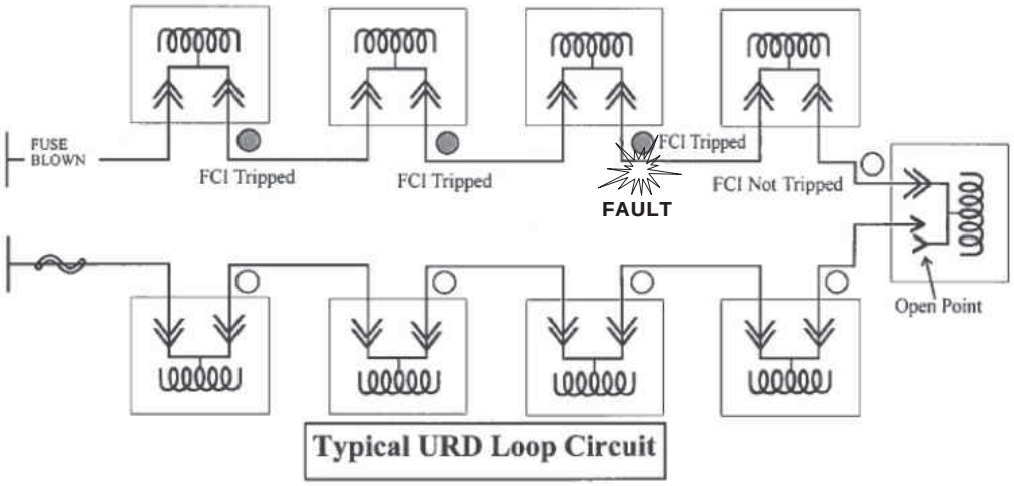


FIGURE 1

THE FCI'S DESCRIBED IN DWG. 26.20-101 INCORPORATE A FLASHING LED LIGHT IN CONJUNCTION WITH A FIBER OPTIC CABLE. THIS CABLE ATTACHES TO THE INDICATOR AND IS RUN TO THE EXTERIOR OF THE TRANSFORMER. REFER TO THE INSTRUCTIONS AND FIGURE 2 BELOW.

1. DRILL OR PUNCH A 5/16" HOLE IN THE LID OF THE TRANSFORMER, PREFERABLY IN A LOCATION THAT CAN BE VIEWED FROM THE ROAD BY A PASSING VEHICLE.

2. SNAP FIBER CABLE WITH PLASTIC END FITTING ONTO FAULT INDICATOR.

3. INSERT LENS THROUGH 5/16" HOLE. BE SURE TO ROUTE THE FIBER CABLE IN SUCH A MANNER THAT WILL NOT INTERFERE WITH SWITCHING EXERCISES OR WHILE MOVING AND PARKING ELBOWS.

4. SECURELY SCREW THE CABLE'S SOCKET ONTO THE FRONT LENS.

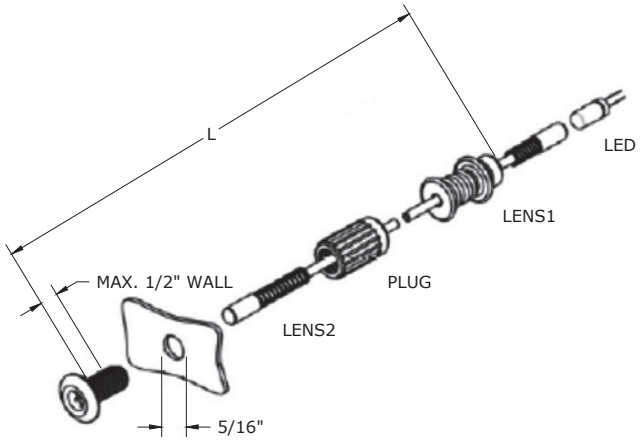


FIGURE 2

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK

APPLICATION GUIDE FOR
FAULTED CIRCUIT INDICATORS
AUTOMATIC RESET, LED INDICATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.20-103A

LOCATION OF FAULTED CIRCUIT INDICATORS

INSTALL INDICATORS ON THE LOAD, OR OUTGOING, PRIMARY SIDE CABLES OF EACH TRANSFORMER, SWITCH OR OTHER DEVICE LOCATED ON A LOOP (FOR THOSE LOOPS WHERE THIS IS BEING CONSIDERED) OR RADIAL. THE EXCEPTION TO THIS WOULD BE THE LAST DEVICE ON A RADIAL FEED WITH MULTIPLE DEVICES.

PROPER PLACEMENT OF THE FCI ON THE PRIMARY CABLE IS CRITICAL TO ITS CORRECT INDICATION. THE TWO ACCEPTABLE LOCATIONS ARE 1) BELOW THE CABLE ACCESSORY, DIRECTLY OVER THE CABLE SEMI-CON AND ABOVE THE LC SHIELD OR CONCENTRIC NEUTRAL WIRES (THIS IS THE PREFERRED LOCATION), OR 2) IF THERE IS NOT ENOUGH ROOM FOR THIS, IT CAN BE PLACED OVER BOTH THE CABLE JACKET AND THE GROUND BRAID OR BUNDLED CONCENTRIC NEUTRAL WIRES. IT CANNOT BE PLACED OVER THE CABLE JACKET ONLY, NOR CAN IT BE PLACED DIRECTLY OVER ONLY THE LC SHIELD OR CONCENTRIC NEUTRALS. IN THIS INSTANCE THE FAULT CURRENT FLOWING IN A FORWARD DIRECTION ALONG THE PHASE CONDUCTOR IS CANCELED OUT BY THE RETURN CURRENT ON THE NEUTRAL AND THERE WILL BE NO INDICATION OF A FAULT. BOTH OF THE PERMISSIBLE LOCATIONS ARE DESCRIBED BELOW.

3				
2				
1				
0	6/30/18	EANES	FLETCHER	ADCOCK
REVISED		BY	CHK'D	APPR.

APPLICATION GUIDE FOR
FAULTED CIRCUIT INDICATORS
AUTOMATIC RESET, LED INDICATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

26.20-103B

27.00 PAD-MOUNTED TRANSFORMERS- GENERAL

27.01 GROUNDING

27.02 FUSING

27.03 ELBOW ARRESTERS

27.04 THREE-PHASE PAD-MOUNTED TRANSFORMERS

27.05 SINGLE-PHASE PAD-MOUNTED TRANSFORMERS

DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
4 7/31/17	KATIGBAK	EANES	ADCOCK
3 10/31/14	KATIGBAK	GUINN	ADCOCK
2 10/12/12	KATIGBAK	BURLISON	ADCOCK
0 10/29/10	CECCONI	GUINN	ELKINS

SECTION 27 - PAD-MOUNTED TRANSFORMERS

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

27.06 THREE-PHASE PAD-MOUNTED TRANFORMERS

TRANSFORMERS

THE STANDARD TRANSFORMER FOR SINGLE-PHASE UNDERGROUND SYSTEMS IS THE PAD-MOUNTED TYPE WITH AN INTERNAL, HIGH VOLTAGE WEAK LINK AND BAYONET FUSE. ALL UNITS HAVE A LOADBREAK ELBOW FOR VISIBLE DISCONNECT MEANS ON EACH OF THE TWO HIGH-VOLTAGE CABLES.

WHERE TRANSFORMERS HAVE TWO DISCONNECT BUSHING WELLS AND ONLY ONE CABLE ELBOW IS TO BE CONNECTED, A BUSHING AND DEAD-END RECEPTACLE ARE TO BE INSTALLED IN THE UNUSED WELL. UNUSED CABLE ELBOWS ARE TO HAVE A PLUG OR BUSHING.

THE STANDARD SINGLE-PHASE TRANSFORMER IS 400 SERIES STAINLESS STEEL. SPECIAL 304L SERIES STAINLESS STEEL (A BETTER GRADE OF STAINLESS) UNITS ARE AVAILABLE FOR THE DEFINED COASTAL AREAS. SEE DWG. 12.06-03 FOR 304L STAINLESS STEEL SINGLE AND THREE-PHASE PAD-MOUNTED TRANSFORMERS.

THE STANDARD TRANSFORMER FOR THREE-PHASE UNDERGROUND WYE-SECONDARY SYSTEMS IS THE PAD-MOUNTED TYPE WITH AN INTERNAL, HIGH VOLTAGE WEAK LINK AND BAYONET FUSE. ON RADIAL FEED SYSTEMS, PROTECTION MUST BE PROVIDED BY FUSES ON THE DIP POLE SIZED ACCORDING TO FUSING TABLES.

TRANSFORMER PADS

TRANSFORMER PADS AND ALL ASSOCIATED PREPARATIONS FOR A TRANSFORMER SHALL BE CONSTRUCTED ACCORDING TO SECTION 24. THE EARTH SHALL BE LEVEL AND THOROUGHLY TAMPED TO GIVE COMPACTION ESSENTIALLY EQUIVALENT TO UNDISTURBED EARTH BEFORE PADS ARE INSTALLED. THE PADS MAY BE PRECAST OR POURED AT SITE. THOSE PADS POURED AT SITE SHALL BE ALLOWED TO SET A MINIMUM OF THREE DAYS BEFORE THE TRANSFORMER IS PLACED.

TRANSFORMER INSTALLATION

AT ALL STAGES OF TRANSPORTING AND INSTALLING, CARE SHALL BE TAKEN TO AVOID SCRATCHING OR DAMAGING THE TRANSFORMER EXTERIOR. DAMAGED AREAS MUST BE TOUCHED-UP WITH PAINT.

DO NOT INSTALL TRANSFORMERS OVER CULVERTS, DRAIN LINES OR DROP INLETS. CARE SHOULD BE TAKEN IN PLACING THE TRANSFORMER ON THE PAD SO AS TO AVOID DAMAGE TO CABLES AND OTHER EQUIPMENT. THE TRANSFORMER SHALL BE SECURELY BOLTED TO PAD USING THE BOLTS CAST INTO THE PAD OR OTHER APPROVED FASTENERS.

LIFTING BOLTS ON EACH SIDE OF A SINGLE-PHASE TRANSFORMER SHOULD BE REMOVED AFTER THE TRANSFORMER IS INSTALLED. THESE MAY BE KEPT FOR FUTURE USE.

THE CONTACT SURFACE BETWEEN THE TRANSFORMER AND PAD SHALL BE TAMPER-PROOF. ANY SPACE BETWEEN THE BOTTOM OF TRANSFORMER CABLE COMPARTMENT AND PAD SHALL BE FILLED WITH GROUT ON THE INSIDE OF THE TERMINAL COMPARTMENT. NO DIRT SHALL BE IN CONTACT WITH THE TRANSFORMER.

TRANSFORMER SECURITY

TRANSFORMER COMPARTMENTS SHALL BE KEPT LOCKED WITH A PADLOCK AT ALL TIMES EXCEPT WHEN WORK IS BEING PERFORMED IN THE COMPARTMENT ACCORDING TO ESTABLISHED SAFETY RULES. IN ADDITION, EACH PAD-MOUNTED TRANSFORMER SHALL BE SECURED WITH A PENTA-HEAD BOLT TO MEET ENCLOSURE INTEGRITY GUIDELINES OUTLINED IN ANSI STANDARD C57.12.28. EACH PAD-MOUNTED TRANSFORMER IS SHIPPED FROM THE MANUFACTURER WITH A PENTA-HEAD BOLT IN THE LOCKING MECHANISM.

REPLACEMENT PENTA-HEAD BOLTS WITH FLAT WASHERS AND RETAINERS ARE AVAILABLE AT THE GENERAL WAREHOUSE (WILDWOOD) FOR MAINTENANCE PURPOSES. A COMPATIBLE UNIT (ASSEMBLY) HAS BEEN ESTABLISHED FOR THE REPLACEMENT PENTA-HEAD BOLT.

REPLACEMENT PENTA-HEAD BOLTS			
COMPATIBLE UNIT	CATALOG NUMBER	QUANTITY	DESCRIPTION
TUAPENTABLTF	9220110921	-	BOLT, 1/2-13, 1-1/4", PENTAHEAD, STAINLESS STEEL
	9220110923	-	RETAINER, BOLT, 1/2", NEOPRENE
	9220110924	-	WASHER, FLAT, 1/2", 1" OD, STAINLESS STEEL

REVISED		BY	CK'D	APPR.
3				
2	3/28/12	DANNA	BURLISON	ELKINS
1	6/13/11	SIMMONS	BURLISON	ELKINS
0	10/28/10	SIMMONS	GUINN	ELKINS

UNDERGROUND DISTRIBUTION SPECIFICATIONS

Progress Energy

FLA

DWG. 27.00-01

IDENTIFICATION PROCEDURES

ONE OF THE MAJOR DIFFERENCES BETWEEN OVERHEAD AND UNDERGROUND DISTRIBUTION IS THAT THE SOURCE OF FEED FOR THE VARIOUS CABLES AND APPARATUS CANNOT BE VISIBLY TRACED IN THE UNDERGROUND SYSTEM. A COMPLETE IDENTIFICATION METHOD MUST BE USED FOR UNDERGROUND PROJECTS. IT MUST BE SIMPLE, PERMANENT, AND EASILY IDENTIFIABLE IN ORDER TO KNOW THE SOURCE, DIRECTION OF FEED, AND TERMINATION POINT OF THE CONDUCTORS.

ALL TERMINAL POLES, PADS, TRANSFORMERS, PEDESTALS, PRIMARY PHASES, AND ANY OTHER APPARATUS SHALL BE NUMBERED OR LETTERED ON LAYOUT MAPS ON THE SYSTEM BY ENGINEERING BEFORE CONSTRUCTION IS STARTED. DURING CONSTRUCTION, ALL CABLE ENDS MUST BE TAGGED BEFORE TRENCHES ARE BACKFILLED. IF TEMPORARY TAGS ARE USED DURING CONSTRUCTION, PERMANENT TAGS MUST BE INSTALLED BEFORE THE SYSTEM IS ENERGIZED. THE LETTERS X, Y, AND Z ARE USED TO IDENTIFY DIFFERENT UNDERGROUND PHASES. THIS IS DONE TO PREVENT CONFUSION IF THE OVERHEAD PHASES A, B, AND C SERVING THE UNDERGROUND ARE LATER SWAPPED.

PROTECTION AND COORDINATION

LIGHTNING PROTECTION SHALL BE PROVIDED BY A DIRECT-CONNECTED RISER POLE TYPE ARRESTERS INSTALLED ON EACH CABLE AT ALL NEW TERMINAL POLES.

IN ADDITION, ON ALL NEW RESIDENTIAL INSTALLATIONS, IF THE TRANSFORMER AT THE OPENING POINT OF THE UNDERGROUND SYSTEM DOES NOT CONTAIN AN INTERNAL ARRESTER, AN ELBOW ARRESTER SHALL BE INSTALLED. ALSO INSTALL AN ELBOW ARRESTER ON ALL RADIAL (STUB) FED TRANSFORMERS IF AN INTERNAL ARRESTER IS NOT PRESENT.

PROTECTION AGAINST FAULT CURRENTS SHOULD BE PROVIDED BY A SECTIONALIZING FUSE, ON ALL CABLE TERMINAL POLES AS SPECIFIED BY THE ENGINEER.

CARE SHOULD BE TAKEN TO ENSURE THAT THE PROTECTIVE DEVICE ON THE TERMINAL POLE PROPERLY COORDINATES WITH THAT IN THE LARGEST TRANSFORMER IN THE LOOP, AS WELL AS THE NEXT OVERHEAD PROTECTIVE DEVICE TOWARD THE SUBSTATION.

GROUNDING

DRIVEN GROUND RODS SHALL BE PROVIDED AT EACH CABLE TERMINAL POLE AND AT EACH TRANSFORMER.

GROUND LEADS FROM THE DRIVEN GROUNDS SHALL BE SOLIDLY CONNECTED TO THE PRIMARY NEUTRAL, THE SECONDARY NEUTRAL, AND TO THE GROUNDING CONNECTION OF ALL EQUIPMENT.

REPLACEMENT POLICY

DISTRIBUTION TRANSFORMERS ARE PRIMARY COST COMPONENTS IN PROVIDING CUSTOMER SERVICE. THE ESTIMATED SERVICE LIFE FOR TRANSFORMERS IS 30 YEARS. TRANSFORMERS SHOULD NOT BE REPLACED UNLESS ABSOLUTELY NECESSARY.

TRANSFORMER RETURNS TO TRANSFORMER REPAIR SHOP SHOULD INCLUDE DOCUMENTATION ON FAILURE MODE OF THE UNIT.

DO NOT REPLACE A TRANSFORMER UNLESS:

- PHYSICAL DAMAGE OCCURS THAT CANNOT BE FIELD REPAIRED SUCH AS BROKEN BUSHINGS, RUSTING, LEAKING OIL, LOCKING PROBLEMS, DAMAGED DOORS, ETC. BEFORE REPLACING THREE-PHASE PAD-MOUNTED TRANSFORMERS, CHECK WITH TRANSFORMER REPAIR SHOP TO SEE IF UNIT CAN BE REPAIRED IN FIELD.
- THE CONDITION OF THE TRANSFORMER IS AN IMMEDIATE SAFETY HAZARD.
- THE TRANSFORMER IS OVERLOADED.
- THE TRANSFORMER IS UNDERLOADED AND CAN BE ECONOMICALLY DOWNSIZED.
- THE TRANSFORMER IS AN OBSOLETE SINGLE-PHASE LIVE FRONT PAD-MOUNTED AND THE UNDERGROUND CABLE IS ALSO BEING REPLACED.
- THE TRANSFORMER IS KNOWN TO HAVE A PCB CONCENTRATION OF 50 PPM OR MORE.

TRANSFORMERS SHOULD NOT BE REPLACED WHEN DOING UNDERGROUND PRIMARY CABLE REPLACEMENT UNLESS THEY ARE LIVE FRONT SINGLE-PHASE UNITS. ALSO, TRANSFORMERS SHOULD NOT BE REPLACED WHEN THE PRIMARY NON-LOADBREAK ELBOWS ARE BEING REPLACED WITH LOADBREAK ELBOWS. THE BUSHING INSERTS SHOULD BE REPLACED RATHER THAN THE ENTIRE TRANSFORMER.

PRIOR TO RETURNING TRANSFORMERS TO THE REPAIR SHOP, VERIFY THAT THE BAYONET FUSES ARE NOT BLOWN ON UNITS IN WHICH THERE IS NO MEASURED VOLTAGE AT THE SECONDARY TERMINALS. SEE DWG. 27.02-10 FOR BAYONET FUSE OPERATING PROCEDURES.

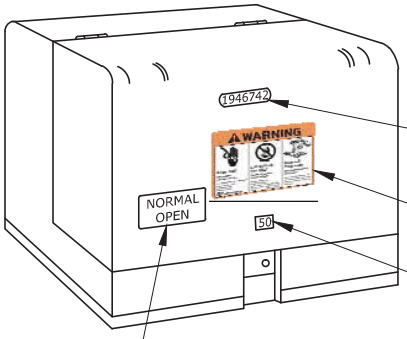
REINSTALLATION POLICY

ONLY NON-PCB TRANSFORMERS (LESS THAN 50 PPM) AS SHOWN BY BLUE DOT, BLUE NON-PCB LABEL, OR NAMEPLATE SHOULD BE INSTALLED. ANY TRANSFORMER OF UNKNOWN PCB CONTENT THAT HAS BEEN REMOVED FROM SERVICE SHOULD HAVE A "PCB ARTICLE STORAGE FOR REUSE" LABEL PLACED ON IT (CN 440230) AND SENT TO THE WILDWOOD TRANSFORMER SHOP. THE LABEL MUST BE PLACED ON THE TRANSFORMER AS SOON AS IT ARRIVES AT THE L&S YARD.

NON-PCB TRANSFORMERS IN OPERABLE CONDITION SHOULD BE RESTOCKED AND RE-USED. DO NOT SEND OPERABLE TRANSFORMERS TO THE TRANSFORMER SHOP UNLESS THEY NEED REPAIR, PAINTING, TESTING, OR HAVE A KNOWN OR ASSUMED PCB CONTENT OF 50 PPM OR MORE.

A PAD-MOUNTED TRANSFORMER OF UNKNOWN PCB CONTENT MAY NOT BE TRANSFERRED IN THE FIELD.

LOW PROFILE SINGLE DOOR
LOCATE ENERGIZED EQUIPMENT
SIGN IN THE MIDDLE OF DOOR



SEVEN DIGIT GIS-ID NUMBER (1-9/16" X 7/8" ALPHANUMERIC TAG) ATTACHED TO ALUMINUM TAG STRIP CN 443603

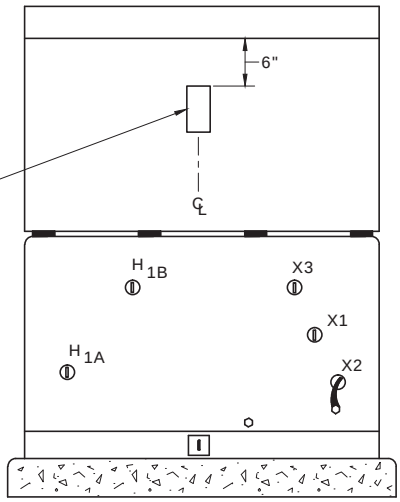
ENERGIZED EQUIPMENT SIGN
CN 9220111316

KVA STICKER
CN 440___

NORMAL OPEN
CN 440246

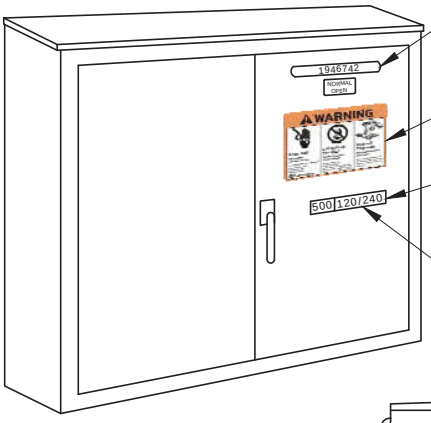
*DANGER LABEL SHALL BE LOCATED ON THE INSIDE OF TRANSFORMER DOOR, ON CENTER LINE OF DOOR HANDLE, SIX INCHES FROM DOOR EDGE AS SHOWN, CN 21129804.

DANGER LABEL
INTERIOR MOUNTING ONLY



SINGLE-PHASE MINI-PAD
DOOR OPEN

*ANY TRANSFORMER WITH MISSING DANGER LABEL OR ENERGIZED EQUIPMENT SIGN SHALL HAVE THESE ADDED AS SOON AS POSSIBLE.



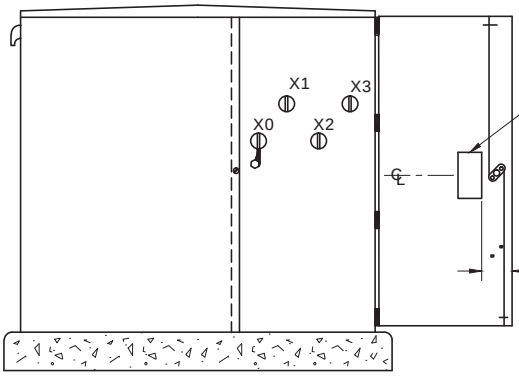
SEVEN DIGIT GIS-ID NUMBER (1-9/16" X 7/8" ALPHANUMERIC TAG) ATTACHED TO ALUMINUM TAG STRIP CN 443603

ENERGIZED EQUIPMENT SIGN
CN 9220111316

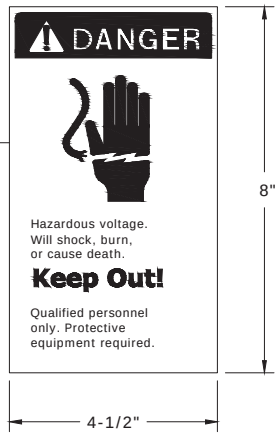
VOLTAGE SIGN
CN 44025_

KVA STICKER
CN 440___

*DANGER LABEL SHALL BE LOCATED ON THE INSIDE OF TRANSFORMER DOOR, ON CENTER LINE OF DOOR HANDLE, SIX INCHES FROM DOOR EDGE AS SHOWN, CN 21129804.



THREE-PHASE PAD-MOUNT
DOOR OPEN



DANGER LABEL
INTERIOR MOUNTING ONLY

*ANY TRANSFORMER WITH MISSING DANGER LABEL OR ENERGIZED EQUIPMENT SIGN SHALL HAVE THESE ADDED AS SOON AS POSSIBLE.

3				
2				
1	11/8/13	SIMMONS	DANNA	ADCOCK
0	10/28/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MARKINGS FOR PAD-MOUNTED TRANSFORMERS

DUKE ENERGY.

FLA

DWG. 27.00-03

SINGLE-PHASE UNITS					
CATALOG NUMBER	COMPATIBLE UNIT	KVA	HV	LV	TAPS
1301230025	TU25DL4121CF	25	12470GRDY/7200	240/120	NT
1301230050	TU50DL4121CF	50	12470GRDY/7200	240/120	NT
1301230075	TU75DL4121CF	75	12470GRDY/7200	240/120	NT
1301230100	TU100DL4121CF	100	12470GRDY/7200	240/120	NT
1301230167	TU167DL4121CF	167	12470GRDY/7200	240/120	NT
1302230050	TU50DL4121DF	50	12470GRDY/7200	480/240	NT
9220216294	TU167DL4121DF	167	12470GRDY/7200	480/240	NT
1401230025	TU25DL4131CF	25	13200GRDY/7620	240/120	2 2-1/2% A&BN
1401230050	TU50DL4131CF	50	13200GRDY/7620	240/120	2 2-1/2% A&BN
1401230075	TU75DL4131CF	75	13200GRDY/7620	240/120	2 2-1/2% A&BN
1401230100	TU100DL4131CF	100	13200GRDY/7620	240/120	2 2-1/2% A&BN
1401230167	TU167DL4131CF	167	13200GRDY/7620	240/120	2 2-1/2% A&BN
9220128341	TU25DL4M1CF	25	12470GRDY/7200 X 24940GRDY/14400	240/120	NT
9220128342	TU50DL4M1CF	50	12470GRDY/7200 X 24940GRDY/14400	240/120	NT
9220128343	TU100DL4M1CF	100	12470GRDY/7200 X 24940GRDY/14400	240/120	NT
9220128344	TU167DL4M1CF	167	12470GRDY/7200 X 24940GRDY/14400	240/120	NT

NOTES:

1. THESE CATALOG NUMBERS ARE THE STANDARD UNITS THAT ARE CURRENTLY PURCHASED AND STOCKED. OTHER SPECIAL ORDER UNITS ARE AVAILABLE ON REQUEST.

2. SEE DWG. 12.06-03 FOR 304L STAINLESS STEEL, SINGLE AND THREE-PHASE PAD-MOUNTED TRANSFORMERS. THESE UNITS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS OR VAULTS THAT ARE SUBJECT TO FLOODING AND/OR OTHER CONTAMINATION.

REVISED		BY	CK'D	APPR.
3				
2				
1	6/13/11	SIMMONS	BURLISON	ELKINS
0	10/28/10	SIMMONS	GUINN	ELKINS

SINGLE-PHASE PAD-MOUNTED

TRANSFORMER CATALOG NUMBERS

Duke Energy®

FLA

DWG. 27.00-10

THREE-PHASE UNITS (ALL UNITS HAVE ±2 @ 2.5% TAPS)				
CATALOG NUMBER	COMPATIBLE UNIT	KVA	HV	LV
3301230075	TU75DL412YBF	75	12470GRDY/7200	208Y/120
3301230150	TU150DL412YBF	150	12470GRDY/7200	208Y/120
3301230300	TU300DL412YBF	300	12470GRDY/7200	208Y/120
3301230500	TU500DL412YBF	500	12470GRDY/7200	208Y/120
3301230750	TU750DL412YBF	750	12470GRDY/7200	208Y/120
3301231000	TU1000DL412YBF	1000	12470GRDY/7200	208Y/120
3301231500	TU1500DL412YBF	1500	12470GRDY/7200	208Y/120
3303230075	TU75DL412YFF	75	12470GRDY/7200	480Y/277
3303230150	TU150DL412YFF	150	12470GRDY/7200	480Y/277
3303230300	TU300DL412YFF	300	12470GRDY/7200	480Y/277
3303230500	TU500DL412YFF	500	12470GRDY/7200	480Y/277
3303230750	TU750DL412YFF	750	12470GRDY/7200	480Y/277
3303231000	TU1000DL412YFF	1000	12470GRDY/7200	480Y/277
3303231500	TU1500DL412YFF	1500	12470GRDY/7200	480Y/277
3303232500	TU2500DL412YFF	2500	12470GRDY/7200	480Y/277
3303233000	TU3000DL412YFF	3000	12470GRDY/7200	480Y/277
3311231000	TU1000DL412YJF	1000	12470GRDY/7200	4160Y/2400
3311231500	TU1500DL412YJF	1500	12470GRDY/7200	4160Y/2400
3311232500	TU2500DL412YJF	2500	12470GRDY/7200	4160Y/2400
3601230075	TU75DL413YBF	75	13200GRDY/7620	208Y/120
3601230150	TU150DL413YBF	150	13200GRDY/7620	208Y/120
3601230300	TU300DL413YBF	300	13200GRDY/7620	208Y/120
3601230500	TU500DL413YBF	500	13200GRDY/7620	208Y/120
3601230750	TU750DL413YBF	750	13200GRDY/7620	208Y/120
3603230075	TU75DL413YFF	75	13200GRDY/7620	480Y/277
3603230150	TU150DL413YFF	150	13200GRDY/7620	480Y/277
3603230300	TU300DL413YFF	300	13200GRDY/7620	480Y/277
3603230500	TU500DL413YFF	500	13200GRDY/7620	480Y/277
3603230750	TU750DL413YFF	750	13200GRDY/7620	480Y/277
9220128331	TU75DL425YBF	75	24940GRDY/14400	208Y/120
9220128332	TU150DL425YBF	150	24940GRDY/14400	208Y/120
9220128333	TU300DL425YBF	300	24940GRDY/14400	208Y/120
9220128336	TU500DL425YBF	500	24940GRDY/14400	208Y/120
9220128337	TU75DL425YFF	75	24940GRDY/14400	480Y/277
9220128338	TU150DL425YFF	150	24940GRDY/14400	480Y/277
9220128339	TU300DL425YFF	300	24940GRDY/14400	480Y/277
9220128340	TU500DL425YFF	500	24940GRDY/14400	480Y/277
9220105306	TU1500DL425YFF	1500	24940GRDY/14400	480Y/277
3703232500	TU2500DL425YFF	2500	24940GRDY/14400	480Y/277

NOTES:

1. THESE CATALOG NUMBERS ARE THE STANDARD UNITS THAT ARE CURRENTLY PURCHASED AND STOCKED. OTHER SPECIAL ORDER UNITS ARE AVAILABLE ON REQUEST.

2. SEE DWG. 12.06-03 FOR 304L STAINLESS STEEL, SINGLE AND THREE-PHASE PAD-MOUNTED TRANSFORMERS. THESE UNITS ARE TO BE USED ONLY IN DESIGNATED COASTAL AREAS OR VAULTS THAT ARE SUBJECT TO FLOODING AND/OR OTHER CONTAMINATION.

3. SEE DWG. 11.11-01 FOR 4160Y/2400 VOLT METERING ENCLOSURES.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2	7/25/14	DANNA	DANNA	ADCOCK
1	6/13/11	SIMMONS	BURLISON	ELKINS
0	11/9/10	SIMMONS	GUINN	ELKINS

THREE-PHASE PAD-MOUNTED

TRANSFORMER CATALOG NUMBERS

DEC	DEM	DEP	DEF
			X

27.00-11

APPROXIMATE WEIGHT IN POUNDS				
SIZE IN KVA	HV	LV	TOTAL WEIGHT (POUNDS)	OIL CAPACITY (GALLONS)
25	12470GRDY/7200	240/120	539	25
25	13200GRDY/7620	240/120	536	25
25	12470GRDY/7200 X 24940GRDY/14400	240/120	585	27
50	12470GRDY/7200	240/120	563	29
50	13200GRDY/7620	240/120	714	28
50	12470GRDY/7200	480/240	700	28
75	12470GRDY/7200	240/120	876	36
75	13200GRDY/7620	240/120	1022	48
100	12470GRDY/7200	240/120	1073	44
100	13200GRDY/7620	240/120	1299	60
167	12470GRDY/7200	240/120	1624	84
167	13200GRDY/7620	240/120	1724	87
167	12470GRDY/7200	480/240	1611	85

NOTES:

1. LISTED WEIGHTS AND GALLONS OF OIL ARE TYPICAL FOR UNITS PRESENTLY BEING PURCHASED. OLDER UNITS MAY BE HEAVIER AND/OR HAVE MORE OIL.

3				
2				
1				
0	8/15/14	SIMMONS	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SINGLE-PHASE PAD-MOUNTED TRANSFORMER

WEIGHTS AND OIL CAPACITIES

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

27.00-12A

APPROXIMATE WEIGHT IN POUNDS				
SIZE IN KVA	HV	LV	TOTAL WEIGHT (POUNDS)	OIL CAPACITY (GALLONS)
75	12470GRDY/7200	208Y/120	2820	180
75	13200GRDY/7620	208Y/120	2737	172
75	12470GRDY/7200	480Y/277	2864	195
75	13200GRDY/7620	480Y/277	2725	173
150	12470GRDY/7200	208Y/120	3382	202
150	13200GRDY/7620	208Y/120	3426	196
150	12470GRDY/7200	480Y/277	3263	186
150	13200GRDY/7620	480Y/277	3258	189
300	12470GRDY/7200	208Y/120	4235	212
300	13200GRDY/7620	208Y/120	4336	230
300	12470GRDY/7200	480Y/277	4229	218
300	13200GRDY/7620	480Y/277	4205	208
500	12470GRDY/7200	208Y/120	5193	197
500	13200GRDY/7620	208Y/120	5922	285
500	12470GRDY/7200	480Y/277	4919	190
500	13200GRDY/7620	480Y/277	4934	195
750	12470GRDY/7200	208Y/120	6875	294
750	13200GRDY/7620	208Y/120	7820	316
750	12470GRDY/7200	480Y/277	6584	288
750	13200GRDY/7620	480Y/277	7410	329
1000	12470GRDY/7200	208Y/120	8827	381
1000	12470GRDY/7200	480Y/277	8004	357
1000	12470GRDY/7200	4160Y/2400	7660	327
1500	12470GRDY/7200	208Y/120	12301	476
1500	12470GRDY/7200	480Y/277	9816	390
1500	12470GRDY/7200	4160Y/2400	10156	423
2500	12470GRDY/7200	480Y/277	14241	541
2500	12470GRDY/7200	4160Y/2400	13565	543
3000	12470GRDY/7200	480Y/277	15766	574

NOTES:

1. LISTED WEIGHTS AND GALLONS OF OIL ARE TYPICAL FOR UNITS PRESENTLY BEING PURCHASED. OLDER UNITS MAY BE HEAVIER AND/OR HAVE MORE OIL.

2. TRANSFORMERS > 500 KVA WILL GENERALLY REQUIRE A CRANE FOR LIFTING. ALWAYS VERIFY LIFTING CAPACITY VS. TRANSFORMER WEIGHT.

DUKE ENERGY.

3				
2				
1				
0	8/15/14	SIMMONS	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PAD-MOUNTED TRANSFORMER

WEIGHTS AND OIL CAPACITIES

DEC	DEM	DEP	DEF
			X

27.00-12B

MAXIMUM KVA LOADING

TYPES OF COMMERCIAL AND INDUSTRIAL BUSINESSES			
TYPE OF BUSINESS	PEAK DEMAND DURATION (HOURS)	TYPE OF BUSINESS	PEAK DEMAND DURATION (HOURS)
FAST FOOD	8	CONVENIENCE STORES	4
SUPERMARKETS	8	HOTELS	4
LARGE & SMALL RETAIL STORES	8	SMALL OFFICE BUILDINGS	4
LARGE OFFICE BUILDINGS	8	RESTAURANTS	4
		SCHOOLS	4

SINGLE-PHASE COMMERCIAL PAD-MOUNTED TRANSFORMERS					
TRANSFORMER SIZE	SUMMER (100%)	WINTER (140%)	TRANSFORMER SIZE	SUMMER (100%)	WINTER (140%)
25	25	35	100	100	140
37.5	37.5	52	167	167	233
50	50	70	250	250	350
75	75	105			

SINGLE-PHASE RESIDENTIAL PAD-MOUNTED TRANSFORMERS					
TRANSFORMER SIZE	SUMMER 130%	WINTER 160%	TRANSFORMER SIZE	SUMMER 130%	WINTER 160%
25	32	40	75	97	120
37.5	49	60	100	130	160
50	65	80	167	217	267
			250	325	350

THREE-PHASE UNDERGROUND TRANSFORMERS								
BANK SIZE OR TRANSFORMER SIZE	HOSPITAL AND SPECIAL CARE FACILITIES		INDUSTRIALS AND VAULTS		4 HOUR PEAK		8 HOUR PEAK	
	SUMMER 100%	WINTER 140%	SUMMER 100%	WINTER 140%	SUMMER	WINTER	SUMMER	WINTER
75	75	105	75	105	90	122	77	105
112	112	156	112	156	134	172	115	157
150	150	210	150	210	180	225	155	215
300	300	420	300	420	360	450	309	425
500	500	700	500	700	600	750	515	710
750	750	1,050	750	1,050	900	1,125	773	1,060
1,000	1,000	1,400	1,000	1,400	1,200	1,500	1,030	1,420
1,500	1,500	2,100	1,500	2,100	1,800	2,250	1,545	2,125
2,500	2,500	3,500	2,500	3,500	3,000	3,750	2,575	3,540
3,000	3,000	4,200	3,000	4,200	3,600	4,500	3,090	4,248
3,750	3,750	4,500	3,750	4,500	4,500	5,625	3,862	5,312

NOTES:

1. SELECT THE TYPE OF BUSINESS. THE CORRESPONDING DEMAND DURATION IS HOW LONG THE CUSTOMER'S DEMAND LASTS ON PEAK DAYS BASED ON DATA FROM LOAD RESEARCH STUDIES. THE CUSTOMER'S DEMAND TYPICALLY DROPS TO 75% OF THE MAXIMUM DURING ALL OTHER TIMES.

2. NOTE THAT TRANSFORMER LOADING IS GIVEN IN KVA. ADJUSTMENTS FOR POWER FACTOR NEED TO BE DEFINED BY THE ENGINEER.

3. HIGHLY FLUCTUATING INTERMITTENT LOADS (HFIL): TAKE THE SUM OF THE HFILS AND DIVIDE BY THREE (ΣHFIL/3), AND ADD TO THE CONSTANT LOAD. FUSE CURVES NEED TO BE CHECKED BY USING THE SUM OF THE HFIL (NOT DERATED BY 3) AND THE CONSTANT LOAD DUE TO FUSE PERFORMANCE.

3				
2				
1				
0	6/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

MAXIMUM TRANSFORMER LOADING (UG)

Duke Energy®

PGN DWG. 27.00-13

TRANSFORMER PROCEDURES

1. INSURE THAT ALL CABLE IS DE-ENERGIZED BY FOLLOWING PROPER SAFETY PROCEDURES.

2. VERIFY AND TAG PRIMARY AND SECONDARY CABLES.

   A. USE WHITE PLASTIC IDENTIFICATION TAGS (CN 443333) ON PRIMARY TO IDENTIFY PHASE, DEVICE COORDINATE NUMBER AND DIRECTION TO DEVICE AT OPPOSITE END OF CABLE. USE THESE TAGS FOR OTHER INFORMATION WHERE NEEDED.

   B. USE COLOR MARKING TIES ON SECONDARY CABLES TO DESIGNATE SERVICES. MARKING TIE COLORS ARE NOT TO BE DUPLICATED AT A TRANSFORMER LOCATION.

3. VERIFY THAT CABLE IS PROPERLY POSITIONED IN RELATIONSHIP TO THE FUTURE TRANSFORMER PAD. (EX: SINGLE PHASE PRIMARY CABLE FEEDS INTO H1A AND OUT OF H1B. THREE-PHASE PRIMARY CABLE FEEDS INTO H1A, H2A, H3A, AND OUT OF H1B, H2B, AND H3B.

4. SET PROPER TRANSFORMER AND TRANSFORMER PAD.

5. FOR SCREW ON CONNECTORS: SCREW CONNECTOR COMPLETELY ONTO TRANSFORMER STUD. AFTER STUD HAS BOTTOMED, TURN CONNECTOR BACKWARDS UNTIL PROPER POSITION IS ATTAINED. BACKTIGHTEN JAM NUT (IF SUPPLIED) AGAINST CONNECTOR TO SECURE CONNECTION.

6. FOR TERMINALS THAT SLIP ON: SLIP CONNECTOR FULLY ONTO TRANSFORMER STUD. TIGHTEN SET SCREW(S) TO 20 FT.-LBS. MINIMUM TORQUE TO LOCK CONNECTOR TO STUD. WHEN GROUND STRAP IS CONNECTED TO NEUTRAL BUSHING, LOCATE GROUND STRAP BETWEEN A JAM NUT AND THE CONNECTOR BLOCK.

TRANSFORMER SECONDARY BLOCKS

COMPATIBLE UNIT	CATALOG NUMBER	CONDUCTOR SIZE	DESCRIPTION	AMPACITY	MAXIMUM TRANSFORMER SIZE		
					120/208	277/480	120/240
KXS586W40F	327906	6-250	5/8" HOLE OR SLIP FIT, 8 WAY	600	-	-	75
KXS586WF	327901	2-500	5/8" HOLE OR SLIP FIT, 6 WAY	800	-	-	75
KXS588W50F	327907	2-500	5/8" HOLE OR SLIP FIT, 8 WAY	800	-	-	75
KXS18W50F	327908	2-500	1' HOLE OR SLIP FIT, 8 WAY	1200	-	-	167
KXB6W40F	320974	10-350	BOLT-ON, 6 WAY, SINGLE SET SCREW	1200	300 *	750 *	-
KXB6W50F	327867	6-500	BOLT-ON, 6 WAY, SINGLE SET SCREW	1200	300 *	750 *	-
KXB6W7510F	327832	1/O-750	BOLT-ON, 6 WAY, DOUBLE SET SCREW LAY-IN	2400	750 *	2000 *	-
KXB8W75F	327833	1/0-750	BOLT-ON, 8 WAY, DOUBLE SET SCREW LAY-IN	3200	1000 *	2500 *	-

* IF TWO (2) CONNECTORS ARE BACKED UP ON THE SAME SPADE THE TRANSFORMER SIZE MAY BE DOUBLED.

EXAMPLE: USING 2 OF THE 1/O-750 CONNECTORS CN 327832, THE TOTAL AMPACITY WOULD INCREASE TO 4800, AND THE MAXIMUM TRANSFORMER SIZE WOULD BE 1500 KVA FOR 120/208V AND 4000 KVA FOR 277/480V.

SET SCREW TORQUE VALUES

CONDUCTOR SIZE	RECOMMENED TORQUE (FT.-LBS.)
#12 - 350	30
500 - 750	40

NOTES:

1. TORQUE CONDUCTOR SET SCREWS PER THE TABLE ABOVE. TORQUE SET SCREW(S) USED TO ATTACH TERMINAL TO BUSHING WITH 30 FT.-LBS. MINIMUM.

2. ON NARROW THREE-PHASE TRANSFORMER COMPARTMENTS (DEPTH), IT MAY BE NECESSARY TO INSTALL NON LAY-IN SECONDARY BLOCKS:
   8WAY - CN 9220261909
   6WAY - CN 9220261901

REVISED		BY	CK'D	APPR.
3				
2	1/29/14	DANNA	DANNA	ADCOCK
1	3/6/12	DANNA	BURLISON	ELKINS
0	10/28/10	SIMMONS	GUINN	ELKINS

SECONDARY SET SCREW CONNECTORS

DUKE ENERGY.

FLA

DWG. 27.00-14

REPLACEMENT STUDS

FRONT VIEW
REPLACEMENT STUD ABB
(2009 AND BEFORE)
STUD SIZE 3/8 X 3/8
CN 326602

FRONT VIEW
REPLACEMENT STUD CENTRAL MALONEY AND ABB
(MANUFACTURED IN 2010 OR LATER)
STUD SIZE 7/16 X 3/8
CN 326603

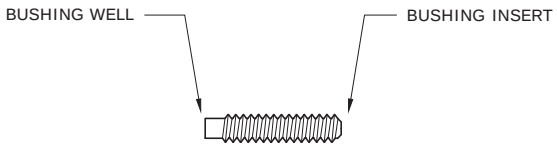
HEX-SPANNER NUT

HEX SPANNER NUT
CN 9220201402
(USE WITH 15/16" SHALLOW WELL SOCKET)

NOTE: MUST BE ORDERED SEPARATE.

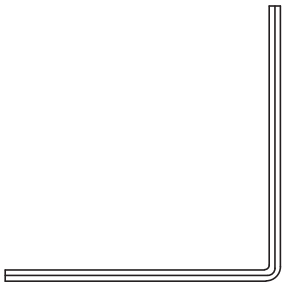
ELASTIMOLD TYPE
CN 10332807

REPLACEMENT STUD



SIDE VIEW

HEX-ALLEN WRENCH



SIDE VIEW

NOTES:

1. ALL PAD-MOUNTED TRANSFORMERS MANUFACTURED AFTER 1983 COME EQUIPPED WITH REPLACEABLE STUD BUSHING WELLS.
2. BROKEN BUSHING WELL STUDS SHOULD BE REPLACED IN THE FIELD WHEN POSSIBLE.
3. HEX-SPANNER NUT FOR CENTRAL MALONEY OR ABB MUST NOW BE ORDERED SEPARATELY FROM THE STUDS.
4. HEX-ALLEN WRENCH FOR ELASTIMOLD IS INCLUDED WITH EACH REPLACEMENT STUD.
5. TO REPLACE BROKEN STUDS:
   A. IDENTIFY WHICH TYPE OF STUD IS TO BE REPLACED.
   B. USE CORRECT WRENCH OR NUT FOR APPROPRIATE STUD TO REMOVE BROKEN STUD.
   C. INSERT APPROPRIATE END OF REPLACEMENT STUD INTO BUSHING WELL.
   D. TIGHTEN REPLACEMENT STUD UNTIL SEATED (APPROXIMATELY 15 FT-LBS).

3				
2				
1				
0	10/28/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

REPLACEMENT STUDS - 200 AMP BUSHING WELLS

Duke Energy®

FLA

DWG. 27.00-16

PROGRESS ENERGY STANDARD PROCEDURES BULLETIN

IDLE TRANSFORMERS

DEFINITION:

AN IDLE TRANSFORMER IS A TRANSFORMER THAT IS INSTALLED ON THE DISTRIBUTION SYSTEM BUT IS SERVING NO USEFUL PURPOSE. THERE IS NO CUSTOMER BEING SERVED, NO LIGHTS, NO TRAFFIC SIGNALS. THERE IS ALSO NO REASONABLE POTENTIAL FOR SERVING A CUSTOMER IN THE FUTURE. A TRANSFORMER INSTALLED IN A NEW UNDERGROUND DEVELOPMENT THAT IS SERVING NO CUSTOMERS BUT WILL IN THE FUTURE IS NOT CONSIDERED IDLE BECAUSE IT WILL BE SERVING CUSTOMERS IN THE NEAR FUTURE.

EXAMPLES ARE AS FOLLOWS:

1. A TRANSFORMER THAT WAS USED FOR TEMPORARY CONSTRUCTION SERVICE IS IDLE AFTER THE CONSTRUCTION IS COMPLETED AND THE TRANSFORMER IS NO LONGER NEEDED FOR CONSTRUCTION SERVICE.

2. A TRANSFORMER THAT SERVED A RESIDENTIAL CUSTOMER IS IDLE IF THE HOME IS NO LONGER OCCUPIED AND THERE IS NO PROSPECT OF SERVING A CUSTOMER AT THE SAME LOCATION.

3. A TRANSFORMER BANK THAT SERVED A COMMERCIAL/INDUSTRIAL CUSTOMER IS IDLE IF THE CUSTOMER IS NO LONGER IN BUSINESS AND THE TRANSFORMER BANK IS NOT NEEDED FOR A POTENTIAL NEW CUSTOMER AT THE SAME LOCATION.

ISSUES WITH IDLE TRANSFORMERS:

THERE ARE SEVERAL REASONS WHY IDLE TRANSFORMERS SHOULD BE REMOVED FROM THE SYSTEM. ONE THAT IS LEFT ENERGIZED EXPERIENCES "NO-LOAD" CORE LOSSES EVEN WHEN IDLE. THESE ARE ANNUAL LOSSES. A 25 KVA TRANSFORMER IS ESTIMATED TO HAVE $35 OF ANNUAL CORE LOSSES. A 167 KVA TRANSFORMER IS ESTIMATED TO HAVE $200 OF ANNUAL CORE LOSSES. A TRANSFORMER THAT THAT IS IDLE IS A POTENTIAL FOR VANDALISM, RESULTING IN AN ENVIRONMENTAL ISSUE, AN OIL SPILL. THERE HAVE BEEN A NUMBER OF SPILLS DUE TO VANDALISM OF IDLE TRANSFORMERS AND SOME OF THESE REQUIRED SIGNIFICANT COSTS FOR CLEANUP.

A TRANSFORMER THAT IS IDLE IS A POTENTIAL HAZARD FOR CRIMINALS WHO WOULD ATTEMPT TO VANDALIZE THE UNITS TO STEAL COPPER. THEY WILL TAKE EXTRAORDINARY RISKS WITH NO REGARD FOR THEIR OWN SAFETY OR PROPERTY OF OTHERS.

TRANSFORMER COSTS HAVE INCREASED SUBSTANTIALLY SINCE 2004 DUE TO THE RISING COSTS OF RAW MATERIALS: COPPER, CORE STEEL, MINERAL OIL. COSTS WILL INCREASE AGAIN SIGNIFICANTLY IN JANUARY, 2010 AS NEW DEPARTMENT OF ENERGY (DOE) EFFICIENCY REQUIREMENTS ARE IMPLEMENTED. IT IS A SIGNIFICANT FINANCIAL BENEFIT TO THE COMPANY TO REMOVE AND RE-USE IDLE TRANSFORMERS VERSUS BUYING NEW ONES AT SIGNIFICANTLY HIGHER PRICES. ONES THAT HAVE BEEN REMOVED AND RE-USED DO DO NOT HAVE TO MEET THE MORE STRINGENT EFFICIENCY REQUIREMENTS OF DOE.

PROCEDURE:

ANY TRANSFORMER THAT IS IDLE BUT LEFT ON THE POLE SHALL BE DE-ENERGIZED TO SAVE ANNUAL CORE LOSSES. TRANSFORMERS WITH NO CUTOUTS (CSP) SHALL HAVE THE HOT LINE CLAMP REMOVED FROM THE PRIMARY AND GROUNDED TO THE SYSTEM NEUTRAL. TRANSFORMERS WITH CUTOUTS MAY BE DE-ENERGIZED BY OPENING THE CUTOUT AND REMOVING THE CUTOUT BARREL.

WHEN A TRANSFORMER HAS BEEN DE-ENERGIZED, ASSET ENGINEERING SHALL BE NOTIFIED. ASSET ENGINEERING WILL EVALUATE AND DETERMINE IF THE TRANSFORMER SHOULD BE REMOVED AND IF SO, PREPARE A WORK ORDER TO REMOVE. ASSOCIATED EQUIPMENT (CUTOUTS, ARRESTERS, SERVICE CONDUCTORS, ETC.) SHOULD BE REMOVED AT THE SAME TIME THE TRANSFORMER IS REMOVED.

FOR TRANSFORMER BANKS SERVING COMMERCIAL OR INDUSTRIAL CUSTOMERS, CONTACT WITH ACCOUNT MANAGERS WILL BE REQUIRED TO DETERMINE IF THERE IS POTENTIAL FOR FUTURE CUSTOMERS OCCUPYING A VACANT FACILITY.

TRANSFORMERS THAT HAVE BEEN REMOVED SHALL BE PLACED IN STOCK AT THE LOCAL STOREROOM, IF THE TRANSFORMER IS IN GOOD CONDITION AND IS NON-PCB. IF NOT IN GOOD CONDITION, OR THE PCB CONTENT IS UNKNOWN, THE TRANSFORMER SHALL BE RETURNED TO THE WILDWOOD TRANSFORMER SHOP WHERE IT WILL BE EVALUATED, REPAIRED, REPAINTED AND RETURNED TO STOCK, IF POSSIBLE.

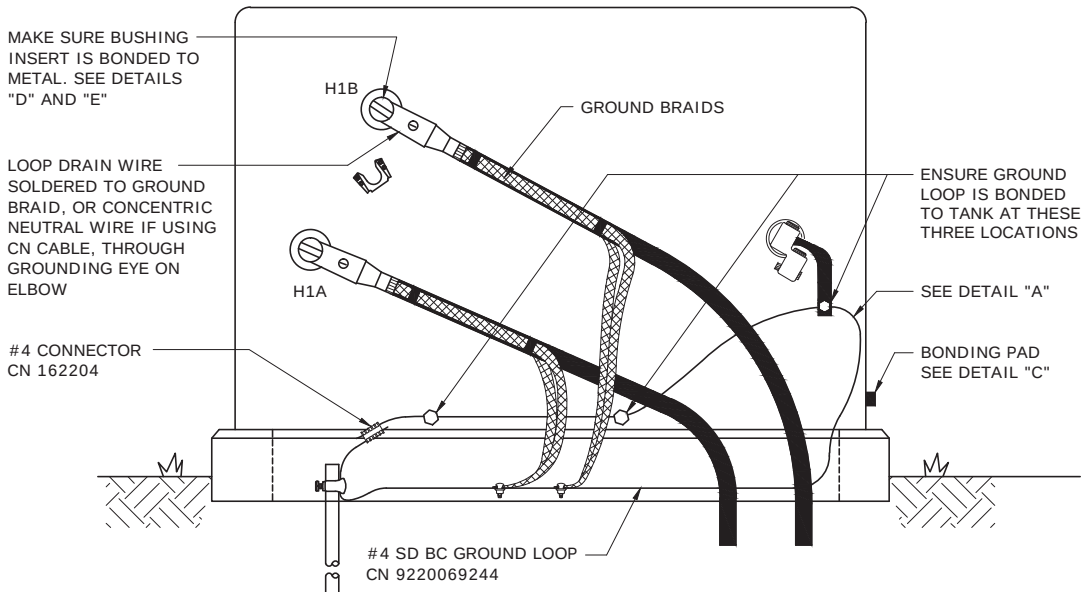
3				
2				
1				
0	10/28/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

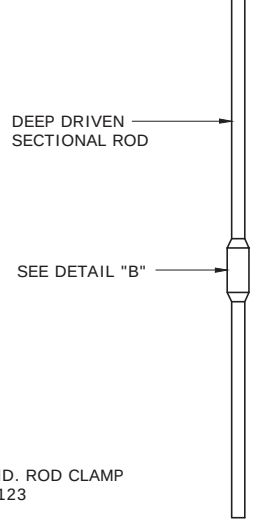
IDLE TRANSFORMERS

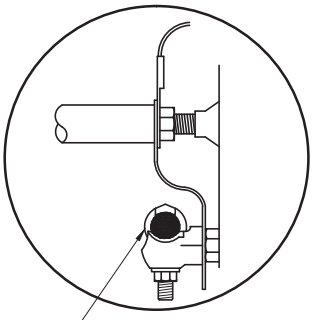
Duke Energy®

FLA

DWG. 27.00-22

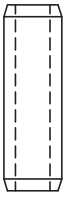




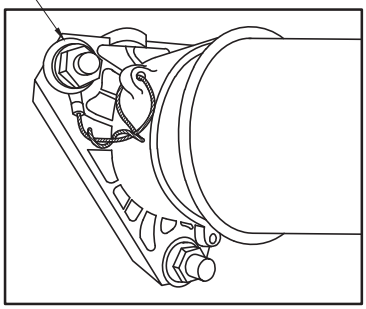


DETAIL "A"
CN 160182

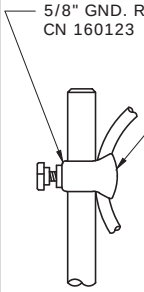
BOND INSERT TO MOUNTING STUD WHEN BUSHING FLANGE IS PLASTIC

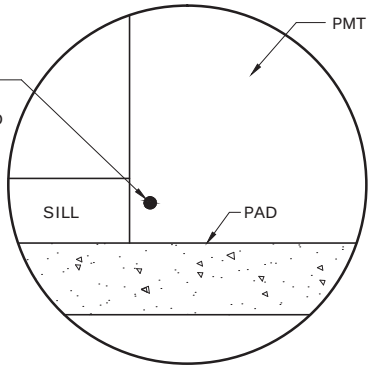


DETAIL "B"
5/8" COUPLING
CN 060136

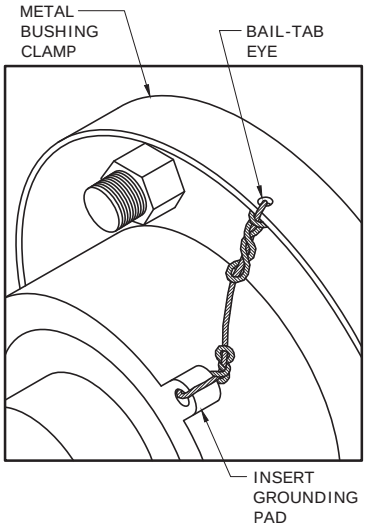


DETAIL "E"
PLASTIC BUSHING CLAMP





DETAIL "C"



DETAIL "D"
METALLIC BUSHING CLAMP

NOTES:

1. SEE DWG. 20.00-06B FOR ADDITIONAL INFORMATION ON EQUIPMENT GROUNDING AND BONDING.

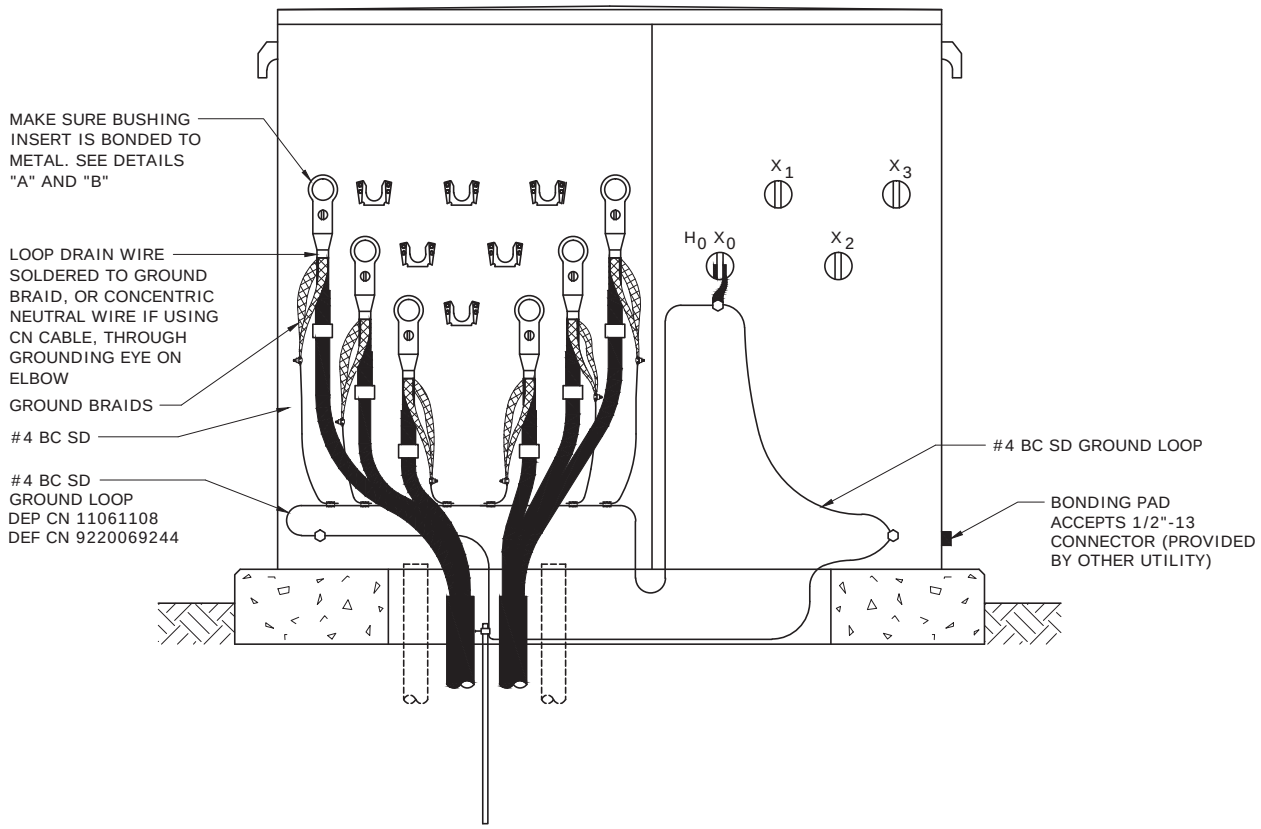
3				
2				
1				
0	12/17/14	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

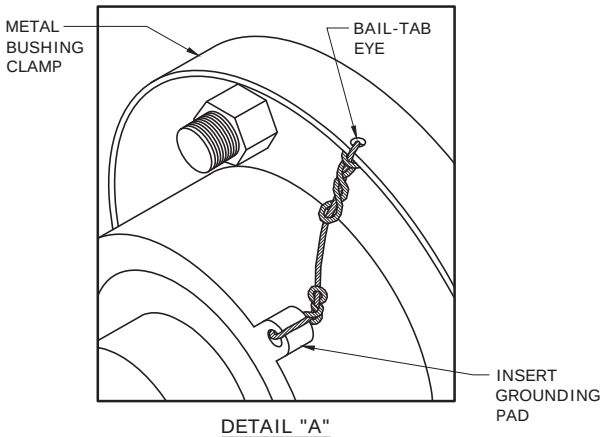
GROUNDING DETAILS FOR SINGLE-PHASE LOW-PROFILE PAD-MOUNTED TRANSFORMERS

DUKE ENERGY.

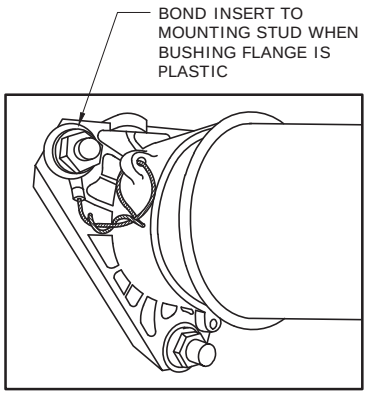
DEC	DEM	DEP	DEF
		X	X

27.01-03





DETAIL "A"
METALLIC BUSHING CLAMP



DETAIL "B"
PLASTIC BUSHING CLAMP

NOTES:

1. THE DRAWING ABOVE SHOWS A H0-X0 GROUNDING BUSHING. SOME DESIGNS HAVE SEPARATE H0 AND X0 GROUNDING BUSHINGS.
2. GROUND WIRE IS TO BE BONDED TO TANK GROUND PADS IN BOTH COMPARTMENTS THROUGH THE GROUND STRAP AT THE H0 AND X0 BUSHINGS, AND TO THE PRIMARY CONCENTRIC NEUTRAL WITH A COPPER CONNECTOR.
3. FOR TRANSFORMERS WITH A SEPARATE H0 AND X0 BUSHING USED TO PROVIDE 480Y 3 WIRE SERVICES, THE GROUNDING STRAP SHOULD BE REMOVED FROM THE X0 BUSHING. DO NOT REMOVE THE GROUNDING STRAP ON THE H0 BUSHING.
4. SEE DWG. 20.00-06B FOR ADDITIONAL INFORMATION ON EQUIPMENT GROUNDING AND BONDING.
5. SEE DWGS. 27.06-16 THROUGH 27.06-28 FOR THE GROUNDING REQUIRED ON 3-WIRE SECONDARY SERVICES.

3				
2				
1				
0	12/17/14	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

GROUND DETAILS FOR THREE-PHASE LOOP FEED TRANSFORMERS

DUKE ENERGY.

DEC	DEM	DEP	DEF
		X	X

27.01-04

FUSE SIZE FOR SINGLE-PHASE VAULT TRANSFORMERS							
SINGLE-PHASE TRANSFORMER SIZE	WYE CONNECTED PRIMARY				DELTA CONNECTED PRIMARY		
	PRIMARY VOLTAGE - GROUND				PRIMARY VOLTAGE		
	2400	4800	7200	14400	2400	4800	12470
50	40	15	10	5	65	50	10
75	50	30	15	7	80	65	15
100	65	40	25	10	100	80	25
167	100	50	40	15	125	125	40
250	125	65	50	30	150	125	50
333	150	100	65	40	200	125	65
500	200	125	80	65	-	200	80

NOTES:

1. TERMINAL POLE AND SWITCHGEAR FUSES FOR VAULT TRANSFORMERS SHOULD BE SPECIFIED BY ENGINEERING, AND WILL BE BASED ON INDIVIDUAL TRANSFORMER SIZE. VAULT TRANSFORMERS DO NOT HAVE INTERNAL FUSES LIKE PAD-MOUNTS, AND THEREFORE REQUIRE CLOSE COORDINATION FROM THE TERMINAL POLE FUSE.

2. IF DIFFERENT SIZE TRANSFORMERS ARE USED WITH A DELTA CONNECTED PRIMARY, THE COMMON LEAD SHOULD BE FUSED BASED ON THE LARGER TRANSFORMER.

3. WHEN ONE FUSE IS BLOWN ON A THREE-PHASE TERMINAL POLE, ALL FUSES SHALL BE REPLACED. THIS IS NECESSARY BECAUSE THE FAULT AND SINGLE PHASING CAN CHANGE THE CHARACTERISTICS OF THE FUSES THAT DID NOT BLOW.

4. THE TABLE ABOVE SHOWS THE REQUIRED FUSE SIZE FOR SINGLE-PHASE VAULT TRANSFORMERS.

3					
2					
1					
0	10/29/10	SIMMONS	GUINN	ELKINS	
REVISED		BY	CK'D	APPR.	

FUSING GUIDELINES FOR VAULT TRANSFORMERS

Duke Energy®

FLA

DWG. 27.02-02

MINIMUM TERMINAL POLE FUSING FOR THREE-PHASE PAD-MOUNTED TRANSFORMERS						
PRIMARY RATING (KV)	KVA	MINIMUM TERMINAL POLE FUSE (SEE NOTE 2)	ITEM NUMBER	MINIMUM SWITCHGEAR FUSING	ITEM NUMBER (SML20 FUSE REFILL)	ITEM NUMBER (OLDER PMH FML-4Z FUSE HOLDER SM-4 FUSE REFILL)
12.47 & 13.2	75	20K	230109	25E	230622	230666
12.47 & 13.2	150	25K	230110	40E	230623	230669
12.47 & 13.2	300	50K	230113	65E	230624	230672
12.47 & 13.2	500	80K	230115	100E	230626	230673
12.47 & 13.2	750	100KS	230121	125E	230627	230675
12.47 & 13.2	1000	100KS*	230121	150E	230628	230676
12.47 & 13.2	1500	100KS*	230121	200E	230629	230678
12.47 & 13.2	2500	100KS*	230121	200E	230629	230678
12.47 & 13.2	3000	100KS*	230121	200E*	230629	230678
24.94	75	30K	230111	25E	230622	230666
24.94	150	30K	230111	40E	230623	230669
24.94	300	40K	230112	40E	230623	230669
24.94	500	50K	230113	65E	230624	230672
24.94	750	80K	230115	100E	230626	230673
24.94	1000	80K	230115	100E	230626	230673
24.94	1500	100KS	230121	125E	230627	230675
24.94	2500	100KS	230121	150E	230628	230676

THESE ARE MINIMUM POLE FUSE SIZES TO COORDINATE WITH TRANSFORMER BAY-O-NET FUSES. LARGER FUSES MAY BE USED.

* TERMINAL POLE/ SWITCHGEAR FUSE WILL **NOT** COORDINATE WITH BAY-O-NET FUSE (SEE NOTE 5).

NOTES:

1. TERMINAL POLE AND SWITCHGEAR FUSE SIZES SHOULD BE SPECIFIED BY ENGINEER AND WILL BE BASED ON CABLE SIZE, CONNECTED KVA, AND UPSTREAM DEVICES. SINCE MOST PAD-MOUNTED TRANSFORMERS HAVE INTERNAL HIGH SIDE FUSES, TERMINAL POLE FUSES FOR PAD-MOUNTS MAY OFTEN BE LARGER THAN A FUSE USED FOR THE SAME SIZE OVERHEAD TRANSFORMER.

2. MAXIMUM TERMINAL POLE FUSE SIZE FOR #2 ALUMINUM CABLE IS 100A KS.

3. WHEN ONE FUSE BLOWS ON A TERMINAL POLE OR IN A SWITCHGEAR THAT SERVES A THREE-PHASE TRANSFORMER OR BANK OF TRANSFORMERS, ALL FUSES SHALL BE REPLACED. THIS IS NECESSARY BECAUSE THE FAULT AND SINGLE-PHASING CAN CHANGE THE CHARACTERISTICS OF THE FUSES THAT DID NOT BLOW.

4. FOR MULTIPLE TRANSFORMERS, CONTACT A DPAC SYSTEM PROTECTION ENGINEER.

5. THESE FUSES WILL NOT PROPERLY COORDINATE WITH THE BAY-O-NET FUSES OF THE TRANSFORMER. THE TRANSFORMERS THAT CORRESPOND WITH THE FUSES IN THIS TABLE SHOULD HAVE MANUAL FAULT INDICATORS PLACED ON THE TRANSFORMER PRIMARY SOURCE-SIDE CABLES TO ASSIST WITH IDENTIFYING ANY FUTURE TRANSFORMER FAILURES. SHOULD ONE OF THESE TRANSFORMERS FAIL OR BAY-O-NET FUSES BLOW, **ALL** BAY-O-NET **AND** TERMINAL POLE/SWITCHGEAR FUSES SHALL BE REPLACED SINCE UNBLOWN FUSES ARE LIKELY DAMAGED.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	3/31/17	MORGAN	BURLISON	ADCOCK
0	10/29/10	SIMMONS	GUINN	ELKINS

FUSING GUIDELINES FOR

PAD-MOUNTED TRANSFORMERS

DEC	DEM	DEP	DEF
			X

27.02-04

SINGLE-PHASE PMTS - GENERAL

GENERAL DESIGN:

LIVE FRONT TRANSFORMERS ARE OBSOLETE. WHENEVER THESE TRANSFORMERS ARE REMOVED THEY SHOULD BE SCRAPPED. ALL NEW TRANSFORMERS ARE DEAD FRONT WITH TWO PRIMARY BUSHING WELLS.

PRIMARY VOLTAGES:

A 7200 VOLT PRIMARY RATING IS AVAILABLE FOR INSTALLATION ON 12KV SYSTEMS. A 7620 VOLT RATING IS AVAILABLE FOR INSTALLATION ON 13.2 KV SYSTEMS (SEBRING). A 14,400 VOLT PRIMARY RATING IS AVAILABLE FOR INSTALLATION ON 25 KV SYSTEMS (HOLOPAW AND UNIVERSITY OF FLORIDA - GAINESVILLE).

SECONDARY VOLTAGES:

120/240 VOLT 3-WIRE SECONDARY VOLTAGES ARE AVAILABLE IN ALL KVA SIZES. 240/480 VOLT 3-WIRE SECONDARY VOLTAGES ARE AVAILABLE IN 50 KVA AND 167 KVA SIZES. THE 167KVA IS ONLY AVAILABLE IN 304L STAINLESS STEEL AND IS NON-STOCK, BUT MAY BE ORDERED.

KVA RATINGS:

STANDARD KVA RATINGS ARE 25, 50, 75, 100 AND 167 KVA. 37-1/2 KVA UNITS ARE NO LONGER PURCHASED, BUT SHOULD BE RECYCLED AND REUSED IF POSSIBLE.

FUSE PROTECTION:

ALL NEW TRANSFORMERS (LATE 2005 VINTAGE) ARE PROTECTED WITH BAY-O-NET FUSES AND EITHER CURRENT LIMITING FUSES OR INTERNAL WEAK LINKS ON THE PRIMARY SIDE. TRANSFORMERS PRIOR TO LATE 2005 ARE PROTECTED WITH INTERNAL PRIMARY EXPULSION FUSES. OLDER TRANSFORMERS WILL CONTINUE TO BE RECYCLED AND REUSED UNDER THE SAME ITEM NUMBERS AS NEW TRANSFORMERS WITH BAY-O-NET FUSING.

SINGLE-PHASE FUSE TABLE

TRANSFORMER SIZE, KVA	TRANSFORMER VOLTAGE RATING			
	7200 VOLTS OR 7620 VOLTS		14,400 VOLTS	
	FUSE LINK SIZE		FUSE LINK SIZE	
	AMPS	ITEM #	AMPS	ITEM #
25	6	21142906	5	21124102
37.5	12	21124201	6	21142906
50	15	21124607	8	21124508
75	25	21124300	N/A	N/A
100	25	21124300	15	21124607
167	40	9220285549	25	21124300

ALL BAY-O-NET FUSE LINKS FOR SINGLE-PHASE PAD-MOUNTED TRANSFORMERS ARE DUAL ELEMENT FUSES.

REVISED		BY	CK'D	APPR.
3				
2				
1	3/31/17	MORGAN	BURLISON	ADCOCK
0	10/29/10	SIMMONS	GUINN	ELKINS

DUKE ENERGY.

STANDARD SINGLE-PHASE
PAD-MOUNTED TRANSFORMERS
AND SINGLE-PHASE FUSE TABLE

DEC	DEM	DEP	DEF
			X

27.02-05

THREE-PHASE LOOP-FEED PAD-MOUNTED TRANSFORMERS

GENERAL DESIGN: LOOP FEED TRANSFORMERS HAVE A DEAD-FRONT PRIMARY COMPARTMENT WITH SIX BUSHING WELLS.

FUSING: TRANSFORMERS ARE PROTECTED ON THE PRIMARY SIDE WITH BAYONET FUSING AND EITHER CURRENT LIMITING FUSES OR INTERNAL WEAK LINKS.

PRIMARY VOLTAGES: STANDARD PRIMARY VOLTAGES ARE 12,470GRDY/7200 VOLTS (IN SIZES UP TO 3000 KVA), 13,200GRDY/7620 (IN SIZES UP TO 750 KVA), AND 24,940GRDY/14,400 (IN SIZES UP TO 2500 KVA).

VOLTAGE TAP SETTINGS: (2) ±2.5% TAPS ARE AVAILABLE ON ALL NEW 13200GRDY/7620V TRANSFORMERS AND ALL NEW 12470GRDY/7200V TRANSFORMERS 300KVA AND GREATER. 24940GRDY/14400V TRANSFORMERS WITH 208Y/120V SECONDARY VOLTAGE HAVE 4 TAPS BELOW NOMINAL IN 2.5% STEPS. 24940GRDY/14400V TRANSFORMERS WITH 480Y/277V SECONDARY VOLTAGE HAVE 1 TAP 2.5% ABOVE NOMINAL AND 3 TAPS BELOW NOMINAL IN 2.5% STEPS.

SECONDARY VOLTAGES: STANDARD 208Y/120 VOLT SECONDARY VOLTAGE IS AVAILABLE IN SIZES UP TO 750 KVA FOR TRANSFORMERS WITH PRIMARY VOLTAGE OF 13,200GRDY/7620, UP TO 1500 KVA FOR TRANSFORMERS WITH PRIMARY VOLTAGE OF 12,470GRDY/7200, AND UP TO 500 KVA FOR TRANSFORMERS WITH PRIMARY VOLTAGE OF 24,940GRDY/14,400. THE 1500 KVA TRANSFORMER SHOULD NOT BE USED FOR A NEW POINT OF DELIVERY BUT IS AVAILABLE TO RELIEVE AN OVERLOADED 1000 KVA TRANSFORMER. 480Y/277 VOLT SECONDARY VOLTAGE IS AVAILABLE IN SIZES UP TO 3000 KVA @ 12,470GRDY/7200 PRIMARY VOLTAGE, UP TO 750 KVA @ 13,200GRDY/7620 PRIMARY VOLTAGE, AND 2500 KVA @ 24,940GRDY/14,400 PRIMARY VOLTAGE. 4160Y/2400 VOLT SECONDARY VOLTAGE IS AVAILABLE IN 1000, 1500 AND 2500 VOLT SIZES @ 12,470GRDY/7200 PRIMARY VOLTAGE.

DIP POLE OR SWITCHGEAR FUSING: DIP POLE OR SWITCHGEAR FUSES MUST BE EQUAL TO OR LARGER THAN BAY-O-NET FUSE SIZES SHOWN BELOW WITH THE EXCEPTION OF THE 2500 KVA AND 3000 KVA TRANSFORMERS. SEE THE TABLE ON DWG. 27.02-04 FOR THE MINIMUM DIP POLE AND SWITCHGEAR FUSE TO SELECT FOR A GIVEN TRANSFORMER.

PRIMARY RATING (KV)	TRANSFORMER KVA	HV BAYONET FUSE LINK AMPERE RATING	BAYONET FUSE ITEM NUMBER
12.47 & 13.2	75	6*	21142906
12.47 & 13.2	150	12*	21124201
12.47 & 13.2	300	25*	21124300
12.47 & 13.2	500	40*	9220285549
12.47 & 13.2	750	65*	9220285559
12.47 & 13.2	1000	100**	9220176434
12.47 & 13.2	1500	100**	9220176434
12.47 & 13.2	2500	125**	9220176436
12.47 & 13.2	3000	140***	21144407
24.94	75	5*	21124102
24.94	150	8*	21124508
24.94	300	15*	21124607
24.94	500	25*	21124300
24.94	750	40*	9220285549
24.94	1000	50*	9220285553
24.94	1500	65*	9220285559
24.94	2500	100**	9220176434

* BAY-O-NET FUSE LINKS ARE DUAL ELEMENT FUSES.
** BAY-O-NET FUSE LINKS ARE HIGH AMP OVERLOAD FUSES.
*** BAY-O-NET FUSE LINKS ARE DUAL SENSING FUSES.

NOTES:

1. DIP POLE FUSING RECOMMENDATIONS BASED ON SINGLE TRANSFORMER OF INDICATED SIZE. FOR MULTIPLE UNITS ON RADIAL FEED, CONSULT WITH AUTHORIZED DAP (DISTRIBUTION ASSET PERFORMANCE) PROTECTION ENGINEER FOR DIP POLE FUSING.
2. UNITS THAT CURRENTLY USE A COOPER 140 AMPERE RATED BAYONET FUSE (COOPER #4000358C18CB) SHOULD BE REFUSED WITH THE SAME (ITEM # 21144407).
3. ALL 3 FUSES (DIP POLE OR BAYONET) SHOULD BE REPLACED IF ONE BLOWS. FOR INSTANCE, IF ONE OF THE BAYONET FUSES BLOWS, ALL THREE BAYONET FUSES SHOULD BE REPLACED SINCE ONE OF THE OTHER FUSES COULD BE COMPROMISED.

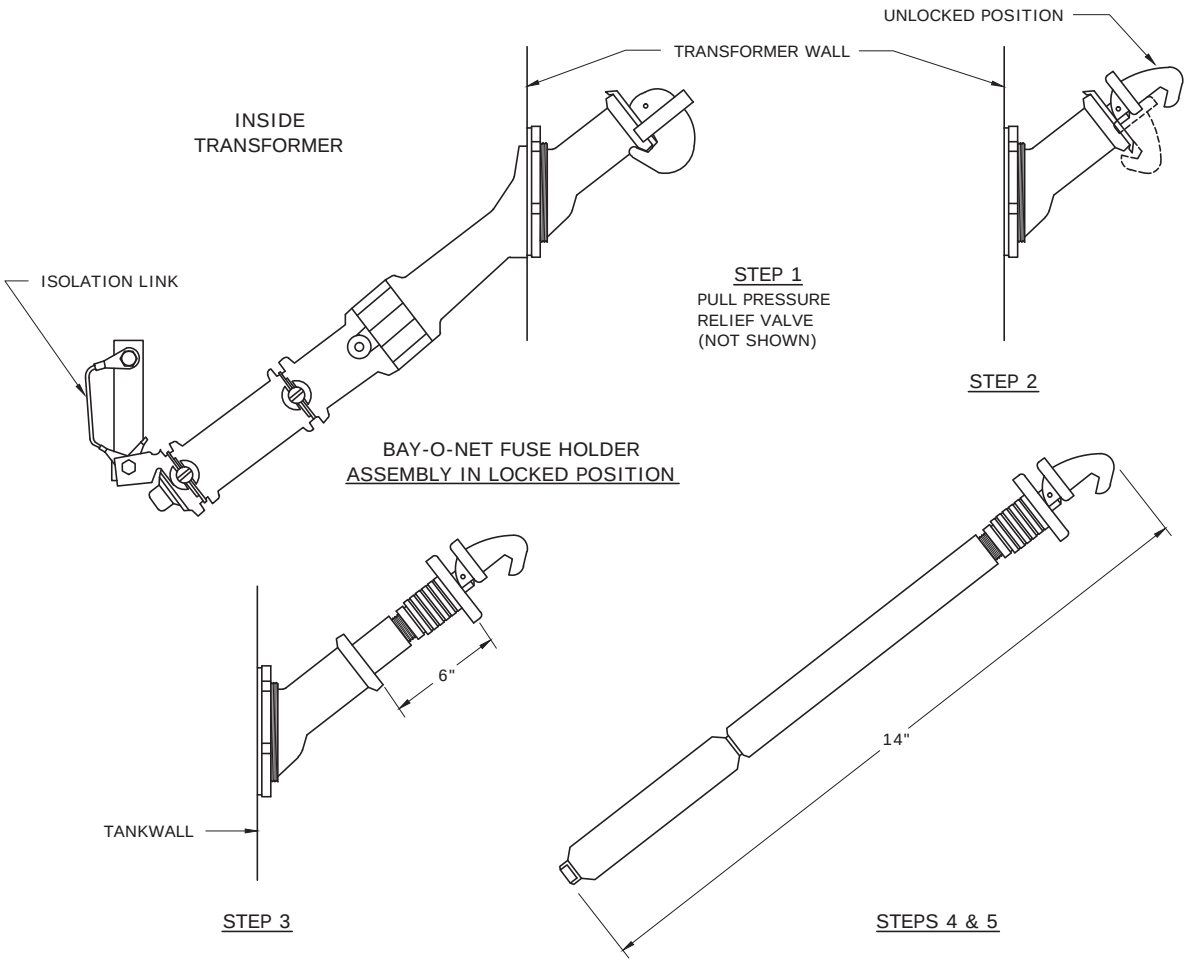
DUKE ENERGY.

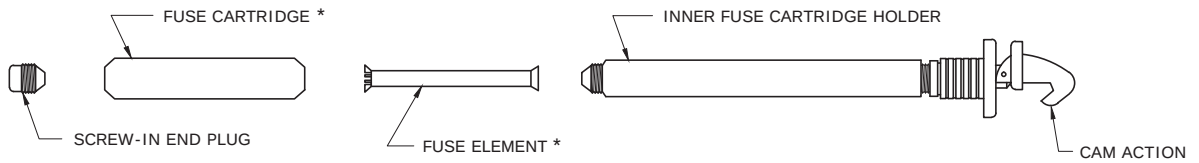
REVISED		BY	CK'D	APPR.
3				
2	3/31/17	MORGAN	BURLISON	ADCOCK
1	8/27/12	SIMMONS	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

STANDARD THREE-PHASE
PAD-MOUNTED TRANSFORMERS
AND BAY-O-NET FUSE TABLE

DEC	DEM	DEP	DEF
			X

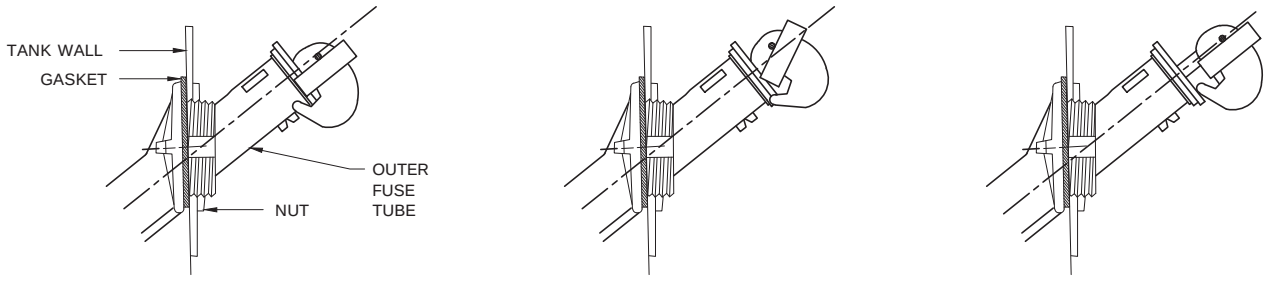
27.02-07





FUSE HOLDER ASSEMBLY

THE FUSE HOLDER ASSEMBLY (MINUS THE FUSE) CAN BE ORDERED AS CN 9220156356



STEP 6

*THE FOLLOWING FUSES COMBINE THE ELEMENT AND CARTRIDGE AS ONE COMPONENT - **DO NOT DISASSEMBLE.** 140 AMP (CN 21144407), 100 AMP (CN 9220176434), 125 AMP (CN 9220176436) AND SHORTING BAR (CN 9220176433).

3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

BAY-O-NET FUSE OPERATING INSTRUCTIONS

Duke Energy®

FLA

DWG. 27.02-09

NOTES FOR DWG. 27.02-09

IMPORTANT SAFETY AND ENVIRONMENTAL PRECAUTIONS

- **FOLLOW ALL SAFETY AND SWITCHING & TAGGING PROCEDURES**
- **BAY-O-NET FUSES MUST BE OPERATED UNDER OIL AT ALL TIMES**
- **BAY-O-NET FUSES MUST NOT BE OPERATED WHEN ANY OF THE FOLLOWING CONDITIONS EXIST:**
  - **VISIBLE DAMAGE TO TRANSFORMER**
  - **OIL LEVEL GAUGE (IF SO EQUIPPED) INDICATING LOW OIL**
  - **TRANSFORMER LEAKING OIL**
  - **TRANSFORMER BADLY LEANING (NO OIL ON BAY-O-NET FUSE)**
  - **ARCING SOUND COMING FROM TRANSFORMER**
  - **IF THE TRANSFORMER IS OPERATING WITH A LOW OIL LEVEL OR ARCING SOUNDS, IT NEEDS TO BE REPLACED. DE-ENERGIZE THE TRANSFORMER REMOTELY BEFORE OPERATING THE PRESSURE RELIEF DEVICE, TRANSFORMER ON/OFF SWITCH, BAYONET FUSE, ETC.**

STEP 1: USE APPROVED INSULATED STICK TO GENTLY PULL RING ON PRESSURE RELIEF VALVE TO RELEASE INTERNAL PRESSURE BEFORE UNLATCHING OR REMOVING BAY-O-NET FUSE.

STEP 2: ATTACH APPROVED INSULATED STICK (SHOTGUN) TO FUSE HANDLE. PULL FUSE HANDLE TO THE OPEN POSITION AND ROTATE FUSE ASSEMBLY 90 DEGREES. THIS WILL BREAK ANY ADHESION BETWEEN THE SEAL GASKET AND THE OUTER TUBE ASSEMBLY. SOME ADDITIONAL TANK PRESSURE MAY BE RELEASED.

STEP 3: PULL OUT THE FUSE HOLDER ABOUT SIX INCHES TO INTERRUPT THE LOAD. WAIT A FEW SECONDS FOR THE OIL TO DRAIN INTO THE TANK. AVOID DRIPPING OIL ON CABLES: IT WILL DAMAGE THE INSULATION. REMOVE THE FUSE ASSEMBLY.

STEP 4: WIPE OFF THE HOLDER IN PREPARATION TO REMOVING THE FUSE CARTRIDGE. WHILE THERE IS NO OUTSIDE INDICATING DEVICE THAT SHOWS THE FUSE IS BLOWN, IT CAN BE CHECKED WITH AN OHM METER BEFORE REMOVING THE FUSE FROM THE FUSE CARTRIDGE. UNSCREW FUSE CARTRIDGE, REMOVE END PLUG AND INSPECT THE FUSE. TO REMOVE THE FUSELINK, STRAIGHTEN SCALLOPED END FERRULE AND PUSH THE FUSE LINK OUT OF THE FUSE HOLDER.

CAUTION: COOPER HI-AMP OVERLOAD BAYONET FUSES CANNOT BE REMOVED FROM THE FUSE CARTRIDGE [CN 9220176434 (100 AMP), CN 9220176436 (125 AMP) AND CN 9220176433 (SHORTING BAR]. THE COOPER 140 AMP DUAL SENSING BAYONET FUSE (CN 21144407) IS ALSO INTEGRAL TO THE FUSE CARTRIDGE. THE ENTIRE FUSE CARTRIDGE MUST BE REPLACED ON THESE ITEMS.

STEP 5: TO INSTALL NEW FUSE, BE SURE THE FORMED END-FERRULE OF THE FUSE IS SECURED IN PLACE BETWEEN THE FUSE CARTRIDGE AND THE HOLDER. TIGHTEN BEFORE THE END PLUG IS INSERTED. TIGHTEN THE END PLUG TO EXPAND THE SCALLOPED END-FERRULE. USE AN ADJUSTABLE WRENCH TO TIGHTEN ALL CONNECTIONS. THE FUSE CARTRIDGE HOLDER ASSEMBLY IS READY FOR REINSTALLING IN THE TRANSFORMER.

STEP 6: USING AN APPROVED INSULATED STICK (SHOTGUN) REINSTALL FUSE ASSEMBLY INTO OUTER FUSE TUBE TO A FULLY SEATED POSITION. PROPERLY LATCH THE FUSE ASSEMBLY IN THE LOCKED POSITION UNDER THE LIP OF THE OUTER FUSE TUBE AS SHOWN. IF THE ASSEMBLY IS NOT PROPERLY LATCHED, ARCING WILL OCCUR BETWEEN THE FUSE CONTACTS AND WILL EVENTUALLY CAUSE THE TRANSFORMER TO FAIL.

NOTES:

1. ALL THREE FUSE ELEMENTS IN A THREE-PHASE TRANSFORMER SHOULD BE REPLACED WHEN ENCOUNTERING ONE BLOWN FUSE ELEMENT.

2. TO RAISE OR LOWER THE PRIMARY TAP CHANGER (IF SO EQUIPPED), THE TRANSFORMER MUST BE DE-ENERGIZED. PRIOR TO CHANGING TAPS, ONE OF THE FOLLOWING MUST BE DONE:
   - PLACE TRANSFORMER "ON/OFF" SWITCH IN THE "OFF" POSITION OR
   - COMPLETELY SWITCH OUT THE TRANSFORMER (PARK CABLES ON EITHER SIDE) OR
   - UTILIZE FEED THRU BUSHINGS

3. THE BAY-O-NET FUSE CAN BE A LOADBREAK DEVICE ON ALL PAD-MOUNT TRANSFORMERS. SEE NOTE 4 FOR SPECIAL OPERATING PROCEDURE ON 2500 AND 3750KVA TRANSFORMERS.

4. BAY-O-NET FUSES IN 2500 KVA AND 3750 KVA TRANSFORMERS AT 23 KV SHOULD BE OPERATED AS DESCRIBED ABOVE ONLY IF ONE OF THE FOLLOWING ACTIONS HAS BEEN TAKEN:
   - OPEN INTERNAL OIL SWITCH, IF SO EQUIPPED
   - HAVE CUSTOMER OPEN MAIN DISCONNECT TO DROP LOAD
   - SWITCH OUT TRANSFORMER

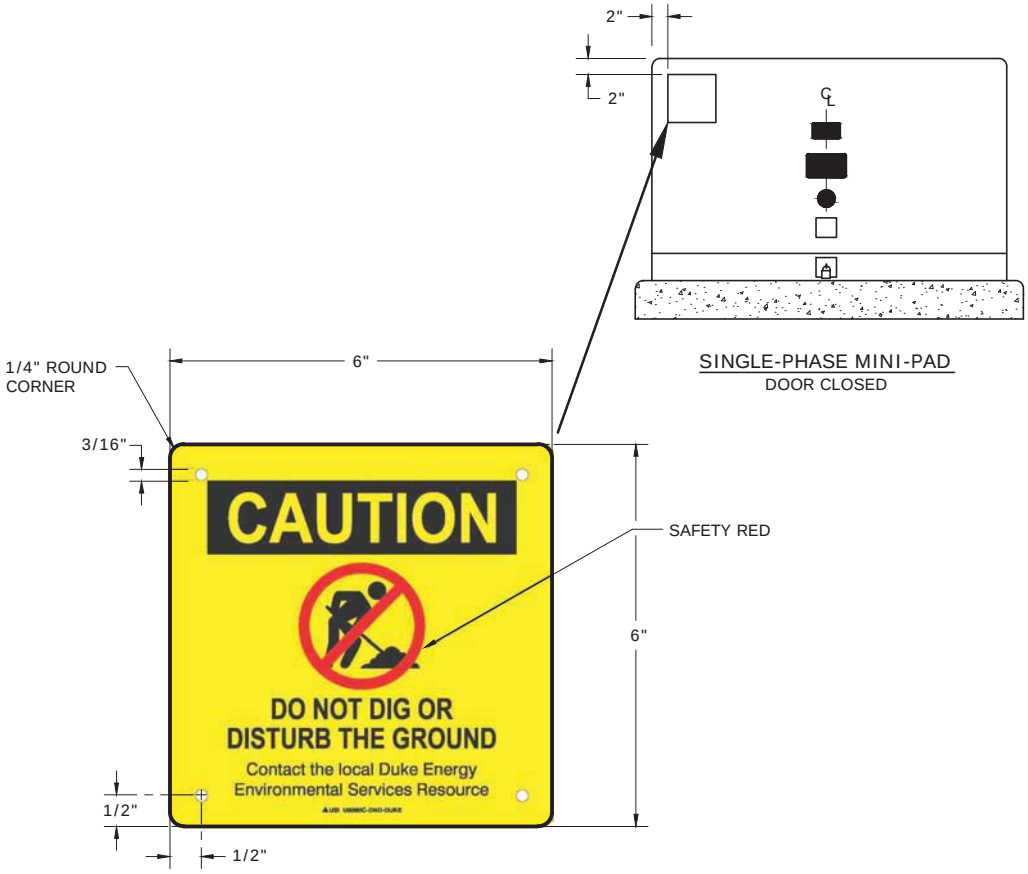
REVISED		BY	CK'D	APPR.
3				
2				
1	3/17/14	SIMMONS	GUINN	ADCOCK
0	6/29/10	SIMMONS	GUINN	ELKINS

BAY-O-NET FUSE OPERATING INSTRUCTIONS

DUKE ENERGY.

PGN DWG. 27.02-10

LOCATION OF BROWNFIELD LABEL
(FIELD APPLIED)



SINGLE-PHASE MINI-PAD
DOOR CLOSED

REGION	COMPATIBLE UNIT	ITEM NUMBER
DEC	MISC-SIGN-BROWNFIELD-UG-C	1542559
DEM	MISC-SIGN-BROWNFIELD-UG-M	1542559
DEP	MISC-SIGN-BROWNFIELD-UG-P	1542559
DEF	MISC-SIGN-BROWNFIELD-UG-F	1542559

NOTES:

1. A 'BROWNFIELD' IS A PROPERTY THAT HAS KNOWN PAST OR CURRENT ENVIRONMENTAL IMPACTS AND WHICH MAY HAVE ACCESS OR USE RESTRICTIONS ON SOME OR ALL OF THE PARCEL(S).
2. ALL FACILITIES LOCATED WITHIN A BROWNFIELD SITE, AS IDENTIFIED BY EH&S, SHALL HAVE THIS TAG APPLIED.
3. FOR PAD-MOUNTED FACILITIES, THIS LABEL SHALL BE PLACED ON THE FRONT PANEL, IN THE UPPER LEFT HAND CORNER AS SHOWN ABOVE.
4. SURFACE TEMPERATURE SHOULD NOT BE BELOW 50° F WHEN LABEL IS APPLIED.
5. WIPE METAL SURFACES WITH CABLE CLEANER AND A CLEAN CLOTH BEFORE APPLYING LABEL.
6. LABELS MUST BE APPLIED CAREFULLY. ONCE THIS MATERIAL IS APPLIED, IT CANNOT BE MOVED.
7. WHEN A POLE OR PIECE OF EQUIPMENT WITH THE BROWNFIELD TAG IS ENCOUNTERED IN THE FIELD, CONTACT THE LOCAL DUKE ENERGY ENVIRONMENTAL SERVICES RESOURCE FOR INSTRUCTIONS BEFORE DIGGING.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	8/7/17	EANES	BURLISON	ADCOCK

LABELING SINGLE-PHASE
PAD-MOUNTED TRANSFORMERS
LOCATED WITHIN AN IDENTIFIED BROWNFIELD SITE

DEC	DEM	DEP	DEF
X	X	X	X

27.02-116C

PURPOSE:

TO GUIDE IN THE INSTALLATION OF ELBOW SURGE ARRESTERS ON THE UNDERGROUND DISTRIBUTION SYSTEM.

SAFETY:

SAFETY SHALL BE OF FIRST IMPORTANCE IN THE PERFORMANCE OF ALL DUTIES. OBSERVE ALL SAFETY RULES AND PRACTICES AT ALL TIMES.

GENERAL:

1. MAKE SURE THE MAXIMUM CONTINUOUS OPERATING VOLTAGE (MCOV) OF THE SYSTEM DOES NOT EXCEED THE MCOV OF THE ARRESTER.

MAXIMUM CONTINUOUS OPERATING VOLTAGE				
SYSTEM VOLTAGE (KV)	REGULATED		UNREGULATED	
	DUTY CYCLE (KV)	MCOV (KV)	DUTY CYCLE (KV)	MCOV (KV)
24.94GY/ 14.4	18	15.3	21	17
13.2GY / 7.62	10	8.4	10	8.4
12.47GY / 7.2	10	8.4	10	8.4

THE MCOV RATING OF THE ARRESTER IS PRINTED ON THE DISC LOCATED BENEATH THE OPERATING EYE.

2. CHECK CONTENTS OF PACKAGE FOR DAMAGE, RATINGS, AND COMPATIBILITY WITH MATING PARTS.

3. PREPLAN SPACE FOR THE ARRESTER AND GROUND LEADS SO THE OPERATION OF THIS OR OTHER LOADBREAK DEVICES IS NOT RESTRICTED.

4. CAUTION:

A. DO NOT HI-POT WITH ELBOW SURGE ARRESTERS INSTALLED. ARRESTERS ARE NOT RATED FOR HI-POT OVERVOLTAGES. IF SUBJECTED TO HI-POT OVERVOLTAGES, THEY WILL FAIL.

INSTALLATION PROCEDURE:

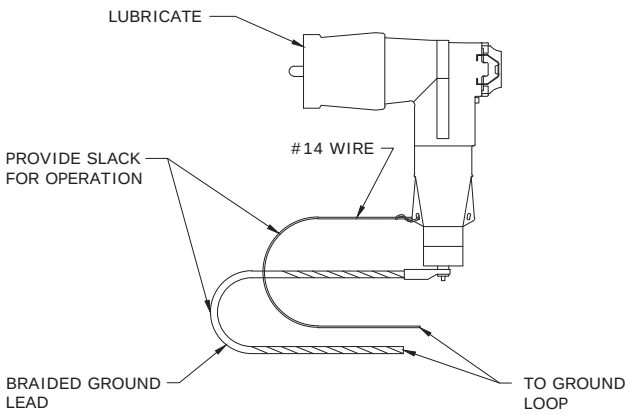
A. GROUNDING

CONNECT FREE END OF THE BRAIDED GROUND LEAD TO THE SYSTEM GROUND. ATTACH A #14 OR EQUIVALENT WIRE TO THE ELBOW GROUNDING EYE AND CONNECT TO THE SYSTEM GROUND IN THE SAME SPLIT BOLT CONNECTOR AS THE ELBOW ARRESTER BRAIDED GROUND LEAD ATTACHES TO THE SYSTEM GROUND.

B. LUBRICATION

APPLY A LIGHT, UNIFORM COAT OF SUPPLIED GREASE, WORKING THOROUGHLY INTO SURFACE.

CAUTION:
EXCESS GREASE MAY PREVENT THE ELBOW ARRESTER FROM BEING FULLY SEATED IN THE "LOCKED ON" POSITION. KEEP THE INTERNAL MATING SURFACE FREE FROM DIRT AND GRIME.



3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OPERATING PROCEDURE FOR INSTALLING ELBOW SURGE ARRESTERS

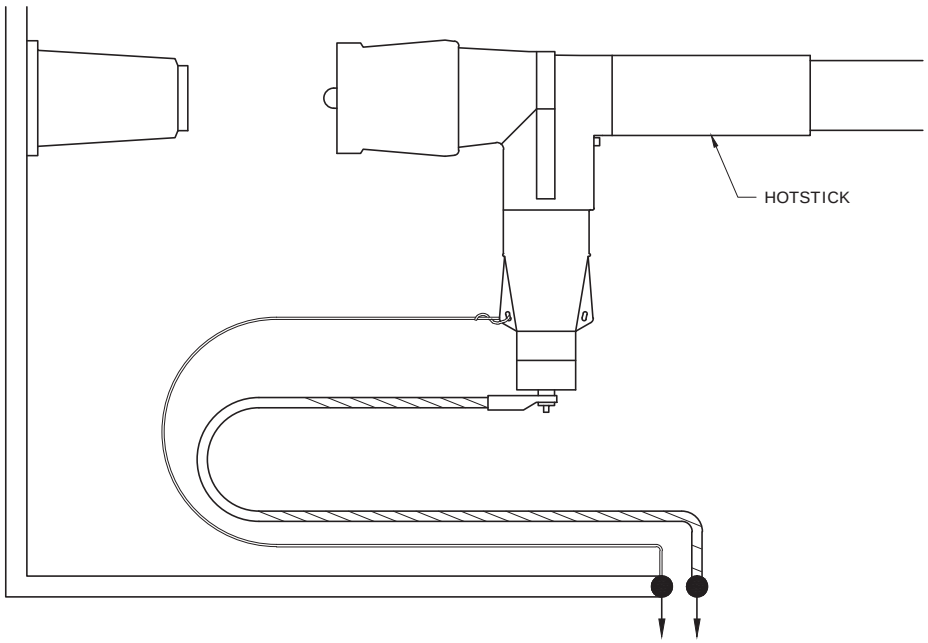
Duke Energy®

FLA

DWG. 27.03-02A

C. CONNECTION

1. OPERATE PER THE FOLLOWING INSTRUCTIONS: DO NOT OPERATE BY HAND
2. REMOVE EXISTING LOADBREAK ELBOW OR DEADEND RECEPTACLE FROM BUSHING WITH A HOTSTICK.
3. INSTALL A FEED THRU CONNECTOR ON EQUIPMENT PARKING STAND.
4. INSTALL FIRST ELBOW ARRESTER ON THE FEED THRU CONNECTOR.
5. INSTALL LOADBREAK ELBOW ON FEED THRU CONNECTOR ADJACENT TO THE ELBOW ARRESTER.
6. INSTALL SECOND ELBOW ARRESTER ON TRANSFORMER.
7. WHEN INSTALLING ELBOW ARRESTERS ON ENERGIZED CIRCUITS, THE FOLLOWING PROCEDURE SHOULD BE FOLLOWED:
   - A. FIRMLY TIGHTEN A HOTSTICK TO THE ELBOW ARRESTER OPERATING EYE.
   - B. POSITION ELBOW ARRESTER RECEPTACLE SO THAT ITS GROUNDED END POINTS ARE IN A DOWNWARD DIRECTION. PLACE THE ELBOW ARRESTER RECEPTACLE AREA OVER THE BUSHING, INSERTING THE PROBE TIP JUST INTO THE BUSHING.
   - C. TURN FACE AWAY AND FIRMLY THRUST THE ELBOW ARRESTER HOME WITH A FAST, STRAIGHT MOTION, WHICH WILL ENGAGE THE INTERNAL LOCK OF THE ELBOW ARRESTER ONTO THE BUSHING INTERFACE.
   - D. INSPECT GROUND LEADS FOR PROPER CONNECTION. IF EITHER GROUND LEAD DISCONNECTS DURING OPERATION, DO NOT ATTEMPT TO REATTACH WITHOUT FIRST PULLING ARRESTER OFF THE BUSHING WITH HOTSTICK.



3				
2				
1				
0	6/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

OPERATING PROCEDURE FOR INSTALLING
ELBOW SURGE ARRESTERS

Duke Energy®

PGN DWG. 27.03-02B

UNDERGROUND CIRCUITS WHERE OVER VOLTAGES MAY OCCUR FROM FERRORESONANCE

DUKE ENERGY FLORIDA HAS ONE TYPE OF THREE-PHASE DISTRIBUTION TRANSFORMER CONNECTION SERVED WITH UNDERGROUND PRIMARY CABLE THAT IS SUSCEPTIBLE TO FERRORESONANCE OVERVOLTAGES IF CERTAIN OPERATIONAL PROCEDURES ARE NOT FOLLOWED.

A. GROUNDED WYE-GROUNDED WYE PAD-MOUNTED TRANSFORMERS (WITH NO LOAD CONNECTED)

- **DE-ENERGIZING THE TRANSFORMER:** REMOVE THE ELBOWS FROM THE INSERT BUSHING AND PLACE THE ENERGIZED CABLE ON INSULATING STANDOFF BUSHINGS. THEN DE-ENERGIZE THE CABLE. IF TRANSFORMER CONTAINS A THREE-PHASE LOADBREAK SWITCH IN THE PRIMARY COMPARTMENT, THE TRANSFORMER CAN BE DE-ENERGIZED WITH THIS SWITCH IN LIEU OF REMOVING THE ELBOWS.

- **ENERGIZING THE TRANSFORMER:** WITH THE ELBOWS ON INSULATING STANDOFF BUSHINGS IN THE TRANSFORMER, ENERGIZE THE CABLE. THEN ENERGIZE THE TRANSFORMER BY INSERTING THE ELBOWS ONTO THE BUSHING INSERTS. IF THE TRANSFORMER CONTAINS A THREE-PHASE LOADBREAK SWITCH IN THE PRIMARY COMPARTMENT, THE TRANSFORMER CAN BE ENERGIZED WITH THIS SWITCH IF ELBOWS ARE CONNECTED TO THE BUSHING INSERTS.

NOTE: THE IMPORTANT THING TO REMEMBER THAT APPLIES TO ALL THREE TYPES OF THESE TRANSFORMER CONNECTION/SITUATIONS IS TO NEVER HAVE A PARTIALLY ENERGIZED TRANSFORMER BANK, BACK-FEEDING UNDERGROUND PRIMARY CABLE.

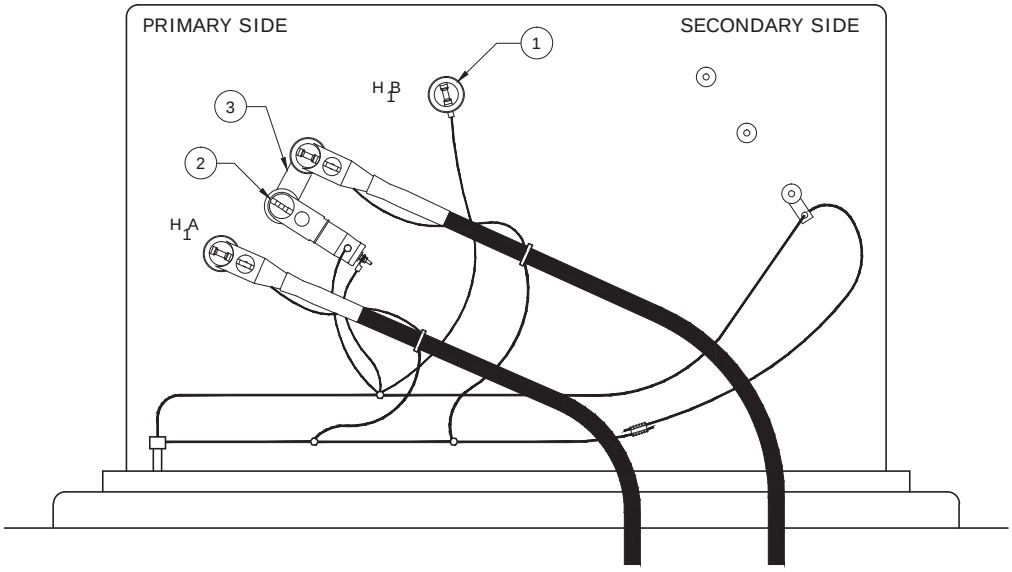
REVISED		BY	CK'D	APPR.
3				
2	11/6/13	SIMMONS	DANNA	ADCOCK
1	10/12/12	SIMMONS	BURLISON	ADCOCK
0	10/29/10	SIMMONS	GUINN	ELKINS

OPERATING PROCEDURE FOR
MITIGATION OF FERRORESONANCE
IN UNDERGROUND CIRCUITS

DUKE ENERGY.

FLA

DWG. 27.03-02C



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY PER MACRO	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	TUA15DUSTCOVF	1	326246	1	DUST COVER
	2	ARREL10F	1	162206	1	CONNECTOR, VISE TYPE 1/0 CU
				220526	1	ARRESTER, ELBOW, 10KV
	3	TUAFDTHR152WF	1	326222	1	BUSHING, FEED-THRU, 2-WAY

NOTES:

1. TRAIN PRIMARY CABLE TO FINAL ASSEMBLED POSITION ALLOWING SLACK FOR LOADBREAK OPERATION.
2. TRANSFORMERS WITH HIGH VOLTAGE UNDER OIL LIGHTNING ARRESTERS (HVLA) WILL HAVE A HVLA DECAL.
3. INSTALL ARRESTERS AT NORMAL OPENING POINTS.
4. SPLIT BOLT CONNECTOR CAN BE USED TO CONNECT THE ELBOW ARRESTER GROUND LEAD TO THE #4 BC GROUND LOOP. DO NOT SHORTEN THE ELBOW ARRESTER GROUND LEAD.
5. SEE DWG. 27.01-03 FOR GROUNDING DETAILS.

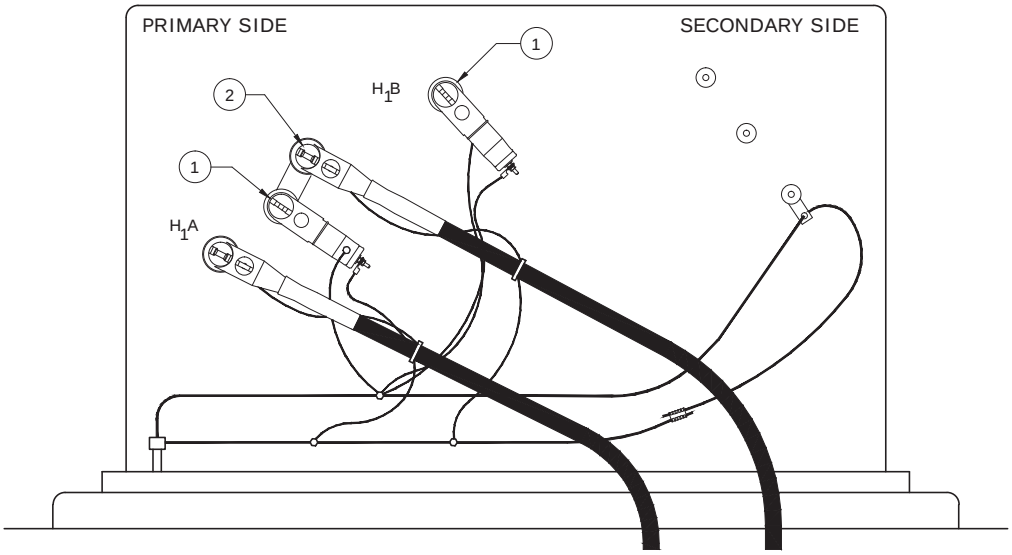
REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

ARRESTER - FEED-THRU SINGLE-PHASE PAD-MOUNT WITH INTERNAL ARRESTER

Progress Energy

FLA

DWG. 27.03-12



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY PER MACRO	CATALOG NUMBER	QTY PER CU	DESCRIPTION
AE1L M	1	ARREL10F	2	162206	1	CONNECTOR, VISE TYPE 1/0 CU
				220526	1	ARRESTER, ELBOW, 10KV
	2	TUAFDTHR152WF	1	326222	1	BUSHING, FEED-THRU, 2-WAY

NOTES:

1. TRAIN PRIMARY CABLE TO FINAL ASSEMBLED POSITION ALLOWING SLACK FOR LOADBREAK OPERATION.
2. TRANSFORMERS WITH HIGH VOLTAGE UNDER OIL LIGHTNING ARRESTERS (HVLA) WILL HAVE A HVLA DECAL.
3. INSTALL ARRESTERS AT NORMAL OPENING POINTS AND IN LAST TRANSFORMER OF RADIAL FEED.
4. SPLIT BOLT CONNECTOR CAN BE USED TO CONNECT THE ELBOW ARRESTER GROUND LEADS TO THE #4 BC GROUND LOOP. DO NOT SHORTEN THE ELBOW ARRESTER GROUND LEAD.
5. SEE DWG. 27.01-03 FOR GROUNDING DETAILS.

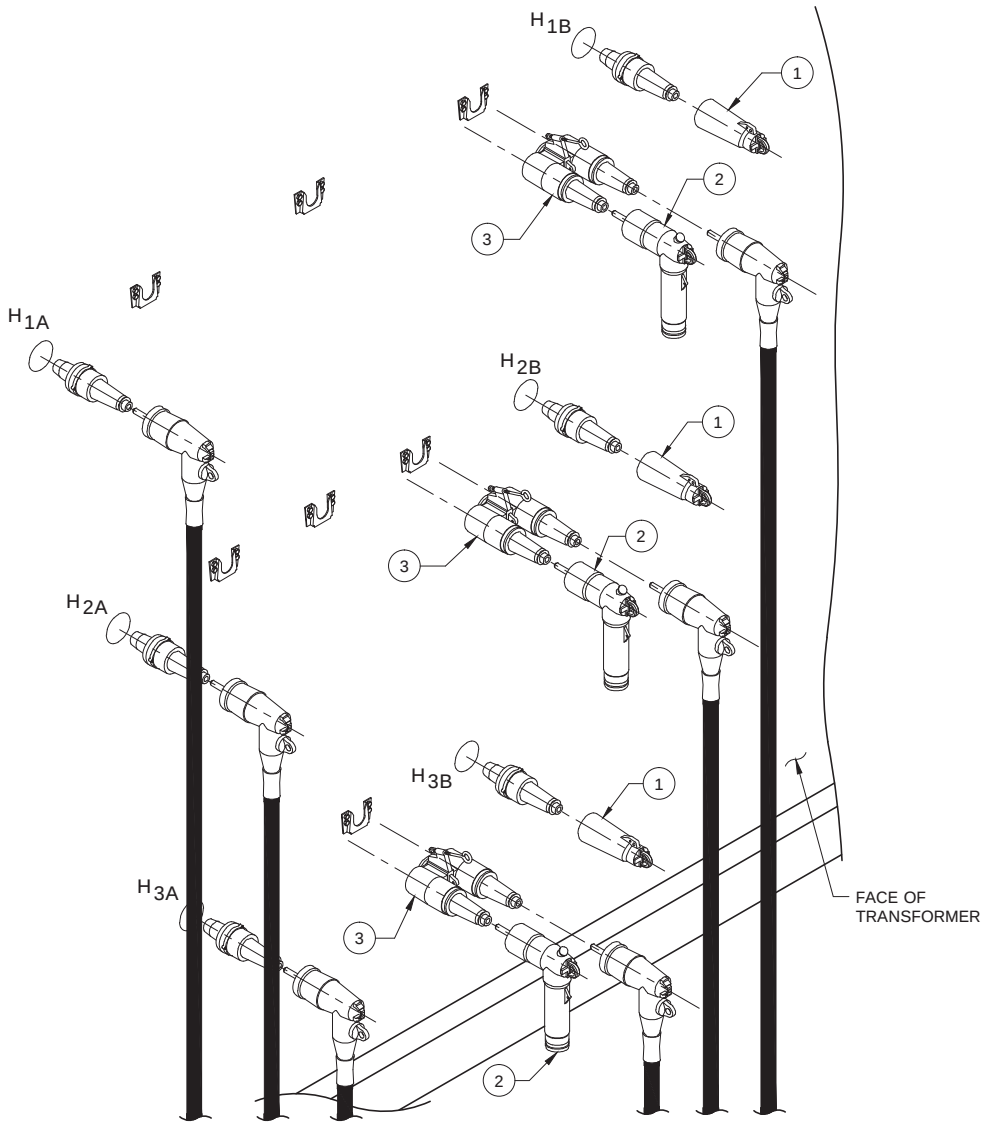
REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

ARRESTER-ELBOW AND FEED-THRU,
SINGLE-PHASE PAD-MOUNT
WITHOUT INTERNAL ARRESTER

Progress Energy

FLA

DWG. 27.03-13



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	TUA15DUSTCOVF	3	326246	1	DUST COVER
	2	ARREL10F	3	162206	1	CONNECTOR, VISE TYPE 1/0 CU
				220526	1	ARRESTER, ELBOW, 10KV
	3	TUAFDTHR152WF	3	326222	1	BUSHING, FEED-THRU, 2-WAY

NOTES:

1. TRAIN PRIMARY CABLE TO FINAL ASSEMBLED POSITION ALLOWING FOR LOADBREAK OPERATION.
2. TRANSFORMERS WITH HIGH VOLTAGE UNDER OIL LIGHTNING ARRESTERS (HVLA) WILL HAVE A HVLA DECAL.
3. DO NOT INSTALL PARKING STAND ARRESTERS ON THREE-PHASE PAD-MOUNTED TRANSFORMERS. THEIR PHYSICAL LOCATION AND LENGTH INTERFERES WITH THE OPERATION OF THE LOADBREAK ELBOW BELOW.
4. INSTALL ARRESTERS AT NORMAL OPENING POINTS.
5. CONNECT DRAIN WIRES AND ELBOW ARRESTER GROUNDS TO GROUND LOOP.

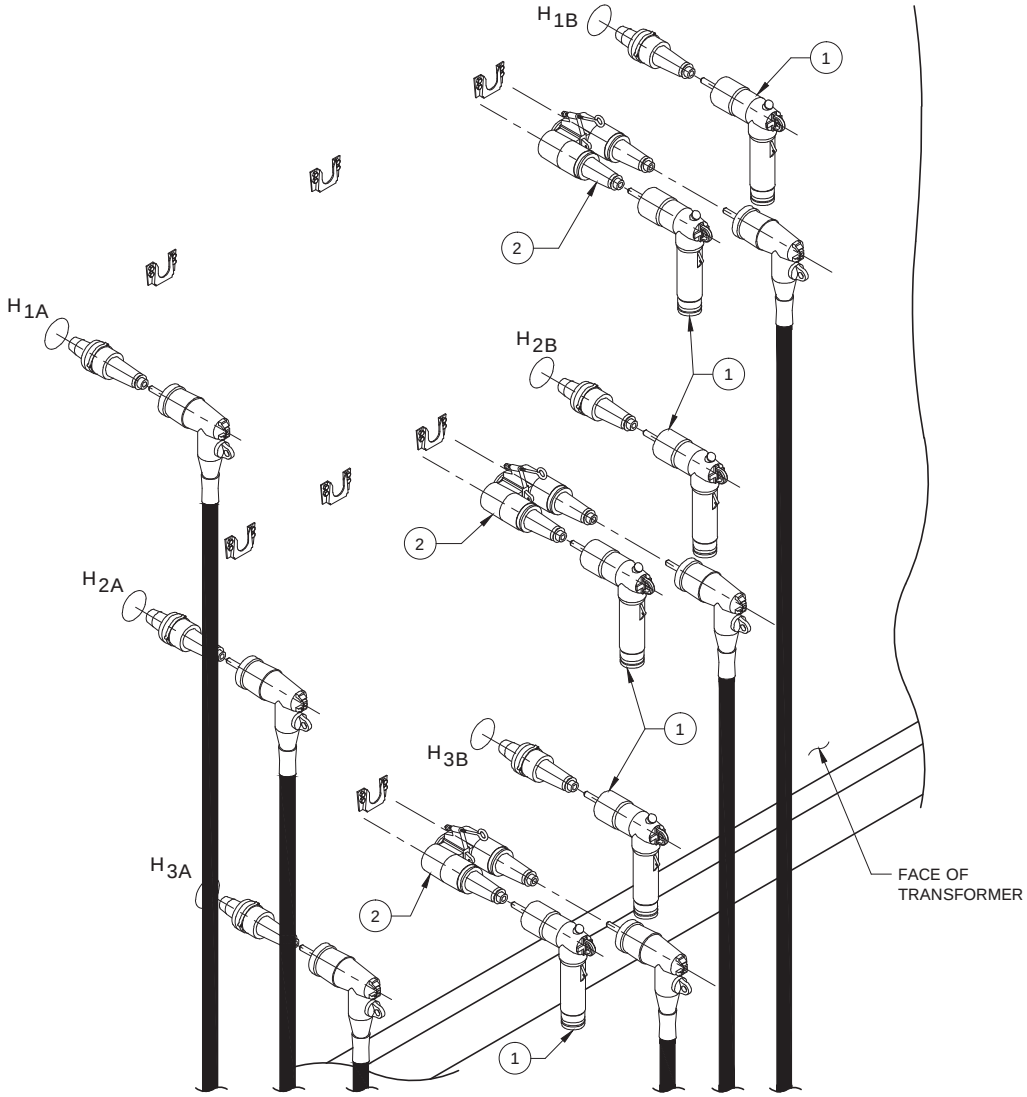
REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

ARRESTER-ELBOW
THREE-PHASE DEADFRONT LOOP
WITH INT-HVLA

Progress Energy

FLA

DWG. 27.03-14



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ARREL10F	6	162206	1	CONNECTOR, VISE TYPE 1/0 CU
				220526	1	ARRESTER, ELBOW, 10KV
	2	TUAFDTHR152WF	3	326222	1	BUSHING, FEED-THRU, 2-WAY

NOTES:

1. TRAIN PRIMARY CABLE TO FINAL ASSEMBLED POSITION ALLOWING FOR LOADBREAK OPERATION.
2. TRANSFORMERS WITH HIGH VOLTAGE UNDER OIL LIGHTNING ARRESTERS (HVLA) WILL HAVE A HVLA DECAL.
3. DO NOT INSTALL PARKING STAND ARRESTERS ON THREE-PHASE PAD-MOUNTED TRANSFORMERS. THEIR PHYSICAL LOCATION AND LENGTH INTERFERES WITH THE OPERATION OF THE LOADBREAK ELBOW BELOW.
4. INSTALL ARRESTERS AT NORMAL OPENING POINTS AND IN THE LAST TRANSFORMER OF RADIAL FEED.
5. CONNECT DRAIN WIRES AND ELBOW ARRESTER GROUNDS TO GROUND LOOP.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DANNA	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

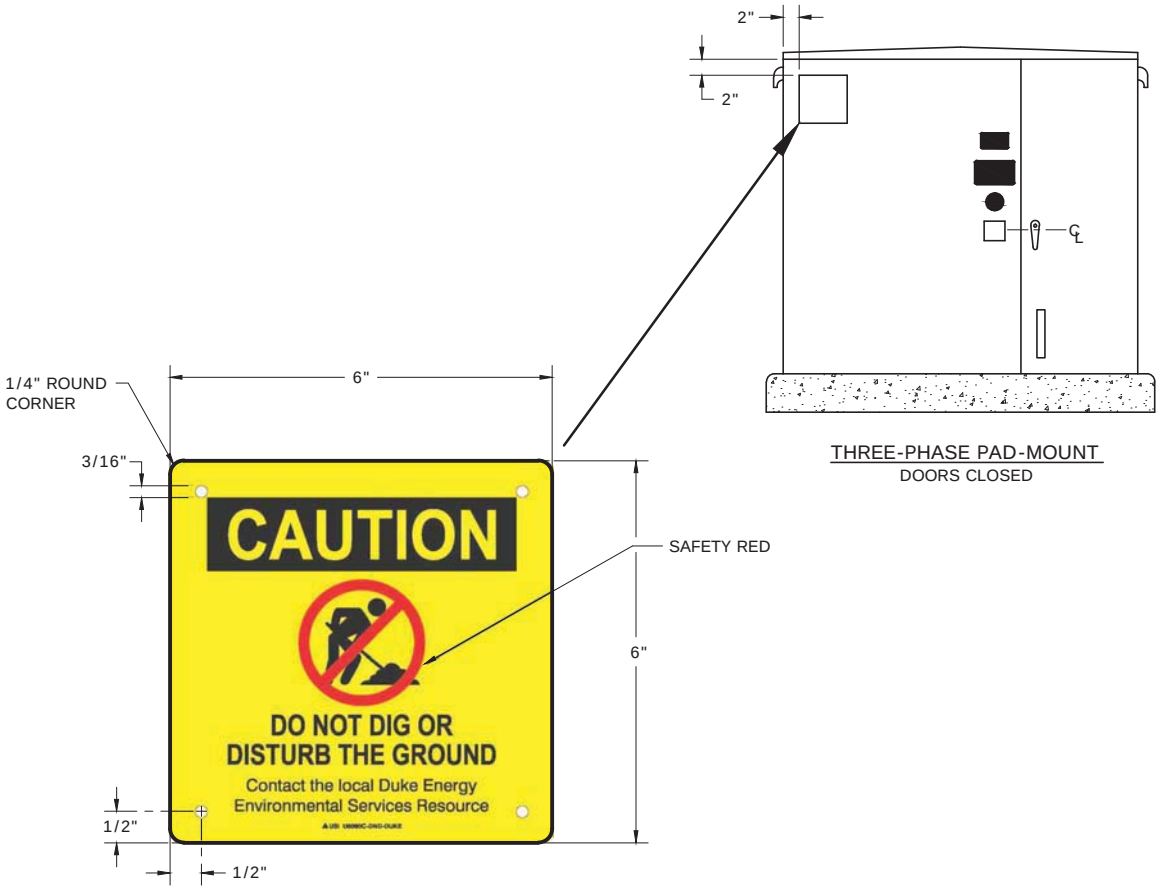
ARRESTER-ELBOW
THREE-PHASE DEADFRONT LOOP
NON INT-HVLA

Progress Energy

FLA

DWG. 27.03-15

LOCATION OF BROWNFIELD LABEL
(FIELD APPLIED)



THREE-PHASE PAD-MOUNT
DOORS CLOSED

REGION	COMPATIBLE UNIT	ITEM NUMBER
DEC	MISC-SIGN-BROWNFIELD-UG-C	1542559
DEM	MISC-SIGN-BROWNFIELD-UG-M	1542559
DEP	MISC-SIGN-BROWNFIELD-UG-P	1542559
DEF	MISC-SIGN-BROWNFIELD-UG-F	1542559

NOTES:

1. A 'BROWNFIELD' IS A PROPERTY THAT HAS KNOWN PAST OR CURRENT ENVIRONMENTAL IMPACTS AND WHICH MAY HAVE ACCESS OR USE RESTRICTIONS ON SOME OR ALL OF THE PARCEL(S).
2. ALL FACILITIES LOCATED WITHIN A BROWNFIELD SITE, AS IDENTIFIED BY EH&S, SHALL HAVE THIS TAG APPLIED.
3. FOR PAD-MOUNTED FACILITIES, THIS LABEL SHALL BE PLACED ON THE FRONT PANEL, IN THE UPPER LEFT HAND CORNER AS SHOWN ABOVE.
4. SURFACE TEMPERATURE SHOULD NOT BE BELOW 50°F WHEN LABEL IS APPLIED.
5. WIPE METAL SURFACES WITH CABLE CLEANER AND A CLEAN CLOTH BEFORE APPLYING LABEL.
6. LABELS MUST BE APPLIED CAREFULLY. ONCE THIS MATERIAL IS APPLIED, IT CANNOT BE MOVED.
7. WHEN A POLE OR PIECE OF EQUIPMENT WITH THE BROWNFIELD TAG IS ENCOUNTERED IN THE FIELD, CONTACT THE LOCAL DUKE ENERGY ENVIRONMENTAL SERVICES RESOURCE FOR INSTRUCTIONS BEFORE DIGGING.

DUKE ENERGY.

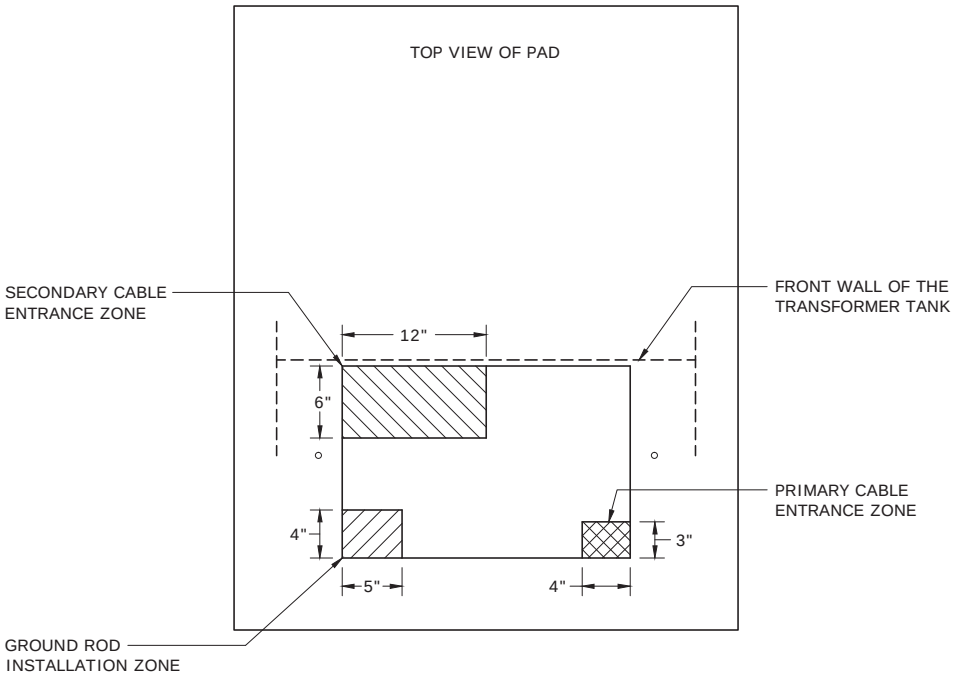
3				
2				
1				
0	8/7/17	EANES	BURLISON	ADCOCK
REVISED		BY	CHK'D	APPR.

LABELING THREE-PHASE
PAD-MOUNTED TRANSFORMERS
LOCATED WITHIN AN IDENTIFIED BROWNFIELD SITE

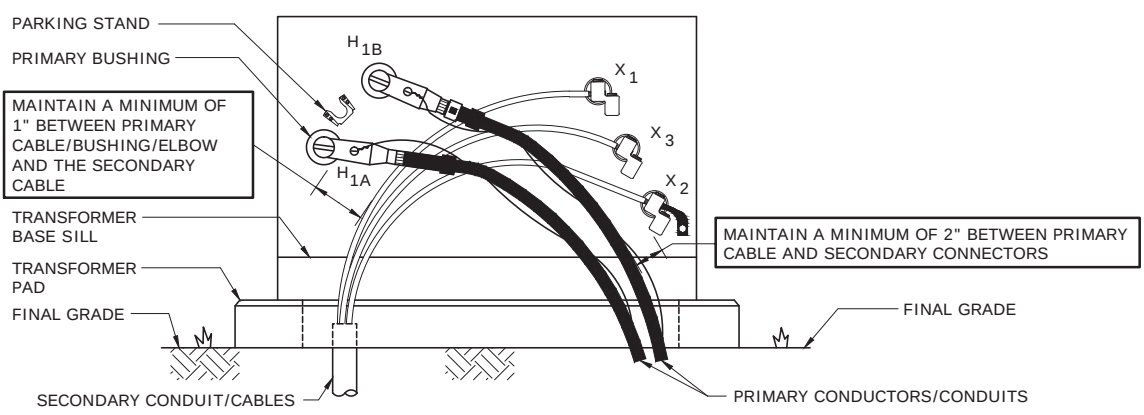
DEC	DEM	DEP	DEF
X	X	X	X

27.04-130C

CABLE, CONDUIT AND GROUND ROD ENTRANCE ZONES
FOR FLAT OR BOX PADS



CABLE TRAINING



NOTES:

1. ALL TRANSFORMERS SHALL BE BOLTED TO THE PAD WITH HOLD DOWN CLAMPS. USE CLAMPS SUPPLIED BY TRANSFORMER MANUFACTURER WITH EACH UNIT.
2. BOTH PRIMARY CABLES SHALL BE PROPERLY TRAINED SUCH THAT THE ELBOWS CAN BE FREE TO MOVE TO A STAND-OFF PLUG MOUNTED ON THE PARKING STAND WHILE USING AN INSULATED ELBOW PULLING STICK.
3. WHEN CONNECTING SECONDARY CABLES, START AT THE BACK (CLOSEST TO THE TANK) AND WORK TOWARD THE FRONT LEAVING THE CONNECTION HOLES CLOSEST TO THE FRONT OPEN FOR FUTURE INSTALLATIONS.

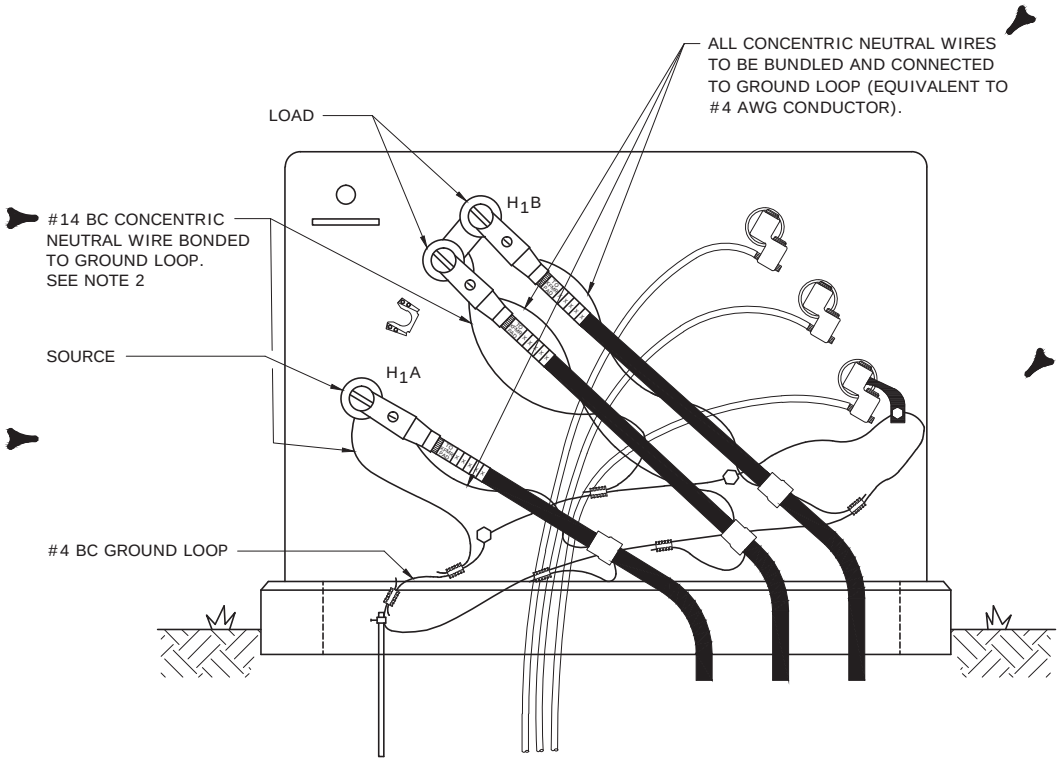
DUKE ENERGY.

3				
2				
1				
0	3/31/17	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE TRAINING FOR SINGLE-PHASE TRANSFORMERS ON A FLAT PAD OR BOX PAD

DEC	DEM	DEP	DEF
			X

27.05-00



NOTES:

1. ALL LOADBREAK ELBOWS SHALL BE PROPERLY CABLE TRAINED AND FREE TO MOVE TO AN INSULATING BUSHING (CN 326236) MOUNTED ON A PARKING STAND WHILE USING AN INSULATED ELBOX PULLING STICK.

2. BOND FEED THROUGH BUSHING INSERT (CN 326248), BUSHING INSERT (CN 326245) AND ALL ELBOWS (CN 326410) WITH #14 BC CONCENTRIC NEUTRAL WIRE. THIS CONNECTION CAN BE MADE TO THE GROUND LOOP OR METALLIC PARTS OF THE TRANSFORMER (SEE DWG. 27.01-03).

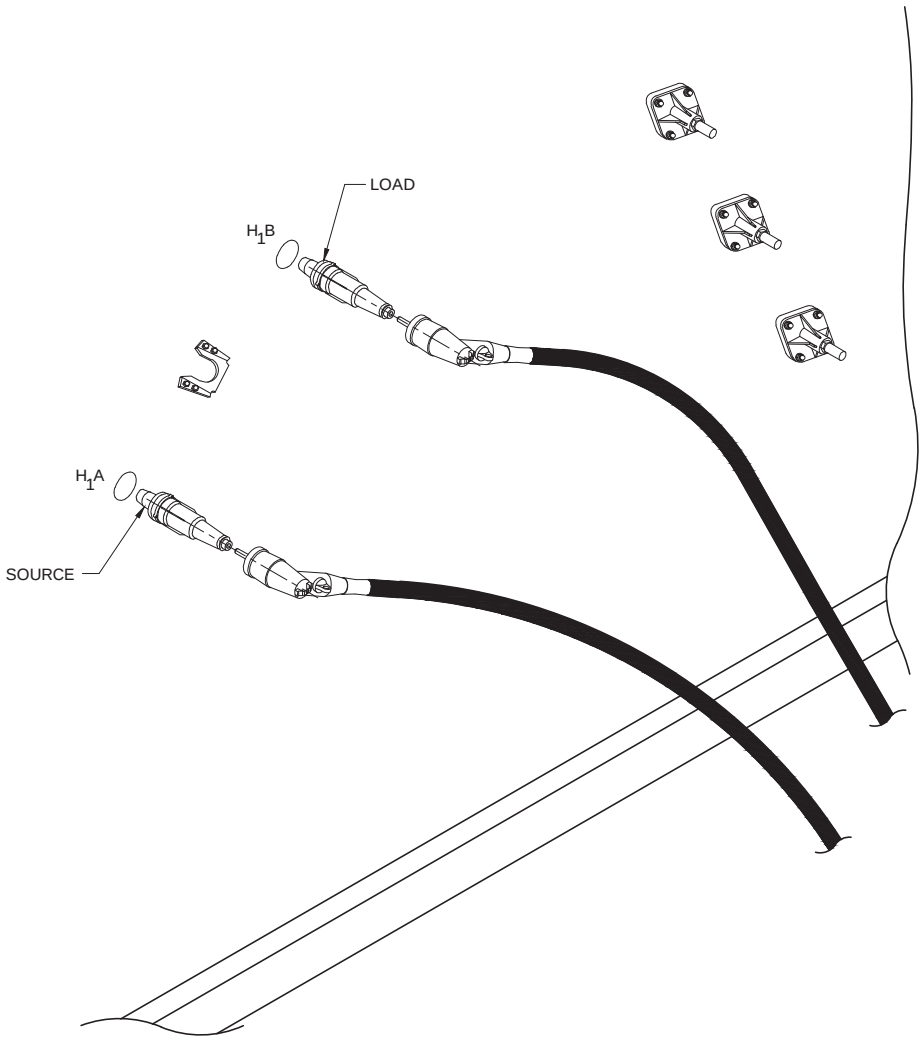
REVISED		BY	CK'D	APPR.
3				
2				
1	1/10/13	SIMMONS	DANNA	ADCOCK
0	10/29/10	SIMMONS	GUINN	ELKINS

FEED THROUGH BUSHING INSERT IN LOW PROFILE PAD-MOUNTED TRANSFORMERS

Duke Energy®

FLA

DWG. 27.05-10



BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	TUA15BUSHINLBEF	2	152197	1	BUSHING INSERT, EXTENDED

NOTES:

1. EXTENDED BUSHINGS SHOULD BE USED WHEN SECONDARIES CONTAIN 6 OR MORE RUNS OF 350KCM OR LARGER CABLE.

2. ALL LOADBREAK ELBOWS SHALL BE PROPERLY CABLE TRAINED AND FREE TO MOVE TO AN INSULATING BUSHING (CN 326236) MOUNTED ON A PARKING STAND WHILE USING AN INSULATED ELBOW PULLING STICK.

3. SEE DWG. 27.01-03 FOR PROPER GROUNDING DETAILS.

3				
2				
1				
O	7/7/11	DANNA	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

EXTENDED BUSHING INSERT IN

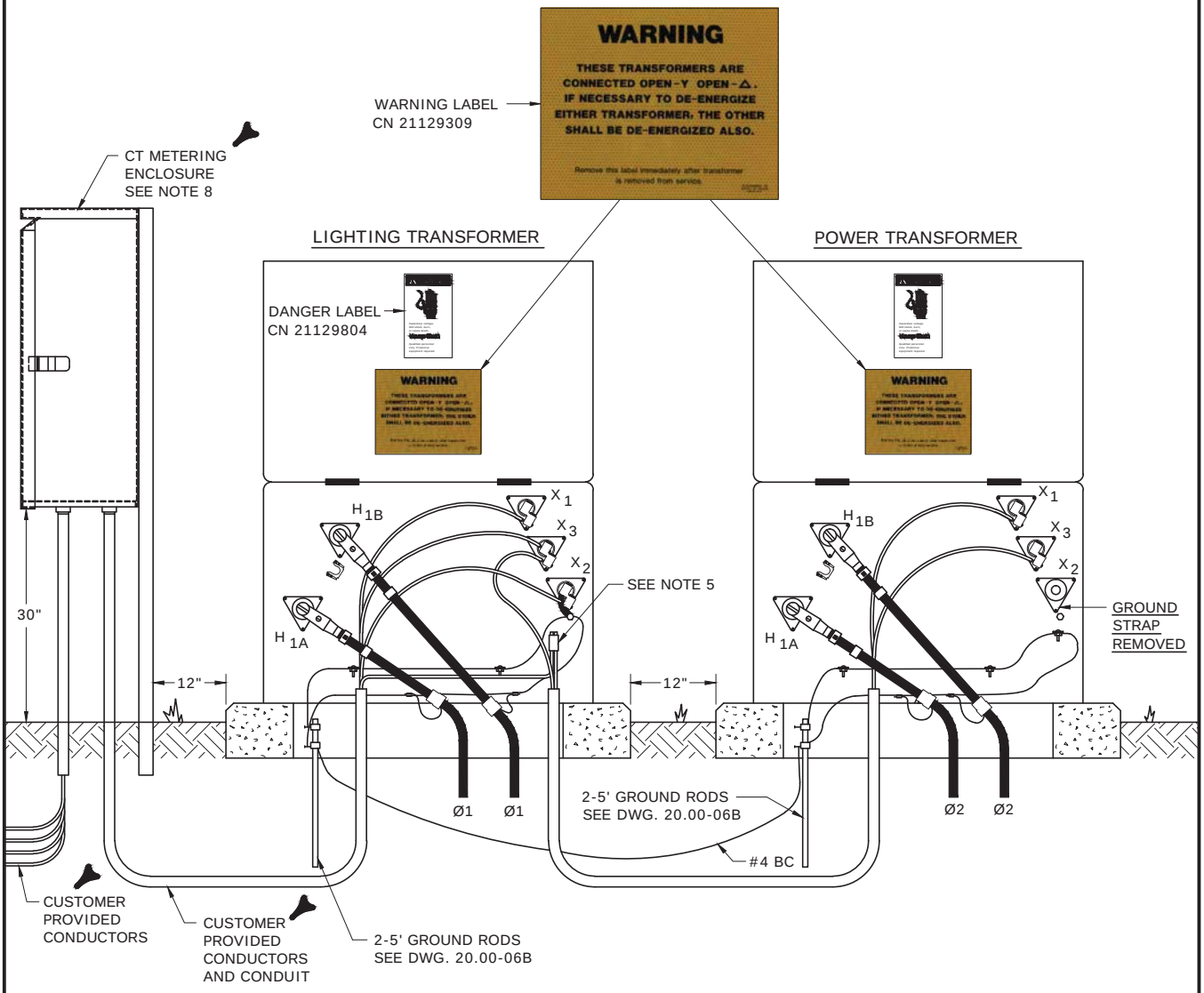
LOW PROFILE PAD-MOUNTED TRANSFORMERS

Progress Energy

FLA

DWG. 27.05-11

14.4KV CONNECTIONS - SUBTRACTIVE POLARITY



NOTES:

1. REMOVE X_2 GROUND STRAP ON POWER TRANSFORMER AND TAPE BUSHING WITH VINYL TAPE. GROUND STRAP ON LIGHTING TRANSFORMER MUST REMAIN ATTACHED BETWEEN TRANSFORMER TANK AND X_2 BUSHING.
2. LABEL ALL SECONDARY CABLES.
3. AFFIX "WARNING" LABEL (CN 21129309) INSIDE EACH TRANSFORMER DOOR. IT MUST BE VISIBLE WHEN THE DOOR IS IN THE FULLY OPEN POSITION.
4. DO NOT USE AS AN OPEN POINT BETWEEN TWO SEPARATE PHASES IN A SINGLE-PHASE RESIDENTIAL CABLE LOOP.
5. STUB UP CABLES WITH CONNECTOR BLOCK AND COVER (CU KPW4W40F).
6. CONSULT DST-EDGX-00033, VOLTAGE FLICKER TO DESIGN THIS INSTALLATION.
7. LIGHTING AND POWER TRANSFORMERS SHALL HAVE THE SAME ASSIGNED DIS (LOCID) NUMBER APPLIED TO THE OUTSIDE OF THE TRANSFORMER (SEE DWG. 27.00-03) AS WELL AS PRIMARY CONDUCTOR IDENTIFICATION (A, B OR C).
8. CUSTOMER PROVIDES ALL CONDUCTORS TO CT METERING ENCLOSURE FROM PAD-MOUNTED TRANSFORMERS. CUSTOMER PROVIDES CONDUCTORS FROM THE CT METERING ENCLOSURE TO SERVICE AND THE MOUNTING PROVISIONS FOR THE CT METERING ENCLOSURE.

DUKE ENERGY.

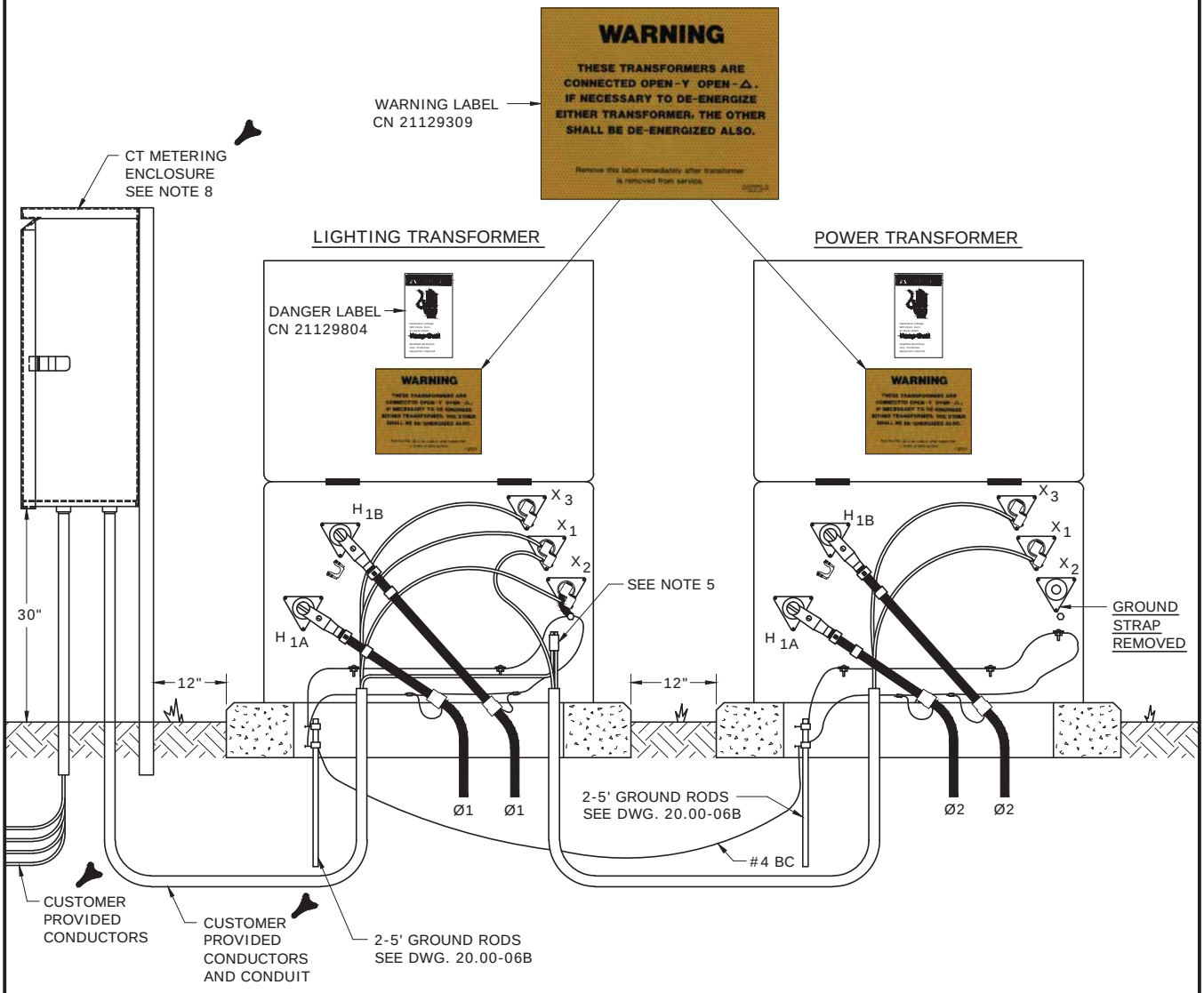
REVISED		BY	CK'D	APPR.
3				
2	9/19/14	SIMMONS	DANNA	ADCOCK
1	2/11/11	SIMMONS	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

OPEN WYE-OPEN DELTA TRANSFORMER BANK
120/240 VOLT, 4-WIRE SERVICE USING
SINGLE-PHASE 14.4KV PAD-MOUNTED TRANSFORMERS

DEC	DEM	DEP	DEF
			X

27.05-12

7.2 AND 7.6KV CONNECTIONS - ADDITIVE POLARITY



NOTES:

1. REMOVE X_2 GROUND STRAP ON POWER TRANSFORMER AND TAPE BUSHING WITH VINYL TAPE. GROUND STRAP ON LIGHTING TRANSFORMER MUST REMAIN ATTACHED BETWEEN TRANSFORMER TANK AND X_2 BUSHING.
2. LABEL ALL SECONDARY CABLES.
3. AFFIX "WARNING" LABEL (CN 21129309) INSIDE EACH TRANSFORMER DOOR. IT MUST BE VISIBLE WHEN THE DOOR IS IN THE FULLY OPEN POSITION.
4. DO NOT USE AS AN OPEN POINT BETWEEN TWO SEPARATE PHASES IN A SINGLE-PHASE RESIDENTIAL CABLE LOOP.
5. STUB UP CABLES WITH CONNECTOR BLOCK AND COVER (CU KPW4W40F).
6. CONSULT DST-EDGX-00033, VOLTAGE FLICKER TO DESIGN THIS INSTALLATION.
7. LIGHTING AND POWER TRANSFORMERS SHALL HAVE THE SAME ASSIGNED DIS (LOCID) NUMBER APPLIED TO THE OUTSIDE OF THE TRANSFORMER (SEE DWG. 27.00-03) AS WELL AS PRIMARY CONDUCTOR IDENTIFICATION (A, B OR C).
8. CUSTOMER PROVIDES ALL CONDUCTORS TO CT METERING ENCLOSURE FROM PAD-MOUNTED TRANSFORMERS. CUSTOMER PROVIDES CONDUCTORS FROM THE CT METERING ENCLOSURE TO SERVICE AND THE MOUNTING PROVISIONS FOR THE CT METERING ENCLOSURE.

DUKE ENERGY.

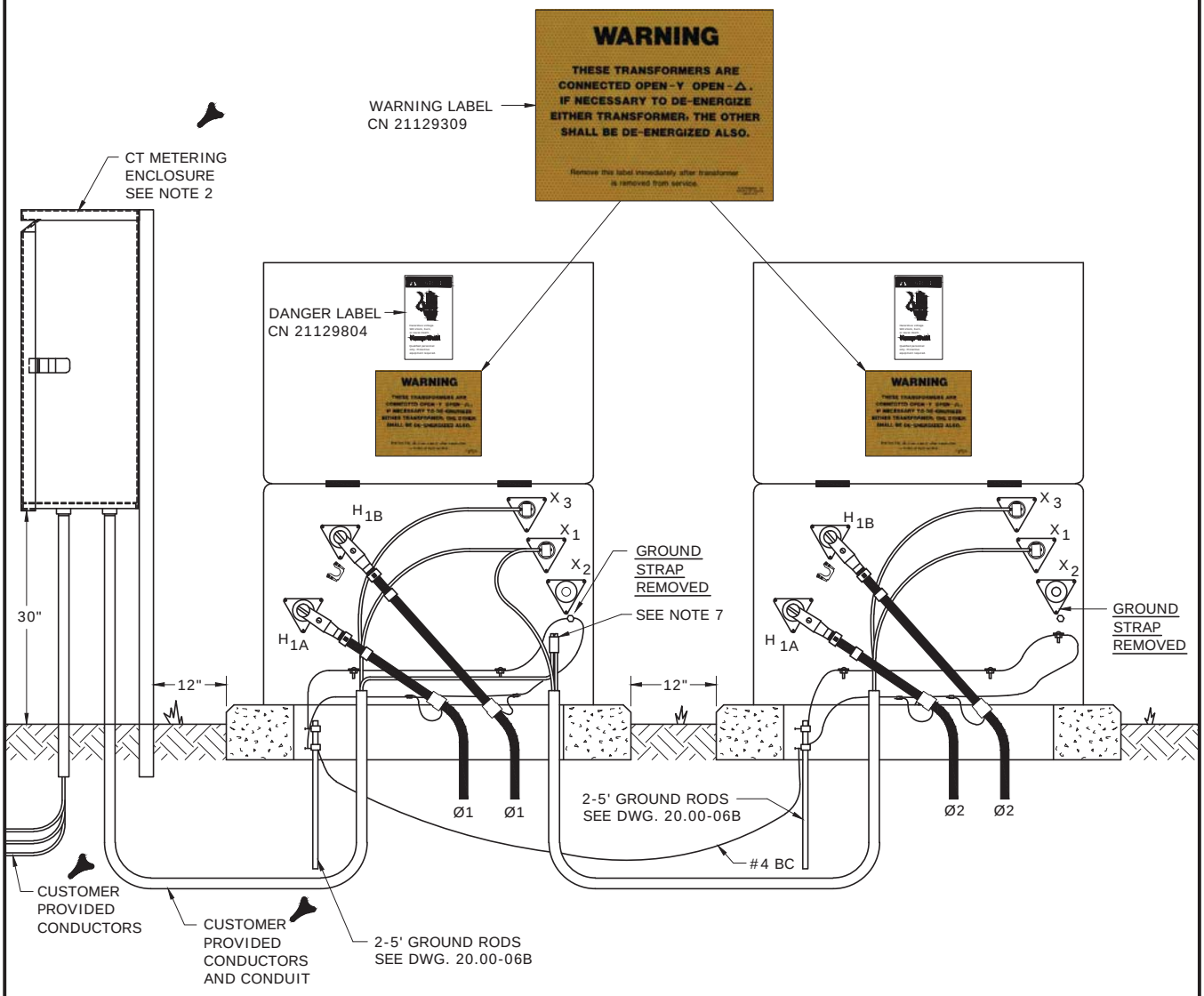
REVISED	BY	CK'D	APPR.
3			
2	9/19/14	SIMMONS	DANNA	ADCOCK
1	2/11/11	SIMMONS	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

OPEN WYE-OPEN DELTA TRANSFORMER BANK
120/240 VOLT, 4-WIRE SERVICE USING SINGLE-PHASE
7.2KV AND 7.6KV PAD-MOUNTED TRANSFORMERS

DEC	DEM	DEP	DEF
			X

27.05-13

7.2 AND 7.6KV CONNECTIONS - ADDITIVE POLARITY



NOTES:

1. TRANSFORMERS ARE 50 AND 167 KVA 240/480 VOLT PADMOUNTS FOR 480 VOLT, 3-WIRE SERVICE TO 480 VOLT PUMPS.
2. CUSTOMER PROVIDES ALL CONDUCTORS TO CT METERING ENCLOSURE FROM PAD-MOUNTED TRANSFORMERS. CUSTOMER PROVIDES CONDUCTORS FROM THE CT METERING ENCLOSURE TO SERVICE AND THE MOUNTING PROVISIONS FOR THE CT METERING ENCLOSURE.
3. REMOVE X_2 GROUND STRAP ON BOTH TRANSFORMERS AND TAPE BUSHING WITH VINYL TAPE.
4. LABEL ALL SECONDARY CABLES.
5. AFFIX "WARNING" LABEL (CN 21129309) INSIDE EACH TRANSFORMER DOOR. IT MUST BE VISIBLE WHEN THE DOOR IS IN THE FULLY OPEN POSITION.
6. DO NOT USE AS AN OPEN POINT BETWEEN TWO SEPARATE PHASES IN A SINGLE-PHASE RESIDENTIAL CABLE LOOP.
7. STUB UP CABLES WITH SUBMERSIBLE CONNECTOR (CU KPW4W40F).
8. IF CUSTOMER PROVIDES A NEUTRAL FOR CONNECTION TO THE TRANSFORMER, STOP ALL WORK AND OBTAIN CLARIFICATION FROM THE PROJECT PLANNER ON TYPE OF SERVICE REQUIRED. NEUTRAL CONNECTION MUST NOT BE INSTALLED ON THIS INSTALLATION.
9. GROUND LOOP IS CONNECTED TO CASE GROUND AND CONCENTRIC NEUTRAL.
10. IF CUSTOMER BRINGS A GROUND BOND TO THE TRANSFORMER, THEN THE BOND SHOULD BE CONNECTED TO THE TRANSFORMER GROUNDING LOOP.
11. BOTH TRANSFORMERS SHALL HAVE THE SAME ASSIGNED DIS (LOCID) NUMBER APPLIED TO THE OUTSIDE OF THE TRANSFORMER (SEE DWG. 27.00-03) AS WELL AS PRIMARY CONDUCTOR IDENTIFICATION (A, B OR C).

REVISED		BY	CK'D	APPR.
3	9/19/14	SIMMONS	DANNA	ADCOCK
2	5/24/12	DANNA	BURLISON	ELKINS
1	2/11/11	SIMMONS	BURLISON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

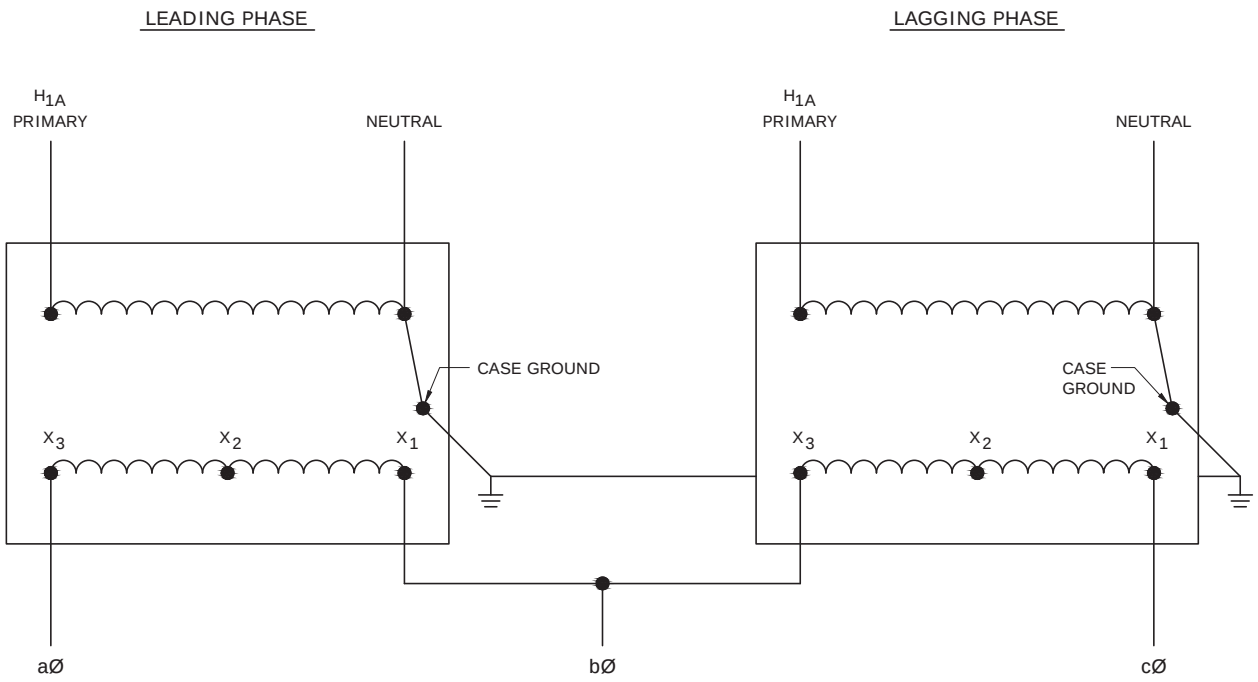
OPEN WYE-OPEN DELTA TRANSFORMER BANK
480 VOLT, 3-WIRE SERVICE USING SINGLE-PHASE
7.2KV AND 7.6KV PAD-MOUNTED TRANSFORMERS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

27.05-14A

7200/12470 TO 240/480V PAD-MOUNTED TRANSFORMER
-ADDITIVE POLARITY-



VOLTAGE CHECK:

- PHASE TO PHASE READINGS (a-b, b-c, c-a) WILL BE 480 VOLTS
- DO NOT CHECK PHASE TO GROUND VOLTAGE. PHASE TO GROUND VOLTAGE WILL VARY DUE TO THERE BEING NO GROUND REFERENCE ON SECONDARY CONNECTIONS.

3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE OPEN WYE-OPEN DELTA CONNECTION
7200/12470 TO 240/480V PAD-MOUNTED TRANSFORMER
480 VOLT THREE-PHASE THREE WIRE SERVICE

Duke Energy®

FLA

DWG. 27.05-14B

STANDARD THREE-PHASE, PAD-MOUNTED TRANSFORMERS

THE STANDARD THREE-PHASE PAD-MOUNTED TRANSFORMER IS A DEAD FRONT, LOOP FEED TRANSFORMER. RADIAL FEED TRANSFORMERS ARE NONSTANDARD AND WILL NO LONGER BE PURCHASED.

EMERGENCY CHANGEOUT OF RADIAL FEED UNITS

USING A LOOP FEED UNIT

(CONVERTING LIVE-FRONT TERMINATIONS TO DEAD-FRONT) AS A TEMPORARY "FIX", IT MAY BE MORE CONVENIENT TO CUT THE PRIMARY CABLE JUST BELOW THE STRESS CONE AND SPLICE ON A SECTION OF CABLE AND AN ELBOW IN THE PRIMARY COMPARTMENT OF THE TRANSFORMER. AN OUTAGE SHOULD BE SCHEDULED WITH THE CUSTOMER AT A LATER DATE TO CUT THE PRIMARY CABLE BACK TO A POINT WHERE THE SPLICE(S) MAY BE BURIED. IF CABLES ARE INSTALLED IN CONDUIT(S), THE ENTIRE CABLE RUN SHOULD BE REPLACED IF POSSIBLE.

STATIC VOLTAGE

IN THREE-PHASE PAD-MOUNTED TRANSFORMERS IF ONE PHASE IS OPEN ON THE PRIMARY SIDE YOU MAY STILL GET STATIC VOLTAGE READINGS ON THE SECONDARY SIDE OF THE TRANSFORMER DUE TO MAGNETIC FLUX. ANYTIME YOU GET ABNORMALLY HIGH SECONDARY VOLTAGE READINGS ON THE SECONDARY SIDE OF A THREE-PHASE PAD-MOUNTED TRANSFORMER, THE TRANSFORMER MAY BE SINGLE PHASING.

SECONDARY BUSHING/TERMINALS

1. THE OVERSIZED SECONDARY TERMINALS WE USE PROVIDE A LONG LEVER ARM AND MAKE BREAKAGE OF THE SECONDARY BUSHING EASY. IF EXCESS FORCE IS APPLIED TO THE TERMINAL WHEN CONNECTING CABLES YOU WILL BREAK THE SECONDARY BUSHING. PLEASE EXERCISE CARE WHEN TIGHTENING UP SECONDARY CABLES.

2. THE PRESENT SECONDARY TERMINALS WE USE ARE PINNED TO THE BUSHING STUD IN ADDITION TO HAVING A JAM NUT. OLDER SECONDARY BUSHINGS DO NOT HAVE THIS JAM NUT. IT IS POSSIBLE TO LOOSEN THE TERMINAL/JAM NUT WHEN CONNECTING CABLES TO THIS UNPINNED TERMINAL. ALWAYS CHECK AND TIGHTEN THE JAM NUT AFTER YOU HAVE FINISHED CONNECTING UP THE CABLES.

3				
2				
1				
0	8/17/12	SIMMONS	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE
PAD-MOUNTED TRANSFORMERS
GENERAL INFORMATION

Duke Energy®

FLA

DWG. 27.06-02A

CONNECTING PARALLEL SECONDARIES

ANY TIME PARALLEL THREE-PHASE SECONDARY CONDUCTORS ARE RUN TO THE CUSTOMER OR THE CUSTOMER COMES TO THE SECONDARY TERMINALS OF THE TRANSFORMER, EACH PARALLEL CONDUCTOR SHOULD BE THE SAME LENGTH. HOWEVER, EXCESSIVE CONDUCTOR LENGTH SHOULD BE CUT SO THE CONDUCTORS MAKE A NEAT, SAFE FIT TO THE SECONDARY TERMINALS. WHEN CUTTING OFF EXCESS CONDUCTORS, DIFFERENT LENGTHS CAN BE TRIMMED FROM THE THREE-PHASE CONDUCTORS OR THE NEUTRAL, AS LONG AS ALL CONDUCTORS ON THE SAME PHASE ARE THE SAME LENGTH.

A POSITIVE TEST FOR CONTINUITY (RING-OUT) SHALL BE PERFORMED TO ENSURE ALL CABLES ARE CONNECTED TO THE CORRECT PHASE.

CABLES SHOULD BE BENT AT THE BOTTOM OF THE SECONDARY COMPARTMENT AND TRAINED TO COME UP STRAIGHT UNDER THE SECONDARY BUSHING WHERE THEY ARE TO BE CONNECTED. THERE SHOULD BE ENOUGH SLACK IN THE CABLES TO ALLOW FOR TRENCH SETTLEMENT. CUT THE CABLES TO PROPERLY FIT AT THE SECONDARY BUSHINGS. ATTACH THE CABLES TO THE SET SCREW BLOCKS STARTING AT THE BACK OF THE SECONDARY BUSHING. ENSURE BOLTS ARE PLACED IN ALL BOLT HOLES COMMON BETWEEN THE SET SCREW BLOCKS(S) AND TRANSFORMER BUSHING SPADES.

SINGLE PHASING

PAD-MOUNTED TRANSFORMERS SHOULD NOT BE LEFT TO SINGLE PHASE FOR LONG PERIODS OF TIME. SINGLE PHASING IS AN OUTAGE CONDITION AND SHOULD BE TREATED AS SUCH. PAD-MOUNTED TRANSFORMERS SUBJECTED TO EXTENDED PERIODS OF SINGLE PHASING WILL OVERHEAT DUE TO CIRCULATING MAGNETIC CURRENTS.

FAULT INDICATORS

THREE-PHASE TRANSFORMERS - MANUAL FAULT INDICATORS (SEE DWG. 26.07-08) SHALL BE INSTALLED ON THE LOAD SIDE PRIMARY 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.

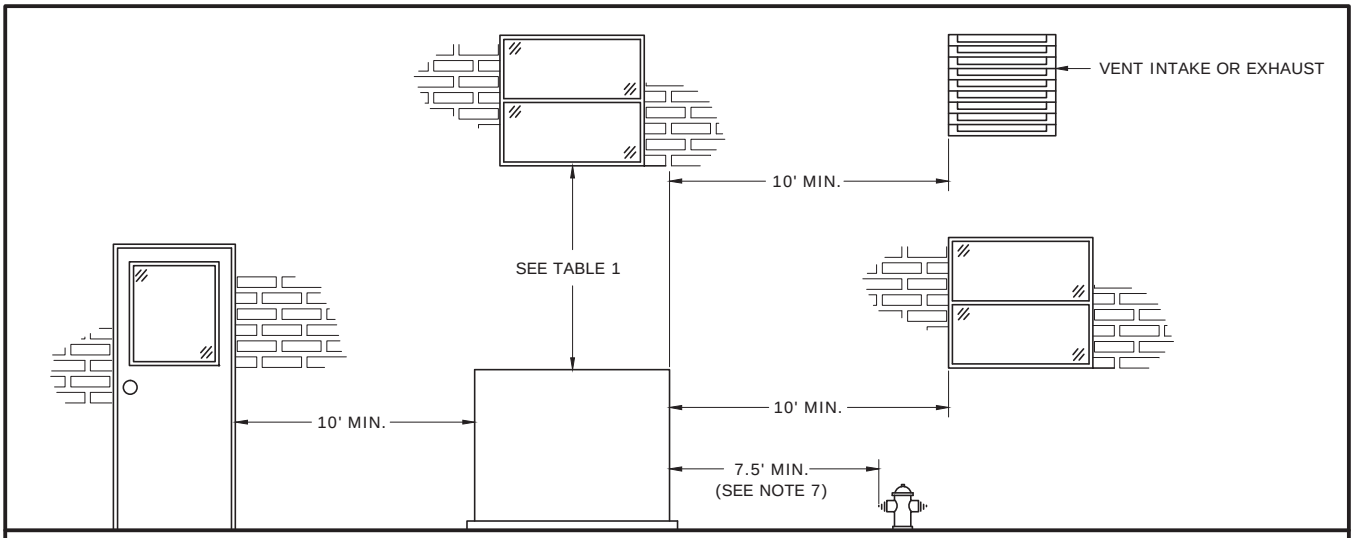
REVISED		BY	CK'D	APPR.
3				
2				
1	11/15/12	GUINN	DANNA	ADCOCK
0	8/17/12	SIMMONS	BURLISON	ELKINS

THREE-PHASE
PAD-MOUNTED TRANSFORMERS
GENERAL INFORMATION

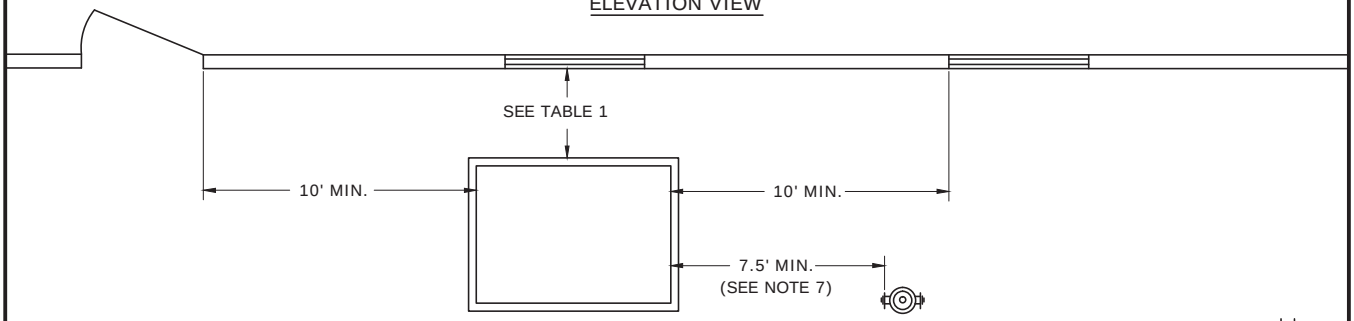
Duke Energy®

FLA

DWG. 27.06-02B



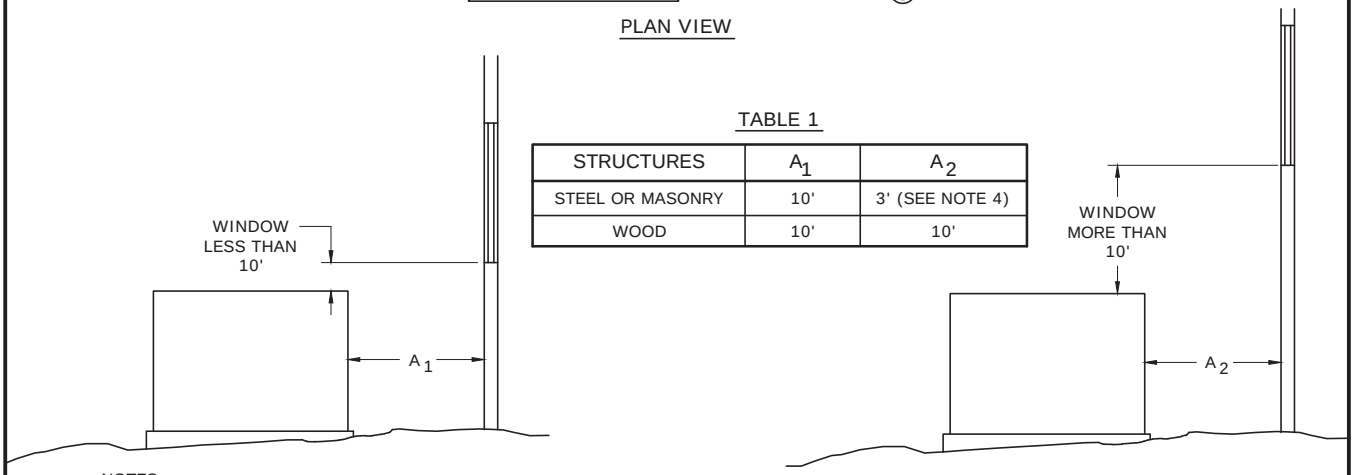
ELEVATION VIEW



PLAN VIEW

TABLE 1

STRUCTURES	A_1	A_2
STEEL OR MASONRY	10'	3' (SEE NOTE 4)
WOOD	10'	10'



NOTES:

1. THE TRANSFORMER SHALL BE INSTALLED SO THAT THE FRONT OF THE UNIT DOES NOT FACE THE BUILDING.
2. ADEQUATE PASSAGEWAYS TO ACCOMMODATE LINE TRUCKS OR OTHER NECESSARY LIFTING AND HAULING EQUIPMENT SHALL BE PROVIDED TO ALLOW FOR MAINTENANCE, OPERATION, OR REPLACEMENT. NO PORTION OF THE BUILDING SHALL EXTEND OVER THE TRANSFORMER.
3. 20' MINIMUM DIMENSION REQUIRED FOR FIRE ESCAPES. 10' MINIMUM DIMENSION REQUIRED FOR OPEN STAIRWAYS.
4. THERE SHALL BE NO ABOVE GROUND OBSTRUCTIONS WITHIN 10 FEET OF THE FRONT OF THE TRANSFORMER OR WITHIN 3' OF THE SIDES AND BACK. IF METERING TROUGH IS LOCATED BEHIND TRANSFORMER, MINIMUM CLEARANCE BETWEEN BACK OF TRANSFORMER AND CLOSEST PART OF TROUGH IS 6 FEET.
5. IT SHALL BE THE CUSTOMER'S RESPONSIBILITY TO COMPLY WITH ANY INSURANCE REGULATIONS, BUILDING CODES, AND LOCAL ORDINANCES AFFECTING THE INSTALLATION.
6. 10' MINIMUM DIMENSION REQUIRED FOR GENERATORS AND GENERATOR FUEL TANKS.
7. THIS CLEARANCE CAN ONLY BE REDUCED BELOW 7.5' WITH APPROVAL OF LOCAL FIRE AUTHORITY.

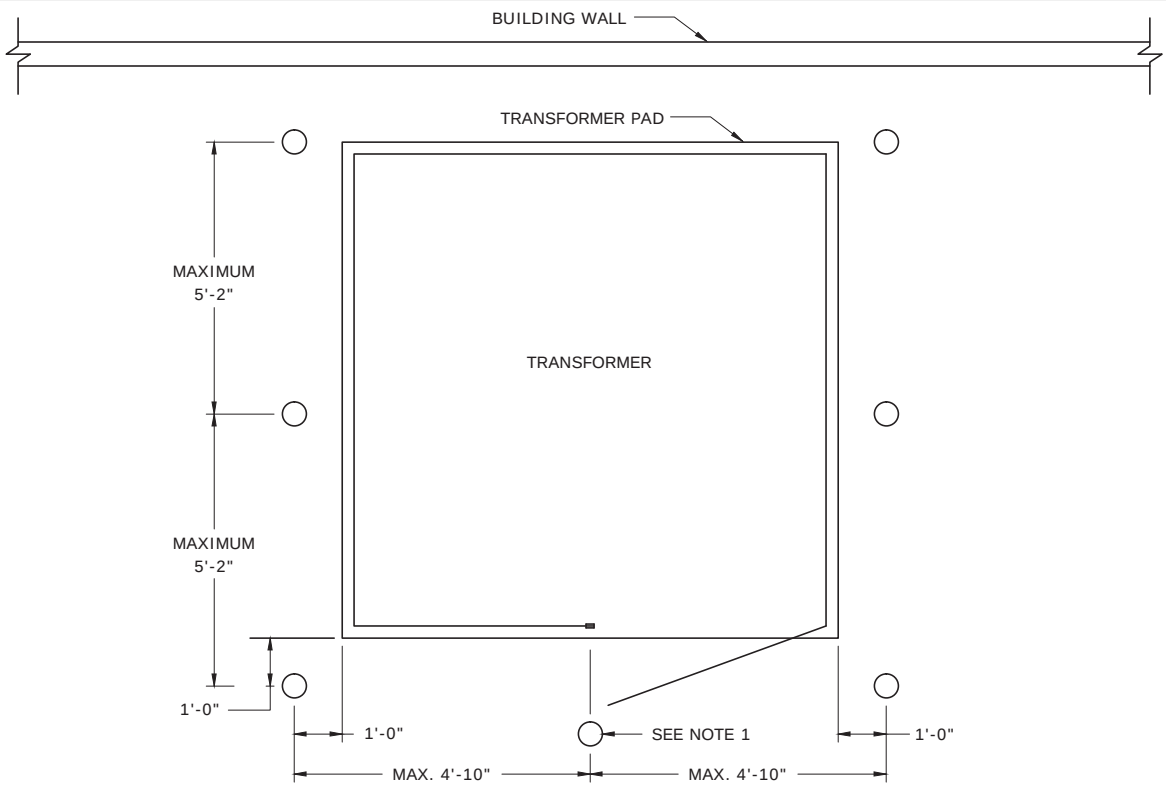
3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOCATION OF OIL FILLED PAD-MOUNTED TRANSFORMERS

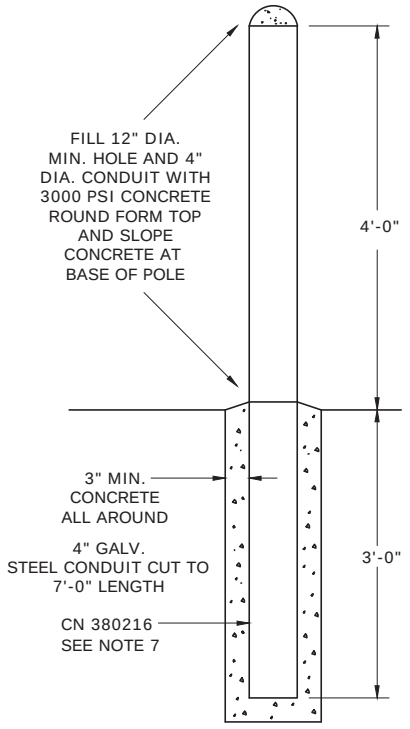
Duke Energy®

FLA

DWG. 27.06-05

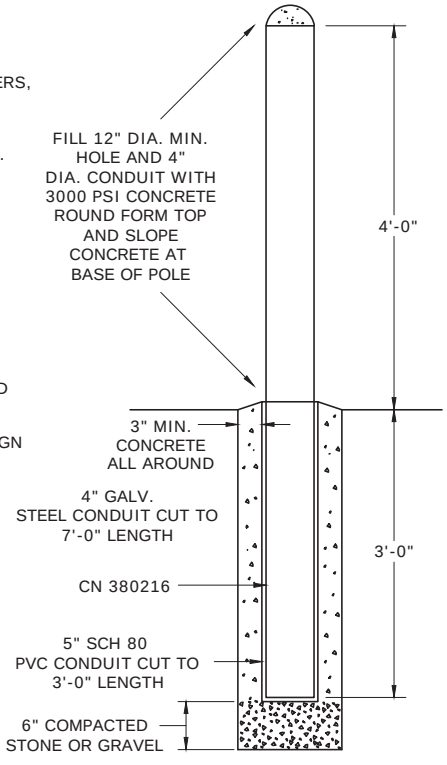


PLAN VIEW



NOTES:

1. ON THREE-PHASE PAD-MOUNTED TRANSFORMERS, THIS POLE SHOULD BE CENTRALLY LOCATED 2'-0" IN FRONT OF THE TRANSFORMER BETWEEN THE DOORS TO ACCOMMODATE THE DOOR SWING AND SHALL BE REMOVABLE. ON SINGLE-PHASE TRANSFORMERS, THIS POLE SHOULD BE LOCATED APPROXIMATELY 3'-6" IN FRONT OF THE TRANSFORMER (NO LESS THAN 3').
2. TRANSFORMER PROTECTION POLES SHOULD BE INSTALLED ON ALL SIDES OF THE TRANSFORMER WHICH ARE SUBJECT TO VEHICULAR TRAFFIC.
3. POLES SHOULD BE PAINTED YELLOW.
4. THESE PROTECTIVE POLES SHALL BE PROVIDED AND INSTALLED BY THE CUSTOMER.
5. CUSTOMER MAY PROVIDE AN ALTERNATE DESIGN FOR A REMOVABLE BARRIER, BUT MUST BE APPROVED BY THE FIELD ENGINEER.
6. ANY SINGLE AND THREE-PHASE PAD-MOUNTED TRANSFORMERS THAT ARE EXPOSED TO PAVED AREAS AND/OR VEHICULAR TRAFFIC SHALL BE HAVE PROTECTIVE BARRIERS PROVIDED AND INSTALLED BY THE CUSTOMER.
7. CN 9220151882 (6"X6"X8' CONCRETE POST, GRAY IN COLOR) IS AVAILABLE AS A PROTECTIVE POLE. EXPOSED PART OF POLE TO BE PAINTED WITH "HIGHWAY YELLOW" (OR SIMILAR YELLOW COLOR) CONCRETE PAINT.



STANDARD POLE

REMOVABLE POLE

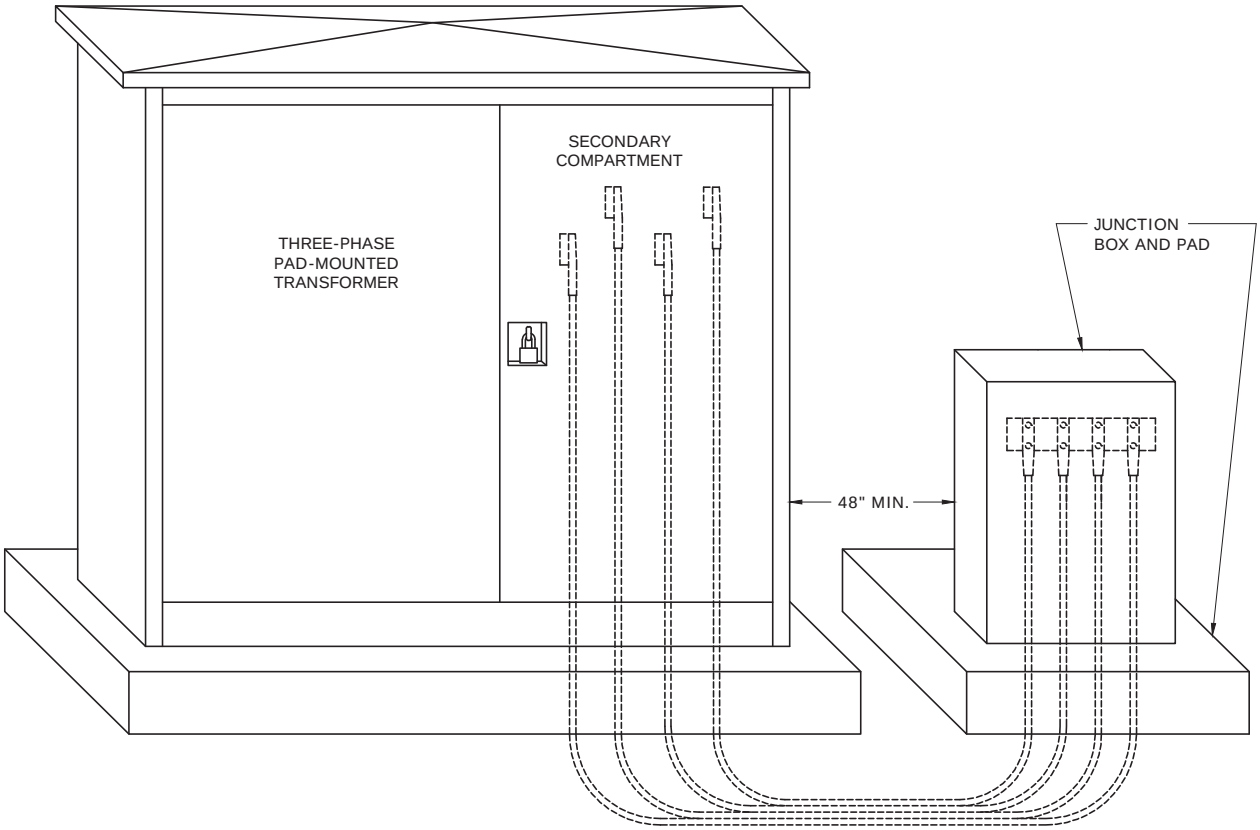
REVISED	BY	CK'D	APPR.
3				
2				
1	1/27/12	SIMPSON	SIMPSON	ELKINS
0	10/29/10	SIMMONS	GUINN	ELKINS

PROTECTIVE POLES FOR OIL FILLED PAD-MOUNTED TRANSFORMERS

Progress Energy

FLA

DWG. 27.06-06



NOTES:

1. THE NORMAL POINT OF DELIVERY FOR AN INDIVIDUAL CUSTOMER SERVED BY A THREE-PHASE PAD-MOUNTED TRANSFORMER INSTALLED SOLELY TO SERVE THE CUSTOMER WILL BE AT THE SECONDARY TERMINALS OF THE TRANSFORMER.

2. IF THE CUSTOMER'S CONDUCTORS EXCEED THE NUMBER ALLOWED IN THE SECONDARY COMPARTMENT OF THE TRANSFORMER, CONSIDER INSTALLING A SECONDARY TERMINATION ENCLOSURE. SEE DWG. 25.03-01.

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

THREE-PHASE PAD-MOUNTED TRANSFORMER WITH CUSTOMER'S SECONDARY CABLE TERMINATION BOX INSTALLATION

Duke Energy®

FLA

DWG. 27.06-08

PAD-MOUNTED TRANSFORMER SIZE (KVA)	NUMBER OF HOLES IN SECONDARY BUSHING SPADE 480Y/277	NUMBER OF HOLES IN SECONDARY BUSHING SPADE 208Y/120	RECOMMENDED NUMBER OF CUSTOMER CONDUCTORS PER PHASE IN PAD-MOUNTED TRANSFORMERS	
			480Y/277	208Y/120
75	6	6	12	12
150	6	6	12	12
300	6	6	12	12
500	12	12	12	12
750	12	12	12	16
1000	12	12	12	16
1500	12	12	16	16
2500	12	N/A	16	N/A
3750	12	N/A	16	N/A

NOTES:

1. IF THE RECOMMENDED CONDUCTOR LIMITS ABOVE ARE EXCEEDED, CONSIDER INSTALLING A SECONDARY TERMINATION ENCLOSURE. SEE DWGS. 25.03-01 AND 27.06-08.
2. SEE DWG. 27.06-12 FOR TRANSFORMER SECONDARY SPADE BLOCK TERMINALS.
3. MAXIMUM CUSTOMER CONDUCTOR SIZE IS 750 MCM CU/AL.
4. PARALLELED CUSTOMER CONDUCTORS MUST BE "RUNG OUT" PRIOR TO ENERGIZING TO PREVENT CROSS PHASING.
5. SIX-CONDUCTOR SECONDARY SPADE BLOCK TERMINALS REQUIRE THAT A MINIMUM OF SIX BOLT HOLES BE ATTACHED TO SECONDARY BUSHING SPADE OF TRANSFORMER. EIGHT-CONDUCTOR BLOCKS REQUIRE A MINIMUM OF EIGHT BOLT HOLES BE ATTACHED TO SECONDARY BUSHING OF TRANSFORMER.
6. SECONDARY BUSHINGS ON OLDER TRANSFORMERS MAY NOT HAVE THE SAME NUMBER OF BOLT HOLES AS INDICATED IN THE TABLE ABOVE, BUT SHOULD BE USED ANYWAY. SECONDARY SPADE BLOCK TERMINALS CAN BE USED TO ACCOMMODATE ADDITIONAL CONDUCTORS. SEE DWG. 27.06-12 FOR ADDITIONAL INFORMATION. IF TERMINATING MORE CONDUCTORS THAN THE SECONDARY BUSHINGS CAN ACCOMMODATE WITHOUT SECONDARY SPADE BLOCK TERMINALS, CONSIDER HAVING WILDWOOD REPAIR SHOP ADD SECONDARY BUSHING SUPPORTS IF NOT ALREADY PRESENT.
7. ALL NEW THREE-PHASE PADMOUNT TRANSFORMERS WITH A 4160Y/2400 VOLT SECONDARY HAVE SECONDARY LIVE-FRONT BUSHINGS WITH A 4-HOLE SPADE (0.56" DIAMETER BOLT HOLES ON 1.75" CENTERS).

REVISED		BY	CK'D	APPR.
3				
2	8/27/12	SIMMONS	BURLISON	ELKINS
1	5/24/12	SIMMONS	BURLISON	ELKINS
0	11/18/10	SIMMONS	GUINN	ELKINS

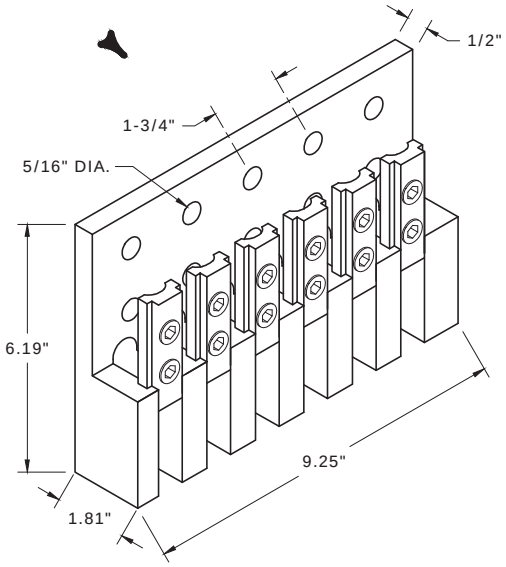
RECOMMENDED NUMBER OF CUSTOMER CONDUCTORS IN SECONDARY COMPARTMENT OF THREE-PHASE PAD-MOUNTED TRANSFORMERS

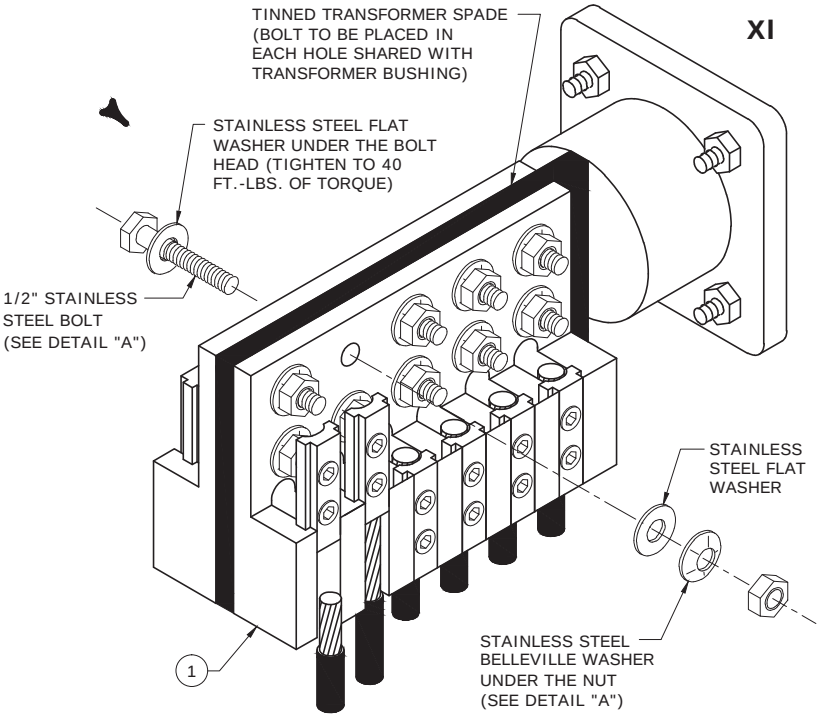
Progress Energy

FLA

DWG. 27.06-09

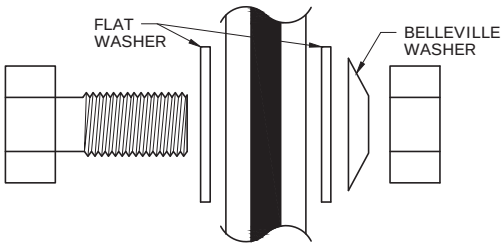
XI





SET SCREW TORQUE VALUES	
CONDUCTOR SIZE	RECOMMENDED TORQUE (FT.-LBS.)
#12 - 350	30
500 - 750	40

KXB6W7510F - SIX POSITION TERMINAL
KXB8W75F - EIGHT POSITION TERMINAL



BOLT ASSEMBLY
DETAIL "A"

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	KXB6W7510F	1	010930	8	BOLT, MACHINE, SS, HEX HEAD, 1/2" X 2.5"
				013128	8	WASHER, ROUND, BELLEVILLE, SPRING, 1/2" BOLT
				327832	1	CONNECTOR, XFMR, BOLTED 6 POSITION, 750 MCM
				10542504	16	WASHER, RD, 1/2, SS, 1.375" OD
	1	KXB8W75F	1	010930	8	BOLT, MACHINE, SS, HEX HEAD, 1/2" X 2.5"
				013128	8	WASHER, ROUND, BELLEVILLE, SPRING, 1/2" BOLT
				327833	1	CONNECTOR, XFMR, BOLTED 8 POSITION, 750 MCM
				10542504	16	WASHER, RD, 1/2, SS, 1.375" OD

NOTES:

1. ALUMINUM TERMINAL WILL ACCEPT #1/0-#750 KCMIL AL. & CU. TORQUE CONDUCTOR SET SCREWS PER THE TABLE ABOVE.
2. FOR COPPER TO ALUMINUM AND ALUMINUM TO ALUMINUM FLAT CONNECTIONS, SEE DWGS. 03.02-09A AND 03.02-09B.
3. ALWAYS APPLY GENERAL PURPOSE INHIBITOR (CN 403108) ON CONDUCTORS AFTER WIRE BRUSHING.
4. RE-USE SECONDARY BLOCK TERMINALS WHEN POSSIBLE. CHECK FOR STRIPPED OR CROSSED THREADS ON THE CONDUCTOR SET SCREWS. CLEAN WITH BRUSH TO REMOVE ANY CONTAMINANTS.
5. PARALLELED CUSTOMER CONDUCTORS MUST BE "RUNG OUT" PRIOR TO ENERGIZING TO PREVENT CROSS PHASING.

REVISED		BY	CK'D	APPR.
3				
2				
1	6/26/13	ROBESON	GUINN	ADCOCK
0	10/29/10	SIMMONS	GUINN	ELKINS

TRANSFORMER SECONDARY SPADE BLOCK TERMINALS

DUKE ENERGY.

FLA

DWG. 27.06-12

THREE-PHASE, THREE WIRE 480 VOLT SERVICE IS NOT SPECIFICALLY LISTED IN THE TARIFF OR REQUIREMENTS FOR ELECTRIC SERVICE AND METER INSTALLATIONS. HOWEVER, THE TARIFF INDICATES THAT WHERE CUSTOMERS HAVE "SPECIAL REQUIREMENTS, THE COMPANY WILL PROVIDE SUCH SERVICE IF FEASIBLE AND THE CUSTOMER SHALL PAY THE COST IN EXCESS OF THE ESTIMATED COST OF THE STANDARD DESIGN."

THE REQUIREMENTS FOR ELECTRIC SERVICE AND METER INSTALLATIONS LISTS THE "STANDARD VOLTAGES AS 120/240, 120/208 AND 277/480". IT ALSO SAYS THAT "IF A VOLTAGE IS REQUESTED OTHER THAN THAT WHICH IS CURRENTLY ESTABLISHED AT THE DESIRED LOCATION THE CUSTOMER MAY BE CHARGED A "CONTRIBUTION-IN-AID OF CONSTRUCTION" TO COVER THE COST TO SUPPLY THE REQUESTED VOLTAGE."

IT IS A VERY RARE REQUEST FOR THREE-PHASE, THREE WIRE 480 VOLT SERVICE. HOWEVER, IT IS FEASIBLE TO DELIVER FROM A PAD-MOUNTED TRANSFORMER. SINCE IT IS A RARE DELIVERY VOLTAGE, THE GROUP SPECIFICATIONS FOR TRANSFORMERS DO NOT INCLUDE PROVISIONS FOR SEPARATE H0 AND X0 BUSHINGS. THE HO-X0 BUSHING IS A COMBINATION BUSHING SO TO DELIVER THIS SERVICE AN INTERNAL MODIFICATION MUST BE MADE BY THE TRANSFORMER SHOP.

SINCE IT IS RARE FOR A CUSTOMER TO REQUEST THREE-PHASE, THREE WIRE 480 VOLT SERVICE EXTRA TIME WILL BE REQUIRED TO PREPARE A PAD-MOUNT FOR THIS SERVICE. THIS SHOULD BE FACTORED IN WHEN DISCUSSING WITH THE CUSTOMER.

THE METER SHOP SHOULD BE NOTIFIED AS SOON AS POSSIBLE ALSO, SO THEY CAN PREPARE FOR METERING THIS SERVICE DIFFERENTLY THAN IS DONE FOR A 48OY/277 VOLT SERVICE.

SEE THE FOLLOWING DRAWINGS IN SECTION 27.06 FOR DETAILS ON CONNECTIONS FOR THREE-PHASE, THREE WIRE 480 VOLT SERVICE AND FOR 480Y/277 VOLT SERVICE.

LABELS

SEE DWG. 27.06-28 FOR A LABEL TO AFFIX TO TRANSFORMER WHEN A THREE-PHASE, THREE WIRE 480 VOLT SERVICE IS PROVIDED. IF TRANSFORMER IS EVER REMOVED FROM SERVICE AND RESTOCKED, THE LABEL MUST BE REMOVED AND GROUNDLINK REINSTALLED (ON TYPE II TRANSFORMERS).

3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

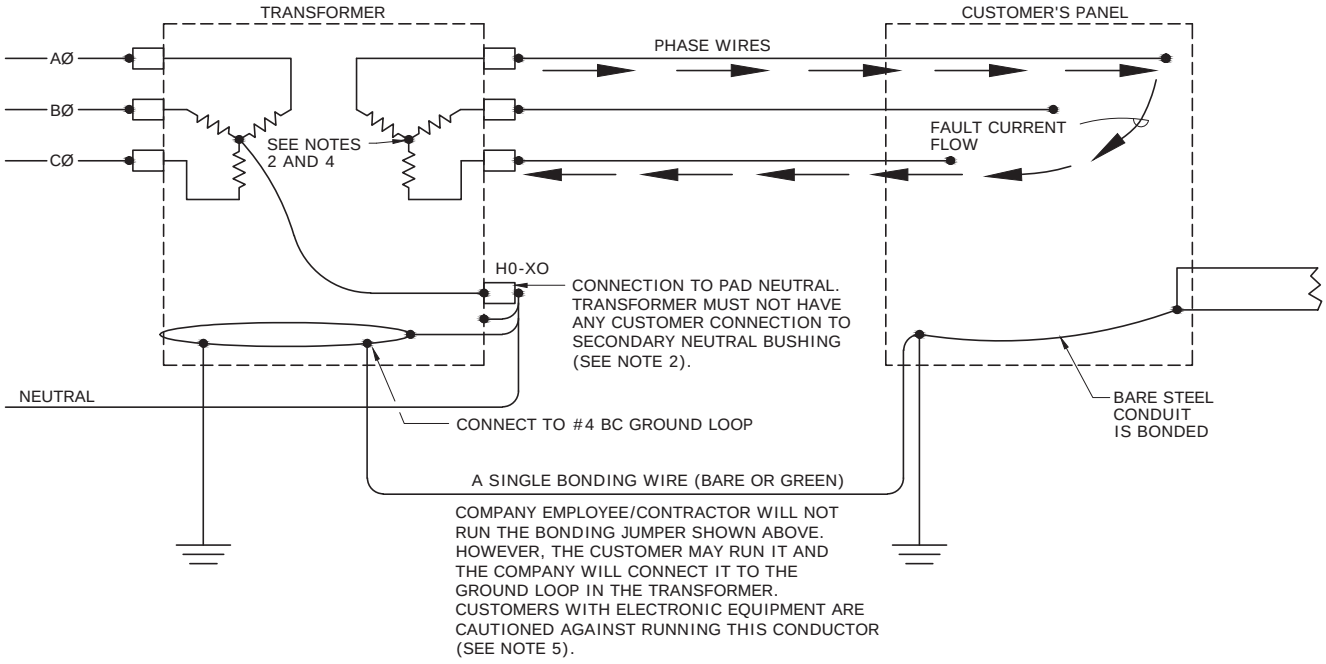
THREE-PHASE, THREE-WIRE 480 VOLT SERVICE

Duke Energy®

FLA

DWG. 27.06-16

TYPE II TRANSFORMER
(COMBINATION H0-X0 BUSHING)



NOTES:

1. BONDING WIRE SHALL BE ONE CONDUCTOR ONLY, TYPICALLY A SMALL CONDUCTOR EASY TO ATTACH TO #4 BC GROUND LOOP IN PAD-MOUNT.

2. IF THE TRANSFORMER IS CONNECTED FOR THREE WIRE SERVICE, THE SECONDARY IS CONNECTED FLOATING WYE DUE TO REMOVAL OF SECONDARY NEUTRAL CONNECTIONS. GROUND STRAP REMAINS AND PRIMARY NEUTRAL IS CONNECTED TO HO-XO AS NORMALLY DONE. THERE SHALL BE NO CUSTOMER CONNECTIONS TO H0-X0.

   ONE EXCEPTION:
   IF CUSTOMER HAS A HIGH RESISTANCE GROUND DETECTION SYSTEM, THEY WILL WANT TO RUN ONE SMALL CONDUCTOR (EX. #12) TO ATTACH TO XO. THIS IS PERMITTED. GROUND STRAP IS STILL NOT CONNECTED IN THIS CASE. IF THERE ARE ANY QUESTIONS ABOUT THIS, CONTACT DISTRIBUTION STANDARDS.

3. A TRANSFORMER CONNECTED FOR THREE WIRE SERVICE (NO NEUTRAL) CANNOT SUPPLY FOUR WIRE SERVICES.

4. THE INTERNAL SECONDARY NEUTRAL CONNECTION MUST BE REMOVED FOR A THREE WIRE SERVICE FROM A TYPE II TRANSFORMER. THIS IS A TRANSFORMER SHOP JOB. SEE DWGS. 27.06-26 AND 27.06-28 FOR ADDITIONAL INFORMATION ON TRANSFORMERS THAT DO NOT HAVE SEPARATE HO-XO BUSHINGS.

5. CUSTOMER SHOULD BE AWARE THAT A THREE WIRE SERVICE SHOULD ONLY BE USED IN SPECIAL CASES. CUSTOMER MUST HAVE A GROUND DETECTION SYSTEM INSTALLED (NEC 250.21). CUSTOMER HAVING ELECTRONIC LOADS SUCH AS VARIABLE SPEED DRIVES OR LIGHTNING CONCERNS SHOULD CONSIDER A GROUNDED WYE CONNECTION.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS

THREE WIRE SERVICES,

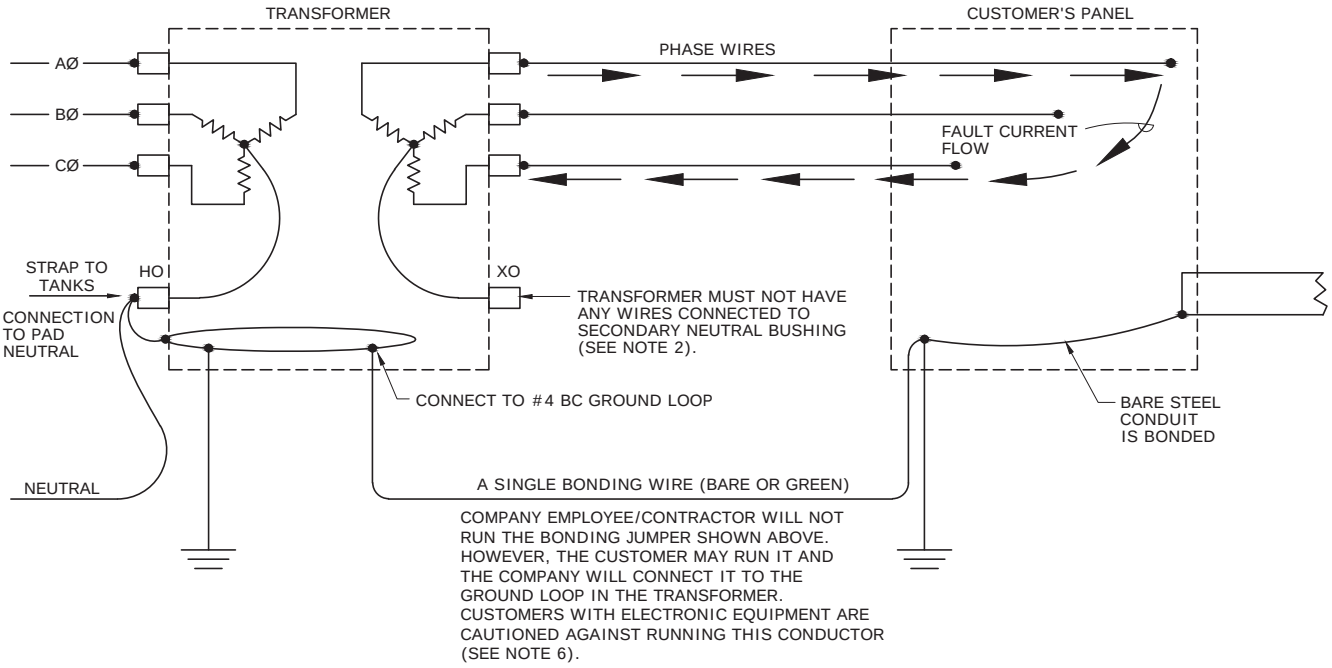
FLOATING WYE CONNECTION

Duke Energy®

FLA

DWG. 27.06-18

TYPE III TRANSFORMER
(SEPARATE H0-X0 BUSHING)



NOTES:

1. BONDING WIRE SHALL BE ONE CONDUCTOR ONLY, TYPICALLY A SMALL CONDUCTOR EASY TO ATTACH TO #4 BC GROUND LOOP IN PAD-MOUNT.

2. IF THE TRANSFORMER IS CONNECTED FOR THREE WIRE SERVICE, THE SECONDARY IS CONNECTED FLOATING WYE. THE SECONDARY NEUTRAL BUSHING MUST BE CLEAR OF ALL CONNECTIONS, INCLUDING THE SECONDARY BUSHING GROUND STRAP. THE SECONDARY NEUTRAL BUSHING MUST BE UNGROUNDED SO FAULT CURRENT WILL ONLY FLOW IN THE PHASE WIRES.

   ONE EXCEPTION:

   IF CUSTOMER HAS A HIGH RESISTANCE GROUND DETECTION SYSTEM, THEY WILL WANT TO RUN ONE SMALL CONDUCTOR (EX. #12) TO ATTACH TO XO. THIS IS PERMITTED. GROUND STRAP IS STILL NOT CONNECTED IN THIS CASE. IF THERE ARE ANY QUESTIONS ABOUT THIS, CONTACT DISTRIBUTION STANDARDS.

3. A TRANSFORMER CONNECTED FOR THREE WIRE SERVICE (NO NEUTRAL) CANNOT SUPPLY FOUR WIRE SERVICES.

4. OPERATIONS PERSONNEL SHALL RUN A BONDING CONDUCTOR (#4 BC) FROM THE GROUND LOOP TO THE METERING LOCATION TO BOND THE METER BOX MOUNTED ON THE WALL OF THE TRANSFORMER. TANK. IF THE METER BOX IS MOUNTED TO THE CUSTOMER'S WALL, THE BONDING CONDUCTOR SHALL BE ATTACHED TO THE CUSTOMER'S GROUND.

5. ONLY PAD-MOUNTED TRANSFORMERS WITH SEPARATE PRIMARY AND SECONDARY NEUTRAL BUSHINGS SHOULD BE USED TO PROVIDE THREE WIRE SERVICES. SEE DWGS. 27.06-26 AND 27.06-28 FOR ADDITIONAL INFORMATION ON TRANSFORMERS THAT DO NOT HAVE SEPARATE HO-XO BUSHINGS.

6. CUSTOMER SHOULD BE AWARE THAT A THREE WIRE SERVICE SHOULD ONLY BE USED IN SPECIAL CASES. CUSTOMER MUST HAVE A GROUND DETECTION SYSTEM INSTALLED (NEC 250.21). CUSTOMER HAVING ELECTRONIC LOADS SUCH AS VARIABLE SPEED DRIVES OR LIGHTNING CONCERNS SHOULD CONSIDER A GROUNDED WYE CONNECTION.

DUKE ENERGY.

3				
2				
1				
O	8/1/14	DANNA	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

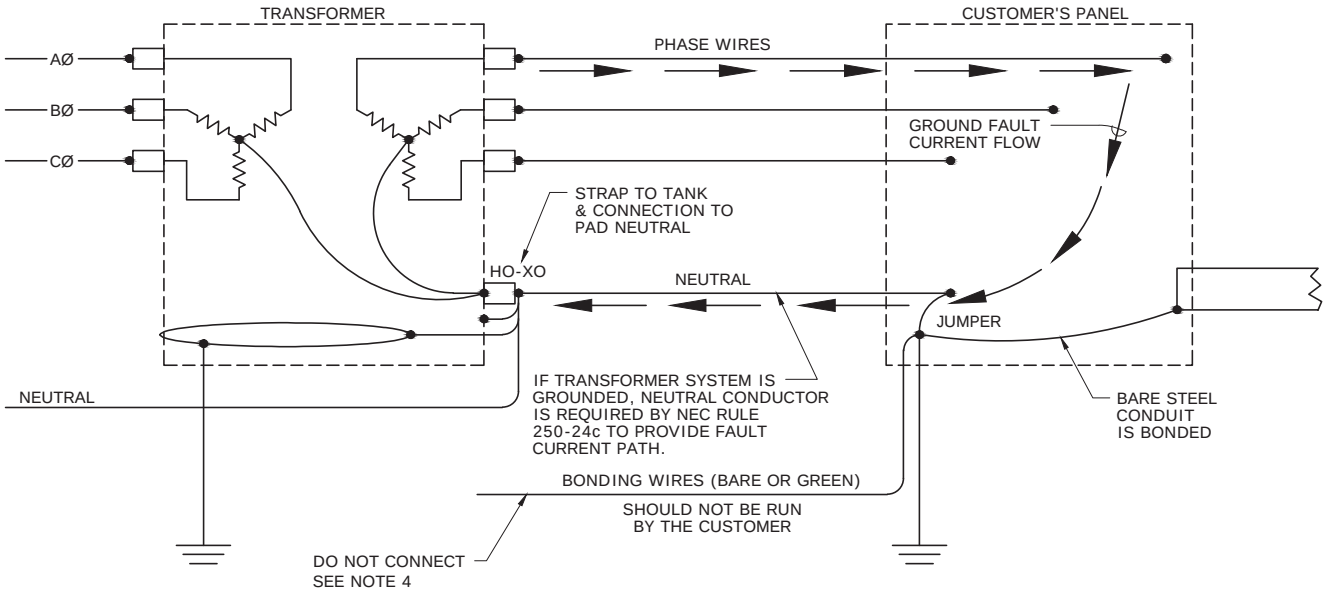
THREE WIRE SERVICES,

FLOATING WYE CONNECTION

DEC	DEM	DEP	DEF
		X	X

27.06-20

TYPE II TRANSFORMER
(COMBINATION H0-X0 BUSHING)



NOTES:

1. IF THE TRANSFORMER SECONDARY NEUTRAL IS GROUNDED, THE CUSTOMER MUST CONNECT A NEUTRAL CONDUCTOR FROM THEIR PANEL TO THE TRANSFORMER. THIS NEUTRAL CONDUCTOR PROVIDES A PATH FOR GROUND FAULT CURRENT TO FLOW.

2. A TRANSFORMER CONNECTED FOR FOUR WIRE SERVICE (GROUNDED NEUTRAL) CANNOT SUPPLY THREE WIRE SERVICES.

3. SEE DWGS. 27.06-26 AND 27.06-28 FOR ADDITIONAL INFORMATION ON TRANSFORMERS THAT DO NOT HAVE SEPARATE HO-XO BUSHINGS.

4. A SEPARATE BONDING CONDUCTOR OR CONDUCTORS ARE NOT NECESSARY. ELECTRICIANS SHOULD BE ADVISED NOT TO RUN BONDING CONDUCTORS. IF THEY INSIST ON RUNNING BONDING CONDUCTORS, DO NOT CONNECT THEM TO ANY PROGRESS ENERGY EQUIPMENT: TAPE THEM UP AND LAY THEM IN THE BOTTOM OF THE TRANSFORMER TANK.

3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

FOUR WIRE SERVICES,

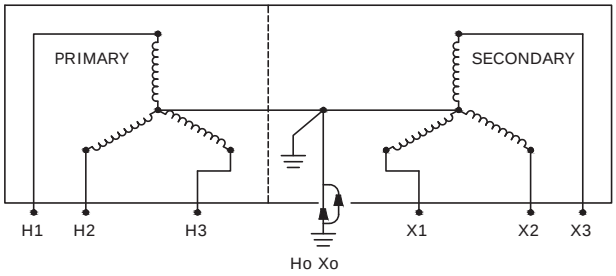
GROUNDED WYE CONNECTION

Duke Energy®

FLA

DWG. 27.06-22

TYPE I TRANSFORMER
(OBSOLETE OLD TRANSFORMER)



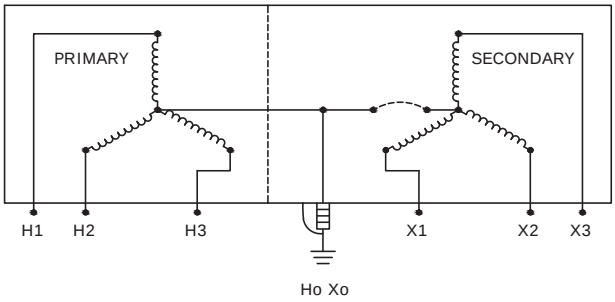
GROUNDED WYE - GROUNDED WYE

THIS TYPE OF TRANSFORMER HAS A PERMANENT INTERNAL SECONDARY GROUND THAT MAKES IT IMPOSSIBLE TO PROVIDE A 3-WIRE. FLOATING WYE SERVICE.

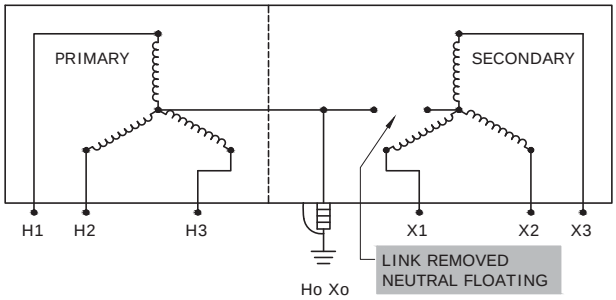
NOTES:

1. THE NEUTRAL CONNECTION BETWEEN THE PRIMARY & SECONDARY WINDING MAY BE A BARE CONDUCTOR AND GROUNDED INTERNAL TO THE TANK. THE Ho Xo BUSHING MAY NOT BE INSULATED.
2. **THIS TRANSFORMER CANNOT BE USED TO PROVIDE 3-WIRE SERVICE.**
3. TRANSFORMER GROUND IS CONNECTED TO THE Ho Xo BUSHING.

TYPE II TRANSFORMER



GROUNDED WYE - GROUNDED WYE



* GROUNDED WYE - FLOATING WYE

NOTES:

1. TO PROVIDE 3-WIRE FLOATING-WYE SERVICE. THE OIL IN THE TRANSFORMER MUST BE DRAWN DOWN AND THE SECONDARY LINK REMOVED THROUGH A HANDHOLE IN THE TRANSFORMER TANK.
2. THE GROUND STRAP ON THE Ho Xo BUSHING REMAINS ATTACHED TO THE TRANSFORMER TANK AND THE BUSHING IS GROUNDED TO THE TRANSFORMER GROUND FOR BOTH CONNECTIONS.

* REQUIRES "CAUTION" LABEL FOR TYPE II TRANSFORMER INSTALLED IN SECONDARY COMPARTMENT

3				
2				
1				
0	10/29/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

THREE-PHASE PAD-MOUNTED TRANSFORMERS PRIMARY AND SECONDARY WINDING - NEUTRAL CONNECTIONS VARIATIONS FOR 3-WIRE SERVICES

Duke Energy®

FLA

DWG. 27.06-26

TYPE II

CN 21129713

CAUTION

Type II Transformer (Combination HoXo Bushing)

This transformer has been modified internally to provide a floating-wye secondary winding, three-wire service to the customer.

The internal secondary grounding link has been removed to isolate the secondary winding from the primary winding neutral and the grounded HoXo bushing. The ground strap and the transformer grounding conductor must be connected to the HoXo bushing to ground the neutral of the primary winding.

Only three wire services may be connected to this transformer.

Certification of correct connection:

_____ _____

DFS/Line Inspector Date

If this transformer is removed from service, the internal secondary grounding link must be re-connected and this label removed. Refer to the transformer section in the Distribution Construction Specifications Manual to determine the "type" of replacement transformer and modification that must be done to provide a three-wire floating wye service.

CN 21129713

TYPE III

CN 21129812

CAUTION

Type III Transformer (Separate HoXo Bushing)

This transformer has been modified externally to provide a floating-wye, three-wire service to the customer.

The tank grounding strap has been removed from the Xo bushing and the bushing is not grounded. The Ho bushing in the primary compartment is grounded to provide a ground to the neutral of the primary winding.

Only three wire services may be connected to this transformer.

Certification of correct connection:

_____ _____

DFS/Line Inspector Date

If this transformer is removed from service, the tank grounding strap is to be re-installed on the Xo bushing and this label removed. Refer to the transformer section in the Distribution Construction Specifications Manual to determine the "type" of replacement transformer and modification that must be done to provide a three-wire floating wye service.

CN 21129812

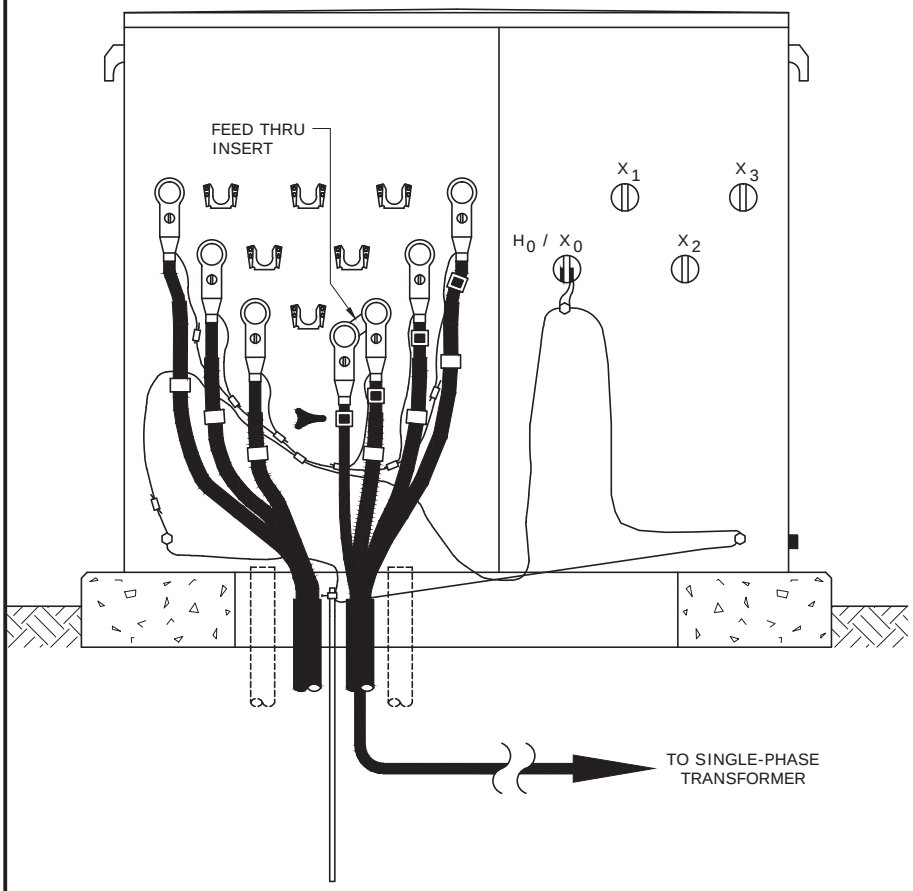
3				
2				
1				
0	6/26/10	SIMMONS	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

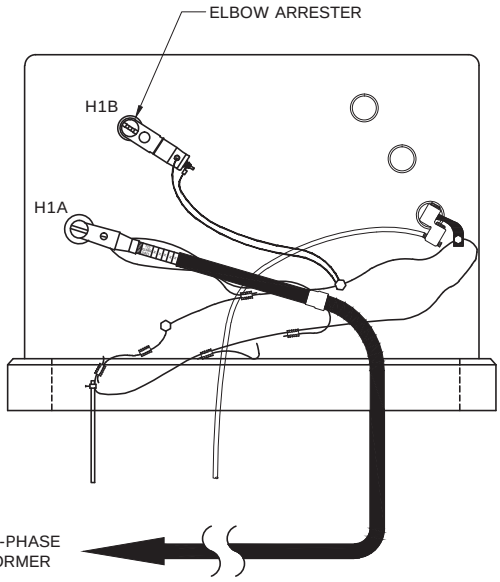
THREE-PHASE PAD-MOUNTED TRANSFORMERS PRIMARY AND SECONDARY WINDING - NEUTRAL CONNECTIONS LABELS FOR 3 WIRE SERVICES

Duke Energy®

PGN

DWG. 27.06-28





NOTES:

1. INSTALL FEED THRU INSERT ON C PHASE OF #2 SIDE (LOAD SIDE) OF THREE-PHASE TRANSFORMER TO PREVENT CONFLICTS WITH OTHER PHASES DURING SWITCHING.
2. SINGLE-PHASE TRANSFORMER TO BE RADIAL FED AND LOCATED WITHIN 50' OF THREE-PHASE TRANSFORMER.
3. INSTALL FAULT INDICATOR ON SINGLE-PHASE RADIAL TAP.

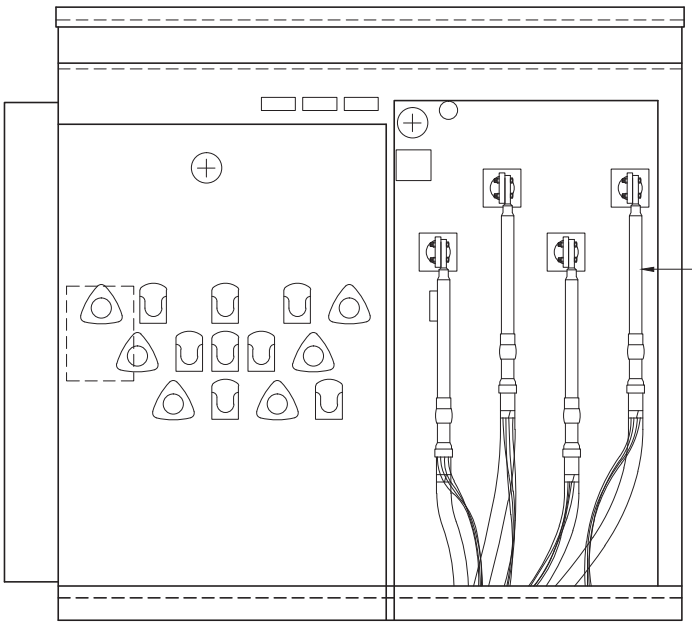
REVISED		BY	CK'D	APPR.
3				
2				
1	11/11/11	DANNA	BURLISON	ELKINS
0	4/13/11	DANNA	BURLISON	ELKINS

THREE-PHASE TRANSFORMER CONNECTION TO SINGLE-PHASE TRANSFORMER

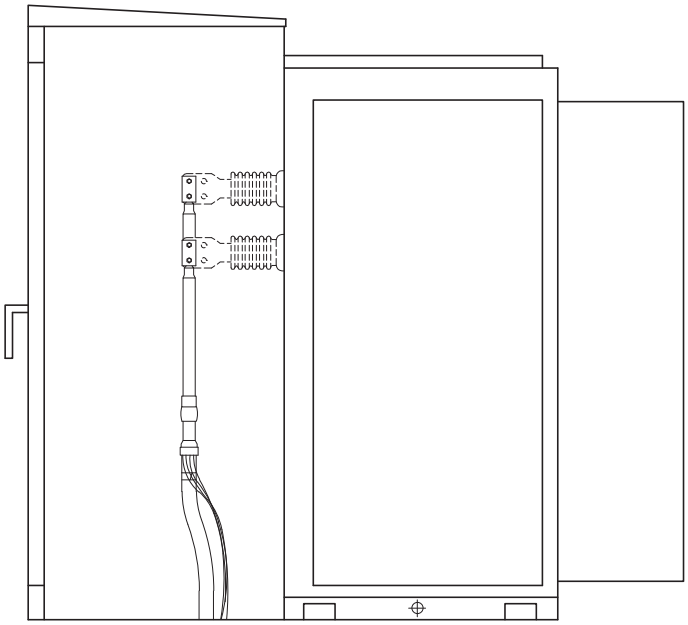
Progress Energy

FLA

DWG. 27.06-30



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 27.06-34B FOR ADDITIONAL VIEWS AND NOTES.

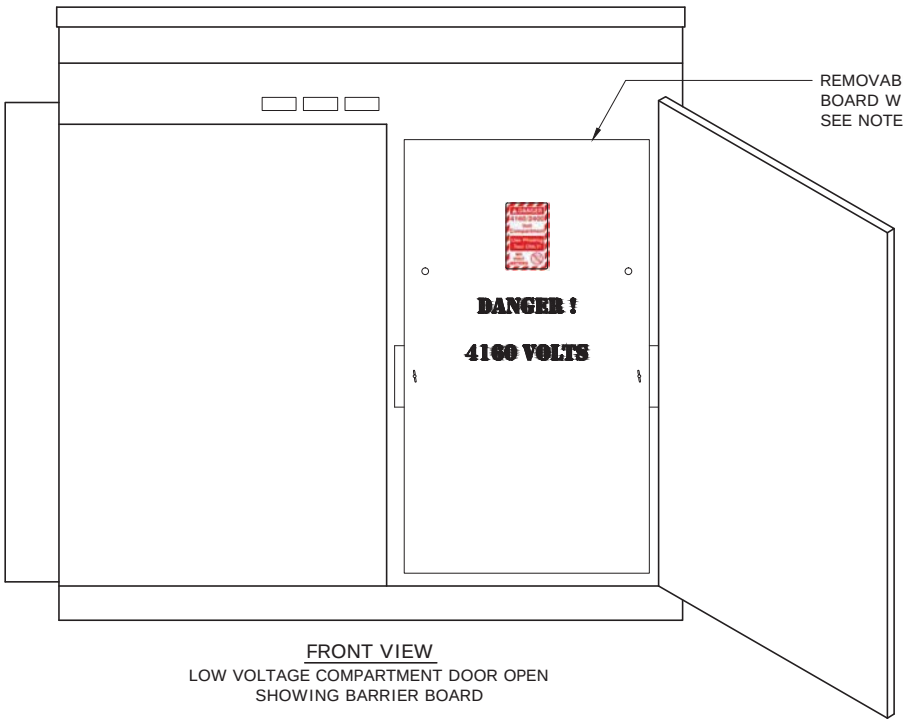
3				
2				
1				
0	2/1/13	SIMMONS	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PAD-MOUNTED TRANSFORMERS WITH
4160Y/2400 VOLT SECONDARY

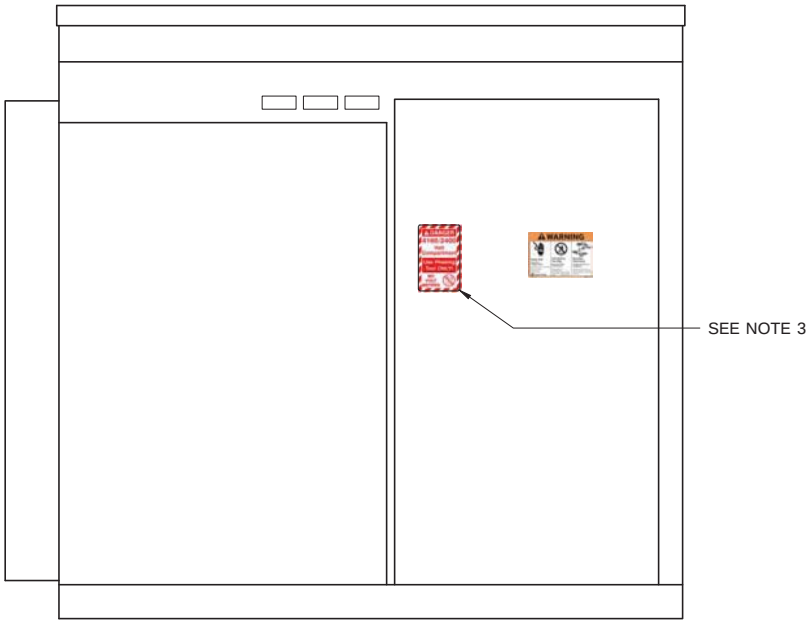
Duke Energy®

FLA

DWG. 27.06-34A



FRONT VIEW
LOW VOLTAGE COMPARTMENT DOOR OPEN
SHOWING BARRIER BOARD



FRONT VIEW
DOORS CLOSED

DANGER LABEL
CN 9220247755

NOTES:

1. SEE DWG. 27.06-34A FOR FRONT AND SIDE VIEWS.
2. TRANSFORMER MUST HAVE REMOVABLE BARRIER BOARD THAT PREVENTS ACCESS TO THE LOW VOLTAGE BUSHING TERMINATION WHEN THE LOW VOLTAGE COMPARTMENT DOOR IS OPEN. ANY TRANSFORMER FOUND WITHOUT A REMOVABLE BARRIER BOARD SHOULD HAVE ONE ADDED BY THE WILDWOOD REPAIR SHOP.
3. THE OUTSIDE OF THE LOW VOLTAGE COMPARTMENT DOOR AND THE BARRIER BOARD MUST HAVE A DANGER LABEL (CN 9220247755) APPLIED AT EYE-LEVEL.
4. LOW VOLTAGE CABLES MUST HAVE STRESS RELIEF TERMINATIONS AND BE TERMINATED TO THE LOW VOLTAGE BUSHINGS WITH 2-HOLE LUGS ATTACHED WITH STAINLESS STEEL BOLTS TORQUED TO 40 FT/LBS.
5. SEE DWG. 27.00-03 FOR OTHER MARKINGS.

3				
2				
1				
0	2/1/13	SIMMONS	DANNA	GUINN
REVISED		BY	CK'D	APPR.

THREE-PHASE PAD-MOUNTED TRANSFORMERS WITH 4160Y/2400 VOLT SECONDARY

Duke Energy®

FLA

DWG. 27.06-34B

28.00 GENERAL SWITCHGEAR INFORMATION

28.01 PME MANUAL SWITCHGEAR

28.02 PME AUTOMATED SWITCHGEAR

DUKE ENERGY.

3					
2					
1					
0	1/31/19	KATIGBAK	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

SECTION 28 - SWITCHGEAR

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

28.02 PME AUTOMATED SWITCHGEAR (CONT.)

28.03 SF6 INSULATED SWITCHGEAR

28.04 SOLID DIELECTRIC PAD-MOUNTED SWITCHGEAR

28.04 SOLID DIELECTRIC PAD-MOUNTED SWITCHGEAR (CONT.)

28.05 SOLID DIELECTRIC VAULT SWITCHGEAR

28.05 SOLID DIELECTRIC VAULT SWITCHGEAR (CONT.)

28.15 PAD-MOUNTED RECLOSER

THIS SECTION CONTAINS ALL SWITCHGEAR THAT IS CURRENTLY APPROVED FOR PURCHASE. FOR INFORMATION AND SPECIFICATIONS ON SWITCHGEAR THAT IS NOT APPROVED FOR PURCHASE BUT IS CURRENTLY STILL IN SERVICE, REFERENCE THE LEGACY DISTRIBUTION MANUALS CONTAINED ON THE STANDARDS SHAREPOINT SITE.

THIS SECTION CONTAINS AN APPLICATION GUIDE THAT WILL HELP THE DESIGNER SELECT THE APPROPRIATE SWITCHGEAR BASED ON THE APPLICATION AND/OR CUSTOMER. SEE DWGS. 28.00-110A THRU 28.00-110E.

LISTED BELOW ARE SOME OF THE COMMON ATTRIBUTES AND DESIGN REQUIREMENTS ASSOCIATED WITH SWITCHGEAR.

INSULATION MEDIUM

PAD-MOUNTED SWITCHGEAR IS TYPICALLY INSULATED WITH AIR, OIL, SF6 GAS, OR SOLID DIELECTRIC MEDIUM. SOLID DIELECTRIC SWITCHGEAR IS AVAILABLE FOR SELECT APPLICATIONS AND ELIMINATES THE ENVIRONMENTAL CONCERNS DUE TO GAS AND OIL LEAKS.

NUMBER OF WAYS

THE TERM "WAY" REFERS TO A SWITCH POSITION TYPICALLY COMPRISED OF 3-600 AMP BUSHINGS OR 3-200 AMP BUSHINGS WELLS. THE NUMBER OF WAYS DIFFER DEPENDING ON THE STYLE OF SWITCHGEAR. TYPICAL PAD-MOUNTED SWITCHGEAR CONTAINS FOUR WAYS. SOLID DIELECTRIC MODELS VARY AND CAN ALSO BE INTERCONNECTED FOR CUSTOM APPLICATIONS.

TERMINATIONS

ALL CURRENT SWITCHGEAR SPECIFIED IN THIS SECTION WILL USE DEAD-FRONT CABLE ACCESSORIES. ALL 600 AMP SOURCE OR LOAD SIDE BUSHINGS USE 600 AMP DEAD-BREAK T-BODY STYLE TERMINATIONS. ALL SOURCE OR LOAD SIDE 200 AMP BUSHINGS WILL USE LOAD BREAK ELBOWS. CABLE ACCESSORIES ARE AVAILABLE TO CONVERT THE 600 AMP BUSHING TO A 200 AMP BUSHING.

ARRESTERS

ELBOW ARRESTERS SHOULD BE INSTALLED ON ALL NORMAL OPEN POINTS OF A SWITCHGEAR. THE ARRESTER SHOULD BE INSTALLED ON BOTH SIDES OF THE NORMAL OPEN SWITCH. THIS IS TYPICALLY ACCOMPLISHED BY INSTALLING THE ELBOW ARRESTER ON THE 200 AMP REDUCING BUSHING ASSOCIATED WITH A 600 AMP T-BODY.

VISIBLE OPEN

MOST CURRENT SWITCHGEAR OPTIONS CONTAIN VISIBLE OPEN WINDOWS ON ALL 600 AMP DEAD BREAK WAYS. FOR AIR INSULATED SWITCHGEAR, THE POSITION OF THE 600 AMP SOLID BLADE SWITCH CAN BE VIEWED DIRECTLY.

SWITCHGEAR THAT USE VACUUM BOTTLES TYPICALLY HAVE A SEPARATE SWITCH IN SERIES WITH THE VACUUM BOTTLE TO OBTAIN A VISIBLE OPEN. THESE WILL USUALLY HAVE 2 SEPARATE OPERATING HANDLES TO ENSURE THE CORRECT SWITCHING SEQUENCE IS MAINTAINED. ELASTIMOLD SWITCHGEAR MAY PROVIDE A VISIBLE OPEN WITH THEIR CAM-OP SYSTEM.

FAULT CLEARING

FAULT CLEARING CAN BE ACCOMPLISHED EITHER WITH A FUSE OR VACUUM INTERRUPTER. VACUUM INTERRUPTERS CAN BE RESET BY USING A RESET HANDLE ON THE SWITCHGEAR OR THE RELAY ASSOCIATED WITH THE SWITCHGEAR. REFER TO THE SPECIFIC OPERATING INSTRUCTIONS FOR REPLACING A FUSE OR RESETTING A VACUUM INTERRUPTER.

AUTOMATIC THROW OVER (ATO) OR AUTOMATIC TRANSFER SWITCH (ATS)

TYPICALLY ATO SWITCHGEAR WILL CONTAIN TWO SOURCE FEEDS AND WILL TRANSFER FROM ONE TO THE OTHER BASED ON CERTAIN CRITERIA PROGRAMMED INTO THE RELAY. THESE SWITCHGEAR VARY IN THEIR DESIGN AND ARE APPLIED DEPENDING ON THEIR APPLICATION AND CUSTOMER REQUIREMENTS. THE APPLICATION GUIDE CONTAINED IN THIS CHAPTER WILL ASSIST IN SPECIFYING THE CORRECT ATO OR ATS SWITCHGEAR.

THE FOLLOWING GUIDE WILL ASSIST IN SELECTING THE CORRECT SWITCHGEAR FOR THE INTENDED APPLICATION AND REQUIREMENTS OF THE PROJECT.

DEFINITIONS OF TERMS:

SUBMERSIBLE - THIS TERM REFERS TO THE RATING OF EQUIPMENT (SWITCHGEAR AND CONTROL) THAT IS DESIGNED TO FUNCTION PROPERLY WHEN SUBMERGED IN WATER FOR AN INDEFINITE PERIOD OF TIME.

VAULT - A ROOM CONTAINING THE SWITCHGEAR AND CAN BE WITHIN A BUILDING STRUCTURE (AT GRADE OR BELOW) OR IN A BELOW GRADE STRUCTURE CONTAINED IN A STREET OR SIDEWALK.

MANUAL LOAD BREAK - A SWITCH WHERE FIELD PERSONNEL ARE REQUIRED TO MANUALLY OPERATE A HANDLE OR OTHER MECHANISM ON SITE TO EITHER OPEN OR CLOSE THE SWITCH.

FAULT INTERRUPTING LOAD WAY - FUSE OR VACUUM INTERRUPTER THAT WILL ISOLATE A CABLE FAULT OR LOAD DEPENDING ON FUSE SIZE AND VACUUM INTERRUPTER SETTINGS.

SUPERVISORY CONTROL - MOTOR OPERATED WAYS- MOTOR OPERATED SWITCHES THAT CAN BE OPERATED VIA SCADA, OR THE SWITCHGEAR RELAY, DEPENDING ON PRE-DETERMINED SETTINGS.

ATO/ATS - AUTOMATIC THROW OVER OR AUTOMATIC TRANSFER SWITCH, THAT WILL AUTOMATICALLY OPEN AND CLOSE SWITCHES BASED ON RELAY SETTINGS TO RESTORE SERVICE TO THE AFFECTED AREA OR CUSTOMER.

ATO/SELF-HEALING (HIGH SPEED) - HAS THE ABILITY TO RESTORE POWER IN CYCLES OR MAY OPERATE IN A CLOSED LOOP SYSTEM BY ISOLATING FAULTS BEFORE THE CUSTOMER OR AFFECTED AREA EXPERIENCES AN OUTAGE.

SELF-HEALING - A TERM THAT DESCRIBES A SYSTEM OF MULTIPLE SWITCHGEAR UNITS WITH PEER TO PEER COMMUNICATION AND PROGRAMMED FOR AUTOMATIC RESTORATION OF CUSTOMERS WHEN A FAULT OCCURS.

MAGNETIC ACTUATOR - A DEVICE THAT CONVERTS ELECTRICAL CURRENT AND ASSOCIATED MAGNETIC FORCE INTO A MECHANICAL OUTPUT. SWITCHGEAR THAT UTILIZE THIS TECHNOLOGY ARE ABLE TO ACHIEVE EXTREMELY FAST TRANSFER TIME IN AN ATO/ATS APPLICATION, MAYBE AS QUICK AS 8 CYCLES.

APPLICATION GUIDE

	MANUAL LOADBREAK (ALL WAYS)	MANUAL LOADBREAK WAYS WITH FAULT INTERRUPTING LOAD WAYS	SUPERVISORY CONTROL-MOTOR OPERATED WAYS WITH OR WITHOUT FAULT INTERRUPTING LOAD WAYS	ATO/SELF-HEALING WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS	ATO/SELF-HEALING (HIGH SPEED) WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS
PAD-MOUNTED NON SUBMERSIBLE	S&C 15/25KV PME-10 (ALL) DWG. 28.01-100	S&C 15/25KV PME - 9 (ALL) DWG. 28.01-100	PME WITH CLEAVELAND PRICE MOTOR OPERATED WITH SEL 2411 (DEF) DWG. 28.02-132	PME 15/25KV ATO WITH MICRO AT CONTROL (DEC,DEP,DEF) DWG. 28.02-100	G&W 15KV 4 WAY MAGNETIC ACTUATOR WITH SEL 487 (ALL) DWG. 28.04-125A
		S&C 15/25KV PME-11 DEM,DEP,DEF DWG. 28.01-100		PME 25KV SUPERVISORY CONTROL MOTOR OPERATED WITH SEL 451 CONTROL (DEC, DEP) DWG. 28.02-116A	VISTA 422, 431 WITH SEL 351 (DEF) (I DRIVE ONLY) DWG. 28.03-101
					G&W 15KV PAD-MOUNTED RECLOSER WITH SEL 651 DWG. 28.15-103 (ALL)
		S&C 15/25KV PME-12 DEP,DEF DWG. 28.01-100			
		G&W 35KV WITH OC CONTROL (DEM) DWG. 28.03-115A			

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SWITCHGEAR APPLICATION GUIDE

DEC	DEM	DEP	DEF
X	X	X	X

28.00-110B

APPLICATION GUIDE

	MANUAL LOADBREAK (ALL WAYS)	MANUAL LOADBREAK WAYS WITH FAULT INTERRUPTING LOAD WAYS	SUPERVISORY CONTROL-MOTOR OPERATED WAYS WITH OR WITHOUT FAULT INTERRUPTING LOAD WAYS	ATO/SELF-HEALING WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS	ATO/SELF-HEALING (HIGH SPEED) WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS
PAD-MOUNTED SUBMERSIBLE	G&W (COASTAL) FOUR WAY MODEL 10 DWG. 28.04-115A (DEM,DEF)	G&W (COASTAL) FOUR WAY MODELS 9 AND 11 WITH S&C OVERCURRENT CONTROL (ALL) DWG. 28.04-113A & DWG. 28.04-117A (DEM,DEF)			
		S&C VISTA SD MODEL 532, 624, 523 WITH S&C OVERCURRENT CONTROL (DEP) DWGS. 28.04-101A, 28.04-103A AND 28.04-105A			
		S&C 25KV FAULT INTERRUPTER MODEL 321 WITH S&C OVERCURRENT CONTROL (DEC) DWG. 28.04-109A			
		G&W 15/25KV FAULT INTERRUPTER SINGLE PHASE WITH G&W TYPE 4 CONTROL (ALL) DWG. 28.04-121A			

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SWITCHGEAR APPLICATION GUIDE

DEC	DEM	DEP	DEF
X	X	X	X

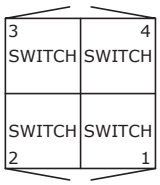
28.00-110C

	MANUAL LOADBREAK (ALL WAYS)	MANUAL LOADBREAK WAYS WITH FAULT INTERRUPTING LOAD WAYS	SUPERVISORY CONTROL-MOTOR OPERATED WAYS WITH OR WITHOUT FAULT INTERRUPTING LOAD WAYS	ATO/SELF-HEALING WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS	ATO/SELF-HEALING (HIGH SPEED) WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS
VAULT NON SUBMERSIBLE		G&W 15KV FAULT INTERRUPTER THREE-PHASE WITH SINGLE-PHASE TRIP WITH TYPE 4 CONTROL (DEF) DWG. 28.05-141A		S&C 25KV ATO VISTA SD MODEL 422 WITH SEL 487 (DEC) DWG. 28.05-131A	
				G&W 15KV ATO LOAD BREAK FOUR WAY (2 UNITS) (DEF) DWG. 28.05-107	

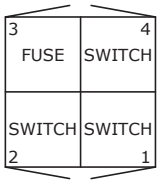
	MANUAL LOADBREAK (ALL WAYS)	MANUAL LOADBREAK WAYS WITH FAULT INTERRUPTING LOAD WAYS	SUPERVISORY CONTROL-MOTOR OPERATED WAYS WITH OR WITHOUT FAULT INTERRUPTING LOAD WAYS	ATO/SELF-HEALING WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS	ATO/SELF-HEALING (HIGH SPEED) WITH OR WITHOUT FAULT INTERRUPTING TAPS OR LOAD WAYS
VAULT SUBMERSIBLE	ELASTIMOLD 15KV MVS TWO WAY 200 AMP ON END LOADBREAK (DEF) DWG. 28.05-101	S&C VISTA SD MODEL 404 S1000 OC CONTROL (ALL) DWG. 28.05-127A	G&W 15KV MOTOR OPERATED SOLID DIELECTRIC THREE WAY WITH SEL 2240 AXION CONTROL (DEF NETWORK) DWG. 28.05-145A	S&C 25KV ATO VISTA SD MODEL 422 WITH SEL 487 (DEC) DWG. 28.05-135A	
	ELASTIMOLD 15KV TAP THREE WAY LOADBREAK 200 AMP ON END (DEF) DWG. 28.05-103	S&C 25KV FAULT INTERRUPTER VISTA SD MODEL 303 WITH S1000 CONTROL (ALL) DWG. 28.05-139A		G&W 15 KV SOLID DIELECTRIC ATO WITH 2 SEL 451 CONTROLS (ALL) DWG. 28.05-147A	
	G&W 15KV TWO WAY LOADBREAK 600 AMP (ALL) DWG. 28.05-105	S&C 25KV FAULT INTERRUPTER VISTA SD MODEL 101 WITH S1000 CONTROL (ALL) DWG. 28.05-143A			

COMPARTMENT ORIENTATIONS

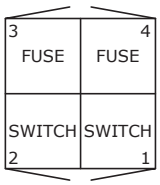
- PME-10
- PME 10 ATS



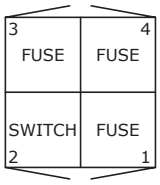
- PME-11
- PME 11 ATS



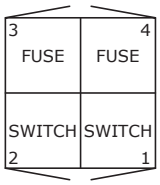
- PME-9
- PME 9 ATS



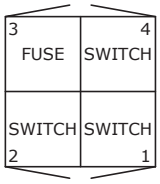
PME-12



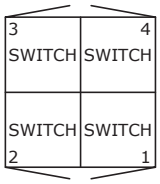
G & W-9



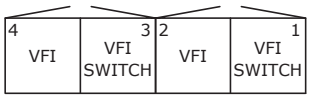
G & W-11



G & W-10



- VISTA 9 I-DRIVE

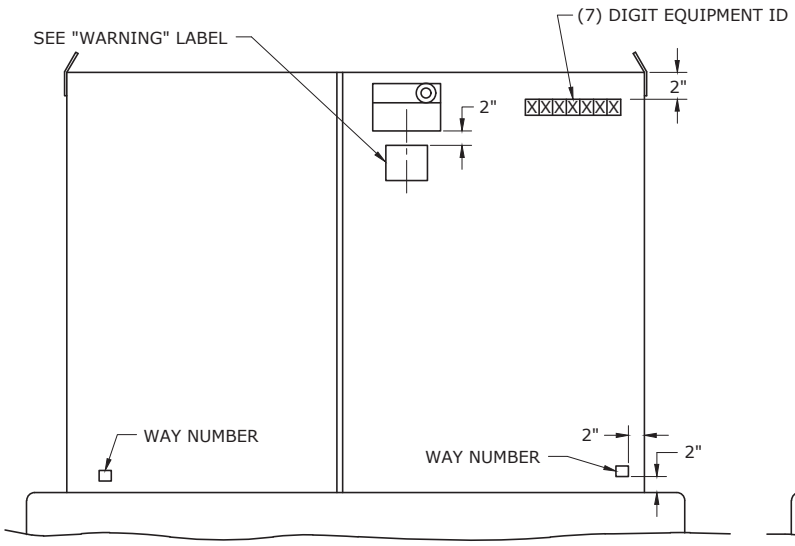


3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

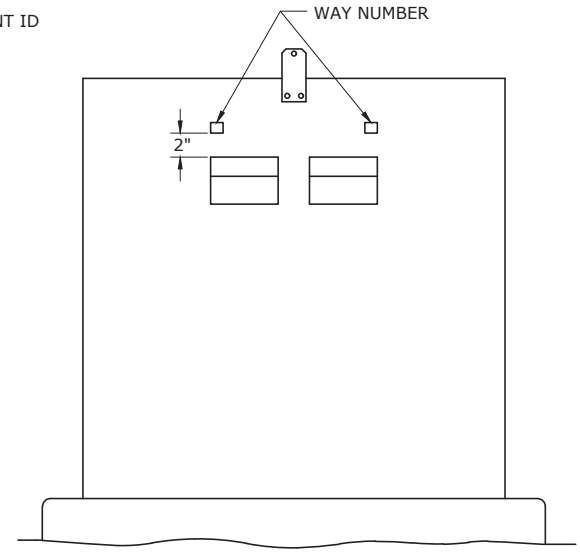
SWITCHGEAR CONFIGURATIONS -
WAY CONVENTION BY TYPE

DEC	DEM	DEP	DEF
		X	X

28.00-112

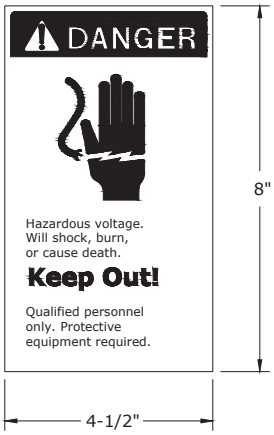


PME SWITCHGEAR (9-12)
FRONT VIEW
DOORS CLOSED



PME SWITCHGEAR (9, 10, 11 & 12 SIMILAR)
SIDE VIEW
DOORS CLOSED

WARNING LABEL
EXTERIOR MOUNTING ONLY
ITEM # 4161096



DANGER LABEL
INTERIOR MOUNTING ONLY
ITEM # 4027964

"WARNING" LABEL SHALL BE LOCATED ON THE OUTSIDE OF PAD-MOUNTED SWITCHGEAR.

NOTES:

1. WIPE METAL SURFACES WITH CABLE CLEANER AND A CLEAN CLOTH BEFORE APPLYING LABEL.
2. LABELS MUST BE APPLIED CAREFULLY. ONCE THIS MATERIAL IS APPLIED, IT CANNOT BE MOVED.
3. NEW SWITCHGEAR COMES WITH A FACTORY APPLIED "WARNING" LABEL.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

LOCATION OF WARNING, DANGER AND EQUIPMENT ID LABELS FOR PAD-MOUNTED SWITCHGEAR

DUKE ENERGY.

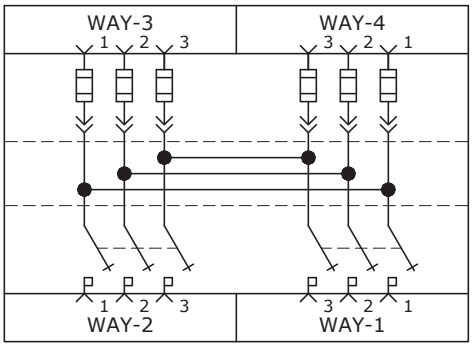
DEC	DEM	DEP	DEF
		X	X

28.00-114

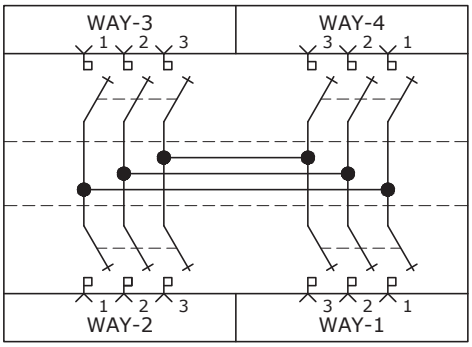
THE MANUAL PME SWITCHGEAR IS AN AIR INSULATED GEAR WITH DEAD FRONT CONSTRUCTION. THE 600 AMP SWITCHES ARE OPERATED WITH A MANUAL HANDLE AT EACH 600 AMP SWITCH POSITION. FUSES ARE BEHIND A SWING DOOR AND ARE CONNECTED TO 200 AMP LOAD BREAK BUSHINGS. THE METAL ENCLOSURE CAN EITHER BE MILD STEEL OR STAINLESS STEEL DEPENDING ON LOCATION.

FUSE TYPE	60-HZ RATINGS							
	KV			CURRENT (IN AMPERES, RMS)			SHORT-CIRCUIT	
				FUSE MAX	MINI-RUPTER SWITCH			
	NOM	MAX	BIL		CONT.	LOAD DROPPING	AMPERES RMS SYM.	MVA 3-PHASE SYM. AT RATED VOLTAGE
SMU-20	15	17.0	95	200	600	600	14,000	350
	25	27	125	200	600	600	12,500	540

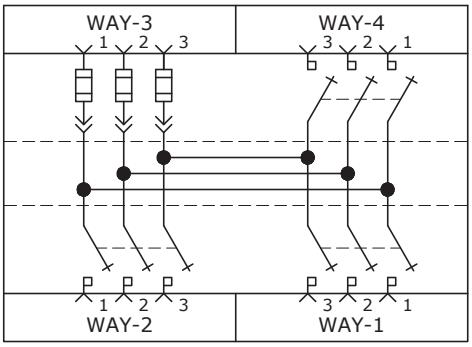
PME CONFIGURATION OPTIONS ARE LISTED BELOW.



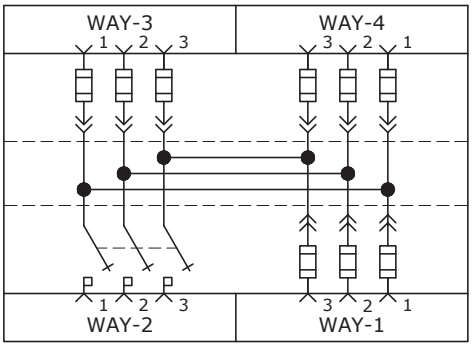
PME-9



PME-10



PME-11



PME-12

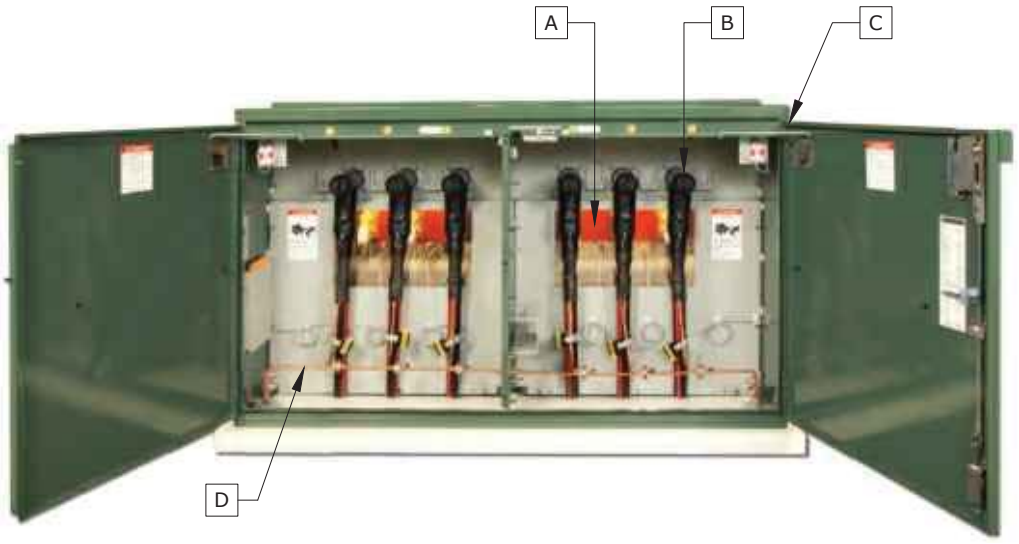
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME - MANUAL

GENERAL DESCRIPTION AND CONFIGURATIONS

DEC	DEM	DEP	DEF
X	X	X	X

28.01-100



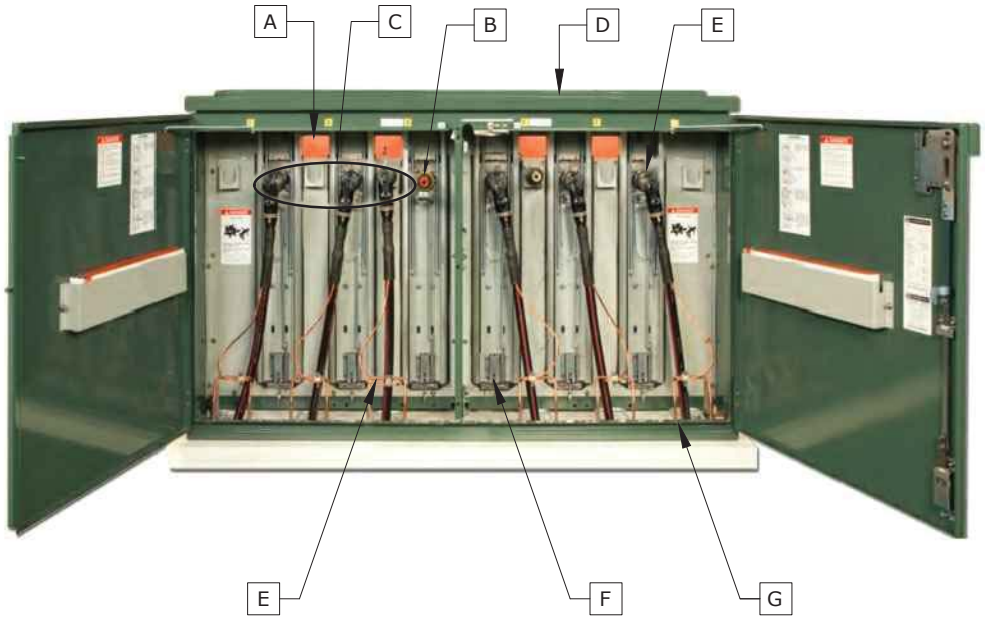
A	VISIBLE BREAK WINDOW
B	600 AMP BUSHINGS SHOWN WITH T-BODY CONNECTIONS
C	PROVISION FOR FAULT INDICATOR (WHERE REQUIRED)
D	GROUNDING BAR

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME - 600 AMP SWITCH COMPARTMENT

DEC	DEM	DEP	DEF
X	X	X	X

28.01-102



A	VIEWING WINDOWS FOR CHECKING BLOWN FUSE INDICATORS
B	200 AMP BUSHINGS
C	PARKING STAND WITH PARKING BUSHING INSTALLED
D	HINGED ROOF FOR CABLE PULLING OPERATIONS
E	GROUNDING RINGS
F	LATCH TO PIVOT PANEL FOR ACCESS TO FUSE
G	CABLE GUIDES

NOTES:

1. ROUTE CABLE THROUGH CABLE GUIDES.

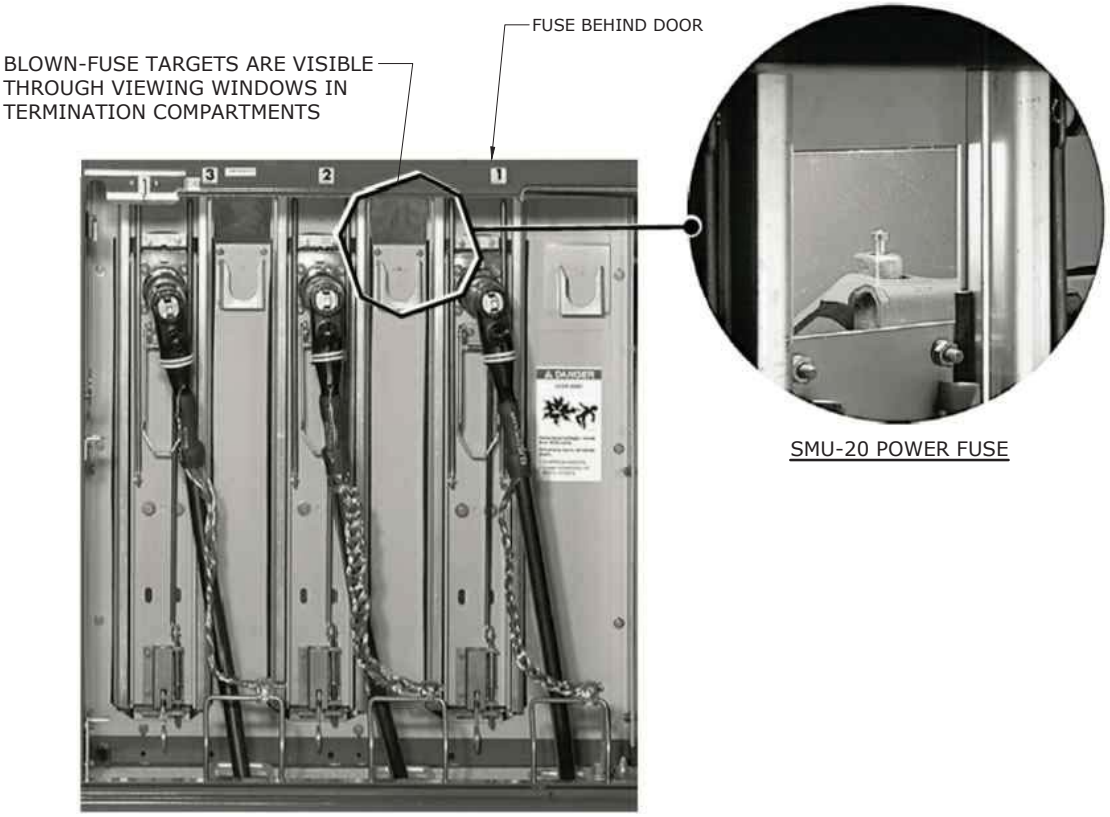
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME SWITCHGEAR - FUSE COMPARTMENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.01-104



SMU-20 POWER FUSE

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME SWITCHGEAR

SMU-20 FUSE AND SME-20 END FITTING

DEC	DEM	DEP	DEF
X	X	X	X

28.01-106

FUSE SIZE	15 KV	
	ITEM NUMBER	COMPATIBLE UNIT
25E	4003676	FUSE-POWER-25-E-14KV-SMU-F
40E	50115538	FUSE-POWER-40-E-14KV-SMU-F
65E	4003677	FUSE-POWER-65-E-14KV-SMU-F
80E	4003678	FUSE-POWER-80-E-14KV-SMU-F
100E	4003679	FUSE-POWER-100-E-14KV-SMU-F
125E	4003680	FUSE-POWER-125-E-14KV-SMU-F
150E	4003681	FUSE-POWER-150-E-14KV-SMU-F
200E	4003682	FUSE-POWER-200-E-14KV-SMU-F

DUKE ENERGY.

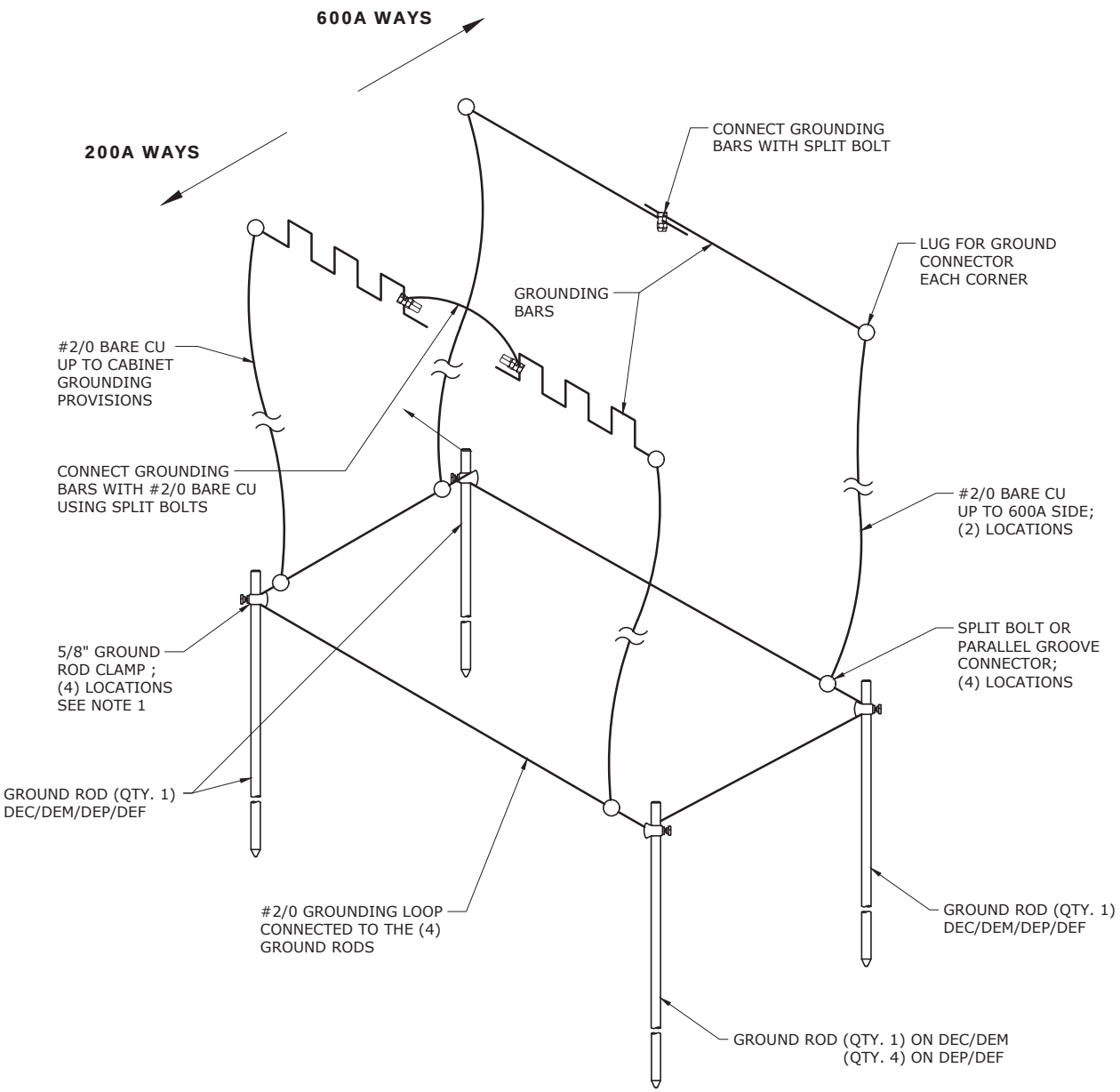
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME SWITCHGEAR

FUSE SIZES

DEC	DEM	DEP	DEF
			X

28.01-108



PME 9 CONFIGURATION

NOTES:

1. GROUND WIRE MUST BE INSTALLED ON OPPOSITE SIDE OF SET SCREW.
2. DEC/DEM: GROUND RODS ARE 8' LONG WITH ONE ROD INSTALLED ON EACH CORNER OF BOX PAD.
3. DEP/DEF: GROUND RODS ARE 5' LONG WITH ONE ROD INSTALLED ON 3 CORNERS AND 4 RODS ATTACHED VERTICALLY ON THE 4TH CORNER.

3				
2				
1				
0	3/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME STYLE SWITCHGEAR GROUNDING

DEC	DEM	DEP	DEF
X	X	X	X

28.01-110

DEC/DEM INSTALL ONE 5/8" X 8' GROUND ROD IN EACH CORNER OF THE MOUNTING BOX OR CABLE PIT TO SUPPORT THE #2/0 CU GROUND LOOP.

DEF/DEP INSTALL FOUR 5/8" X 5' GROUND ROD SECTIONS (CONNECTED VERTICALLY) IN ONE CORNER OF THE SWITCHGEAR MOUNTING BOX AND ONE 5/8" X 5' GROUND ROD IN THE OTHER 3 CORNERS OF THE MOUNTING BOX TO SUPPORT THE #2/0 CU GROUND LOOP.

BUILD A 2/0 GROUND LOOP AND ATTACH #2/0 CU CONDUCTOR TO EACH OF THE SWITCHGEAR GROUNDING PAD AND GROUNDING BARS IF PROVIDED ON EQUIPMENT.

T-BODY CONNECTIONS INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 CU GROUND LOOP.

LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.

IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

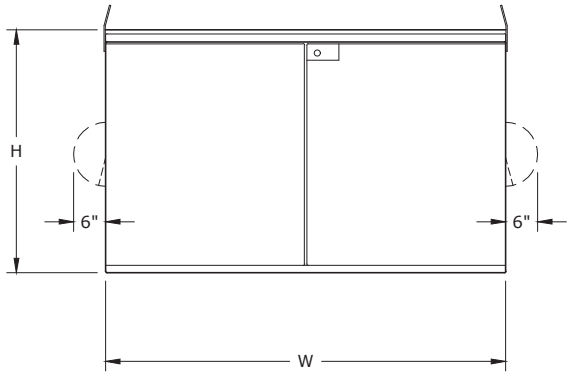
DUKE ENERGY.

3				
2				
1				
0	3/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

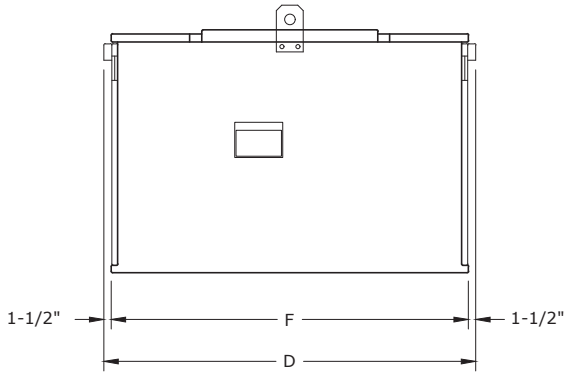
PME - SWITCHGEAR NOTES

DEC	DEM	DEP	DEF
X	X	X	X

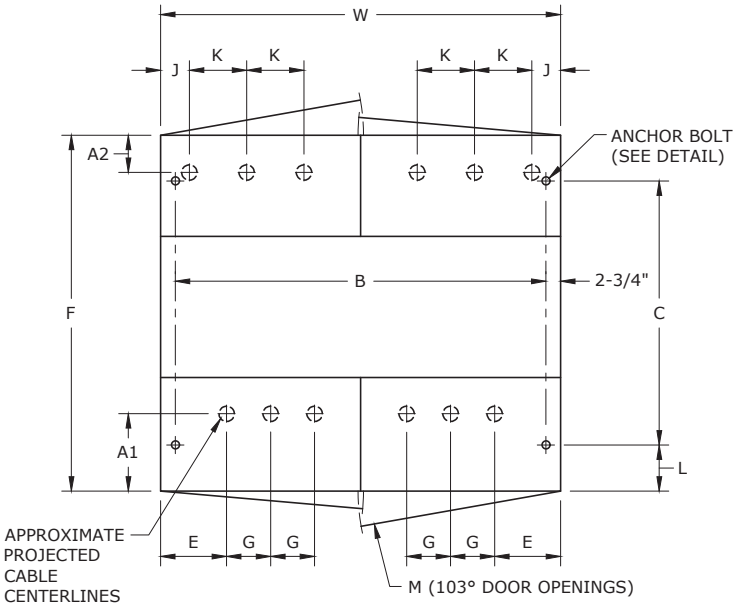
28.01-112



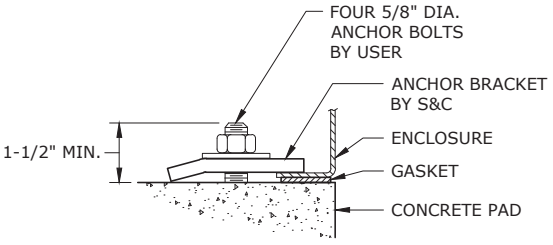
FRONT VIEW



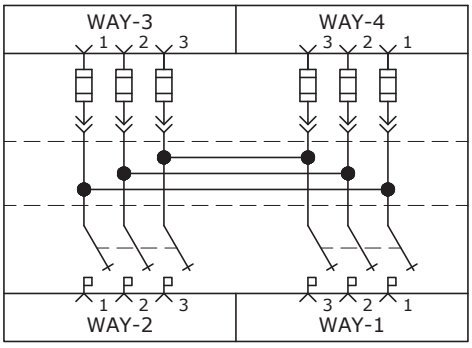
SIDE VIEW



ANCHOR BOLT PLAN



ANCHOR BOLT DETAIL



PME-9

KV NOMINAL	DISTANCE (INCHES)													
	A1	A2	B	C	D	E	F	G	H	J	K	L	M	W
15	14-1/2	7	69-1/2	49-1/2	69-3/4	12-3/8	66-3/4	8-1/4	45-1/2	5-3/8	10-3/4	8-5/8	38	75
25	18-1/2	8-1/8	78-1/2	52	84-3/4	12-7/8	81-3/4	8-1/4	51-1/2	6	12	14-7/8	42-1/2	84

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-9 15/25 KV

DIMENSIONS AND CABLE/CONDUIT PLACEMENT

DEC	DEM	DEP	DEF
X	X	X	X

28.01-118A

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-2SW/600-2F/200-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4004063	1	SWITCHGEAR, PAD-MOUNT, 600A, 3PH, DF, AIR INSUL 2SW CKTS & 2 FUSED CKTS, W/6" BASE SPACER & 6 S&C 200A TYPE
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME 9, 10 & 11.
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT, DEAD FRONT
			4003399	1	CONNECTOR, ELECTRICAL, VISE 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 2	ELBOW-VARIES	6	-	-	LOADBREAK ELBOW- SEE SECTION 26
-	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED 99MS INRUSH RESTRAINT, 24MS TRIP DELAY, SCADA
SEE NOTE 2	ELBOW-INS-AL-200A-15KV-LB-F	6	831048	-	ELBOW INSERT AL 200A 15KV LOADBREAK

NOTES:

1. WHEN THE SOURCE-SIDE OF THE SWITCHGEAR SERVES AS THE OPEN POINT OF AN UNDERGROUND LOOP, ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY. OTHERWISE, A 200 AMP INSULATING CAP WILL BE INSTALLED ON EACH T-BODY.

2. THE NUMBER OF REQUIRED BUSHING INSERTS AND 200A ELBOWS VARIES BASED ON THE NUMBER OF CABLES CONNECTED TO THE LOAD-SIDE POSITIONS OF THE SWITCHGEAR.

3. SEE DWG. 28.01-108 FOR FUSE SELECTION.

DUKE ENERGY.

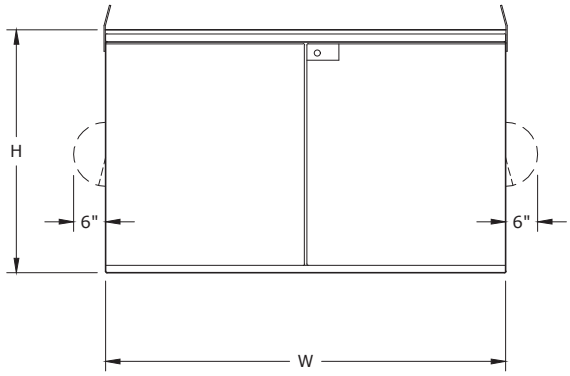
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-9 15KV

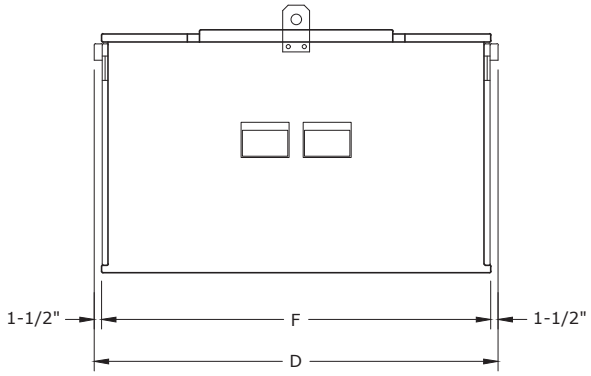
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

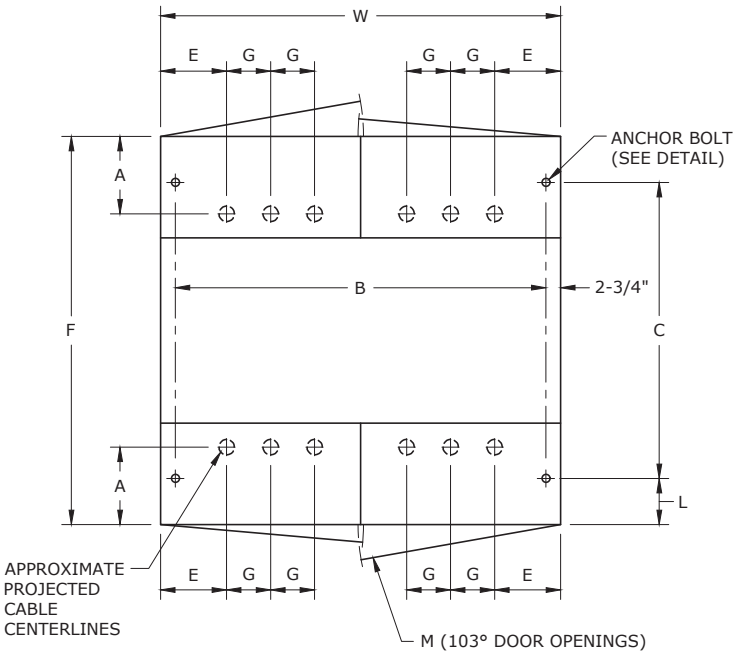
28.01-118B



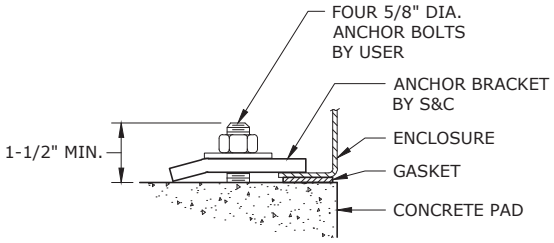
FRONT VIEW



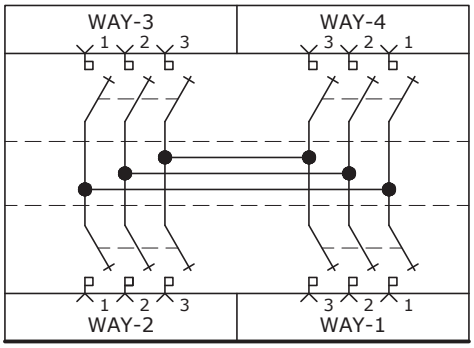
SIDE VIEW



ANCHOR BOLT PLAN



ANCHOR BOLT DETAIL



PME-10

KV NOMINAL	DISTANCE (INCHES)										
	A	B	C	D	E	F	G	H	L	M	W
15	14-1/2	69-1/2	55-1/2	75-3/4	12-3/8	72-3/4	8-1/4	45-1/2	8-5/8	38	75
25	18-1/2	78-1/2	58-1/2	91-1/4	12-7/8	88-1/4	8-1/4	51-1/2	14-7/8	42-1/2	84

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-10 15/25 KV

DIMENSIONS AND CABLE/CONDUIT PLACEMENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.01-120A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-4SW/600-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4004064	1	SWITCHGEAR, PAD MOUNT, 600A, 3PH, SS, DF, AIR INSUL, 4 SW CKT W/6" BASE SPACER, 304L ENCLOSURE, W/O BASE
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME 9, 10 & 11.
-	GND-SG-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A - 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE ELECTRICAL BARE, SOL SD, 2/0 AWG, CU CONDUCTOR 125 SPOOLS
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT, DEAD FRONT
			4003399	1	CONNECTOR, ELECTRICAL, VISE 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT 3-PH UG 1200A TRIP, CURRENT RESET, MODIFIED 99MS INRUSH RESTRAINT, 24MS TRIP DELAY, SCADA
-	ELBOW-T-VARIES	12	-	1	TERMINATOR, ELBOW 600A 15KV, SEE SECTION 26

NOTES:

1. WHEN THE SOURCE-SIDE OF THE SWITCHGEAR SERVES AS THE OPEN POINT OF AN UNDERGROUND LOOP, ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY. OTHERWISE, A 200 AMP INSULATING CAP WILL BE INSTALLED ON EACH T-BODY.

DUKE ENERGY.

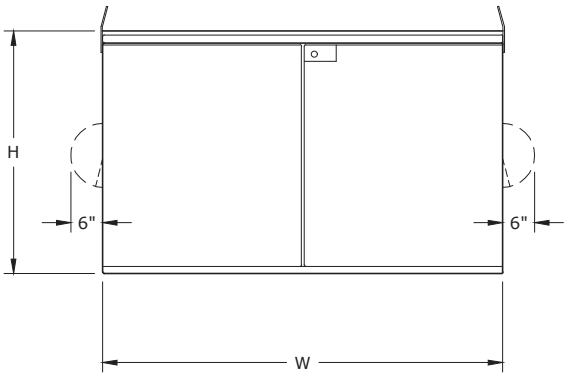
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-10 15KV

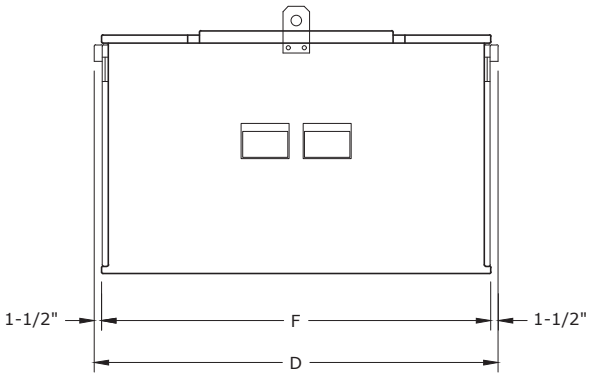
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

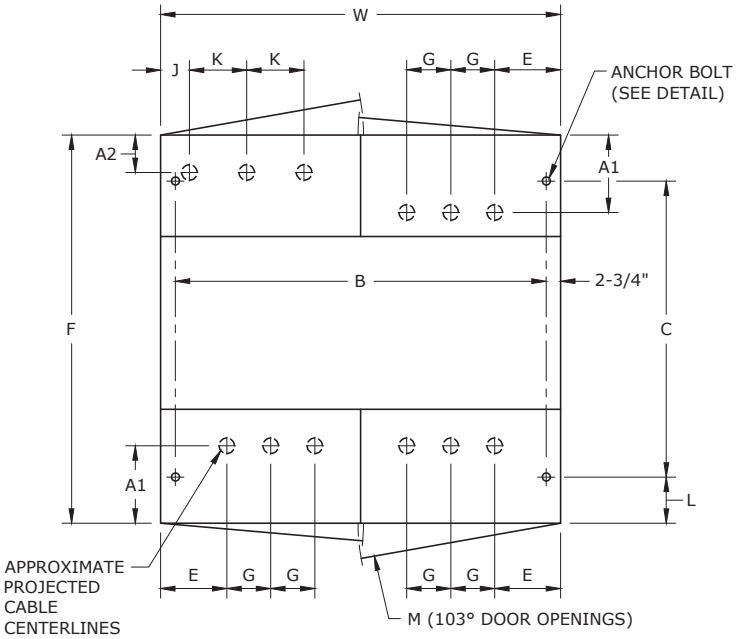
28.01-120B



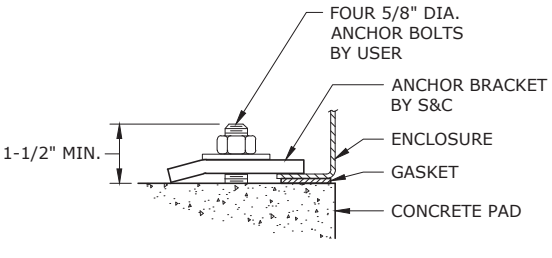
FRONT VIEW



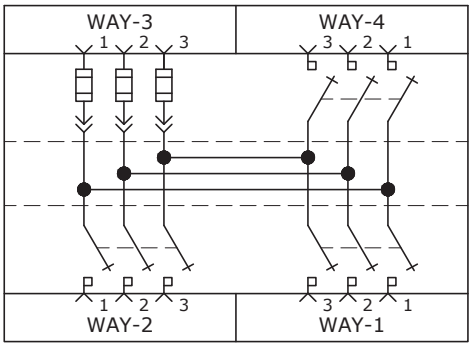
SIDE VIEW



ANCHOR BOLT PLAN



ANCHOR BOLT DETAIL



PME-11

KV NOMINAL	DISTANCE (INCHES)													
	A1	A2	B	C	D	E	F	G	H	J	K	L	M	W
15	14-1/2	7	69-1/2	55-1/2	75-3/4	12-3/8	72-3/4	8-1/4	45-1/2	5-3/8	10-3/4	8-5/8	38	75
25	18-1/2	8-1/8	78-1/2	58-1/2	91-1/4	12-7/8	88-1/4	8-1/4	51-1/2	6	12	14-7/8	42-1/2	84

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-11 15/25 KV

DIMENSIONS AND CABLE/CONDUIT PLACEMENT

DEC	DEM	DEP	DEF
	X	X	X

28.01-122A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-3SW/600-1F/200-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4004065	1	SWITCHGEAR, PAD-MOUNT, 600A, 3-PH, SS, DF AIR INSUL 3 SW & 1 FUSED CKT, W/6" BASE SPACER & 3 S&C 200A TYPE
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME 9, 10 & 11.
-	GND-SG-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	20	WIRE/CABLE ELECTRICAL BARE, SOL SD, 2/0 AWG, CU CONDUCTOR 125 SPOOLS
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT, DEAD FRONT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-VARIES	3	-	1	LOADBREAK ELBOW- SEE SECTION 26
-	ELBOW-T-VARIES	9	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT, 3-PH UG, 1200A TRIP CURRENT RESET, MODIFIED 99MS INRUSH RESTRAINT, 24MS TRIP DELAY, SCADA
-	ELBOW-INS-AL-200A-15KV-LB-F	3	831048	1	ELBOW INSERT AL 200A 15KV LOADBREAK

NOTES:

1. WHEN THE SOURCE-SIDE OF THE SWITCHGEAR SERVES AS THE OPEN POINT OF AN UNDERGROUND LOOP, ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY. OTHERWISE, A 200 AMP INSULATING CAP WILL BE INSTALLED ON EACH T-BODY.

DUKE ENERGY.

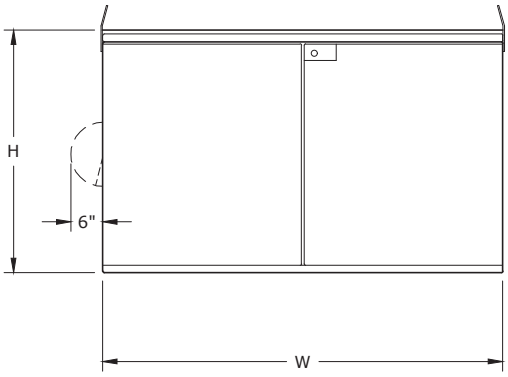
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

PME-11 15KV

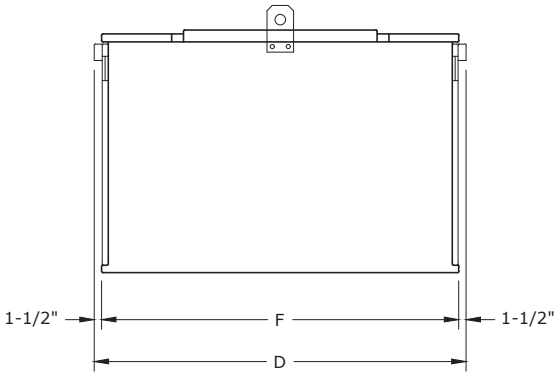
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

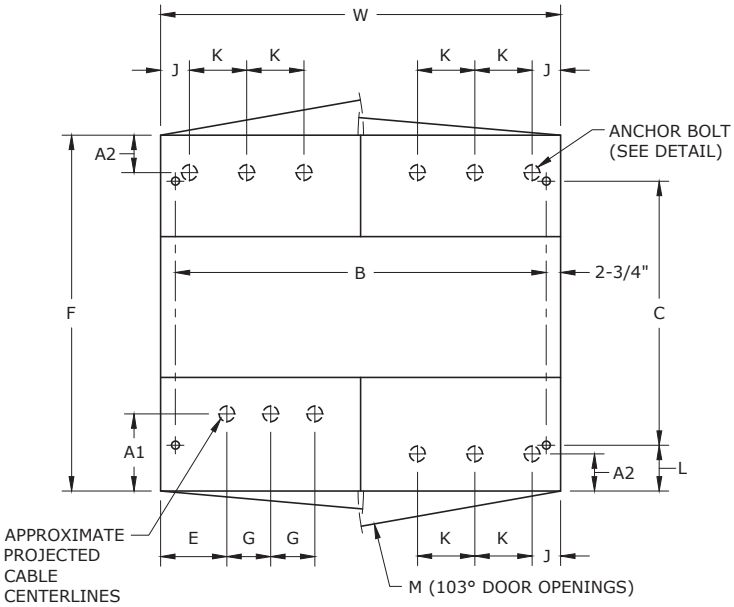
28.01-122B



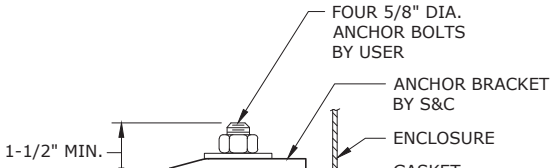
FRONT VIEW



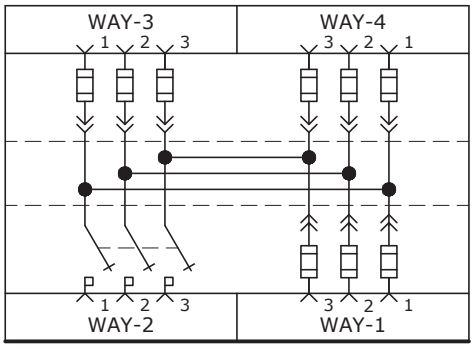
SIDE VIEW



ANCHOR BOLT PLAN



ANCHOR BOLT DETAIL



PME-12

KV NOMINAL	DISTANCE (INCHES)													
	A1	A2	B	C	D	E	F	G	H	J	K	L	M	W
15	14-1/2	7	69-1/2	49-1/2	69-3/4	12-3/8	66-3/4	8-1/4	45-1/2	5-3/8	10-3/4	8-5/8	38	75
25	18-1/2	8-1/8	78-1/2	52	84-3/4	12-7/8	81-3/4	8-1/4	51-1/2	6	12	14-7/8	42-1/2	84

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-12 15/25 KV

DIMENSIONS AND CABLE/CONDUIT PLACEMENT

DEC	DEM	DEP	DEF
		X	X

28.01-124A

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-1SW/600-3F/200-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4204954	1	SWITCHGEAR, PAD-MOUNT, 15KV, PME 12
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME 9, 10 & 11.
-	GND-SG-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE ELECTRICAL BARE, SOL SD, 2/0 AWG, CU CONDUCTOR 125 SPOOLS
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	3	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT, DEAD FRONT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-VARIES	9	-	-	LOADBREAK ELBOW, SEE SECTION 26
-	ELBOW-T-VARIES	3	-	-	TERMINATOR, ELBOW 600A 15KV, SEE SECTION 26
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED 99MS INRUSH RESTRAINT, 24MS TRIP DELAY, SCADA
SEE NOTE 2	ELBOW-INS-AL-200A-15KV-LB-F	9	831048	1	ELBOW INSERT AL 200A 15KV LOADBREAK

NOTES:

1. INSTALL ELBOW ARRESTERS ON T-BODYS.

2. THE NUMBER OF REQUIRED BUSHING INSERTS AND 200A ELBOWS VARIES BASED ON THE NUMBER OF CABLES CONNECTED TO THE LOAD-SIDE POSITIONS OF THE SWITCHGEAR.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-12 15KV

BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

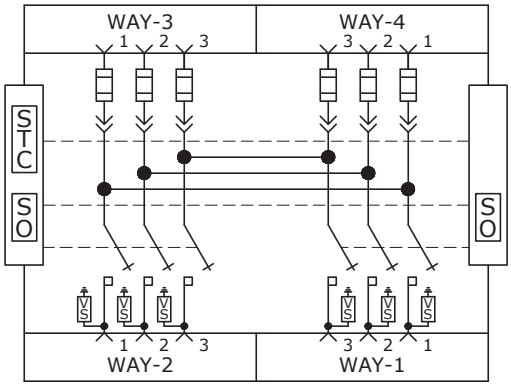
28.01-124B

PME-ATO TRANSFERS ON LOSS OF SOURCE VOLTAGE, UNBALANCE, OR ANY SOURCE OPEN PHASE CONDITION.

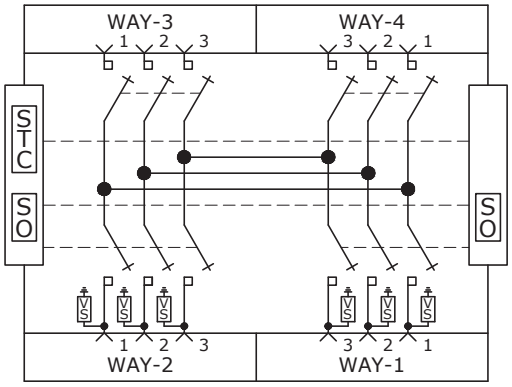
FUSE TYPE	60-HZ RATINGS							
	KV			CURRENT (IN AMPERES, RMS)			SHORT-CIRCUIT	
				FUSE MAX	MINI-RUPTER SWITCH			
	NOM	MAX	BIL		CONT.	LOAD DROPPING	AMPERES RMS SYM.	MVA 3-PHASE SYM. AT RATED VOLTAGE
SME-20	15	17.0	95	200	600	600	14,000	350
	25	27	125	200	600	600	12,500	540

PME-ATO DIMENSIONS AND COMPARTMENT ORIENTATION ARE THE SAME AS NON-ATO PME GEAR, HOWEVER, SWITCH OPERATOR COMPARTMENTS WILL ADD TO OVERALL SIZE OF EACH PARTICULAR SWITCHGEAR.

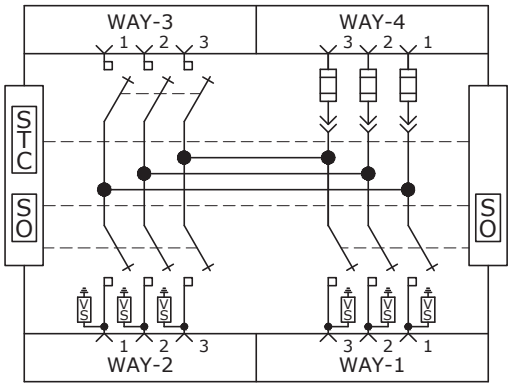
PME-ATO WITH MICRO-AT CONTROL OPTIONS SHOWN BELOW:
STC-SOURCE TRANSFER CONTROL
SO-SWITCH OPERATOR



PME-9 ATO



PME-10 ATO



PME-11 ATO

3					
2					
1					
0	1/31/19	DANNA	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

PME-ATO 15/25 KV MICRO AT CONTROL
GENERAL DESCRIPTION,
RATINGS AND CONFIGURATIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

28.02-100A

NOTES:

1. DEC - INSTALL (1) 5/8" X 8' GROUND ROD IN EACH CORNER OF THE MOUNTING BOX OR CABLE PIT TO SUPPORT THE #2/0 CU GROUND LOOP.

2. DEP/DEF - INSTALL (4) 5/8" X 5' GROUND ROD SECTIONS (CONNECTED VERTICALLY) IN ONE CORNER OF THE SWITCHGEAR MOUNTING BOX, AND (1) 5/8" X 5' GROUND ROD IN EACH OF THE OTHER 3 CORNERS OF THE MOUNTING BOX TO SUPPORT THE #2/0 CU GROUND LOOP.

3. BUILD A #2/0 GROUND LOOP AND ATTACH A #2/0 CU CONDUCTOR TO EACH OF THE SWITCHGEAR GROUNDING PAD AND GROUNDING BARS IF PROVIDED ON EQUIPMENT. SEE DWG. 28.01-110.

4. T-BODY CONNECTIONS INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR #2/0 GROUND LOOP.

5. LOADBREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR #2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

6. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

7. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

8. IF ARRESTERS ARE REQUIRED, ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR #2/0 GROUND LOOP.

9. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6' OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6/0 CU CONDUCTOR.

10. INSTALL INSULATING CAPS ON ALL UNUSED 200 AMP AND 600 AMP BUSHINGS.

11. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEP.

DUKE ENERGY.

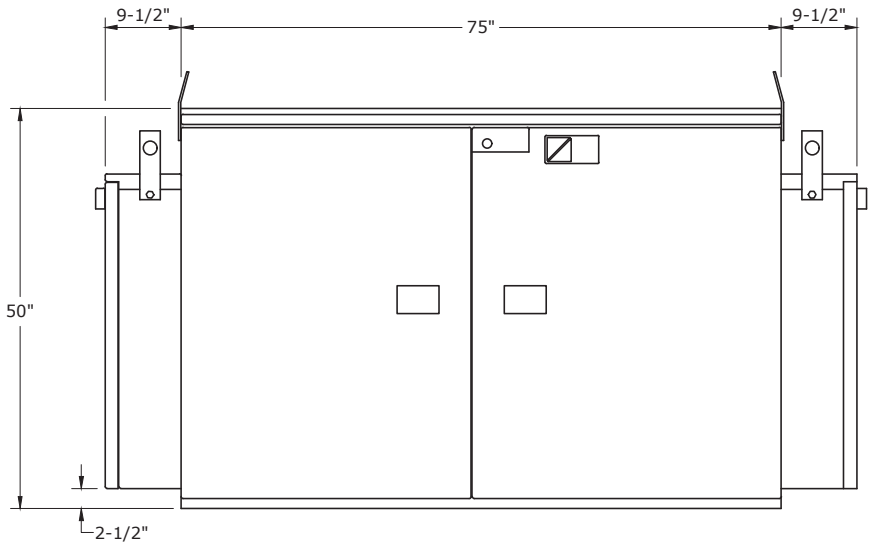
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	3/31/19	DANNA	EANES	ADCOCK

PME-ATO MICRO AT CONTROL

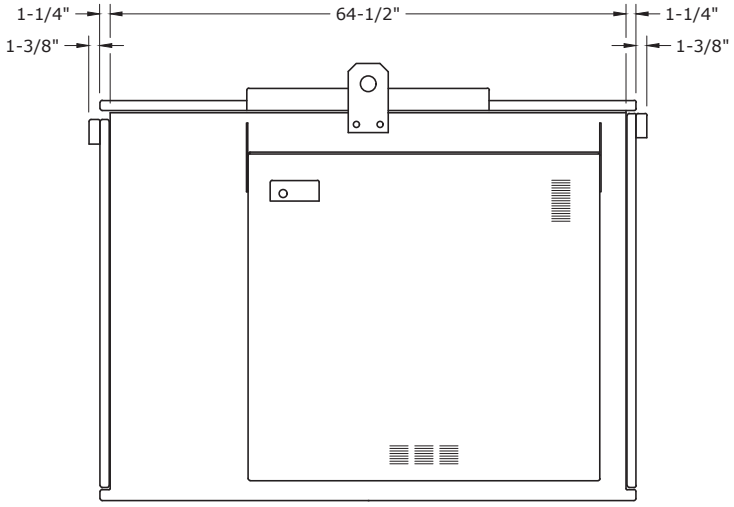
NOTES

DEC	DEM	DEP	DEF
X		X	X

28.02-100B



FRONT VIEW



SIDE VIEW

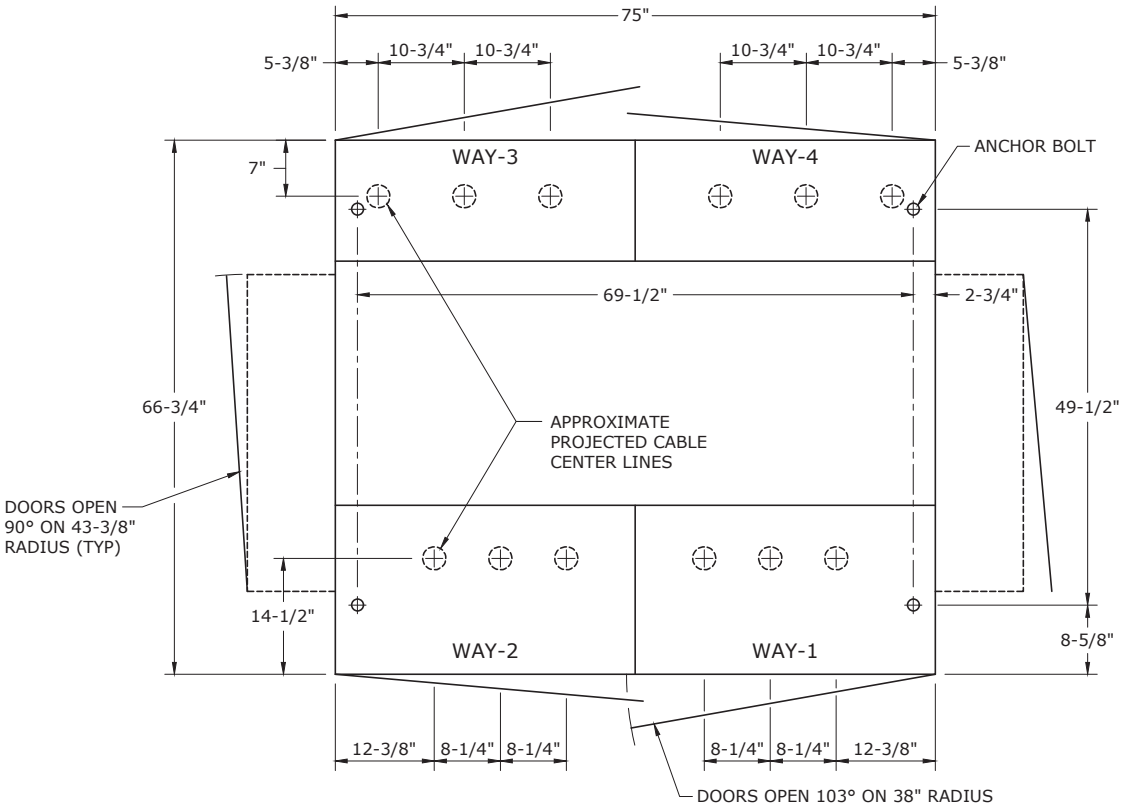
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-9 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

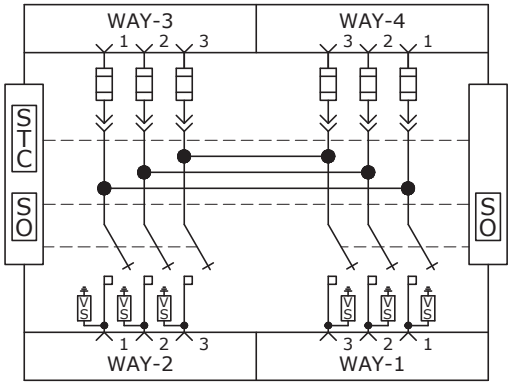
DUKE ENERGY.

DEC	DEM	DEP	DEF
X			X

28.02-102A



ANCHOR BOLT PLAN



CONNECTION DIAGRAM

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-9 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

DEC	DEM	DEP	DEF
X		X	X

28.02-102B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-2SW/600-2F/200-ATO-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4004071	1	SWITCHGEAR, PAD MOUNT, 15KV, SWITCH - AUTOTRANSFER
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT, 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-VARIES	6	-	-	LOADBREAK ELBOW- SEE SECTION 26
-	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
SEE NOTE 2	ELBOW-INS-AL-200A-15KV-LB-F	6	831048	1	ELBOW INSERT AL 200A 15KV LOADBREAK

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY.

2. THE NUMBER OF REQUIRED BUSHING INSERTS AND 200A ELBOWS VARIES BASED ON THE NUMBER OF CABLES CONNECTED TO THE LOAD SIDE POSITIONS OF THE SWITCHGEAR.

DUKE ENERGY.

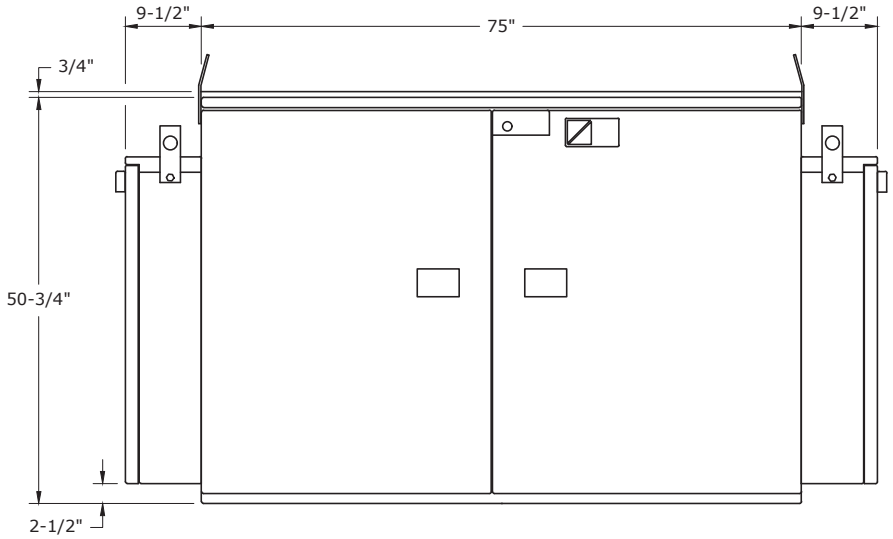
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-9 ATO 15KV WITH MICRO AT CONTROL

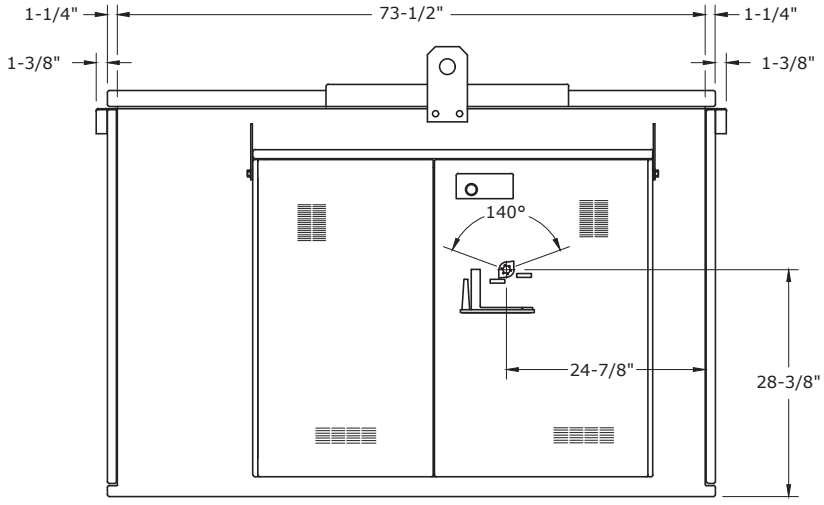
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.02-102C



FRONT VIEW



SIDE VIEW

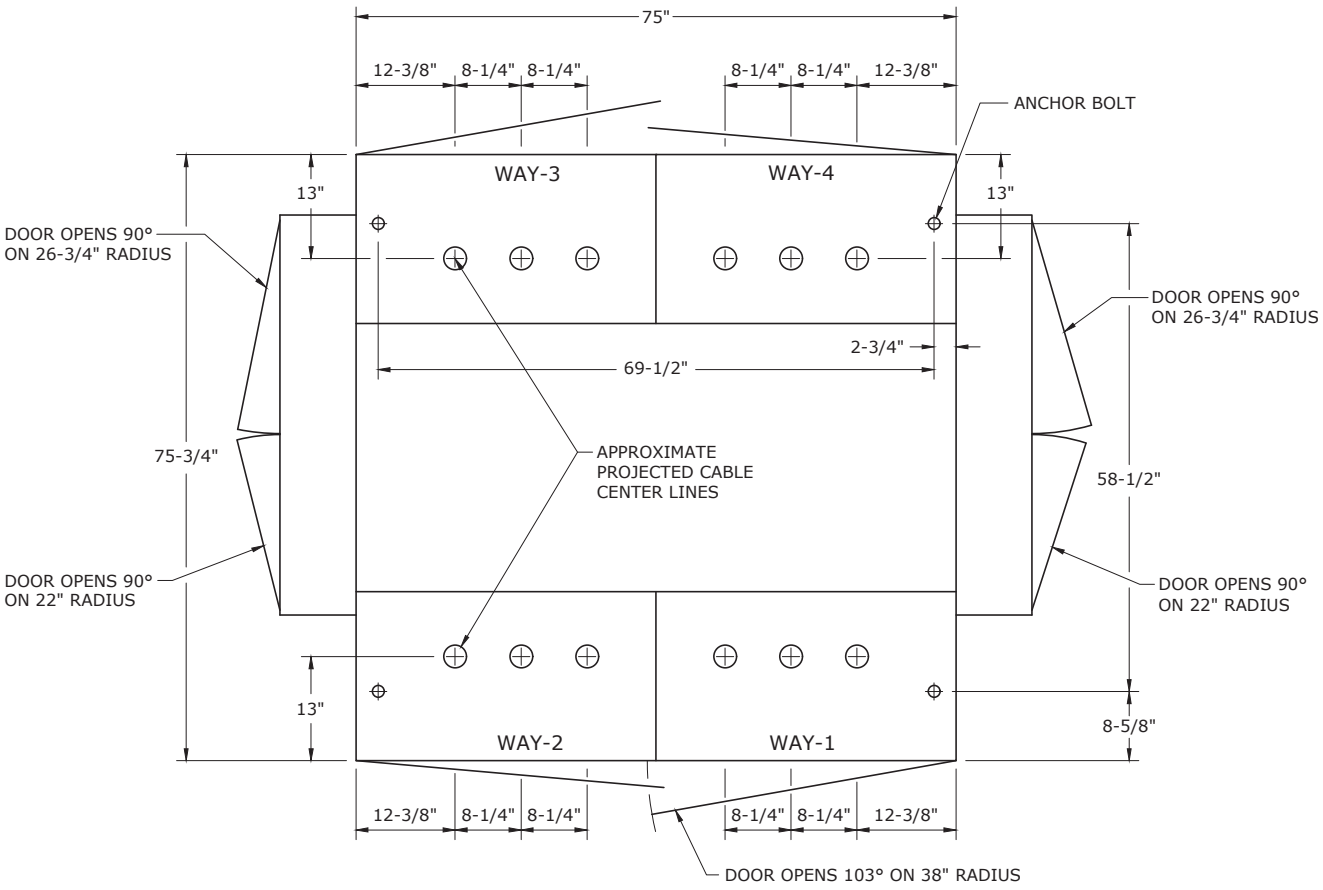
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-10 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

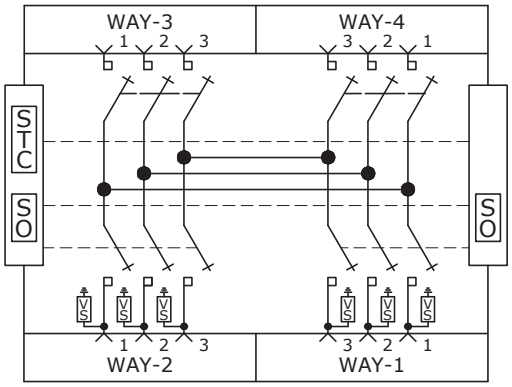
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-104A



ANCHOR BOLT PLAN



PME-10 ATO

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-10 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

DEC	DEM	DEP	DEF
			X

28.02-104B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-4SW/600-ATO-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4004118	1	SWITCH, AUTOMATIC TRANSFER, 14.4KV, PAD MOUNT, A14 SS ENCL
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT, 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-T-VARIES	12	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY IN EACH WAY ASSOCIATED WITH THE TRANSFER SCHEME. 200 AMP INSULATING CAPS SHALL BE INSTALLED 200 ON EACH T-BODY OF THE REMAINING WAYS.

DUKE ENERGY.

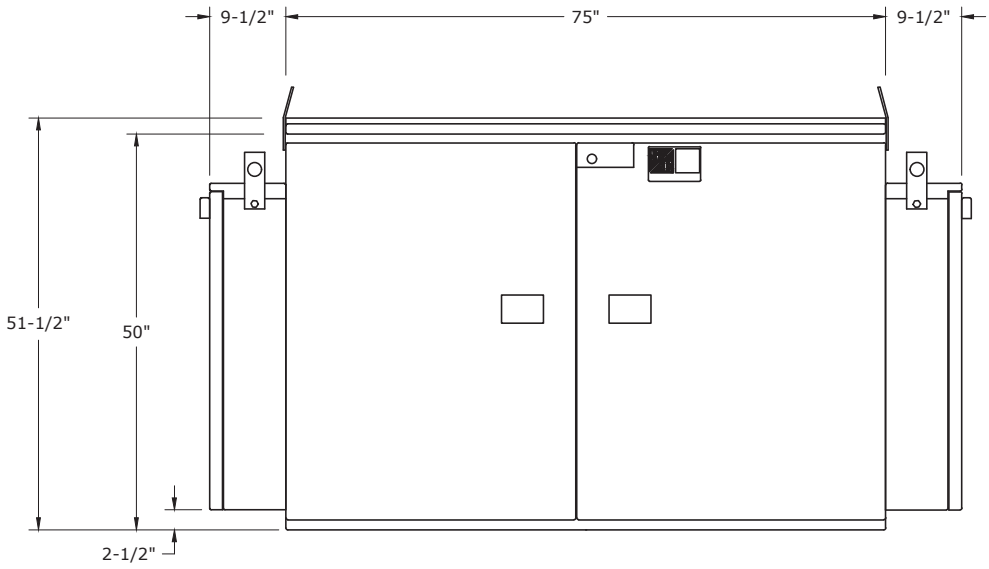
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-10 ATO 15KV WITH MICRO AT CONTROL

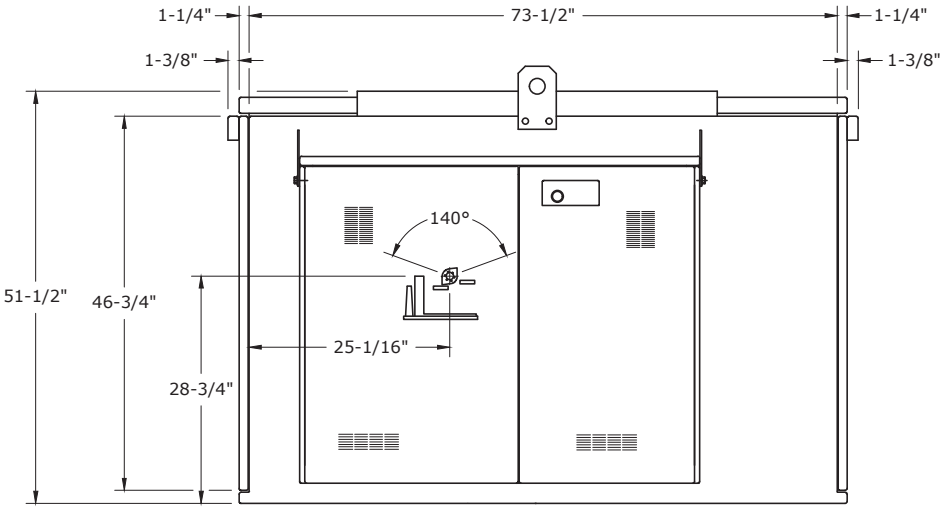
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.02-104C



FRONT VIEW



SIDE VIEW

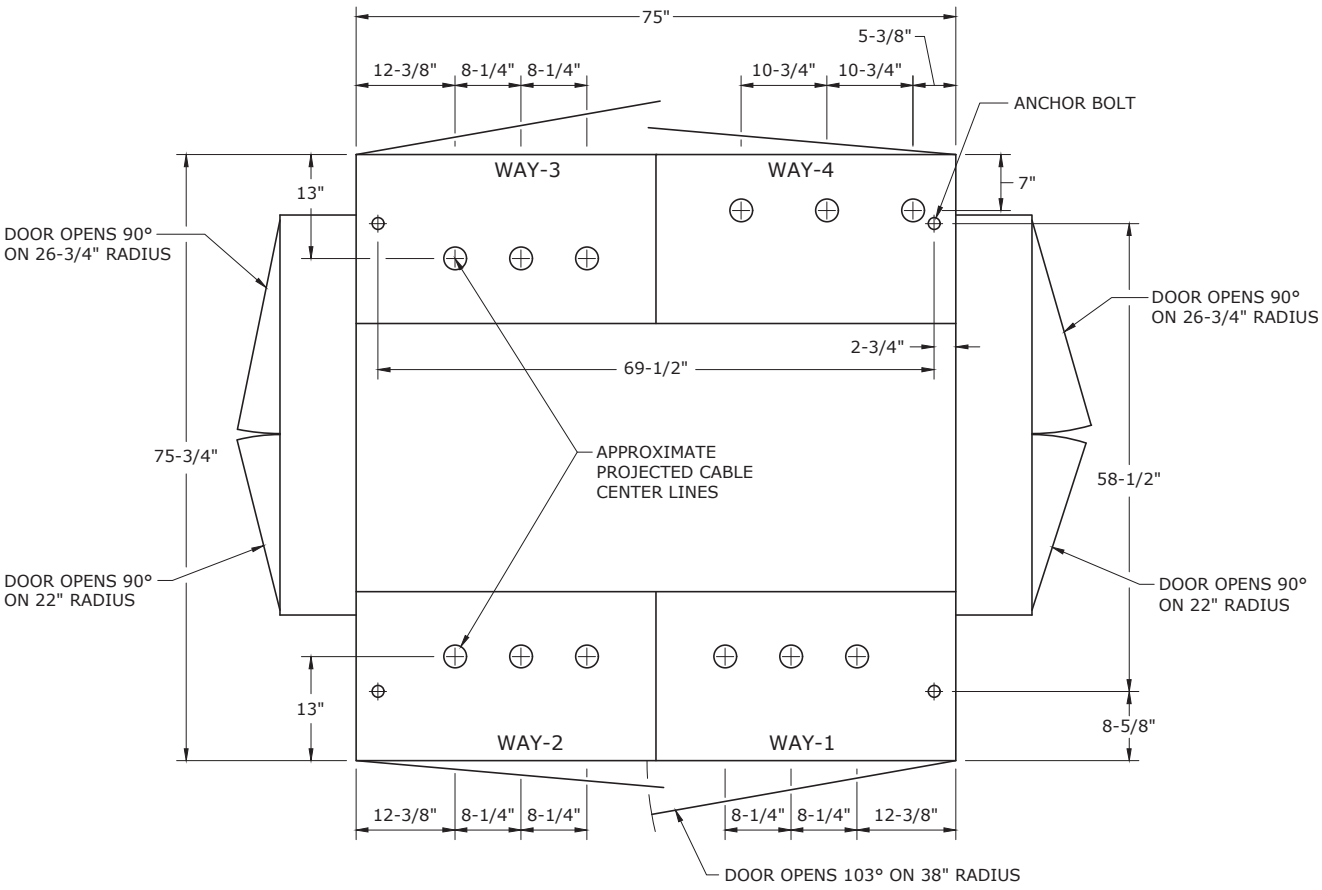
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-11 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

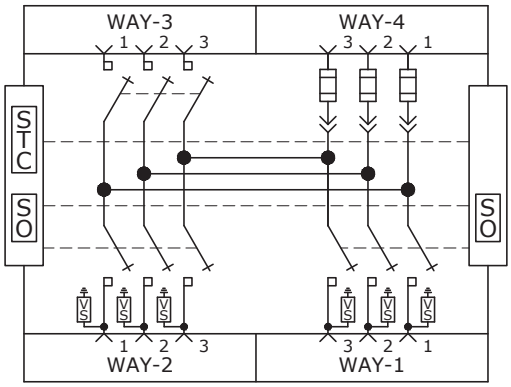
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-106A



ANCHOR BOLT PLAN



PME-11 ATO

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-11 ATO 15KV WITH MICRO AT CONTROL
DIMENSIONS AND CABLE PLACEMENT

DEC	DEM	DEP	DEF
			X

28.02-106B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-3SW/600-1F/200-ATO-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			4204953	1	SWITCHGEAR, AUTO TRANSFER, 15KV, PAD MOUNT, PME 11
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE ELECTRICAL BARE, SOL SD, 2/0 AWG, CU CONDUCTOR
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT, 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-VARIES	3	-	-	LOADBREAK ELBOW- SEE SECTION 26
-	ELBOW-T-VARIES	9	-	-	TERMINATOR, ELBOW 600A 15KV - SEE SECTION 26
-	ELBOW-INS-AL-200A-15KV-LB-F	3	831048	1	ELBOW, INSERT AL 200A 15KV LOADBREAK

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY IN EACH WAY ASSOCIATED WITH THE TRANSFER SCHEME. 200 AMP INSULATING CAPS SHALL BE INSTALLED 200 ON EACH T-BODY OF THE REMAINING WAY.

DUKE ENERGY.

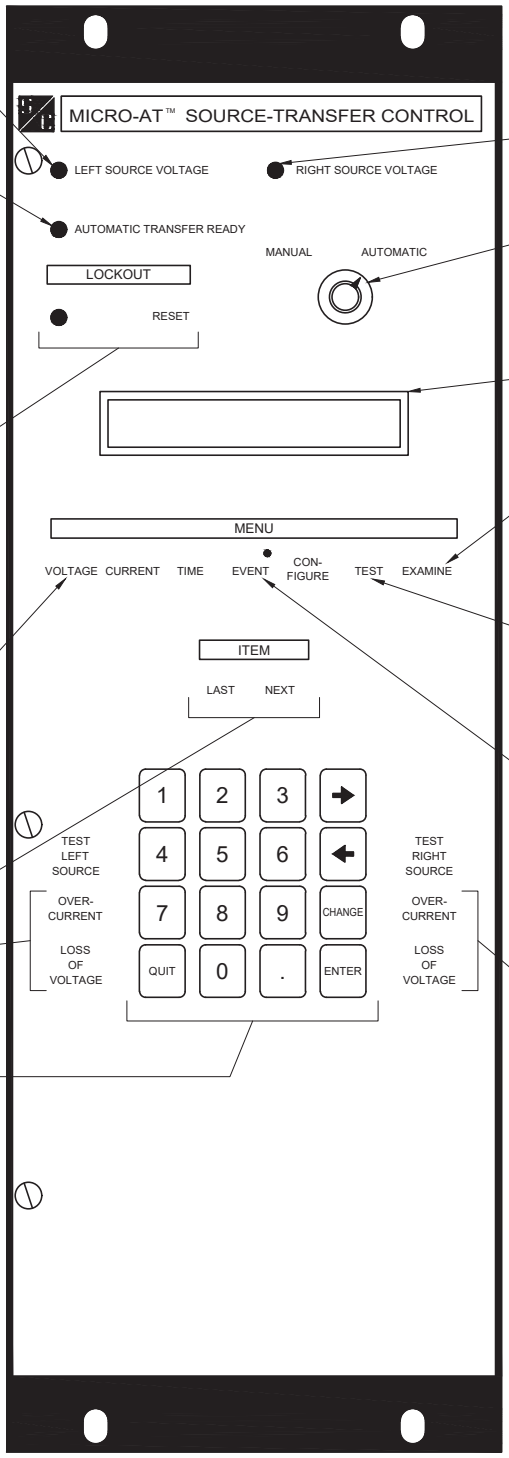
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-11 ATO 15KV WITH MICRO AT CONTROL

BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.02-106C



LEFT SOURCE VOLTAGE INDICATING LAMP INDICATES PRESENCE OF "ACCEPTABLE" VOLTAGE ON LEFT SOURCE.

AUTOMATIC-TRANSFER "READY" INDICATING LAMP PROVIDES STRAIGHTFORWARD INDICATION THAT SOURCE TRANSFER CONTROL, INTERRUPTED SWITCHES, AND SWITCH OPERATORS ARE IN THE CORRECT POSITIONS AND MODES FOR AUTOMATIC SOURCE TRANSFER LCD- WHEN NOT SHOWING MENU INFORMATION- SHOWS MESSAGES EXPLAINING WHY THIS LAMP ISN'T LIGHTED.

OVERCURRENT-LOCKOUT INDICATING LAMP AND RESET KEY. (APPLICABLE TO METAL-ENCLOSED GEAR EQUIPPED WITH S&C CURRENT SENSORS ON THE SOURCES). BLUE LAMP LIGHTS WHEN AN OVERCURRENT OCCURS IN EXCESS OF THE PRESENT LEVEL SETTING; AUTOMATIC SOURCE TRANSFER IS PREVENTED UNTIL THE THE CONTROL IS RESET.

UNBALANCE DETECTION. (APPLICABLE TO METAL-ENCLOSED GEAR EQUIPPED FOR THREE-PHASE VOLTAGE SENSING). INITIATES AUTOMATIC SOURCE TRANSFER IF AN UNBALANCED CONDITION OCCURS EXCEEDING THE PRESENT REFERENCE LEVEL.

LAST AND NEXT ITEM KEYS

TEST KEYS FOR SIMULATING OVERCURRENT AND LOSS OF VOLTAGE ON LEFT SOURCE.

KEYPAD

RIGHT SOURCE VOLTAGE INDICATING LAMP INDICATES PRESENCE OF "ACCEPTABLE" VOLTAGE ON RIGHT SOURCE.

MANUAL/AUTOMATIC OPERATION SELECTOR SWITCH. WHEN IN MANUAL POSITION, PREVENTS AN AUTOMATIC SOURCE TRANSFER, PERMITS MANUAL OPERATION USING THE OPEN/CLOSE PUSH BUTTON.

TWO-LINE 48-CHARACTER BACKFILL LIQUID-CRYSTAL DISPLAY (LCD)

EXAMINE MENU KEY ALLOWS REVIEW OF PRESENT SOURCE VOLTAGE AND CURRENT INPUTS, AND THE PRESENT STATUS OF DISCRETE INPUTS TO AND OUTPUTS FROM THE SOURCE-TRANSFER CONTROL.

TEST MENU KEY FOR CHECKING FUNCTIONING OF THE CONTROL'S LAMPS, DISPLAY, AND KEYPAD. ALSO USED TO ENABLE TEST KEYS FOR SIMULATING AN OVERCURRENT OR LOSS OF VOLTAGE ON THE SOURCES.

EVENT MENU KEY ALLOWS DISPLAY OF SYSTEM STATUS, CONTROL STATUS, AND OPERATING CONDITIONS FOR PAST CONTROL OPERATIONS. EACH OPERATION IS INDICATED BY ILLUMINATION OF THE LAMP ON THE KEY. THE LAST 130 EVENTS ARE STORED IN MEMORY AT ANY GIVEN TIME.

TEST KEYS FOR SIMULATING OVERCURRENT AND LOSS OF VOLTAGE ON RIGHT SOURCE.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PME-MICRO AT CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-108

REMOTE-CONTROL RECEPTACLE (OPTIONAL) FOR ATTACHMENT OF OPTIONAL REMOTE-CONTROL STATION TO PERMIT OPEN-CLOSE OPERATIONS FROM AN ADJACENT AREA-MANUAL-AUTOMATIC OPERATION SELECTOR SWITCH ON MICRO AT SOURCE-TRANSFER CONTROL MUST BE IN MANUAL POSITION.

OPEN/CLOSE PUSH BUTTONS PERMIT LOCAL ELECTRICAL OPERATION WHEN MANUAL/ AUTOMATIC OPERATION SELECTOR SWITCH IS IN MANUAL POSITION

THREE-POSITION OPERATION SELECTOR: OPERATING POSITION PERMITS MANUAL OR ELECTRICAL OPENING AND CLOSING OF SWITCH OR, WHEN SWITCH IS DECOUPLED, EXERCISING AND TESTING OF STORED-ENERGY OPERATOR WITHOUT OPENING OR CLOSING INTERRUPTER SWITCH. LOCK POSITION PREVENTS ALL ELECTRICAL AND MECHANICAL OPERATION WHEN PADLOCKED, CHARGING POSITION PERMITS MANUAL CHARGING OF OPERATOR MECHANISM WHILE PROHIBITING ELECTRICAL AND MECHANICAL TRIPPING.

OPERATION COUNTER REGISTERS NUMBER OF OPERATIONS OF STORED-ENERGY OPERATOR.

EMERGENCY TRIP: KEYED END OF DUAL PURPOSE MANUAL HANDLE CAN BE INSERTED INTO PORT TO INITIATE LOCAL MANUAL OPEN-CLOSE OPERATION WHEN CONTROL POWER IS NOT AVAILABLE FOR LOCAL ELECTRICAL OPERATION.

OPERATOR TARGETS SHOW WHETHER QUICK-MAKE QUICK-BREAK MECHANISM IS CHARGED OR DISCHARGED, AND WHETHER OPERATOR IS IN SWITCH-OPEN OR SWITCH-CLOSE POSITION.

CHARGING SHAFT FOR INSERTION OF NOTCHED END OF DUAL-PURPOSE MANUAL HANDLE FOR CHARGING QUICK-MAKE QUICK-BREAK MECHANISM IN THE EVENT THAT CONTROL POWER IS NOT AVAILABLE.

SWITCH-POSITION TARGET INDICATES WHETHER MINI-RUPTER SWITCH IS OPEN OR CLOSE.

DECOUPLER HANDLE PERMITS CONVENIENT DECOUPLING OF SWITCH FROM SWITCH OPERATOR FOR FUNCTIONAL TESTING OF SOURCE-TRANSFER SCHEMES AND EXERCISING OF SWITCH OPERATORS WITHOUT DISTURBING MEDIUM-VOLTAGE POWER CIRCUITS.

DECOUPLER INDICATOR SHOWS WHETHER SWITCH OPERATOR IS COUPLED TO THE MINI-RUPTER SWITCH OR DECOUPLER.

DUAL-PURPOSE MANUAL HANDLE- UPPER NOTCHED END OF DUAL-PURPOSE HANDLE IS USED FOR CHARGING AND LOWER KEYED END OF HANDLE IS USED FOR TRIPPING THE QUICK-MAKE QUICK-BREAK MECHANISM WHEN CONTROL POWER IS NOT AVAILABLE.

LOW-VOLTAGE CONTROL COMPARTMENT

(SHOWING FEATURES OF THE HIGH-SPEED STORED-ENERGY SWITCH OPERATORS)

DECOUPLER HANDLE

HANDLE MOVES UPWARD TO DECOUPLE AND DOWNWARD TO COUPLE

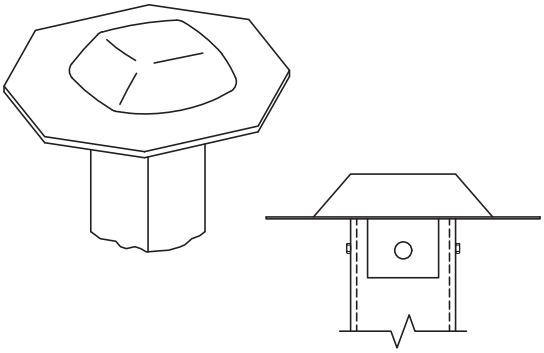
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

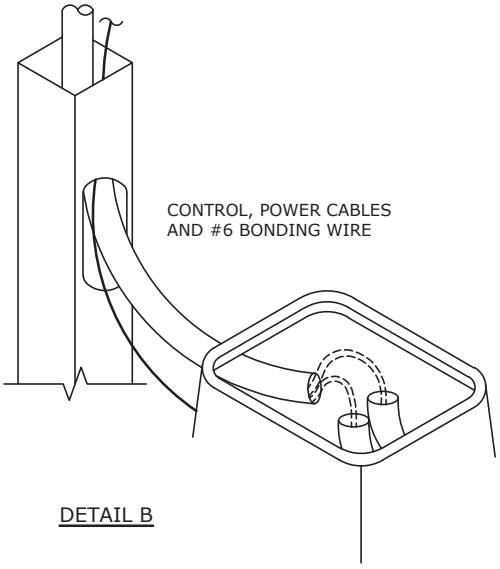
PME-ATO MICRO AT SWITCH MECHANISM

DEC	DEM	DEP	DEF
			X

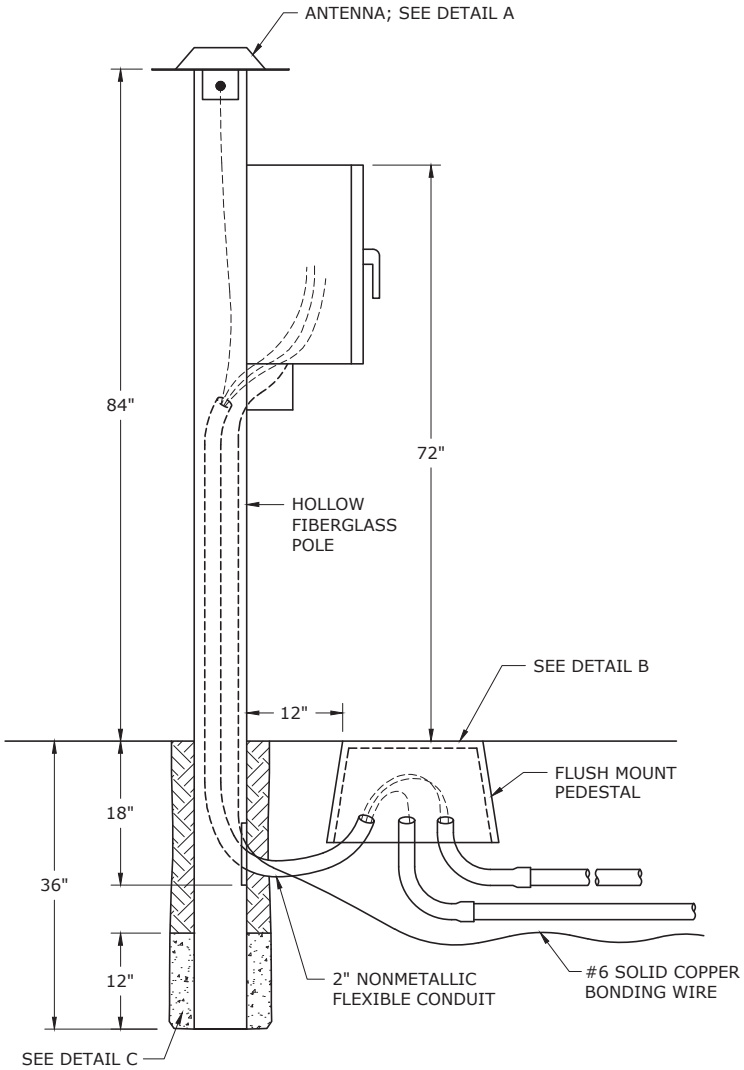
28.02-110

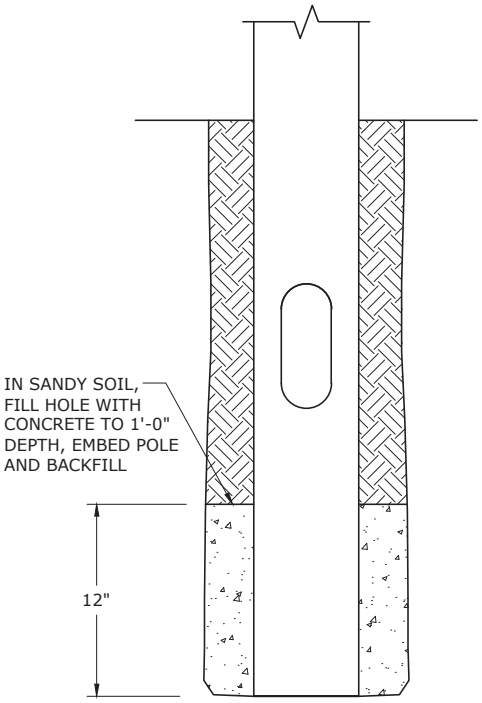


DETAIL A
GROUND PLANE AND ANTENNA
BOLTED TO TOP OF POLE



DETAIL B





DETAIL C

NOTES:

1. SEE DWG. 28.02-112B FOR ATS DETAILS.

2. SEE DWG. 28.02-112C FOR BILL OF MATERIALS.

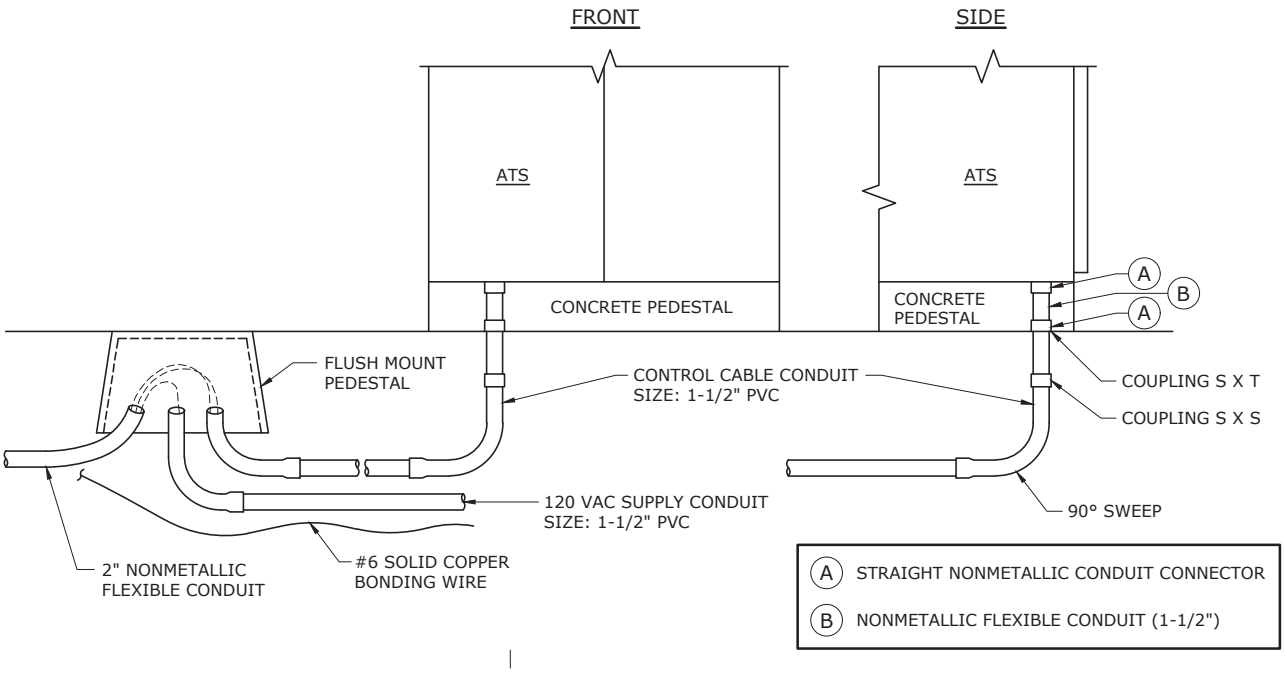
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

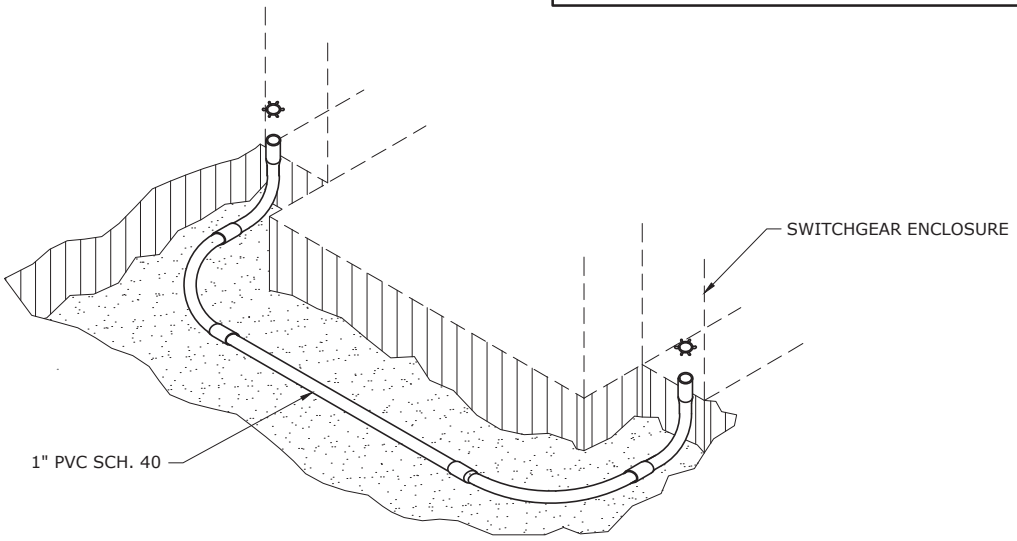
ATS COMMUNICATION CABINET INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-112A





PME PROXIMITY SENSOR CONDUIT

NOTES:

1. THE LOCATION OF THE COMMUNICATION BOX AND POST WILL BE RELATIVE TO THE SWITCHGEAR. LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE ATS, OR OTHER NEARBY SWITCHGEAR OR TRANSFORMER ACCESS. PLACE IN LOCATION FOR EASY ACCESS. GIVE CONSIDERATION TO OTHER ACTIVITY AT THE SITE SUCH AS MOWING.

2. 120 VOLT POWER TO COMMUNICATION BOX MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY, CT METERING CIRCUITS, NON-SWITCHED STREETLIGHT CIRCUITS, OR NEARBY 120 VOLT TRANSFORMER. IN SOME CASES, A SINGLE-PHASE TRANSFORMER WILL NEED TO BE ADDED TO THE 200 AMP LOOP OUT OF THE ATS. CONSIDERATION SHOULD BE GIVEN TO THE MOST ECONOMICALLY FEASIBLE OPTION. (SEE DWG. 28.02-112D FOR CT METERING CIRCUIT.)

3. CONTROL MUST BE BONDED TO SWITCHGEAR GROUND.

4. UP TO 3 ATS GEARS MAY BE CONTROLLED FROM ONE COMMUNICATION BOX.

5. SEE DWG. 28.02-112A FOR POLE, PEDESTAL AND FOUNDATION DETAILS.

6. SEE DWG. 28.02-112C FOR BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

ATS COMMUNICATION CABINET INSTALLATION

DEC	DEM	DEP	DEF
			X

28.02-112B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-SG-ENCL-ATS-F	1	4204898	1	SWITCH, CONTROL, ATS COM DSCADA, SEL 2440, UPS
2	POLE-FG-10-COMM-F	1	4204949	1	POST, ATS COM CONTROL, 10' X 4" X 4", FBG, W/ HOLES F/ CONDUIT
3	-	*	4203999	1	CONTROLLER, DISCRETE PROGRAMMABLE AUTOMATION, RELAY
4	-	*	4204003	1	ROUTER, SECURITY GATEWAY, 12/24VDC POWER SUPPLY
5	-	**	1517091	1	MODEM, CELLULAR, W/ DC POWER CABLE, RUGGEDIZED SIM
6	-	**	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
7,8,12, 13,15, 16,18, 19,20 21,27 28,29	CTRL-SG-ENCL-ATS-ACC-KIT-F	1	4205343	2	BRACKET, SWITCHGEAR PROXIMITY SENSOR MNT, 12 GA THK, GLV ST
			4206751	4	SWITCH, PROXIMITY, 12MM DIA, NON-FLUSH MOUNT, NO SOURCE OUTPUT, SENSOR, WIRE TRIPLE SENSE SS, F/ USE ON S&C
			4005420	2	COUPLING, PIPE, 1-1/2", SCH 40, PVC, NO CENTER STOP PER FPC SPEC MS-117. (25 PER BOX)
			4005394	2	ELBOW, CONDUIT, 1-1/2", BELLED END, PVC, 90 DEG, 12" RADIUS, BEND, SCH 40, W/ COUPLING OR BELLED END, PER FPC
			50063272	2	CONNECTOR, CABLE/CONDUIT, FLEXIBLE, ETP, LA150, 1-1/2" STRAIGHT SEAL TITE FLEXIBLE CONDUIT
			900814	1	ADAPTER, COND, RIGID, 1-1/2", FEM THD, 1-1/2", SOCKET, GRAY PVC
			4028635	4	ELBOW, CONDUIT, 1", PVC, 90 DEG, 18" RADIUS, BEND, TO MEET LATEST EDITION OF NEMA TC-3., 50 PER BOX
			901556	4	COUPLING, CONDUIT, RIGID, 1", SLIP-ON, GRAY PVC, UL APPROVED
			4005388	2	ADAPTER, CONDUIT, TERMINAL, 1", SOLVENT WELD, 1", MALE THD, PVC, SCH 40, 11/16" THD, 50 PER BOX
			4005457	2	NUT, CONDUIT LOCK, 1" DIA, STL
			1415955	50	CONNECTOR, ELECTRICAL, TERMINAL, RING TONGUE, 12-10 AWG CONDUCTOR, SOLDERLESS CONDUCTOR CONNECTION, 0.52" HOLE
			1529346	1 BOX	CONNECTOR, ELECTRICAL, TERMINAL, MALE PIN, 22-16 AWG CONDUCTOR, COMP CONDUCTOR CONNECTION, CU CONNECTOR
			1529345	1 BOX	CONNECTOR, ELECTRICAL, TERMINAL, MALE PIN, 16-14 AWG CONDUCTOR, COMP CONDUCTOR CONNECTION, CU CONNECTOR
9	PED-HH-SM-POLY-F	1	4004629	1	BOX, ELECTRICAL, JUNCTION, 9" X 14" X 12" DP, PEDESTAL, F/ STREET LIGHT CONDUCTOR, FLUSH MOUNT/HANDHOLE
10	COND-COIL-2IN-FLEX-F	10	900113	1 FT	CONDUIT, PANDC FLEXIBLE, 2", 250' LG, GRAY PVC COVERED, PLAIN
11	COND-STICK-1 1/2IN-PVC-SCH40-F	20	4005379	1 FT	CONDUIT, 1-1/2", 20' LG, SCH 40, PVC, COUPLING OR BELLED END
14	COND-COIL-1-1/2IN-FLEX-F	3	900123	1 FT	COND, FLEX LIQUID TIGHT, 1-1/2", 50' COIL LG, PVC, PLAIN, 80 DEG
17	COND-STICK-1IN-PVC-SCH40-F	12	4005378	1 FT	CONDUIT, 1", 20' LG, SCH 40, PVC, PER FPC SPEC MS-117, W/ CPLNG
22	CTRL-CABLE-16-TCU-XLPE-12/C-F	40	4206741	1 FT	WIRE/CABLE, ELECTRICAL, CONTROL, 12 CONDUCTOR, TINNED CU CONDUCTOR, 600V, XLP INSULATION, SHIELDED COVER
23	CTRL-CABLE-16-TCU-XLPE-7/C-LSZH-F	40	4206736	1 FT	WIRE/CABLE, ELECT, CONTROL, 7 COND, TINNED CU CONDUCTOR
24	CTRL-CABLE-6-CU-EPR-1/C-F	40	1503104	1 FT	WIRE/CABLE, ELECTRICAL, CONTROL, 1 CONDUCTOR, 6 AWG, CU, STR, 600V @ 90 DEG C, EPR INSULATION, HYPALON JACKET
25	CONN-UG-HH-SUB-1/0-3POS-F	2	4004785	1	CONNECTOR, ELECTRICAL, WATERPROOF PEDESTAL, 12-1/0 AWG STR
26	CTRL-CABLE-10-CU-DX-PWR-F	15	4003512	1 FT	WIRE/CABLE, ELECT, ST LIGHT, 2 COND, 10 AWG, CU CONDUCTOR
30	GND-ROD-UG-F	1	932539	1	CLAMP, GRNDG, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GRD R
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD

* PROVIDED BY MANUFACTURER (KEMCO CABINET)
** INSTALLED DURING PROVISIONING

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	-	-	1529354	***	POWER SUPPLY UNINTERRUPTABLE 100-200VAC INPUT, 24VDC OUTPUT 5A OUTPUT, W/ MINI-BAT/24/DC/1.3 AH
2	-	-	1529348	***	CONVERTER, POWER SUPPLY, DC/DC, 12-24VDC INPUT, 5-15VDC OUTPUT
3	-	-	1529398	***	POWER SUPPLY, UNINTERRUPTABLE, 24VDC 8A INPUT, 24VDC OUTPUT, 25A OUTPUT, QUINT-BAT SERIES, 3.4AH, BATTERY

*** USE AS NEEDED- PARTS LOCATED IN ST PETE METER STORE ROOM PD-STPETEMTR.

NOTES:

1. SEE DWG. 28.02-112A FOR POLE, PEDESTAL AND FOUNDATION DETAILS.
2. SEE DWG. 28.02-112B FOR ATS DETAILS.
3. SEE DWG. 28.02-112D FOR ALTERNATE POWER SUPPLY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

ATS COMMUNICATION CABINET INSTALLATION
BILL OF MATERIALS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-112C

THIS BOX IS TO BE USED TO SUPPLY 120V POWER TO THE ATS.

COMMUNICATIONS BOX FROM THE CT METERING CIRCUIT. USE WHEN THERE IS NO OTHER 120V SUPPLY AVAILABLE.

JUNCTION BOX TO HOUSE FUSE AND TRANSFORMER IF NECESSARY. MOUNT ON CT METER POST OR SECURE NEAR CT METER JUNCTION BOX.

ITEM # 1523535

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

ALTERNATE POWER SUPPLY FOR ATS COMMUNICATION CABINET FROM CT METERING CABINET

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-112D

SHOWN ABOVE - CLEAVELAND PRICE MOTOR OPERATED SWITCH CABINET MOUNTED TO A PME SWITCHGEAR

WAY-3	WAY-4
WAY-2	WAY-1

PME WAY DIAGRAM

NOTES:

1. INSTALL POSITION NUMBER ON MOTOR OPERATOR CABINET DOOR CONSISTENT WITH THE PME SWITCH ID.

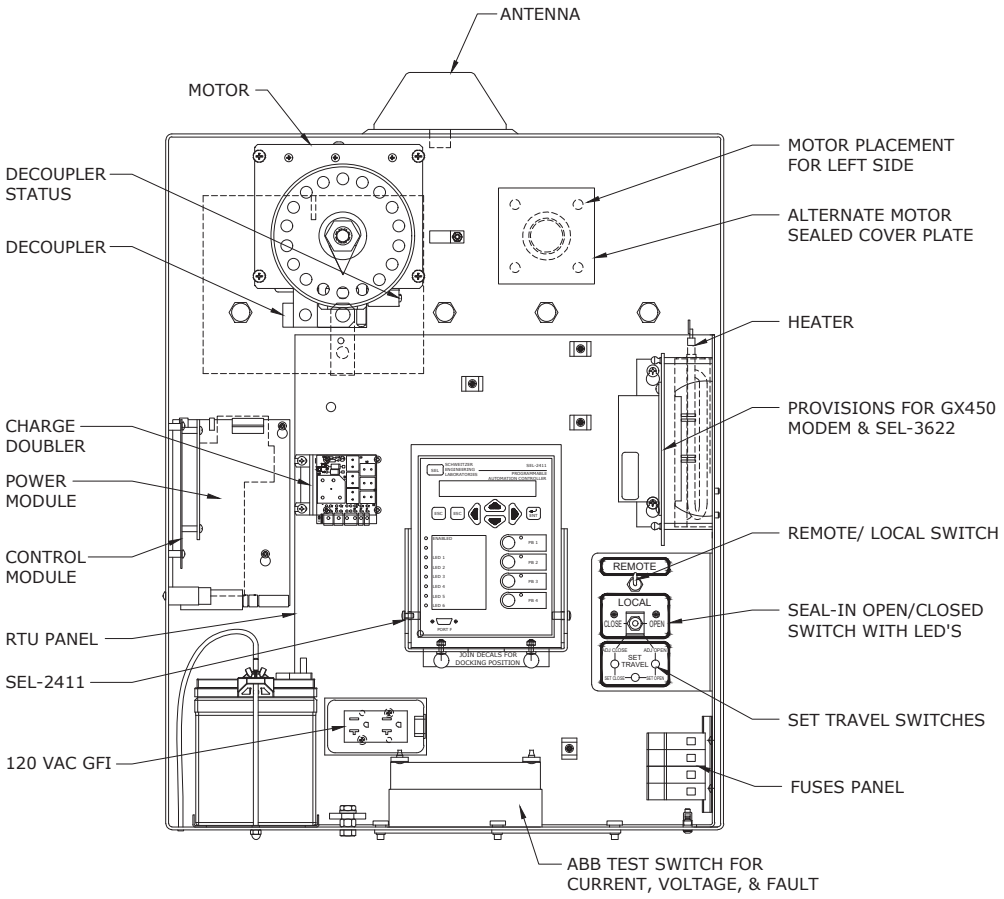
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CLEAVELAND PRICE MOS

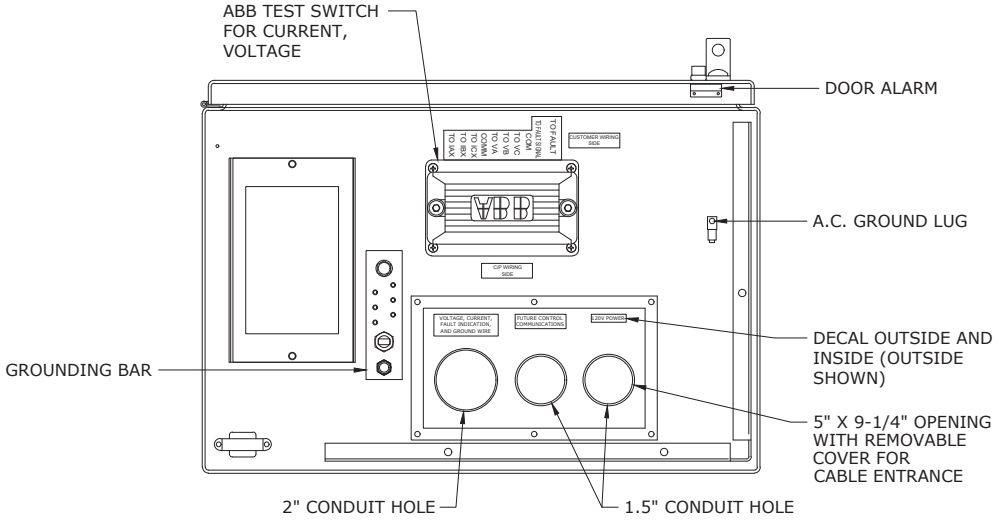
DEC	DEM	DEP	DEF
			X

28.02-132



FRONT VIEW
(DOOR OPEN)

NOTE: MOTOR IN CABINET CAN BE MOUNTED ON LEFT OR RIGHT SIDE OF CABINET DEPENDING ON PME SWITCH CONFIGURATION.



BOTTOM VIEW

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

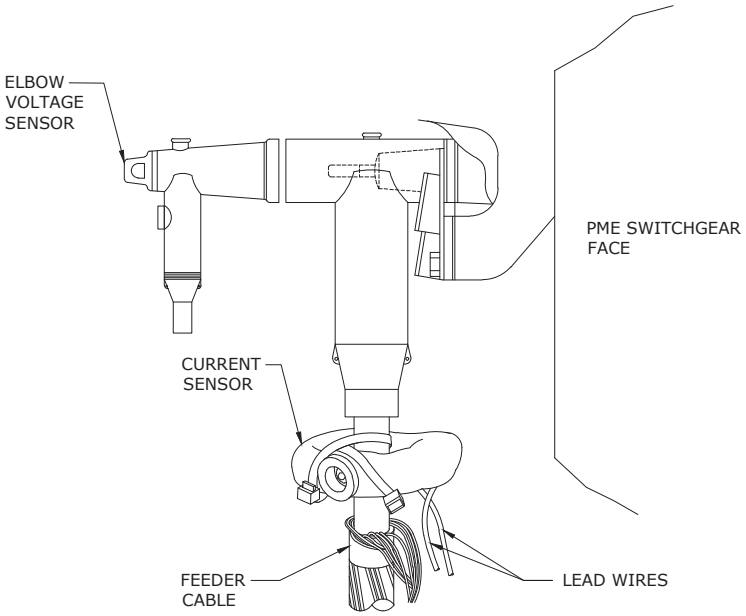
CLEAVELAND PRICE MOTOR OPERATOR DETAIL

DUKE ENERGY.

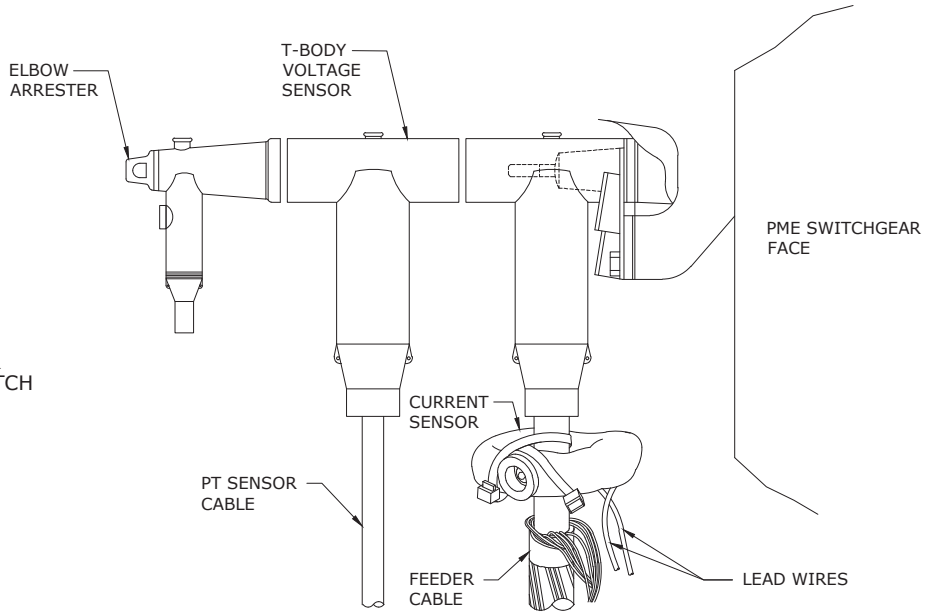
DEC	DEM	DEP	DEF
			X

28.02-134

ELBOW VOLTAGE SENSOR
FOR NORMAL CLOSE SWITCH



ELBOW VOLTAGE SENSOR
FOR NORMAL CLOSE SWITCH



NOTES:

1. INSTALL CURRENT SENSOR ABOVE CABLE'S GROUNDED CONCENTRIC OR LC SHIELD NEUTRAL.

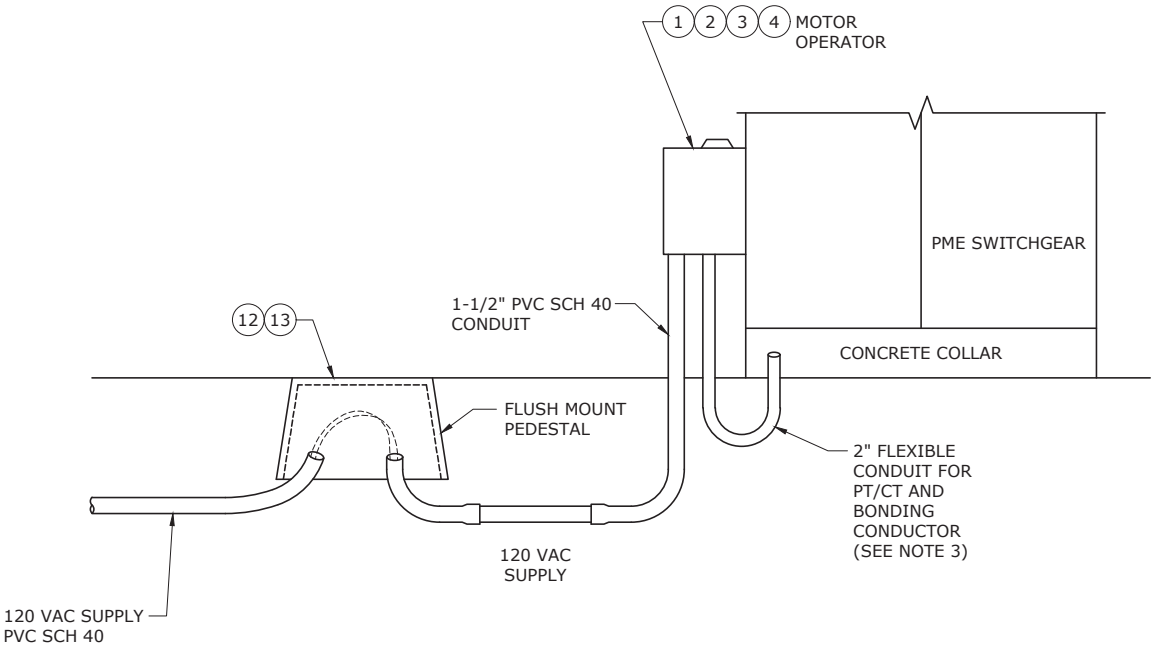
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

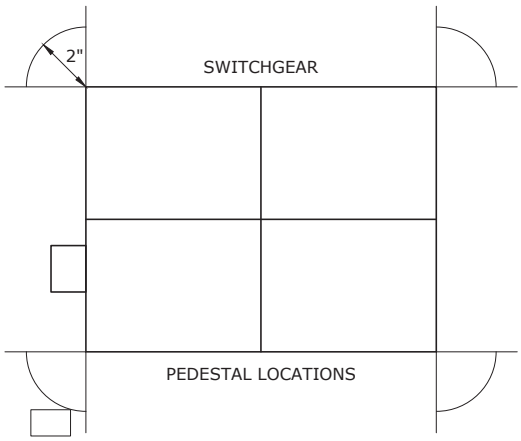
VOLTAGE AND CURRENT SENSOR DETAIL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-135





NOTES:

1. 120 VOLT POWER TO MOTOR OPERATOR MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY, NON-SWITCHED STREETLIGHT CIRCUITS, OR NEARBY 120 VOLT TRANSFORMER.

2. CONTROL MUST BE BONDED TO SWITCHGEAR GROUND. USE 2" FLEX CONDUIT TO INSTALL BONDING CONDUCTOR.

3. USE 2.5" PVC SCH. 40 CONDUIT TO PROTECT EXPOSED FLEX CONDUIT.

4. FOR MOTOR OPERATOR INSTALLATION INSTRUCTIONS, SEE C/P INSTRUCTION BOOK IB-SC10-648M AND OPERATING MANUAL IB-AA10-147A. THESE DOCUMENTS ARE LOCATED IN DOOR COMPARTMENT OF MOTOR OPERATOR.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

MOTOR OPERATOR-PME

SWITCHGEAR - ONE MOS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-136

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-SG-PAD-MO-S2411-RETRO-F	1	1548797	1	OPERATOR, SWITCH, MOTOR, CABINET MOUNTED W/ SEL2411 AUTOMATION CONTROL, ALUM ENCLOSURE POWDER COATED GREEN
2	-	*	4204003	1	MODULE, SECURITY GATEWAY SEL 3622
3	-	*	1517091	1	MODEM, CELLULAR, W/ DC POWER CABLE
4	-	*	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
5	COND-COIL-2IN-FLEX-F	10	900113	1 FT	CONDUIT, PANDC FLEXIBLE, 2", 250' LG, GRAY PVC, COVERED, PLAIN 2.045" ID X 2.375" OD
6	COND-HUB-2IN-FLEX-MALE-F	1	1564270	1	2" HUB, MALE THD, STRAIGHT, LIQUID TIGHT
7	RISER-2 1/2IN-COND-1PC-CTRL-NWD-F	1	61356	10	CONDUIT, RIGID, HEAVY WALL, 2-1/2", 10' LG, SCH 40, PVC, BELLED ONE END, RATED F/ 90 DEG C CONDUCTOR, 2.414" I
8	COND-STICK-1 1/2IN-PVC-SCH40-F	1	4005379	1	CONDUIT, 1-1/2", 20' LG, SCH 40, PVC, COUPLING OR BELLED END PER FPC SPEC MS-117 3600 FT/BUNDLE
9	COND-BEND-1 1/2IN-PVC-90DEG-R36-F	2	4005396	1	ELBOW, CONDUIT, 1-1/2", BELLED END, PVC, 90 DEG, 36" RADIUS BEND, SCHED 40, W/ COUPLING OR BELLED END, PER
			4005418	1	COUPLING, PIPE, 1-1/2", SCH 40, PVC, W/ CENTER STOP PER FPC SPEC MS-117, 50 PER BOX
10	-	1	711	1	ADAPTER, CONDUIT, TERMINAL, 1-1/2", MALE THD, 1-1/2", SOCKET GRAY PVC
11	-	1	4005458	1	NUT, CONDUIT LOCK, 1-1/2" DIA, STL
12	PED-HH-LG-POLY-F	1	4004630	1	BOX, ELECTRICAL, JUNCTION, 12" X 20" X 17" DP, PEDESTAL, F/ SEC & SERV FLUSH MOUNT 12" X 20" GREEN
13	CONN-UG-HH-SUB-1/0-3POS-F	2	4004785	1	CONNECTOR, ELECTRICAL, WATERPROOF PEDESTAL, 12-1/0 AWG STR CONDUCTOR, SUBMERISABLE, INSULATED THREE HOLES
14	CTRL-CABLE-10-CU-DX-PWR-F	15	4003512	1	CABLE LIGHTING, 10 CU DUPLEX
15	GND-EQUIP/EQUIP-6-BOND-F	10	234664	1	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, PER DUKE POWER SPEC CS-26 DATED, 25
16	GND-ROD-UG-F	1	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
17	SENS-CURR-120/1-15KV-CABLE-CLAMP-F	1	1549406	3	SENSOR, CURRENT, 200A-900A RANGE, 600A, 120:1 CURRENT RATIO, 1.5% UP TO 200A ACCURACY
18	-	*	4003516	45	WIRE/CABLE, ELECTRICAL, SIS, 1 CONDUCTOR, 14 AWG, TINNED CU CONDUCTOR, 41 STR, 600V, GRAY, SWITCHBOARD, UL
19	-	*	1523559	3	SPLICE, CONDUCTOR, BUTT, 16-14 AWG CONDUCTOR, STRAIGHT,Z E NYLON GRIP INSULATION, BLUE, MOISTURE WEATHER PROOF
VOLTAGE SENSING NORMAL CLOSE SWITCH					
20	ELBOW-SENS-VOLT-200A-15KV-F	3	1569898	1	SENSOR, VOLTAGE, 200A, 1400:1 VOLTAGE DIVIDER, 25' CABLE, 15KV 95 KV BIL
VOLTAGE SENSING NORMAL OPEN SWITCH					
21	ELBOW-T-SENS-VOLT-200A-15KV-F	3	1543539	1	SENSOR, 200A, T-BODY, 1400:1 VOLTAGE RATIO DIVIDER, 25' CABLE 15KV, 95KV BIL
22	-	3	4004744	1	WELL, BUSHING, 15/25KV 600A, FEMALE LOADBREAK ELBOW 15/25KV 600A ADAPTER
23	ARR-ELBOW-10KV-F	3	1000572	1	ARRESTER, ELECT, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER LOADBREAK ELBOW, DEAD FRONT
		3	4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT

*INSTALLED DURING PROVISIONING/ COMMISSIONING

NOTES:

1. SEE DWGS. 28.02-134 AND 28.02-136 FOR INSTALLATION DETAILS.

2. ISSUE MATERIAL FOR SOURCE POWER SEPARATELY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CLEAVELAND PRICE - ONE MOS

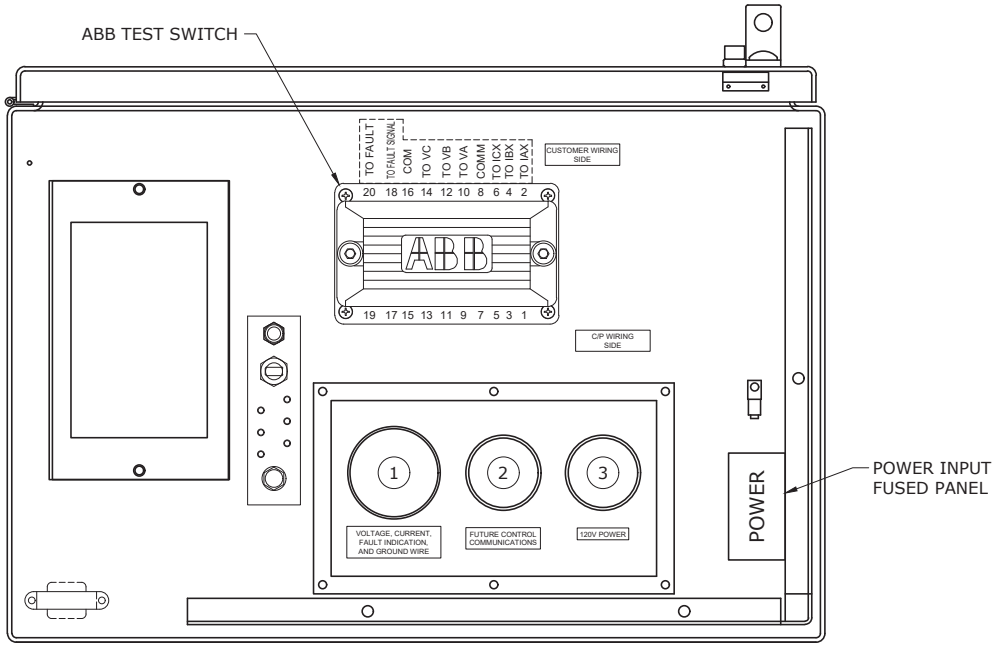
BILL OF MATERIALS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-138

FRONT



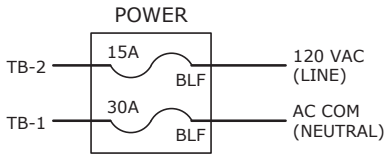
BACK

CONTROL CABINET CONNECTIONS
(CABINET FROM BOTTOM VIEW)

CONDUIT NOTES:

1. PTS, CTS, GROUND USE 2.0" CONDUIT, LABELED 1.
2. CONTROL (2MOS) USE 1.5" CONDUIT, LABELED 2.
3. POWER USE 1.5" CONDUIT, LABELED 3.

ABB TEST SWITCH CONNECTIONS	
FROM CT'S	A PHASE CT TO PIN 2 CURRENT A+
	B PHASE CT TO PIN 4 CURRENT B+
	C PHASE CT TO PIN 6 CURRENT C+
	COM CT TO PIN 8
FROM PT'S	A PHASE PT TO PIN 10 (VOLTAGE A)
	B PHASE PT TO PIN 12 (VOLTAGE B)
	C PHASE PT TO PIN 14 (VOLTAGE C)
	COM PT TO PIN 16 (COM)



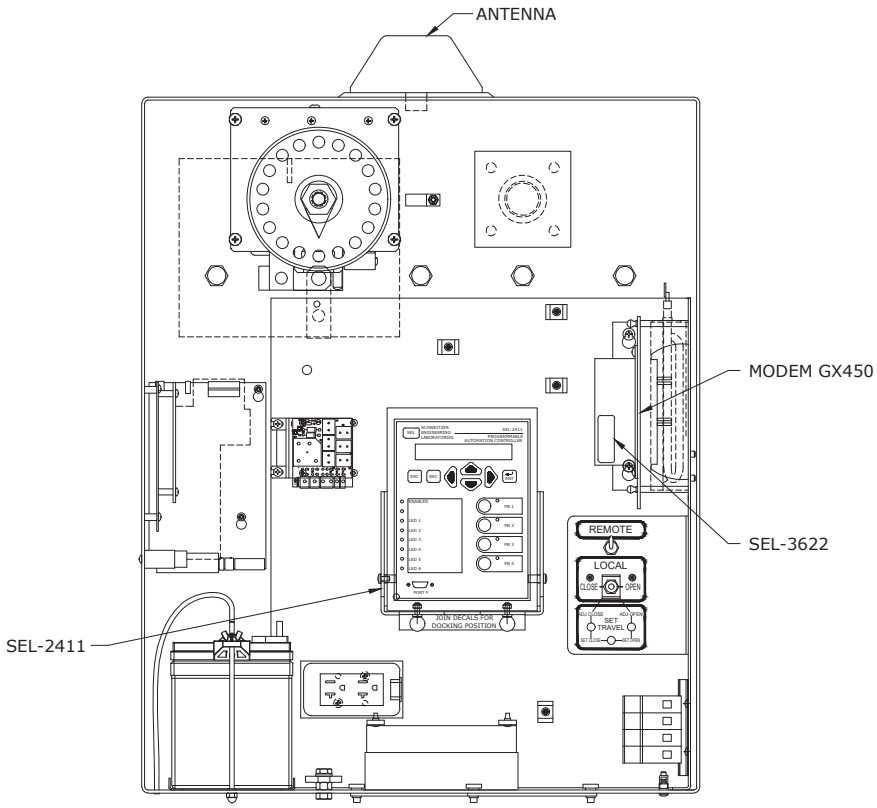
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CLEAVELAND PRICE MOTOR OPERATOR
SWITCH CONNECTIONS

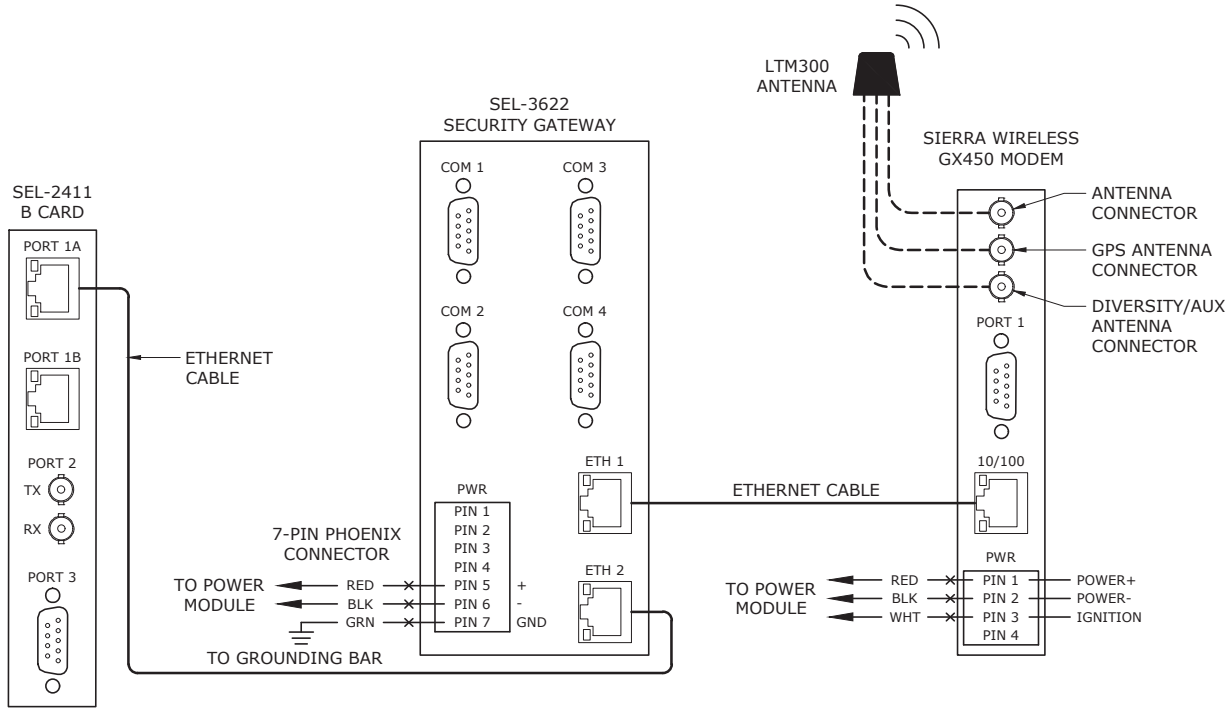
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-140



CONTROL CABINET



NOTES:

1. SEE DWG. 28.02-134 FOR MOS DETAIL.

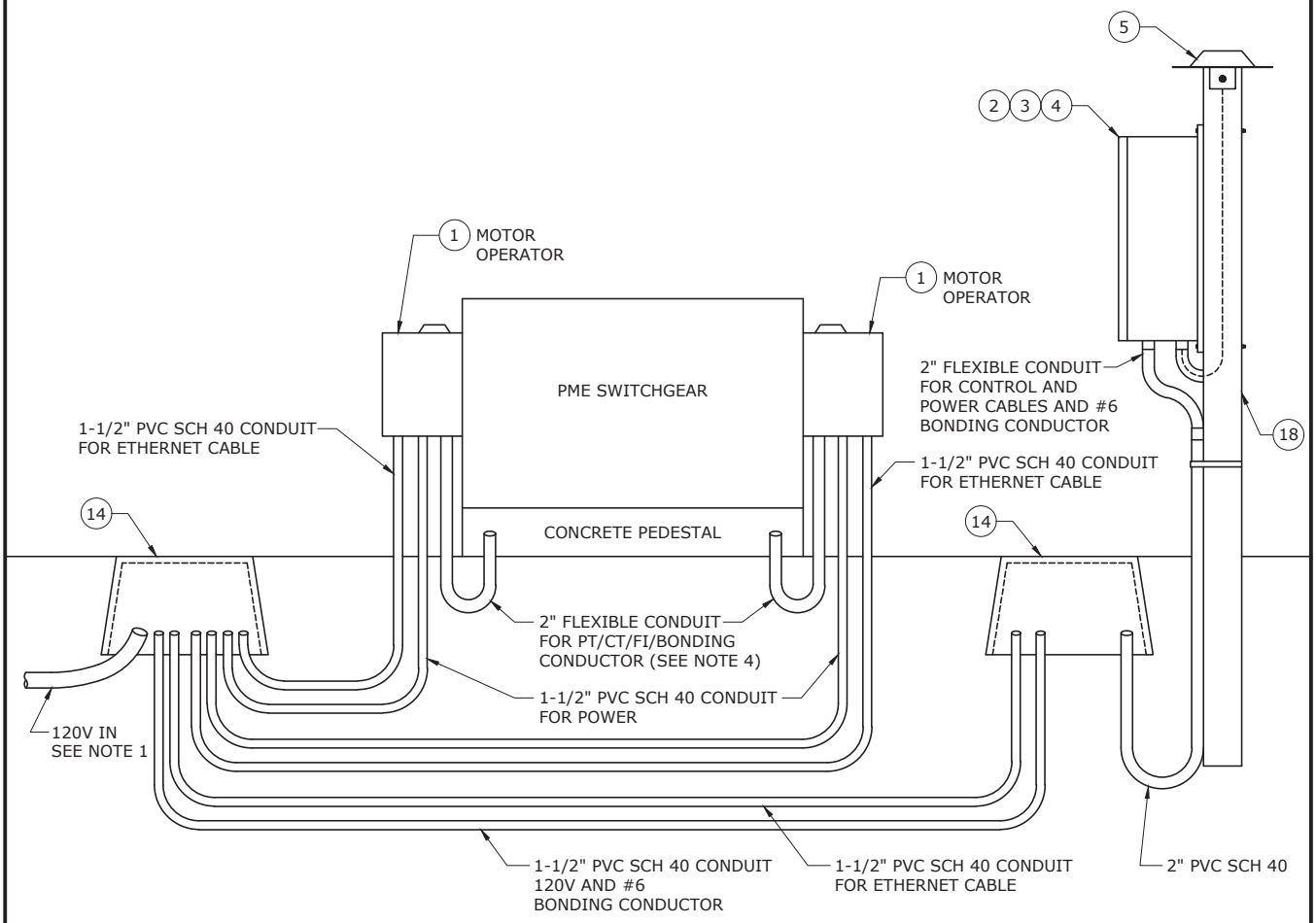
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CLEAVELAND PRICE ONE MOS
CONTROL AND COMMUNICATIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-142



NOTES:

1. 120V POWER TO THE PEDESTAL FEEDING THE MOTOR OPERATORS MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY, NON-SWITCHED STREETLIGHT CIRCUITS, OR NEARBY 120 VOLT TRANSFORMER. POWER CAN COME IN TO EITHER PEDESTAL.

2. THE LOCATION OF THE CONTROL-COMMUNICATIONS BOX FIBERGLASS POLE WILL BE RELATIVE TO THE SWITCHGEAR (NO MORE THAN 20' AWAY). LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE SWITCHGEAR, OR OTHER NEARBY EQUIPMENT. PLACE IN A LOCATION FOR EASY ACCESS, GIVE CONSIDERATION TO OTHER ACTIVITIES AT THE SITE SUCH AS MOWING.

3. CONTROL AND MOTOR OPERATORS MUST BE BONDED TO THE SWITCHGEAR GROUND USING #6 CU.

4. USE 2.5" PVC SCH 40 CONDUIT TO PROTECT EXPOSED FLEX CONDUIT.

5. FOR MOTOR OPERATOR INSTALLATION INSTRUCTIONS, SEE C/P INSTRUCTION BOOK IB-SC10-048M AND OPERATING MANUAL IB-AA10-147A. THESE DOCUMENTS ARE LOCATED IN DOOR COMPARTMENT OF MOTOR OPERATOR.

6. SEE DWG. 28.02-148 FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

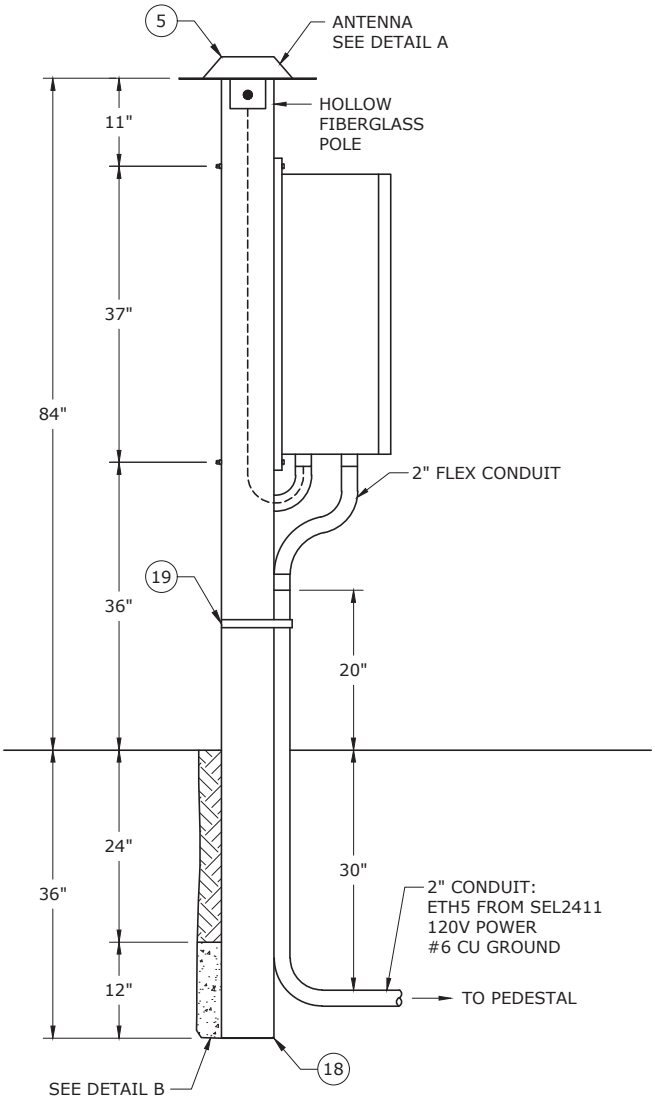
MOTOR OPERATOR - PME

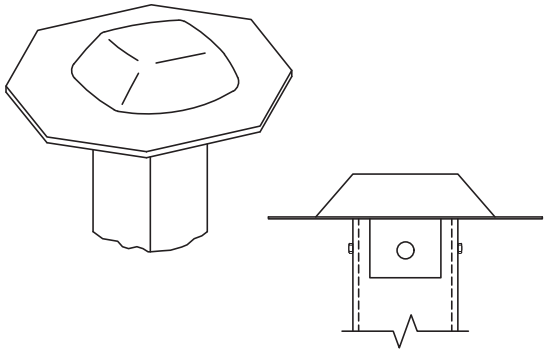
SWITCHGEAR - 2 MOS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

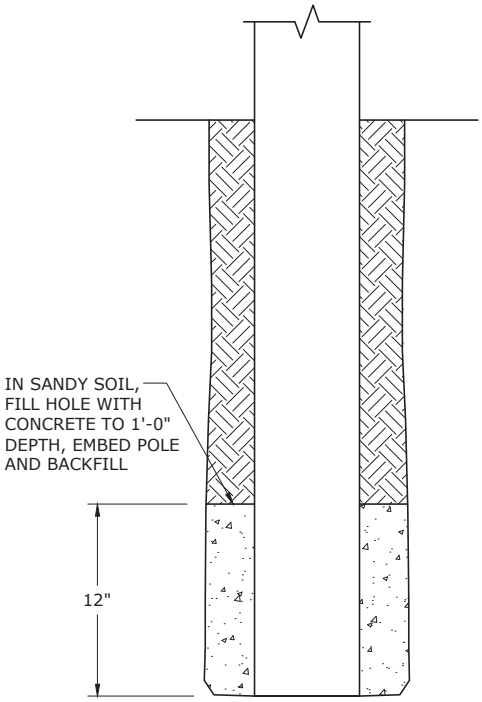
28.02-144





DETAIL A

GROUND PLANE AND ANTENNA
BOLTED TO TOP OF POLE



DETAIL B

NOTES:

1. THE LOCATION OF THE CONTROL-COMMUNICATIONS BOX FIBERGLASS POLE WILL BE RELATIVE TO THE SWITCHGEAR (NO MORE THAN 20' AWAY). LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE SWITCHGEAR, OR OTHER NEARBY EQUIPMENT. PLACE IN A LOCATION FOR EASY ACCESS, GIVE CONSIDERATION TO OTHER ACTIVITIES AT THE SITE SUCH AS MOWING.
2. CONTROL MUST BE BONDED TO SWITCHGEAR GROUND.
3. PULL CONTROL CABLE ETHERNET, 120V POWER, AND GROUND IN 2.0" FLEX CONDUIT FROM PEDESTAL TO CONTROL-COMMUNICATION CABINET.
4. SEE DWG. 28.02-144 FOR CONDUIT LAYOUT 2 MOS.
5. SEE DWG. 28.02-148 FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL - COMMUNICATIONS
CABINET INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-146

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-SG-PAD-MO-S2411-RETRO-F	2	1548797	1	OPERATOR, SWITCH, MOTOR, CABINET MOUNTED W/ SEL2411
2	CTRL-SG-PAD-COMM-S3505-2WAY-F	1	1559768	1	CONTROLLER, DISCRETE PROGRAMMABLE AUTOMATION, SWITCHGEAR
3	-	*	4204003	1	MODULE, SECURITY GATEWAY SEL 3622
4	-	*	1517091	1	MODEM, CELLULAR, W/ DC POWER CABLE
5	-	*	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
6	COND-COIL-2IN-FLEX-F	25	900113	1 FT	CONDUIT, PANDC FLEXIBLE, 2", 250' LG, GRAY PVC, COVERED, PLAIN
7	COND-HUB-2IN-FLEX-MALE-F	3	1564270	1	2" HUB, MALE THD, STRAIGHT, LIQUID TIGHT
8	RISER-2 1/2IN-COND-1PC-CTRL-NWD-F	1	61356	10	CONDUIT, RIGID, HEAVY WALL, 2-1/2", 10' LG, SCH 40, PVC, BELLED
9	COND-BEND-2IN-PVC-90DEG-R18-F	2	4005433	1	ELBOW, CONDUIT, 2", PVC, 90 DEG, 24" RADIUS, PREBENT PEDESTAL
10	COND-STICK-1 1/2IN-PVC-SCH40-F	5	4005379	1	CONDUIT, 1-1/2", 20' LG, SCH 40, PVC, COUPLING OR BELLED END
11	COND-BEND-1 1/2IN-PVC-90DEG-R36-F	14	4005396	1	ELBOW, CONDUIT, 1-1/2", BELLED END, PVC, 90 DEG, 36" RAD, BEND
			4005418	1	COUPLING, PIPE, 1-1/2", SCH 40, PVC, W/ CENTER STOP PER FPC SPEC
12	-	5	711	1	ADAPTER, CONDUIT, TERMINAL, 1-1/2", MALE THD, 1-1/2", SOCKET
13	-	5	4005458	1	NUT, CONDUIT LOCK, 1-1/2" DIA, STL
14	PED-HH-LG-POLY-F	2	4004630	1	BOX, ELECTRICAL, JUNCTION, 12" X 20" X 17" DP, PEDESTAL, F/ SEC
15	CONN-UG-HH-SUB-1/0-3POS-F	4	4004785	1	CONNECTOR, ELECT, WATERPROOF PEDESTAL, 12-1/0 AWG STR COND
16	CTRL-CABLE-10-CU-DX-PWR-F	60	4003512	1	CABLE LIGHTING, 10 CU DUPLEX
17	GND-EQUIP/EQUIP-6-BOND-F	80	234664	1	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU
18	GND-ROD-UG-F	2	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8"
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
19	POLE-FG-10-CTRL-F	1	1539295	1	POLE, RECLOSER CONTROL MOUNTING, 4" SQ. X 10' HT, FIBERGLASS
20	POLE-BAND-STRAP-SM-STL-F	1	1490605	1	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 316 SS, 1800 LB
21	POLE-BAND-STRAP-BUCKLE-SM-STL-F	2	1490606	1	BUCKLE, BANDING, 3/4" WD, SS, MRO ITEM ONLY
22	SENS-CURR-120/1-15KV-CABLE-CLAMP-F	2	1549406	1	SENSOR, CURRENT, 200A-900A RANGE, 600A, 120:1 CURRENT RATIO
23	-	*	4003516	90	WIRE/CABLE, ELECT, SIS, 1 CONDUCTOR, 14 AWG, TINNED CU COND
24	-	*	1523559	6	SPLICE, CONDUCTOR, BUTT 16-14 AWG COND, STRAIGHT, NYLON GRIP
25	-	1	-	70 FT	CAT5E CABLE
26	-	*	1545308	4	CONNECTOR, COMMUNICATIONS, RJ45 CRIMP, 24 AWG CONDUCTOR
27	-	*	1545307	4	COVER, PROTECTIVE, GRAY SILICONE, STRAIN RELIEF
VOLTAGE SENSING NORMAL CLOSE PER SWITCH					
28	ELBOW-SENS-VOLT-200A-15KV-F	3	1569898	1	SENSOR, VOLTAGE, 200A, 1400:1 VOLTAGE DIVIDER, 25' CABLE, 15KV
VOLTAGE SENSING NORMAL OPEN PER SWITCH					
29	ELBOW-T-SENS-VOLT-200A-15KV-F	3	1543539	1	SENSOR, 200A, T-BODY, 1400:1 VOLTAGE RATIO DIVIDER, 25' CABLE
30	-	3	4004744	1	WELL, BUSHING, 15/25KV 600A, FEMALE LOADBREAK ELBOW 15/25KV
31	ARR-ELBOW-10KV-F	3	1000572	1	ARRESTER, ELECT, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER
		3	4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT

*INSTALLED DURING PROVISIONING/ COMMISSIONING

NOTES:

1. SEE DWGS. 28.02-144 AND 28.02-146 FOR INSTALLATION DETAILS.

2. ISSUE MATERIAL FOR SOURCE POWER SEPARATELY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

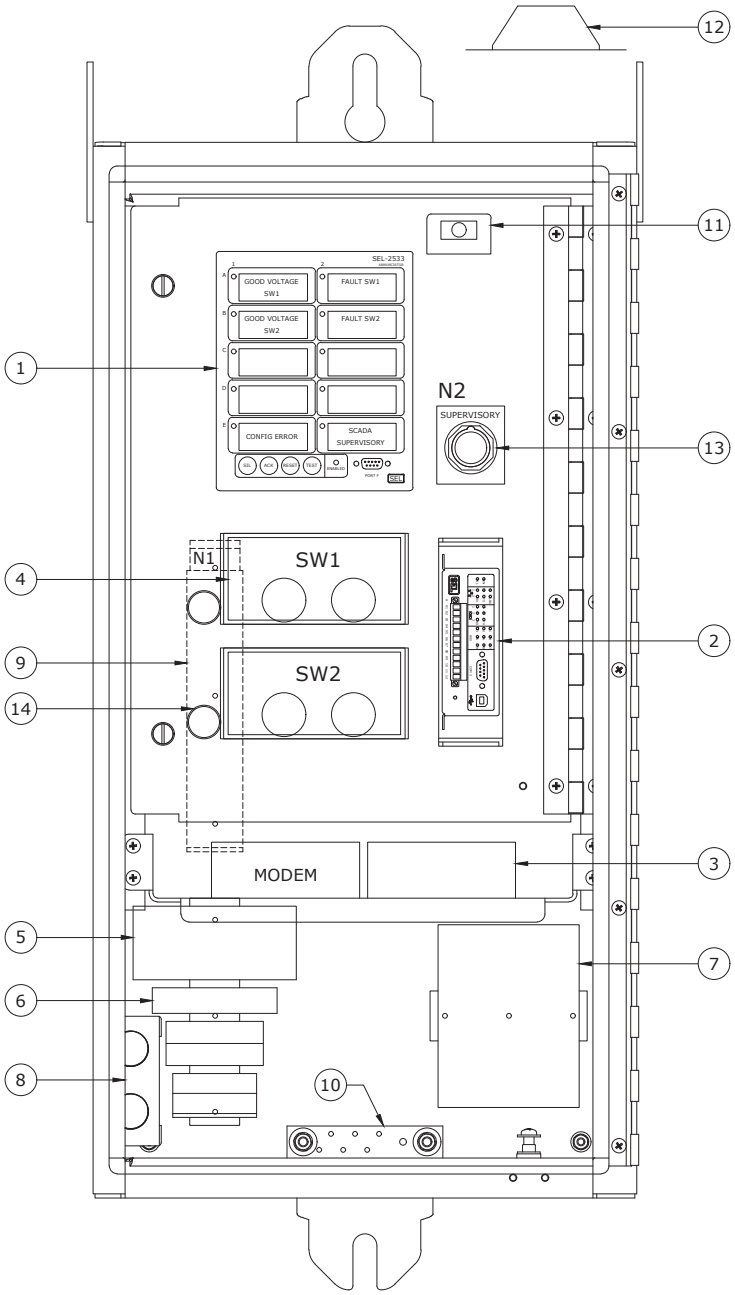
CLEAVELAND PRICE TWO MOS

BILL OF MATERIALS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-148



1	ANNUNCIATOR SEL 2533
2	AUTOMATION CONTROLLER SEL 3505-3
3	SECURITY GATEWAY SEL 3622
4	CONTROL SWITCH MODULE SEL 9510
5	POWER SUPPLY, TRIO UPS
6	CONVERTER MINI-PS-12
7	BATTERY
8	DUPLEX RECEPTACLE GFCI
9	TERMINAL BLOCK
10	GROUNDING BUS
11	DOOR SWITCH
12	ANTENNA
13	SUPERVISORY PUSHBUTTON
14	SWITCH LED C E INDICATION

NOTES:

1. SEE DWG. 28.02-146 FOR POLE AND FOUNDATION DETAILS.
2. SEE DWG. 28.02-144 FOR SWITCHGEAR CONDUIT DETAILS.
3. SEE DWG. 28.02-148 FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL COMMUNICATIONS ENCLOSURE FOR CLEAVELAND PRICE TWO MOS

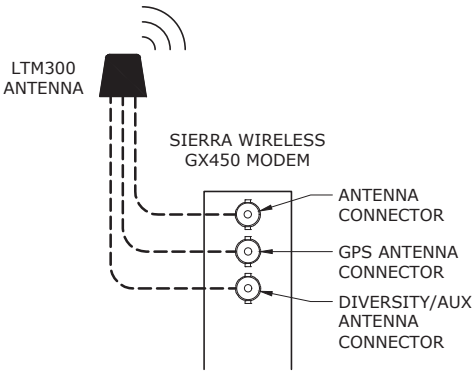
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

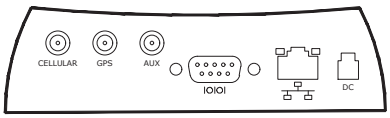
28.02-150

CONTROL COMMUNICATIONS CABINET - TWO MOS

ANTENNA

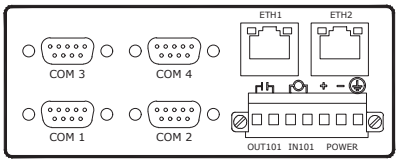


MODEM GX450



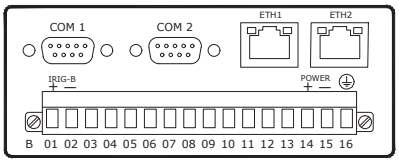
CELLULAR, GPS, AND AUX TO ANTENNA (ANTENNA WIRES)
ETH TO SEL-3622 ETH-1 (CAT-5E)

SEL-3622 SECURITY GATEWAY



ETH-1 TO MODEM ETH (CAT-5E)
ETH-2 TO SEL 3505-3 PORT-1A (CAT-5E)

SEL-3505-3 RTAC



ETH-1 TO SEL-3622 ETH-2 (CAT-5E)
ETH-2 TO SEL-2411 PORT-1A (CAT-5E)
COM2 TO ANNUNCIATOR PORT 3 (SEL-C273A CABLE)

SEL-2411 B CARD

PORT 1A

SEL 2411 MOS-1
PORT 1A TO SEL-3505-3 ETH-2
PORT 1B TO MOS-2 SEL-2411 ETH-1 (CAT-5E)

PORT 1B

SEL 2411 MOS-2
PORT-1A TO MOS-1 SEL-PORT 1B (CAT 5E)

POWER TO ENCLOSURE

FROM TERMINAL 1 ON TB2 TO 120VAC (LINE-POWER SOURCE)
FROM TERMINAL 2 ON TB2 TO 0VAC (NEUTRAL-POWER SOURCE)

NOTES:

1. SEL 2411 AND SEL 3505-3 TO BE CONNECTED IN SERIES. SEL 3505-3 IN CONTROL/COMMUNICATIONS ENCLOSURE CAN BE CONNECTED TO EITHER SEL 2411 AT SWITCHGEAR.
2. SEE DWG. 28.02-150 FOR CONTROL ENCLOSURE DETAIL.
3. CONNECT CABINET GROUND TO SWITCHGEAR GROUND.

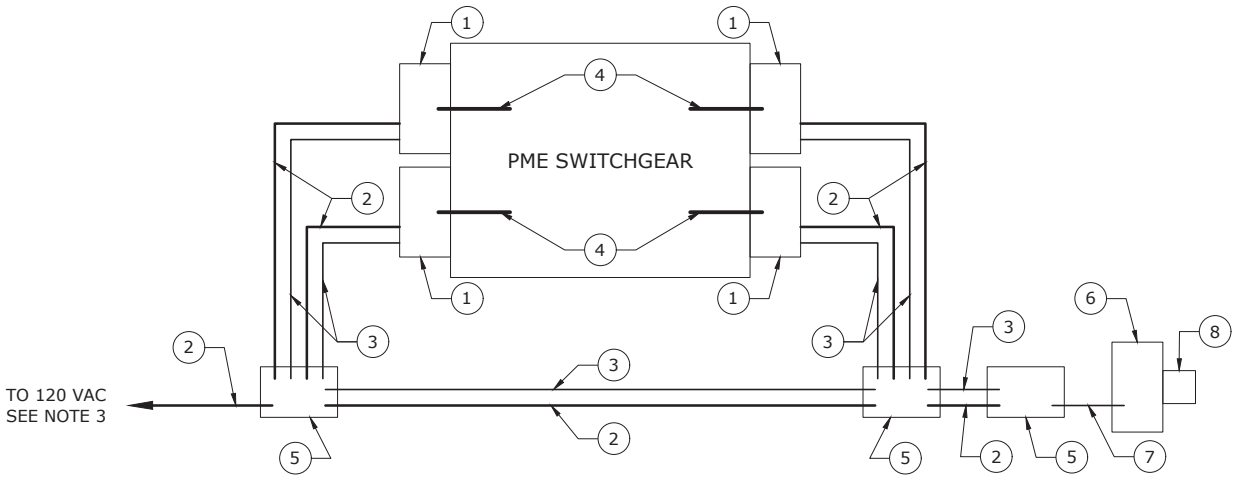
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL COMMUNICATION ENCLOSURE CONNECTIONS
TWO MOS

DEC	DEM	DEP	DEF
			X

28.02-152



TOP VIEW

1. CLEAVELAND PRICE MOS
2. 120V - 1-1/2" PVC SCH. 40 CONDUIT
3. ETH CAT 5 (1-2) - 1-1/2" PVC SCH. 40 CONDUIT
4. PTs/CTs/BONDING GROUND - 2" FLEXIBLE CONDUIT
5. PEDESTAL
6. CONTROL/COMMUNICATIONS ENCLOSURE
7. 120V/ETH CAT 5 BONDING GROUND - 2" PVC SCH. 40 CONDUIT
8. FIBERGLASS POLE

NOTES:

1. PEDESTALS TO BE LOCATED ACCORDING TO DWG. 28.02-134.
2. THE LOCATION OF THE CONTROL-COMMUNICATIONS BOX/ FIBERGLASS POLE WILL BE RELATIVE TO THE SWITCHGEAR (NO MORE THAN 20' AWAY). LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE SWITCHGEAR, OR OTHER NEARBY EQUIPMENT. PLACE IN A LOCATION FOR EASY ACCESS. GIVE CONSIDERATION TO OTHER ACTIVITIES SUCH AS MOWING.
3. 120 VOLT POWER TO MOTOR OPERATOR MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY, NON-SWITCHED STREETLIGHT CIRCUITS, OR NEARBY 120 VOLT TRANSFORMER. POWER COULD COME IN TO EITHER PEDESTAL.
4. CONTROLS MUST BE BONDED TO SWITCHGEAR GROUND.
5. USE 2.5" PVC SCH. 40 CONDUIT TO PROTECT EXPOSED FLEX CONDUIT.
6. FOR 3 WAY REMOVE ONE OF THE CLEAVELAND PRICE CABINETS AND ASSOCIATED CONDUITS.
7. SEE DWG. 28.02-136 FOR PT AND CT INSTALLATIONS.
8. SEE DWG. 28.02-140 FOR MOS CONNECTIONS.
9. SEE DWG. 28.02-146 FOR CONTROL/ COMMUNICATIONS CABINET INSTALLATION.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

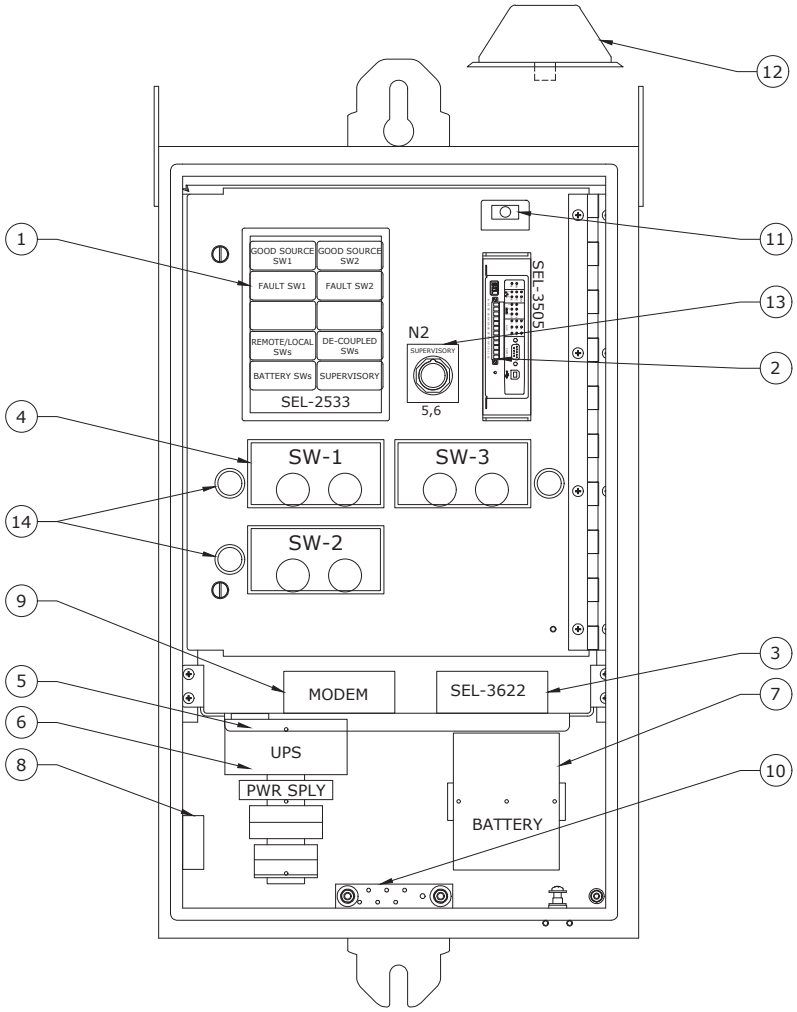
MOTOR OPERATOR-PME

SWITCHGEAR - THREE-FOUR MOS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-154



1. ANNUNCIATOR SEL 2533
2. AUTOMATION CONTROLLER SEL 3505-3
3. SECURITY GATEWAY SEL 3622
4. CONTROL SWITCH MODULE SEL 9510
5. POWER SUPPLY, TRIO UPS
6. CONVERTER MINI-PS-12
7. BATTERY
8. DUPLEX RECEPTACLE GFCI
9. MODEM
10. GROUNDING BUS
11. DOOR SWITCH
12. ANTENNA
13. SUPERVISORY PUSHBUTTON
14. SWITCH LED CFG. E. INDICATION

NOTES:

1. SEE DWG. 28.02-146 FOR FIBERGLASS POLE, AND FOUNDATION DETAILS.

2. SEE DWG. 28.02-154 FOR SWITCHGEAR CONDUIT DETAILS.

3. SEE DWG. 28.02-158 FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL-COMMUNICATIONS ENCLOSURE FOR CLEAVELAND PRICE THREE-WAY MOS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-156

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-SG-PAD-MO-S2411-RETRO-F	3	1548797	1	OPERATOR, SWITCH, MOTOR, CABINET MOUNTED W/ SEL2411 AUTOMATION CONTROL, ALUM ENCLOSURE POWDER COATED GREEN
2	CTRL-SG-PAD-COMM-S3505-3WAY-F	1	1566564	1	CONTROLLER, DISCRETE PROGRAMMABLE AUTOMATION, SWITCHGEAR MOTOR CONTROL SEL 3505, 12/24 VDC POWER SUPPLY
3	-	*	4204003	1	MODULE, SECURITY GATEWAY SEL 3622
4	-	*	1517091	1	MODEM, CELLULAR, W/ DC POWER CABLE
5	-	*	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
6	COND-COIL-2IN-FLEX-F	35	900113	1	CONDUIT, PANDC FLEXIBLE, 2", 250' LG, GRAY PVC, COVERED, PLAIN 2.045" ID X 2.375" OD
7	COND-HUB-2IN-FLEX-MALE-F	4	1564270	1	2" HUB, MALE THD, STRAIGHT, LIQUID TIGHT
8	RISER-2 1/2IN-COND-1PC-CTRL-NWD-F	2	61356	10	CONDUIT, RIGID, HEAVY WALL, 2-1/2", 10' LG, SCH 40, PVC, BELLED ONE END, RATED F/ 90 DEG C CONDUCTOR, 2.414"
9	COND-BEND-2IN-PVC-90DEG-R18-F	2	4005433	1	ELBOW, CONDUIT, 2", PVC, 90 DEG, 24" RADIUS, PRE-BENT PEDESTAL SCH 40, OUTSIDE DIMENSION 2' 3" X 3' 8" WITHOUT
10	COND-STICK-1 1/2IN-PVC-SCH40-F	6	4005379	1	CONDUIT, 1-1/2", 20' LG, SCH 40, PVC, COUPLING OR BELLED END PER FPC SPEC MS-117 3600 FT/BUNDLE
11	COND-BEND-1 1/2IN-PVC-90DEG-R36-F	16	4005396	1	ELBOW, CONDUIT, 1-1/2", BELLED END, PVC, 90 DEG, 36" RADIUS BEND, SCHED 40, W/ COUPLING OR BELLED END, PER
			4005418	1	COUPLING, PIPE, 1-1/2", SCH 40, PVC, W/ CENTER STOP PER FPC SPEC MS-117, 50 PER BOX
12	-	7	711	1	ADAPTER, CONDUIT, TERMINAL, 1-1/2", MALE THD, 1-1/2", SOCKET GRAY PVC
13	-	7	4005458	1	NUT, CONDUIT LOCK, 1-1/2" DIA, STL
14	PED-HH-LG-POLY-F	3	4004630	1	BOX, ELECTRICAL, JUNCTION, 12" X 20" X 17" DP, PEDESTAL, F/ SEC & SERV FLUSH MOUNT 12" X 20" GREEN
15	CONN-UG-HH-SUB-1/0-3POS-F	6	4004785	1	CONNECTOR, ELECTRICAL, WATERPROOF PEDESTAL, 12-1/0 AWG STR SUBMERSIBLE, INSULATED THREE HOLES
16	CTRL-CABLE-10-CU-DX-PWR-F	75	4003512	1	CABLE LIGHTING, 10 CU DUPLEX
17	GND-EQUIP/EQUIP-6-BOND-F	95	234664	1	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, PER DUKE POWER SPEC CS-26 DATED, 25
18	GND-ROD-UG-F	3	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
19	POLE-FG-10-CTRL-F	1	1539295	1	POLE, RECLOSER CONTROL MOUNTING, 4" SQ. X 10' HT, FIBERGLASS W/HARDWARE, ANTENNA GROUND PLANE
20	POLE-BAND-STRAP-SM-STL-F	1	1490605	1	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 316 SS, 1800 LB
21	POLE-BAND-STRAP-BUCKLE-SM-STL-F	2	1490606	1	BUCKLE, BANDING, 3/4" WD, SS, MRO ITEM ONLY
22	SENS-CURR-120/1-15KV-CABLE-CLAMP-F	3	1549406	1	SENSOR, CURRENT, 200A-900A RANGE, 600A, 120:1 CURRENT RATIO 1.5% UP TO 200A ACCURACY
23	-	*	4003516	135	WIRE/CABLE, ELECTRICAL, SIS, 1 CONDUCTOR, 14 AWG, TINNED CU CONDUCTOR, 41 STR, 600V, GRAY, SWITCHBOARD, UL
24	-	*	1523559	9	SPLICE, CONDUCTOR, BUTT, 16-14 AWG CONDUCTOR, STRAIGHT NYLON GRIP INSULATION, BLUE, MOISTURE WEATHER PROOF
25	-	1	-	100 FT	CAT5E CABLE
26	-	*	1545308	6	CONNECTOR, COMMUNICATIONS, RJ45 CRIMP, 24 AWG CONDUCTOR 8 POSITION
27	-	*	1545307	6	COVER, PROTECTIVE, GRAY SILICONE, STRAIN RELIEF
VOLTAGE SENSING NORMAL CLOSE PER SWITCH					
28	ELBOW-SENS-VOLT-200A-15KV-F	3	1569898	1	SENSOR, VOLTAGE, 200A, 1400:1 VOLTAGE DIVIDER, 25' CABLE, 15KV
VOLTAGE SENSING NORMAL OPEN PER SWITCH					
29	ELBOW-T-SENS-VOLT-200A-15KV-F	3	1543539	1	SENSOR, 200A, T-BODY, 1400:1 VOLTAGE RATIO DIVIDER, 25' CABLE
30	-	3	4004744	1	WELL, BUSHING, 15/25KV 600A, FEMALE LOADBREAK ELBOW 15/25KV
31	ARR-ELBOW-10KV-F	3	1000572	1	ARRESTER, ELECT, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER
		3	4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT

*INSTALLED DURING PROVISIONING/ COMMISSIONING

NOTES:

1. SEE DWG. 28.02-144 AND 28.02-146 FOR INSTALLATION DETAILS.

2. ISSUE MATERIAL FOR SOURCE POWER SEPARATELY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

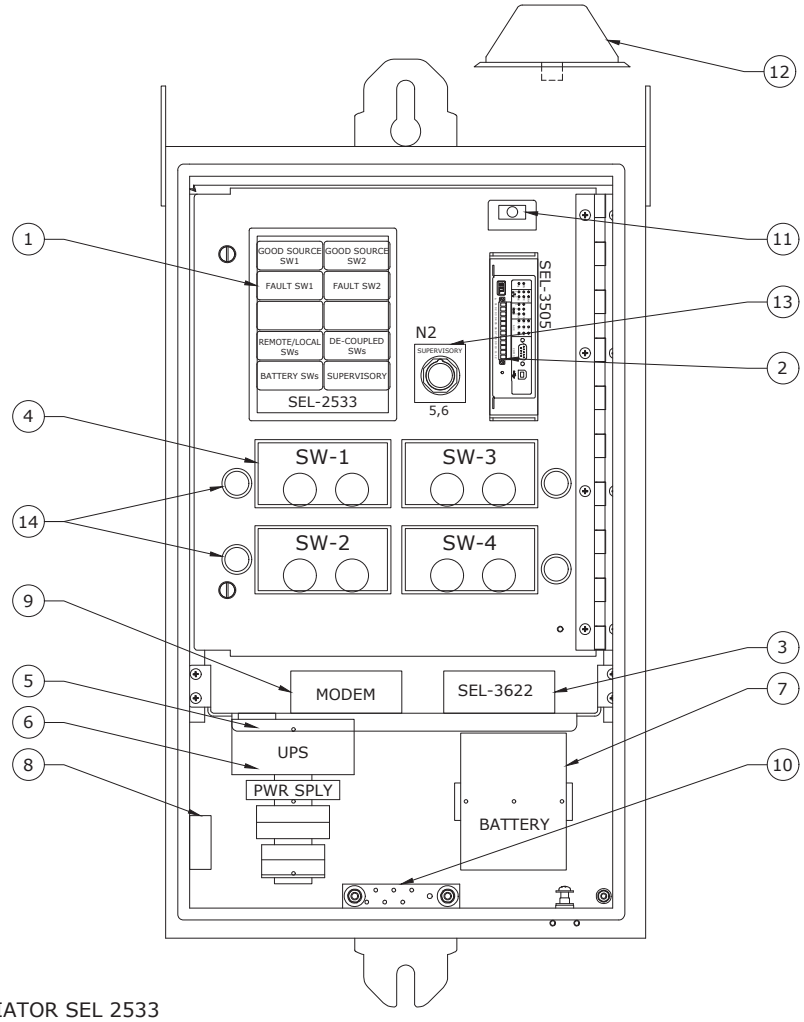
CLEAVELAND PRICE THREE-WAY MOS

BILL OF MATERIALS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-158



1. ANNUNCIATOR SEL 2533
2. AUTOMATION CONTROLLER SEL 3505-3
3. SECURITY GATEWAY SEL 3622
4. CONTROL SWITCH MODULE SEL 9510
5. POWER SUPPLY, TRIO UPS
6. CONVERTER MINI-PS-12
7. BATTERY
8. DUPLEX RECEPTACLE GFCI
9. MODEM
10. GROUNDING BUS
11. DOOR SWITCH
12. ANTENNA
13. SUPERVISORY PUSHBUTTON
14. SWITCH LED CFG. E. INDICATION

NOTES:

1. SEE DWG. 28.02-146 FOR POLE, AND FOUNDATION DETAILS.

2. SEE DWG. 28.02-154 FOR SWITCHGEAR CONDUIT DETAILS.

3. SEE DWG. 28.02-162 FOR BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL-COMMUNICATIONS ENCLOSURE FOR CLEAVELAND PRICE FOUR-WAY MOS

DEC	DEM	DEP	DEF
			X

28.02-160

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	CTRL-SG-PAD-MO-S2411-RETRO-F	4	1548797	1	OPERATOR, SWITCH, MOTOR, CABINET MOUNTED W/ SEL2411 AUTOMATION CONTROL, ALUM ENCLOSURE POWDER COATED GREEN
2	CTRL-SG-PAD-COMM-S3505-4WAY-F	1	1566161	1	CONTROLLER, DISCRETE PROGRAMMABLE AUTOMATION, SWITCHGEAR MOTOR CONTROL SEL 3505, 12/24 VDC POWER SUPPLY
3	-	*	4204003	1	MODULE, SECURITY GATEWAY SEL 3622
4	-	*	1517091	1	MODEM, CELLULAR, W/ DC POWER CABLE
5	-	*	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
6	COND-COIL-2IN-FLEX-F	45	900113	1	CONDUIT, PANDC FLEXIBLE, 2", 250' LG, GRAY PVC, COVERED, PLAIN, 2.045" ID X 2.375" OD
7	COND-HUB-2IN-FLEX-MALE-F	5	1564270	1	2" HUB, MALE THD, STRAIGHT, LIQUID TIGHT
8	RISER-2 1/2IN-COND-1PC-CTRL-NWD-F	2	61356	10	CONDUIT, RIGID, HEAVY WALL, 2-1/2", 10' LG, SCH 40, PVC, BELLED ONE END, RATED F/ 90 DEG C CONDUCTOR, 2.414"
9	COND-BEND-2IN-PVC-90DEG-R18-F	2	4005433	1	ELBOW, CONDUIT, 2", PVC, 90 DEG, 24" RADIUS, PRE-BENT PEDESTAL SCH 40, OUTSIDE DIMENSION 2' 3" X 3' 8" WITHOUT
10	COND-STICK-1 1/2IN-PVC-SCH40-F	7	4005379	1	CONDUIT, 1-1/2", 20' LG, SCH 40, PVC, COUPLING OR BELLED END, PER FPC SPEC MS-117 3600 FT/BUNDLE
11	COND-BEND-1 1/2IN-PVC-90DEG-R36-F	18	4005396	1	ELBOW, CONDUIT, 1-1/2", BELLED END, PVC, 90 DEG, 36" RADIUS, BEND, SCHED 40, W/ COUPLING OR BELLED END, PER
			4005418	1	COUPLING, PIPE, 1-1/2", SCH 40, PVC, W/ CENTER STOP PER FPC SPEC MS-117, 50 PER BOX
12	-	9	711	1	ADAPTER, CONDUIT, TERMINAL, 1-1/2", MALE THD, 1-1/2", SOCKET GRAY PVC
13	-	9	4005458	1	NUT, CONDUIT LOCK, 1-1/2" DIA, STL
14	PED-HH-LG-POLY-F	3	4004630	1	BOX, ELECTRICAL, JUNCTION, 12" X 20" X 17" DP, PEDESTAL, F/ SEC & SERV FLUSH MOUNT 12" X 20" GREEN
15	CONN-UG-HH-SUB-1/0-3POS-F	8	4004785	1	CONNECTOR, ELECTRICAL, WATERPROOF PEDESTAL, 12-1/0 AWG STR SUBMERSIBLE, INSULATED THREE HOLES
16	CTRL-CABLE-10-CU-DX-PWR-F	90	4003512	1	CABLE LIGHTING, 10 CU DUPLEX
17	GND-EQUIP/EQUIP-6-BOND-F	110	234664	1	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, PER DUKE POWER SPEC CS-26 DATED, 25
18	GND-ROD-UG-F	3	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
19	POLE-FG-10-CTRL-F	1	1539295	1	POLE, RECLOSER CONTROL MOUNTING, 4" SQ. X 10' HT, FIBERGLASS W/HARDWARE, ANTENNA GROUND PLANE
20	POLE-BAND-STRAP-SM-STL-F	1	1490605	1	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 316 SS, 1800 LB
21	POLE-BAND-STRAP-BUCKLE-SM-STL-F	2	1490606	1	BUCKLE, BANDING, 3/4" WD, SS, MRO ITEM ONLY
22	SENS-CURR-120/1-15KV-CABLE-CLAMP-F	4	1549406	1	SENSOR, CURRENT, 200A-900A RANGE, 600A, 120:1 CURRENT RATIO 1.5% UP TO 200A ACCURACY
23	-	*	4003516	180	WIRE/CABLE, ELECTRICAL, SIS, 1 CONDUCTOR, 14 AWG, TINNED CU CONDUCTOR, 41 STR, 600V, GRAY, SWITCHBOARD, UL
24	-	*	1523559	12	SPLICE, CONDUCTOR, BUTT, 16-14 AWG CONDUCTOR, STRAIGHT NYLON GRIP INSULATION, BLUE, MOISTURE WEATHER PROOF
25	-	1	-	130 FT	CAT5E CABLE
26	-	*	1545308	8	CONNECTOR, COMMUNICATIONS, RJ45 CRIMP, 24 AWG CONDUCTOR, 8 POSITION
27	-	*	1545307	8	COVER, PROTECTIVE, GRAY SILICONE, STRAIN RELIEF
VOLTAGE SENSING NORMAL CLOSE PER SWITCH					
28	ELBOW-SENS-VOLT-200A-15KV-F	3	1569898	1	SENSOR, VOLTAGE, 200A, 1400:1 VOLTAGE DIVIDER, 25' CABLE, 15KV
VOLTAGE SENSING NORMAL OPEN PER SWITCH					
29	ELBOW-T-SENS-VOLT-200A-15KV-F	3	1543539	1	SENSOR, 200A, T-BODY, 1400:1 VOLTAGE RATIO DIVIDER, 25' CABLE
30	-	3	4004744	1	WELL, BUSHING, 15/25KV 600A, FEMALE LOADBREAK ELBOW 15/25KV
31	ARR-ELBOW-10KV-F	3	1000572	1	ARRESTER, ELECT, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER
		3	4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT

*INSTALLED DURING PROVISIONING/ COMMISSIONING

NOTES:

1. SEE DWG. 28.02-144 AND 28.02-146 FOR INSTALLATION DETAILS.

2. ISSUE MATERIAL FOR SOURCE POWER SEPARATELY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

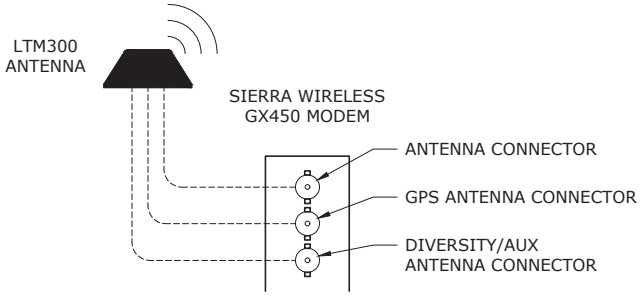
CLEAVELAND PRICE FOUR-WAY MOS

BILL OF MATERIALS

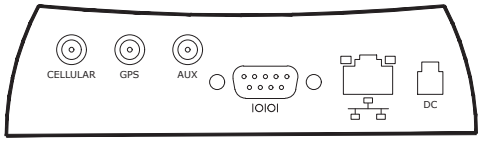
DEC	DEM	DEP	DEF
			X

28.02-162

ANTENNA

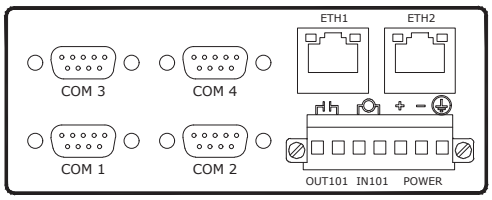


MODEM GX450



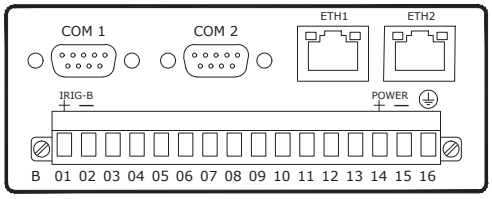
CELLULAR, GPS, AND AUX TO ANTENNA (ANTENNA WIRES)
ETH TO SEL-3622 ETH-1 (CAT-SE)

SEL-3622 SECURITY GATEWAY



ETH-1 TO MODEM ETH (CAT-SE)
ETH-2 TO SEL-3505-3 ETH-2 (CAT-SE)

SEL-3505-3 RTAC



ETH-1 TO SEL-3622 ETH-2 (CAT-SE)
ETH-2 TO SEL-2411 PORT 1A OR 1B (CAT-SE)
COM2 TO ANNUNCIATOR PORT-3 (SEL-C273A CABLE)

SEL-2411 B CARD

PORT 1A

SEL 2411 MOS-1
PORT 1A TO SEL-3505-3 ETH-2 (CAT-5E)
PORT 1B TO MOS-2 SEL-2411 PORT 1A (CAT-5E)

PORT 1B

SEL 2411 MOS-2
PORT 1A TO MOS-1 SEL-2411 PORT 1B (CAT-5E)
PORT 1B TO MOS-2 SEL-2411 PORT 1A (CAT-5E)

SEL 2411 MOS-3
PORT 1A TO MOS-2 SEL-2411 PORT 1B (CAT-5E)
PORT 1B TO MOS-3 SEL-2411 PORT 1A (CAT-5E)

SEL 2411 MOS-4
PORT 1A TO MOS-3 SEL-2411 PORT 1B (CAT-5E)

POWER TO ENCLOSURE

FROM TERMINAL 1 ON TB2 TO 120/AC (LINE-POWER SOURCE)
FROM TERMINAL 2 ON TB2 TO 0VAC (NEUTRAL-POWER SOURCE)

NOTES:

1. SEL 2411 TO BE CONNECTED IN SERIES WITH CAT5E CABLE. SEL 3505-3 IN CONTROL/ COMMUNICATIONS.
2. SEE DWG. 28.02-150 FOR CONTROL ENCLOSURE DETAIL.
3. CONNECT CABINET GROUND TO SWITCHGEAR GROUND.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CONTROL COMMUNICATION CABINET
THREE-WAY AND FOUR-WAY MOS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.02-164

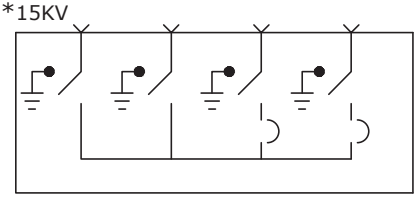
S&C VISTA SWITCHGEAR GENERAL DESCRIPTION/ RATINGS CONFIGURATIONS

THE VISTA SWITCHGEAR IS A DEAD-FRONT, SEALED STAINLESS STEEL TANK DESIGN THAT IS SUBMERSIBLE. THE INSULATION MEDIUM IS SF6 GAS. THE 600AMP SWITCHES ARE TYPICALLY MANUALLY OPERATED WITH THE EXCEPTION OF A FEW APPLICATIONS THAT UTILIZE VACUUM INTERRUPTERS. THE 200 AMP SIDE IS EQUIPPED WITH VACUUM INTERRUPTERS AND CAN BE PROGRAMMED TO A DESIRED FUSE CURVE. THE SWITCHGEAR HAS A VISIBLE OPEN WINDOW FOR THE 600 AMP AND THE 200 AMP POSITIONS.

KV			AMPERES, RMS					
SYSTEM CLASS	MAX.	BILL.	MAIN BUS CONT. CURRENT	SHORT-CIRCUIT SYM.	FAULT INTERRUPTER		LOAD INTERRUPTER SWITCH	
					CONT. & LOAD DROPPING	TEN-TIME DUTY CYCLE FAULT-INTERR. SYM.	CONT. & LOAD DROPPING	MOM. & ONE SECOND SYM.
15.5 (12)	15.5 (15.5)	95 (95)	600 (630)	12500 (12500)	200 (200)	12500 (12500)	600 (630)	12500 (12500)
				25000 (25000)	600 (630)	25000 (25000)	600 (630)	25000 (25000)

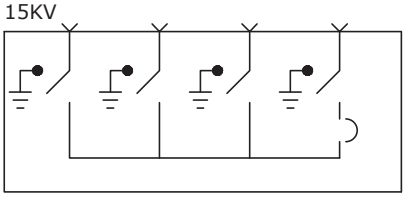
VISTA CONFIGURATIONS:

*15KV



422

15KV



431

*I-DRIVE 422 CONFIGURATION IS CUSTOM DESIGN. SEE DWG. 28.03-103.

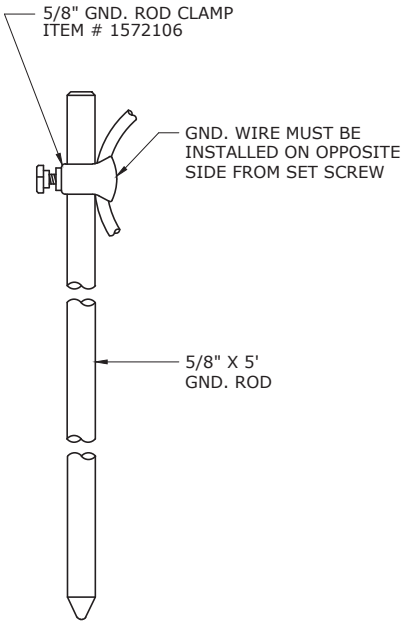
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15 KV VISTA SF6 FAULT INTERRUPTER
MOTOR OP PAD-MOUNTED
WITH NON-SUBMERSIBLE SEL 351

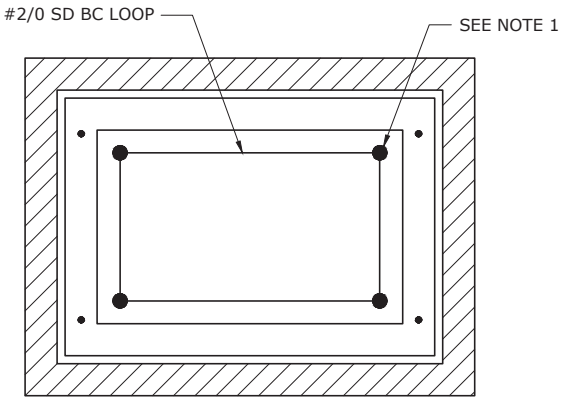
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

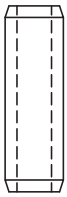
28.03-101A



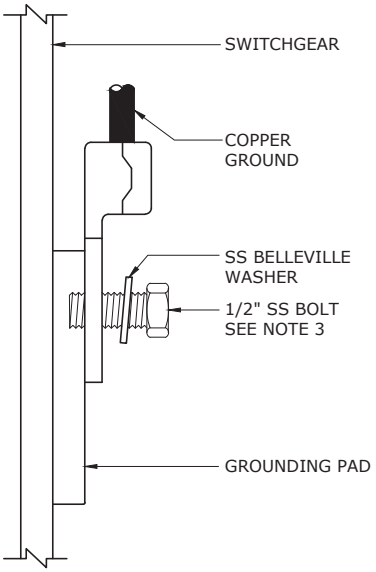
GROUND ROD



VAULT PAD



5/8" COUPLING



GROUNDING LUG

NOTES:

1. INSTALL A GROUND ROD IN EACH CORNER OF THE VAULT PAD. ONE OF THE INSTALLATIONS IS TO BE A DEEP DRIVEN ROD USING FOUR 5' SECTIONS.

2. RUN A LOOP OF #2/0 BARE COPPER INSIDE THE VAULT PAD, LOOPING THE CONDUCTOR THROUGH THE GROUND ROD CLAMP IN EACH CORNER.

3. CONNECT THE LOOPED GROUND BUSS CONDUCTOR TO THE PAD IN EACH CORNER OF THE SWITCHGEAR USING A SHORT PIECE OF #2/0 SOFT DRAWN COPPER. USE THE GROUNDING LUG SHOWN AND ATTACH TO THE GROUNDING PAD WITH A 1/2" STAINLESS STEEL BOLT AND STAINLESS STEEL BELLEVILLE WASHER.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15 KV VISTA SF6 FAULT INTERRUPTER
MOTOR OP PAD-MOUNTED
WITH NON-SUBMERSIBLE SEL 351 GROUNDING DETAIL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.03-101B

OPTIONAL VOLTAGE INDICATOR WITH LIQUID-CRYSTAL DISPLAY. INCLUDES SELF-TEST FEATURE.

COMPACT WELDED-STEEL TANK PROTECTS SWITCHING AND PROTECTION COMPONENTS FROM THE ENVIRONMENT. STAINLESS-STEEL CONSTRUCTION STANDARD IN UNDERCOVER STYLE

GAS-FILL PORT

OPERATING MECHANISMS FOR SWITCHES AND FAULT INTERRUPTERS-PADLOCKABLE IN ANY POSITION

OPERATION SELECTOR PREVENTS INADVERTENT OPERATION FROM "CLOSED" POSITION DIRECTLY TO "GROUNDED" POSITION AND VICE VERSA

MICROPROCESSOR-BASED OVERCURRENT CONTROL HOUSED IN WATERTIGHT ENCLOSURE. CTS (NOT VISIBLE) PROVIDE POWER AND SIGNAL INPUTS

PRESSURE GAUGE (LOCATED UNDER WINDOW) TEMPERATURE AND ALTITUDE COMPENSATED

OPERATING PANEL OF VISTA UDS GEAR. VIEWING WINDOWS, FOR CONFIRMING OPEN GAP AND GROUNDED POSITION ON LOAD-INTERRUPTER SWITCHES AND FAULT INTERRUPTERS, ARE LOCATED UNDER HINGED COVERS OF VOLTAGE INDICATORS.

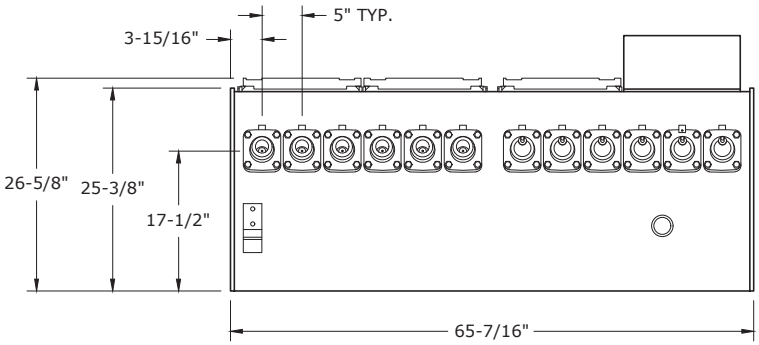
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15 KV VISTA SF6 FAULT INTERRUPTER MOTOR OP PAD-MOUNTED WITH NON-SUBMERSIBLE SEL 351

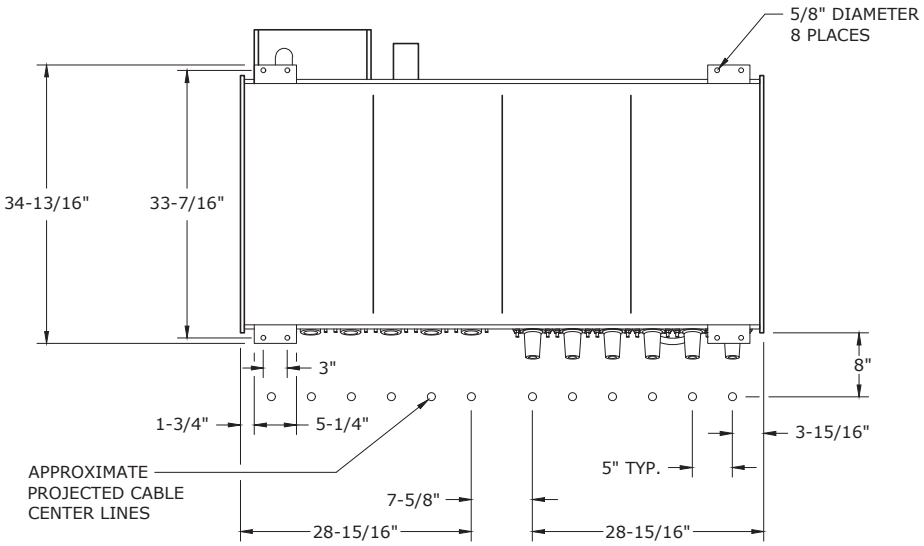
DEC	DEM	DEP	DEF
			X

28.03-101C

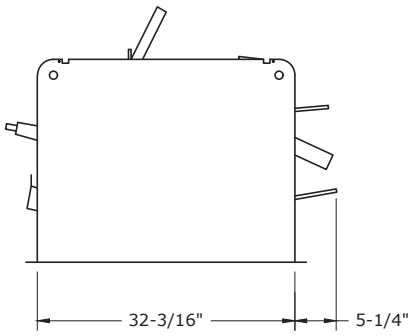
VISTA DIMENSIONS APPLICABLE TO ALL 4 WAY MODELS RATED 15.5KV



ANCHOR BOLT PLAN



ANCHOR BOLT PLAN



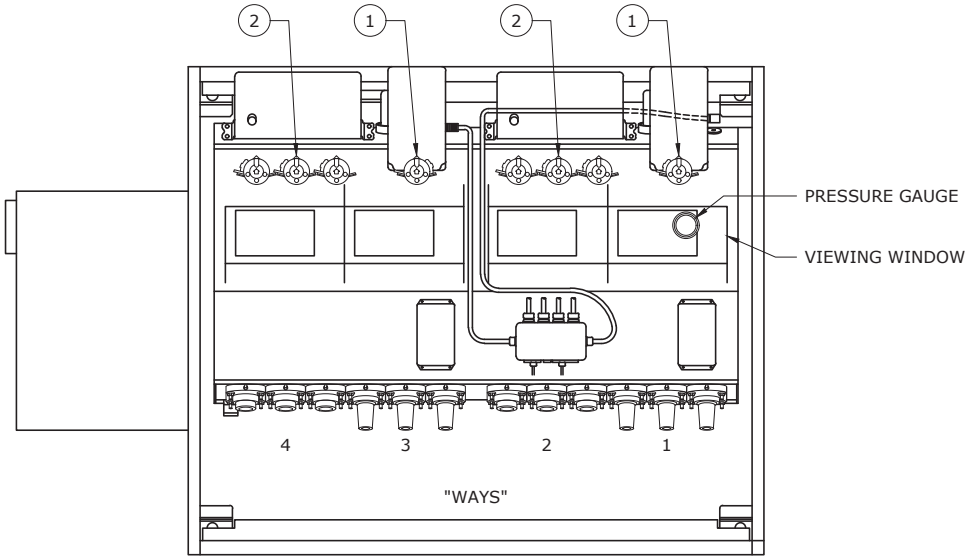
SIDE VIEW

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

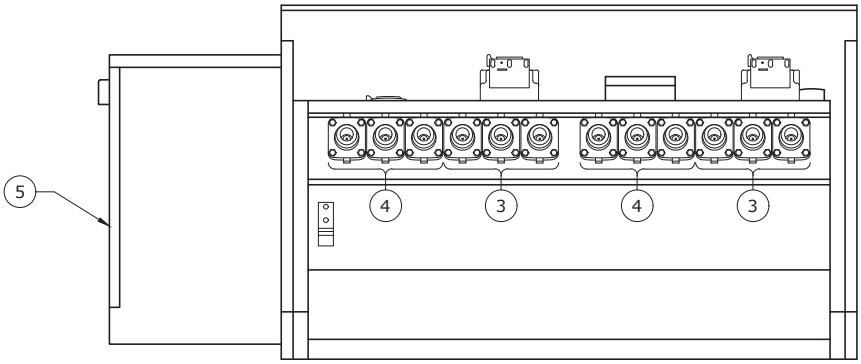
S&C 15 KV VISTA SF6 FAULT INTERRUPTER
MOTOR OP PAD-MOUNTED
WITH NON-SUBMERSIBLE SEL 351 - DIMENSIONS

DEC	DEM	DEP	DEF
			X

28.03-101D



SECTIONAL OPEN TOP VIEW



SECTIONAL OPEN TERMINATION VIEW

ITEM NUMBER	ITEM DESCRIPTION
1	600 AMP MOTOR OPERATED 3-PHASE FAULT INTERRUPTER SWITCH, 3 POSITION
2	200 AMP SINGLE-PHASE FAULT INTERRUPTER SWITCH
3	600 AMP BUSHINGS FOR FAULT INTERRUPTER SWITCH
4	200 AMP BUSHING WELLS FOR FAULT INTERRUPTER SWITCH
5	2 SCHWEITZER SEL-351 OVERCURRENT RELAY AND REMOTE CONTROL

NOTES:

1. SEE DWG. 28.03-105 FOR NOTES AND THREE LINE DIAGRAM.
2. SEE DWG. 28.03-109 FOR BILL OF MATERIALS FOR MODEL 422.

DUKE ENERGY.

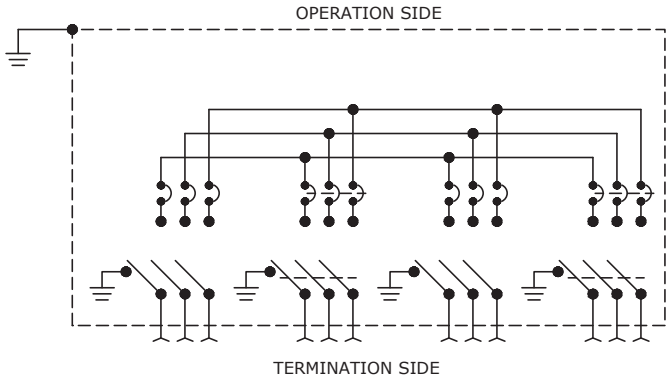
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15 KV VISTA MODEL 422 SF6 FAULT INTERRUPTER MOTOR OP PAD-MOUNTED WITH NON-SUBMERSIBLE SEL 351 LAYOUT

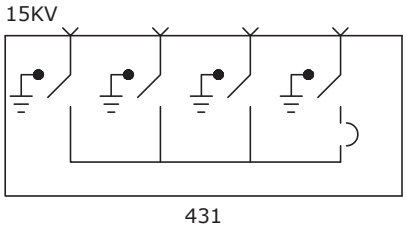
DEC	DEM	DEP	DEF
			X

28.03-103

SCHEMATIC



VISTA MODEL 422
ITEM # 4004056



VISTA MODEL 431
ITEM # 4005057

NOTES:

1. ON 600 SWITCHED WAY, USE 600A BOLTED ELBOW (T-BODY).
2. T-BODY IS NON-LOADBREAK: NO VOLTAGE AND NO CURRENT.
3. FITS MOUNTING BOX (ITEM # 4164793).
4. THE SOLID BLADE SWITCH HAS THREE-POSITIONS: OPEN, CLOSED AND GROUND.
5. LOOK THROUGH WINDOW FOR VISUAL POSITIONS OF SWITCH LOCATED ON OPERATION SIDE OF SWITCHGEAR.
6. ON 200 AMP INTERRUPTER WAY, USE 200A BOLTED T-BODY.
7. TANK CONTAINS SF-6 GAS, CHECK GAUGE BEFORE OPERATION.
8. CONNECT T-BODY AND BOLTED ELBOW GROUND BRAIDS TO A #2/0 BARE COPPER GROUND LOOP THAT IS CONNECTED TO A DEEP DRIVEN GROUND ROD. CONNECT SWITCH GROUNDING PAD TO THE GROUND LOOP USING A #2/0 BARE COPPER JUMPER.
9. SEE DWG. 28.03-101B FOR GROUNDING DETAILS.
10. SEE DWGS. 28.03-101D FOR CABLE/ CONDUIT PLACEMENT.
11. SEE DWG. 24.05-09 FOR MOUNTING BOX.
12. SEE DWG. 28.03-107 AND DWG. 28.03-109 FOR BILL OF MATERIALS.

3				
2				
1				
0	1/15/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

S&C 15 KV VISTA MODEL 422 AND 431 SF6 FAULT INTERRUPTER MOTOR OP PAD-MOUNTED WITH NON-SUBMERSIBLE SEL 351 NOTES

DEC	DEM	DEP	DEF
			X

28.03-105

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-3VI/600-1VFI/200-SF6-ID-F	1	4004057	1	SWITCHGEAR PAD-MOUNT 15KV 3 600A VACUUM INTERRUPTER WAYS 1 200A VFI WAY SF6 INSULATED DEAD FRONT I-DRIVE
-	STRUCT-PAD-SG-CTE-VISTA-F	1	4164793	1	BASE, MOUNTING, FIBERCRETE, F/ 15KV SWITCHGEAR, LOW PROFILE VISTA
-	ELBOW-1/0-AL-200A-15KV-NLB-F	VARIES	4004701	1	ELBOW BOLTED W/TAP 2-1/0
			50124557	1	KIT ACCESSORY 15KV CABLE SIZE 1/0 SPRING GROUND STRAP
-	ELBOW-T-1000-AL-600A-15KV-NLB-F	9	4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS THE ACCOMMODATES CABLES FROM 15 TO 35 KV, IN SIZES
			4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A15KV SW, 1000 F/ DEADFRONT SWITCHGEAR W/ CONNECTOR F/ 15
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0 - 2/0 AWG (0.368 - 0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	FCI-UG-1P-LG-CURR-LED-F	9	1538632	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE MAGNET, FAULT INDICATOR RESET, HOT STICK ASSEMBLY, 6' (2M) FIBER OPTIC CABLE
SEE NOTE 1	FCI-UG-3P-FIBER-LED-F	3	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS

NOTES:

1. INSTALL FAULT INDICATORS ON EACH 600 AMP WAY.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15 KV VISTA MODEL 431 PAD-MOUNTED WITH MOTOR OP AND SEL 351 RELAY

DEC	DEM	DEP	DEF
			X

28.03-107

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-2VI/600-2VFI/600-SF6-F	1	4004056	1	SWITCHGEAR PADMOUNT 15KV 2 600A VACUUM INTERRUPTER WAYS 2 600A VFI WAYS SF6 INSULATED DEAD FRONT
-	STRUCT-PAD-SG-CTE-VISTA-F	1	4164793	1	BASE, MOUNTING, FIBERCRETE, F/ 15KV SWITCHGEAR, LOW PROFILE VISTA
-	ELBOW-1/0-AL-200A-15KV-NLB-F	VARIES	4004701	1	ELBOW BOLTED W/TAP 2-1/0
			50124557	1	KIT ACCESSORY 15KV CABLE SIZE 1/0 SPRING GROUND STRAP
-	ELBOW-T-1000-AL-600A-15KV-NLB-F	6	4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS THE ACCOMMODATES CABLES FROM 15 TO 35 KV, IN SIZES
			4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A15KV SW, 1000 F/ DEADFRONT SWITCHGEAR W/ CONNECTOR F/ 15
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0 - 2/0 AWG (0.368 - 0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	FCI-UG-1P-LG-CURR-LED-F	6	1538632	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE MAGNET, FAULT INDICATOR RESET, HOT STICK ASSEMBLY, 6' (2M) FIBER OPTIC CABLE
SEE NOTE 1	FCI-UG-3P-FIBER-LED-F	2	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS

NOTES:

1. INSTALL FAULT INDICATORS ON EACH 600 AMP WAY.

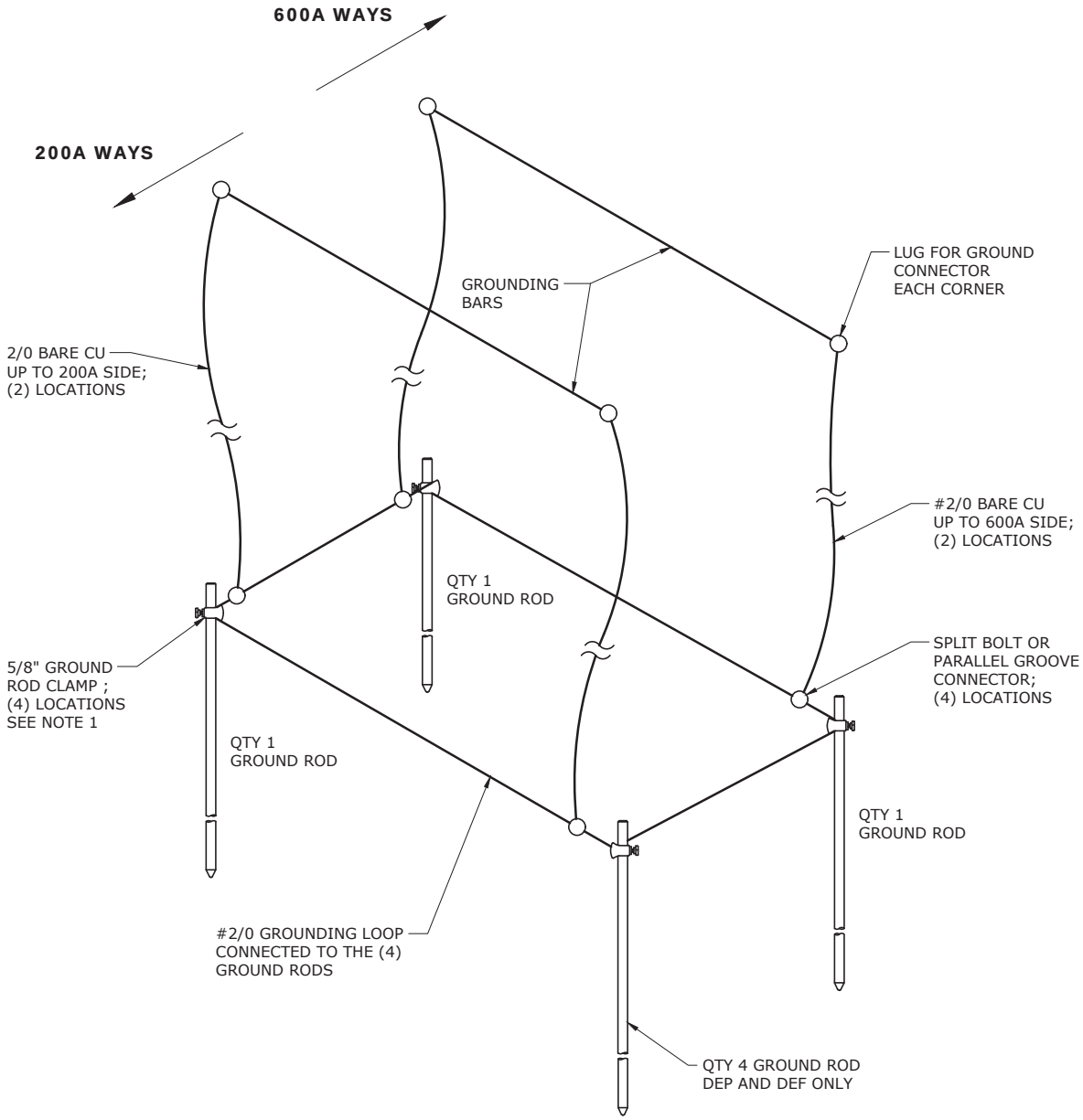
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15 KV VISTA MODEL 422 PAD-MOUNTED WITH MOTOR OP AND SEL 351 RELAY

DEC	DEM	DEP	DEF
			X

28.03-109



NOTES:

1. GROUND WIRE MUST BE INSTALLED ON OPPOSITE SIDE OF SET SCREW.
2. DEC/DEM: GROUND RODS ARE 8' IN LENGTH AND ONE IS INSTALLED IN EACH CORNER OF BOX PAD.
3. DEP/DEF: GROUND RODS ARE 5' IN LENGTH AND ONE ROD IS INSTALLED IN 3 CORNERS AND 4 RODS STACKED VERTICALLY ARE INSTALLED IN THE 4TH CORNER.

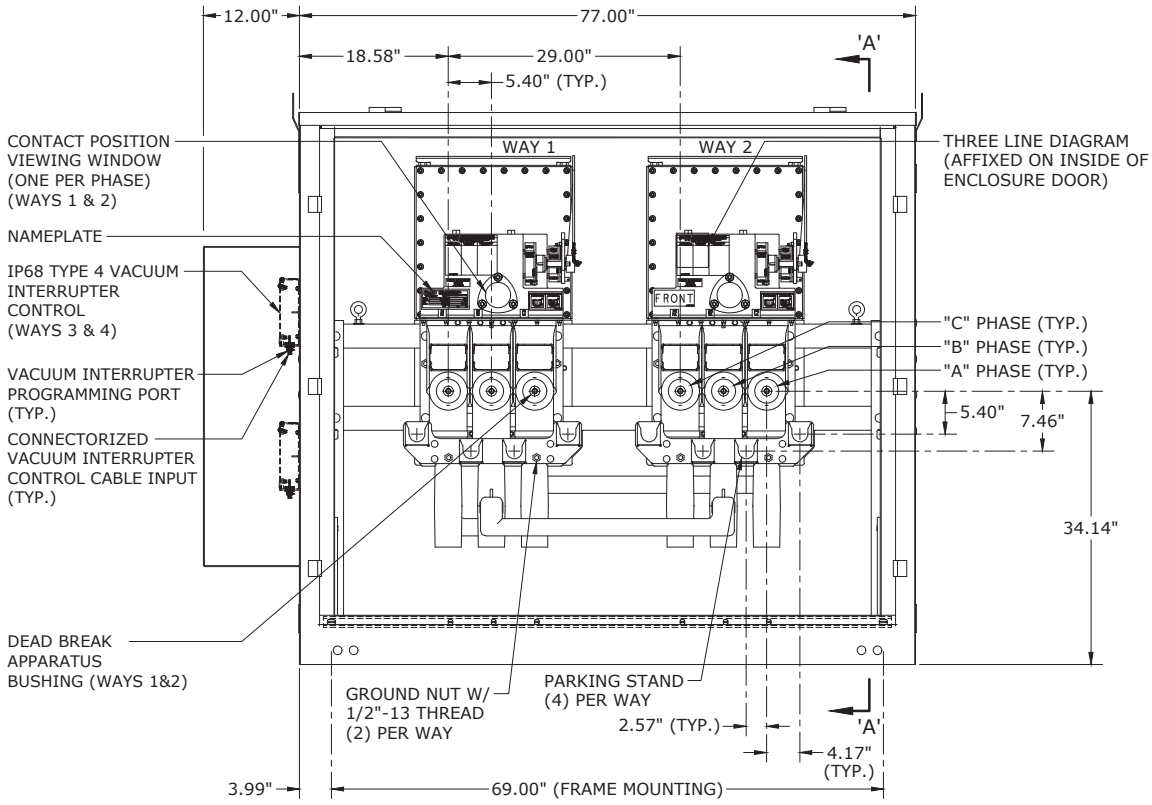
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED SOLID DIELECTRIC SWITCHGEAR GROUNDING

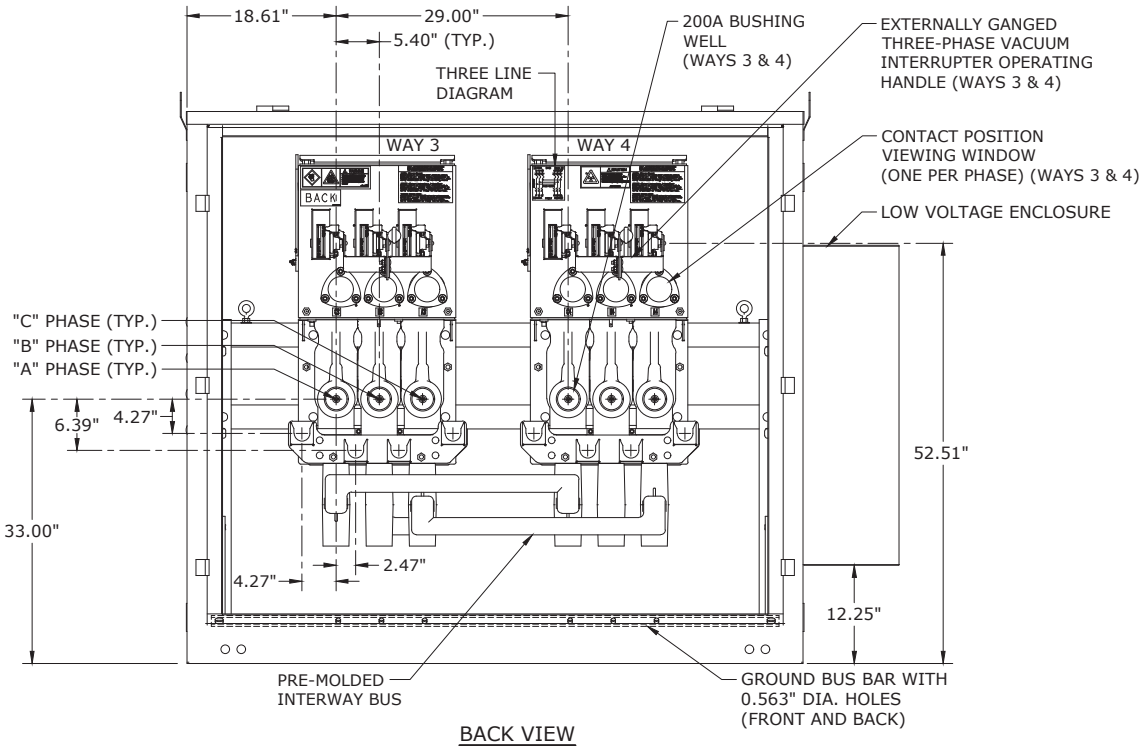
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-100



FRONT VIEW
(600 AMP SIDE)



BACK VIEW
(200 AMP SIDE)

NOTES:

1. SEE DWG. 28.04-113B FOR SECTION 'A'-'A' AND CONNECTION DIAGRAM.
2. SEE DWG. 28.04-113C FOR BILL OF MATERIALS.
3. SEE DWGS. 28.04-119A THROUGH 28.04-119C FOR MOUNTING DETAIL, NOTES AND CONTROL DETAIL.
4. SEE DWG. 28.04-100 FOR GROUNDING DETAILS.

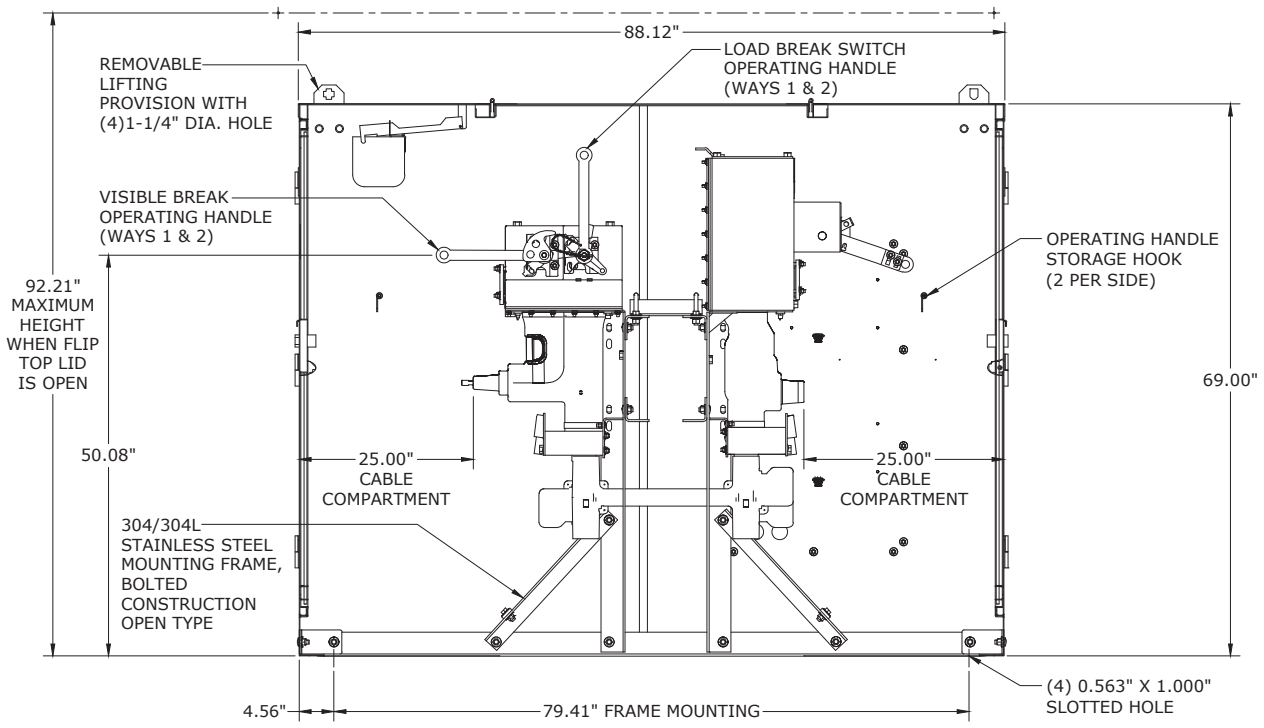
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-9 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

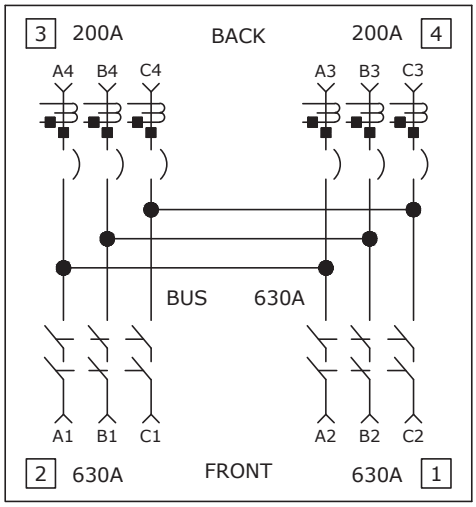
DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-113A



SECTION 'A'-'A'



WIRING DIAGRAM

NOTES:

1. SEE DWG. 28.04-113A FOR SECTION FOR FRONT AND BACK VIEWS.

2. SEE DWG. 28.04-113C FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-9 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-113B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-2VI/600-2VFI/200-SD-COAST-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			1572016	1	SWITCHGEAR, PAD MOUNT, 600A, 3PH, DF
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL, WARNING, F/ SWITCHGEAR,
-	STRUCT-PAD-SG-FG-6W-15KV-SD-SUB-F	1	1573083	1	STRUCTURE, PAD, SWITCHGEAR, FIBERGLASS, 89" X 78" X 37", FOR GW 15KV FAULT INTERRUPTER SOLID DIELECTRIC, 4 WAY, SUBMER.
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	VARIES	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG COND., COMP 1-BOLT
-	ELBOW-VARIES	6	-	-	LOADBREAK ELBOW- SEE SECTION 26
SEE NOTE 2	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
SEE NOTE 3	FCI-UG-1P-LG-CURR-LED-F	6	153862	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE SELF ADJUSTING, 750 MCM - 1000 MCM, LED INDICATION 24HR RESET
SEE NOTE 3	FCI-UG-3P-FIBER-LED-F	2	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS WITH PDP FAULTED CIRCUIT INDICATORS
SEE NOTE 2	ELBOW-INS-AL-200A-15KV-LB-F	6	831048	1	ELBOW INSERT AL 200A 15KV LOAD BREAK

NOTES:

1. WHEN THE SOURCE-SIDE OF THE SWITCHGEAR SERVES AS THE OPEN POINT OF AN UNDERGROUND LOOP, ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY. OTHERWISE, A 200A INSULATING CAP WILL BE INSTALLED ON EACH T-BODY.

2. THE NUMBER OF REQUIRED BUSHING INSERTS AND 200A ELBOWS VARIES BASED ON THE NUMBER OF CABLES CONNECTED TO THE LOAD-SIDE POSITIONS OF THE SWITCHGEAR.

3. INSTALL LED STYLE FAULT INDICATORS ON EACH 600 AMP WAY (SEE DWG. 26.20-101 FOR MORE DETAILS).

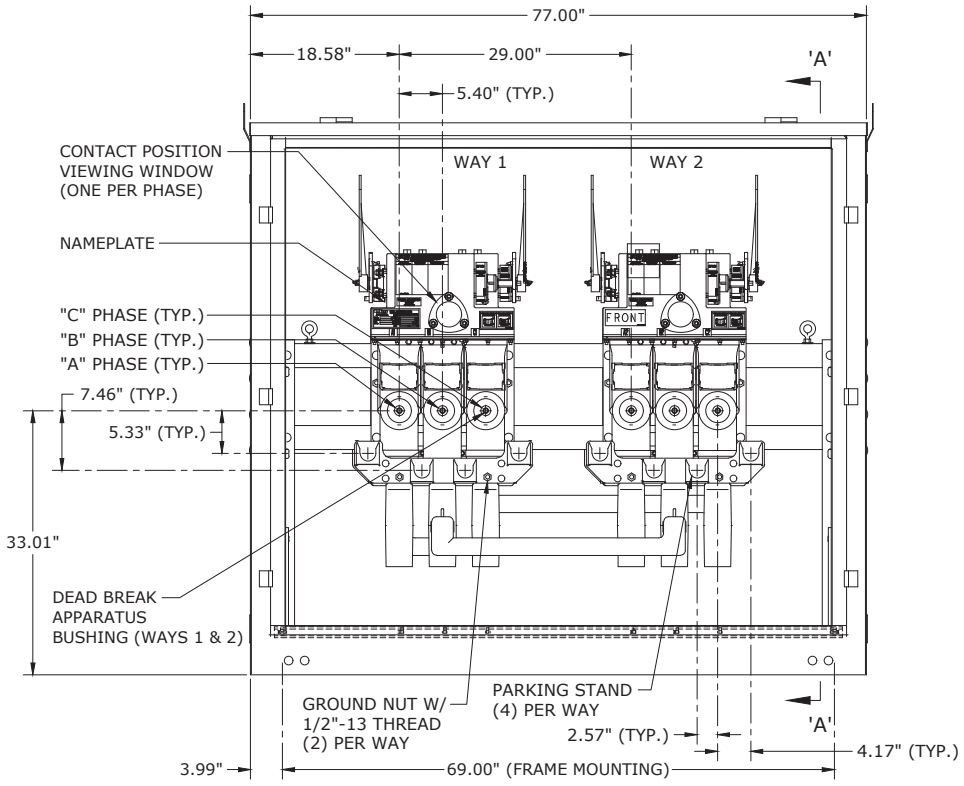
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

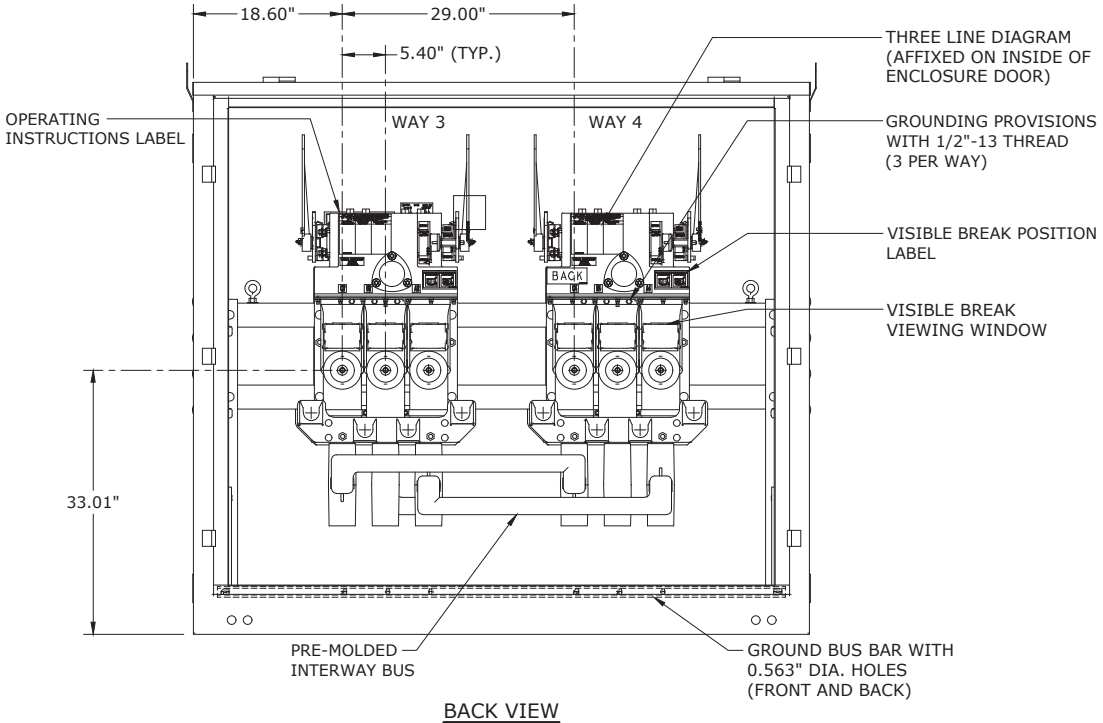
G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-9 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

DEC	DEM	DEP	DEF
			X

28.04-113C



FRONT VIEW
(600 AMP)



BACK VIEW
(600 AMP)

NOTES:

1. SEE DWG. 28.04-115B FOR SECTION 'A'-'A' AND CONNECTION DIAGRAM.
2. SEE DWG. 28.04-115C FOR BILL OF MATERIALS.
3. SEE DWGS. 28.04-119A THROUGH 28.04-119C FOR MOUNTING DETAIL AND NOTES.
4. SEE DWG. 28.00-100 FOR GROUNDING DETAIL.

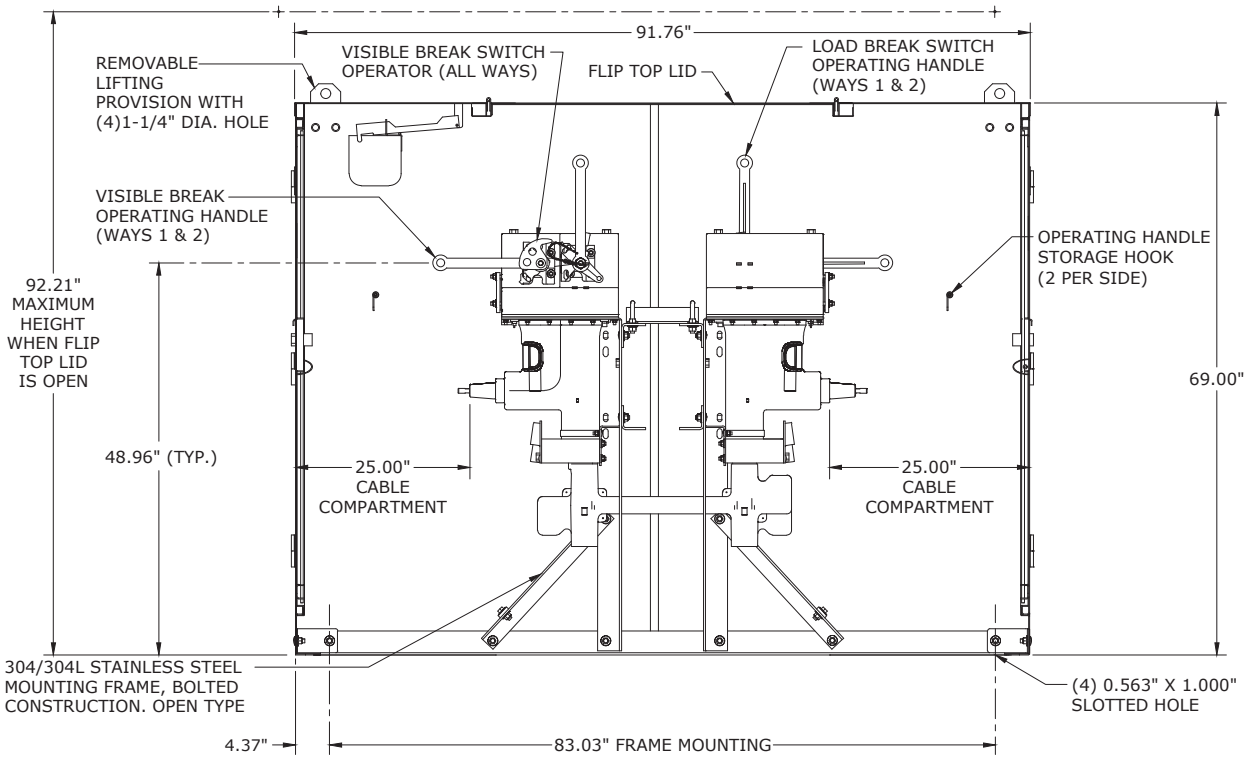
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-10 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS

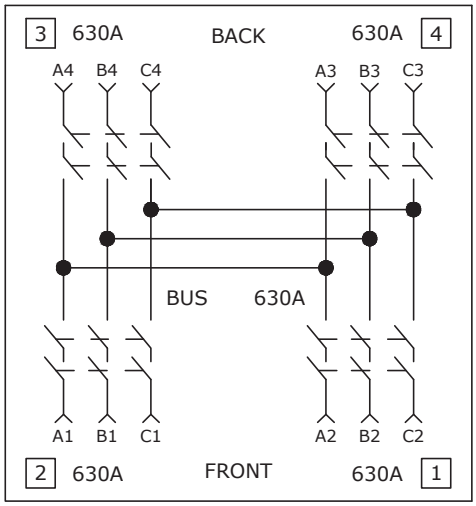
DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-115A



SECTION 'A' - 'A'



WIRING DIAGRAM
PME-10 STYLE IS NON FAULT INTERRUPTING

NOTES:

1. SEE DWG. 28.04-115A FOR FRONT AND BACK VIEWS.

2. SEE DWG. 28.04-115C FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-10 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

DEC	DEM	DEP	DEF
	X		X

28.04-115B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-4VFI/600-SD-COAST-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			1572017	1	SWITCHGEAR, PAD MOUNT, 600A, 3PH, DF
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL, WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-FG-LG-GW-15KV-SD-SUB-F	1	1573083	1	STRUCTURE, PAD, SWITCHGEAR, FIBERGLASS, 89"X78"X37" FOR GW 15KV FAULT INTERRUPTER, SOLID DIELECTRIC, 4 WAY, SUBMERSIBLE
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG COND., COMP 1-BOLT
-	ELBOW-T-VARIES	12	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
SEE NOTE 2	FCI-UG-1P-LG-CURR-LED-F	12	153862	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE SELF ADJUSTING, 750 MCM - 1000 MCM, LED INDICATION 24HR RESET
SEE NOTE 2	FCI-UG-3P-FIBER-LED-F	4	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS WITH PDP FAULTED CIRCUIT INDICATORS

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY THAT IS CONNECTED TO AN OPEN SWITCH AND THE T-BODIES ON ANY ONE OF THE THREE-PHASE FEEDERS CONNECTED TO A CLOSED SWITCH.
2. INSTALL LED STYLE FAULT INDICATORS ON EACH 600 AMP WAY (SEE DWG. 26.20-101 FOR MORE DETAILS).

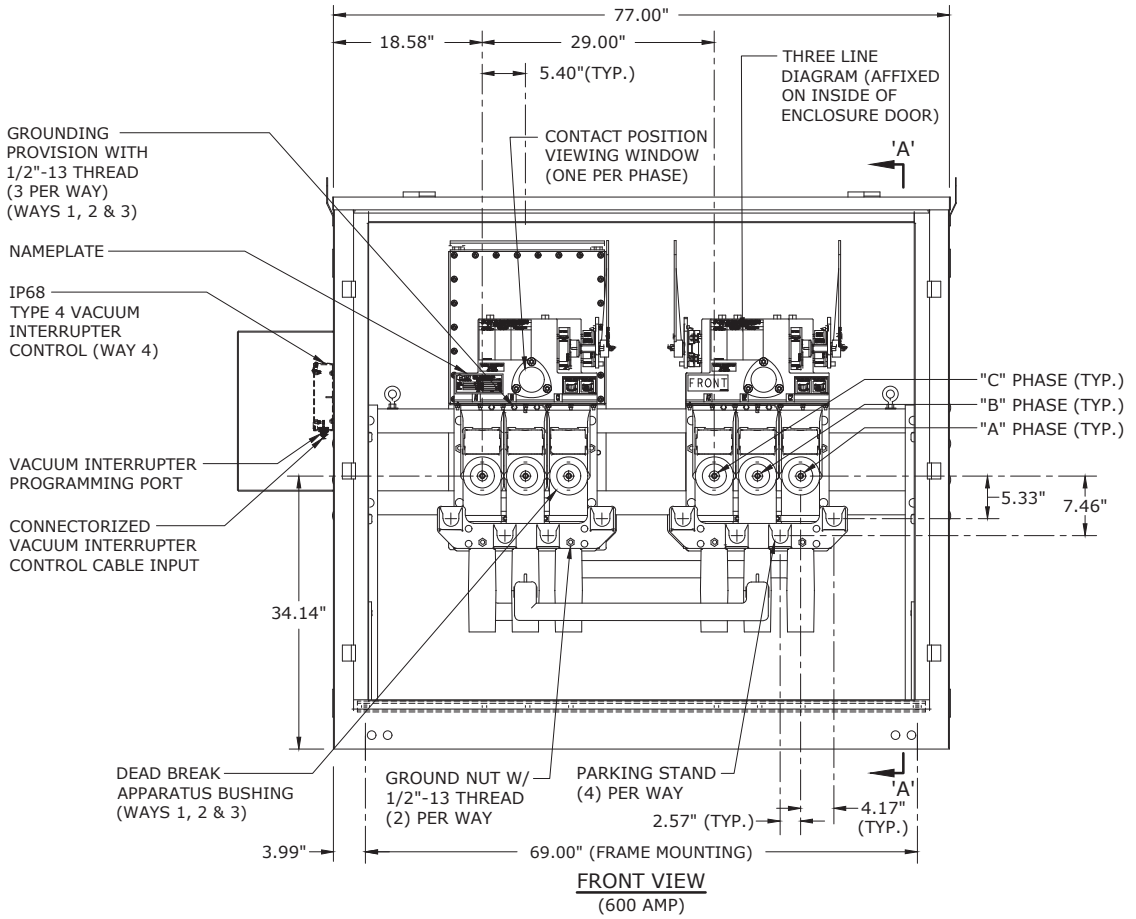
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

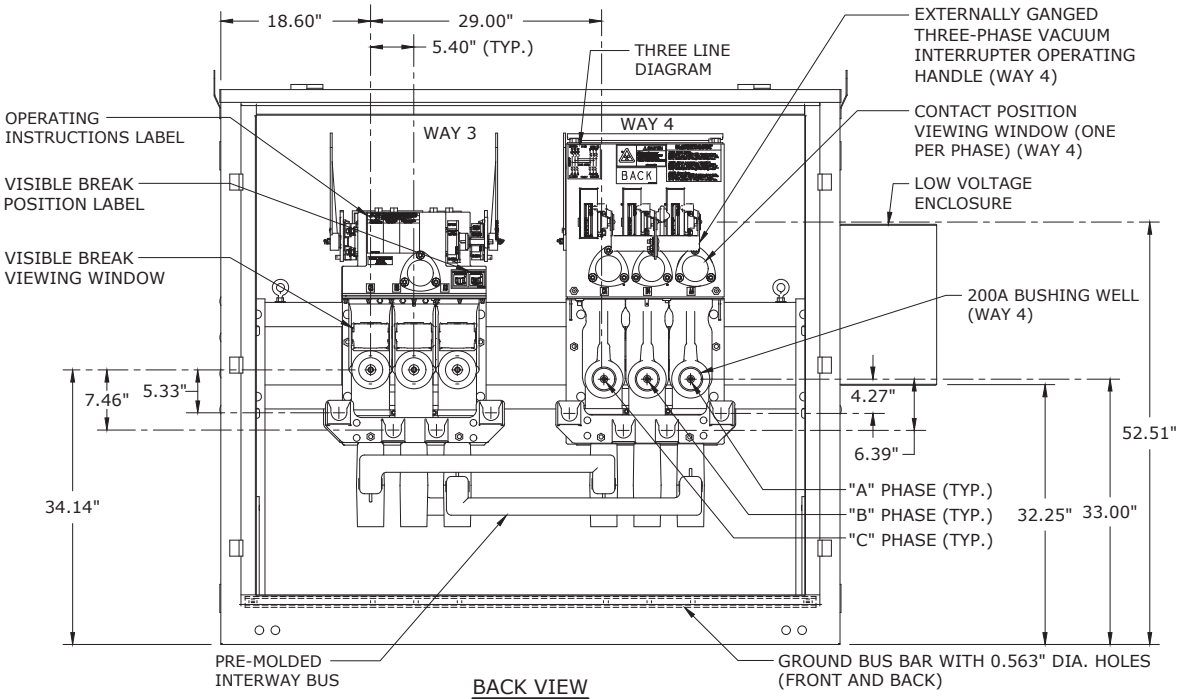
G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-10 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS

DEC	DEM	DEP	DEF
			X

28.04-115C



FRONT VIEW
(600 AMP)



BACK VIEW
(ONE 600 AMP WAY/ ONE 200 AMP WAY)

NOTES:

1. SEE DWG. 28.04-117B FOR SECTION 'A'-'A' AND CONNECTION DIAGRAM.
2. SEE DWG. 28.04-117C FOR BILL OF MATERIALS.
3. SEE DWG. 28.04-119A THROUGH 28.04-119C FOR MOUNTING DETAIL, NOTES AND CONTROL DETAIL.
4. SEE DWG. 28.04-100 FOR GROUNDING DETAIL.

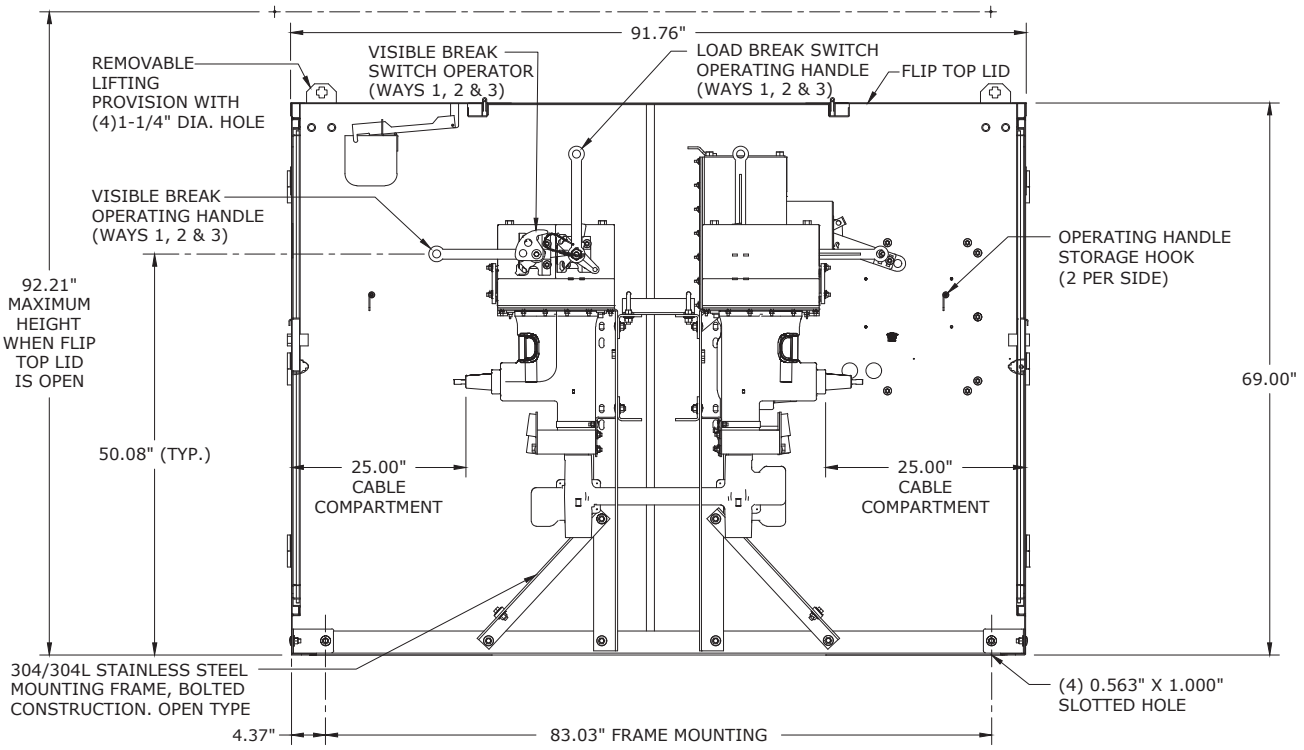
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-11 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

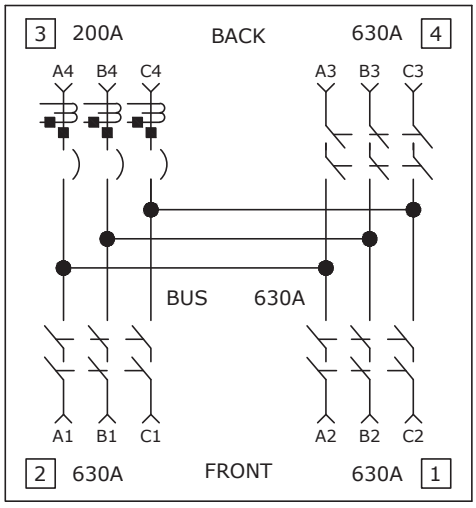
DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-117A



SECTION 'A' - 'A'



WIRING DIAGRAM

NOTES:

1. SEE DWG. 28.04-117A FOR FRONT AND BACK VIEWS.

2. SEE DWG. 28.04-117C FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-11 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-117B

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-3VI/600-1VFI/200-SD-COAST-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			1572018	1	SWITCHGEAR, PAD MOUNT, 600A, 3PH, DF
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL, WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-FG-LG-GW-15KV-SD-SUB-F	1	1573083	1	STRUCTURE, PAD, SWITCHGEAR, FIBERGLASS, 89"X78"X37" FOR GW 15KV FAULT INTERRUPTER, SOLID DIELECTRIC, 4 WAY, SUBMERSIBLE
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG COND., COMP 1-BOLT
-	ELBOW-VARIES	3	-	1	LOADBREAK ELBOW- SEE SECTION 26
-	ELBOW-T-VARIES	9	-	1	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
SEE NOTE 3	FCI-UG-1P-LG-CURR-LED-F	9	153862	1	INDICATOR, FAULT AUTOMATIC RESET, LARGE CORE SELF ADJUSTING, 750 MCM - 1000 MCM, LED INDICATION 24HR RESET
SEE NOTE 3	FCI-UG-3P-FIBER-LED-F	3	1538634	1	CABLE, FIBER OPTIC, 6' LG, F/ 3PH APPLICATIONS WITH PDP FAULTED CIRCUIT INDICATORS
SEE NOTE 2	ELBOW-INS-AL-200A-15KV-LB-F	3	831048	1	ELBOW INSERT AL 200A 15KV LOAD BREAK

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY THAT IS CONNECTED TO AN OPEN SWITCH AND THE T-BODIES ON ANY ONE OF THE THREE-PHASE FEEDERS CONNECTED TO A CLOSED SWITCH.
2. THE NUMBER OF REQUIRED BUSHING INSERTS AND 200A ELBOWS VARIES BASED ON THE NUMBER OF CABLES CONNECTED TO THE LOAD-SIDE POSITIONS OF THE SWITCHGEAR.
3. INSTALL LED STYLE FAULT INDICATORS ON EACH 600 AMP WAY (SEE DWG. 26.20-101 FOR MORE DETAILS).

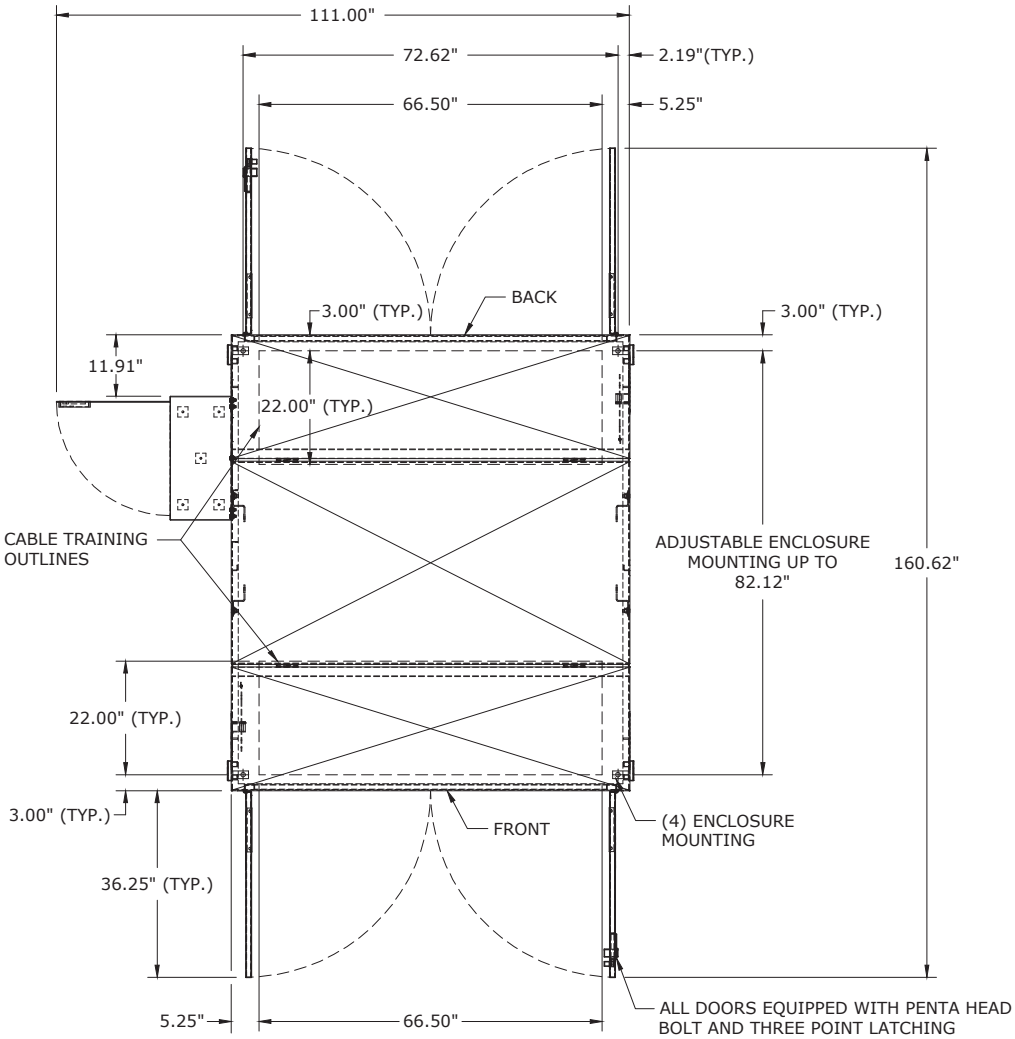
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

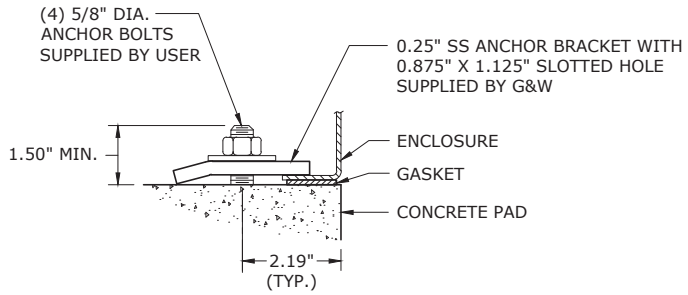
G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY - PME-11 VERSION SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL - BOM

DEC	DEM	DEP	DEF
			X

28.04-117C



PLAN VIEW
(DOORS OPEN)



ENCLOSURE MOUNTING DETAIL

NOTES:

1. SEE DWG. 28.04-119B FOR NOTES.

2. SEE DWG. 28.04-119C FOR CONTROL VIEWS AND CABLE PIN LAYOUT.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL - PLAN VIEW

DUKE ENERGY.

DEC	DEM	DEP	DEF
	X		X

28.04-119A

NOTES:

1. DEM INSTALL ONE 5/8" X 8' GROUND ROD IN EACH CORNER OF THE MOUNTING BOX OR CABLE PIT TO SUPPORT THE #2/0 CU GROUND LOOP.
2. DEF INSTALL FOUR 5/8" X 5' GROUND ROD SECTIONS (CONNECTED VERTICALLY) IN ONE CORNER OF THE SWITCHGEAR MOUNTING BOX AND ONE 5/8" X 5' GROUND ROD IN THE OTHER 3 CORNERS OF THE MOUNTING BOX TO SUPPORT THE #2/0 CU GROUND LOOP.
3. BUILD A 2/0 GROUND LOOP AND ATTACH #2/0 CU CONDUCTOR TO EACH OF THE SWITCHGEAR GROUNDING PAD AND GROUNDING BARS IF PROVIDED ON EQUIPMENT. SEE DWG. 28.04-100 FOR DETAIL.
4. T-BODY CONNECTIONS INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 CU GROUND LOOP.
5. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.
6. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.
7. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.
8. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.
9. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.
10. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.
11. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.
12. SEE DWG. 28.04-119A FOR PLAN VIEW AND ENCLOSURE MOUNTING DETAIL.
13. SEE DWG. 28.04-119C FOR CONTROL VIEWS AND CABLE PIN LAYOUT.

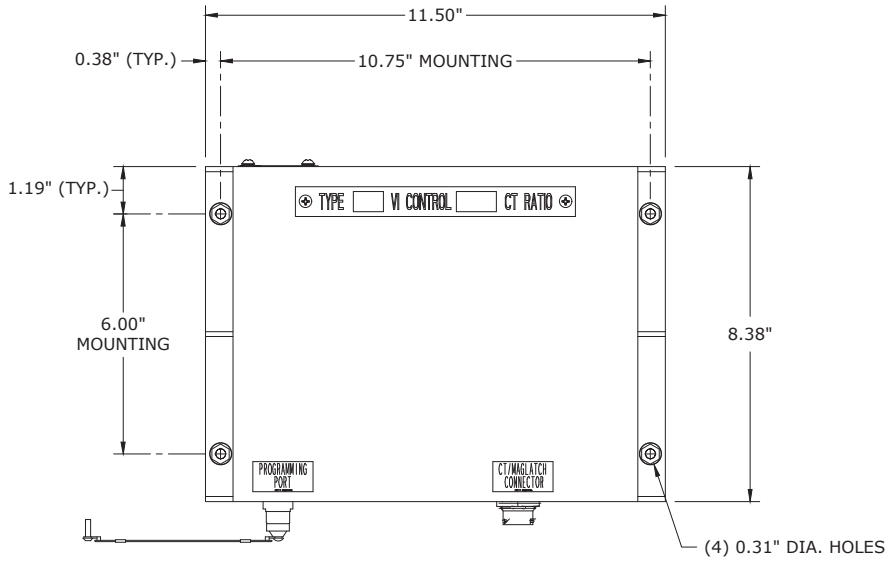
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

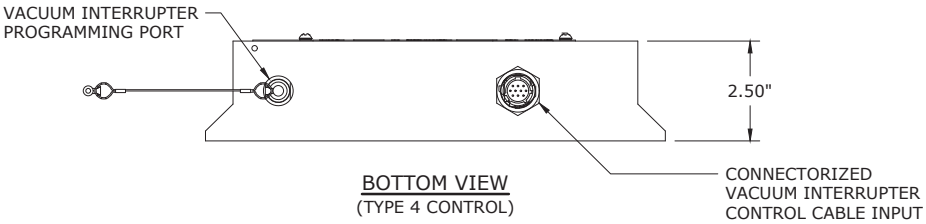
G&W 15KV FAULT INTERRUPTER PAD-MOUNTED
4-WAY SOLID DIELECTRIC
SWITCHGEAR FOR COASTAL/ SUBMERSIBLE
APPLICATIONS WITH TYPE 4 CONTROL - NOTES

DEC	DEM	DEP	DEF
	X		X

28.04-119B



FRONT VIEW
(TYPE 4 CONTROL)



BOTTOM VIEW
(TYPE 4 CONTROL)

INTERNAL CURRENT TRANSFORMER AND MAGLATCH CONTROL CABLE PIN LAYOUT		
DESIGNATION	COLOR / PIN	LOCATION
A PHASE (DOT)	GREEN / BLACK-PIN H	J1-5
A PHASE	ORANGE / BLACK-PIN G	J1-6
B PHASE (DOT)	RED / BLACK-PIN J	J1-3
B PHASE	WHITE / BLACK-PIN K	J1-4
C PHASE (DOT)	ORANGE-PIN D	J1-1
C PHASE	BLUE-PIN C	J1-2
A PHASE MAG LATCH	GREEN-PIN E	J13-3
B PHASE MAG LATCH	WHITE-PIN A	J13-2
C PHASE MAG LATCH	BLACK-PIN B	J13-1
COMMON MAG LATCH	RED-PIN F	J13-4

NOTES:

1. CONTACT PQRI TECH/DPAC FOR PROGRAMMING OF OVERCURRENT CONTROL BASED ON THE SITES SPECIFIC APPLICATIONS.
2. SEE DWG. 28.04-119A FOR PLAN VIEW AND ENCLOSURE MOUNTING DETAIL.
3. SEE DWG. 28.04-119B FOR NOTES.

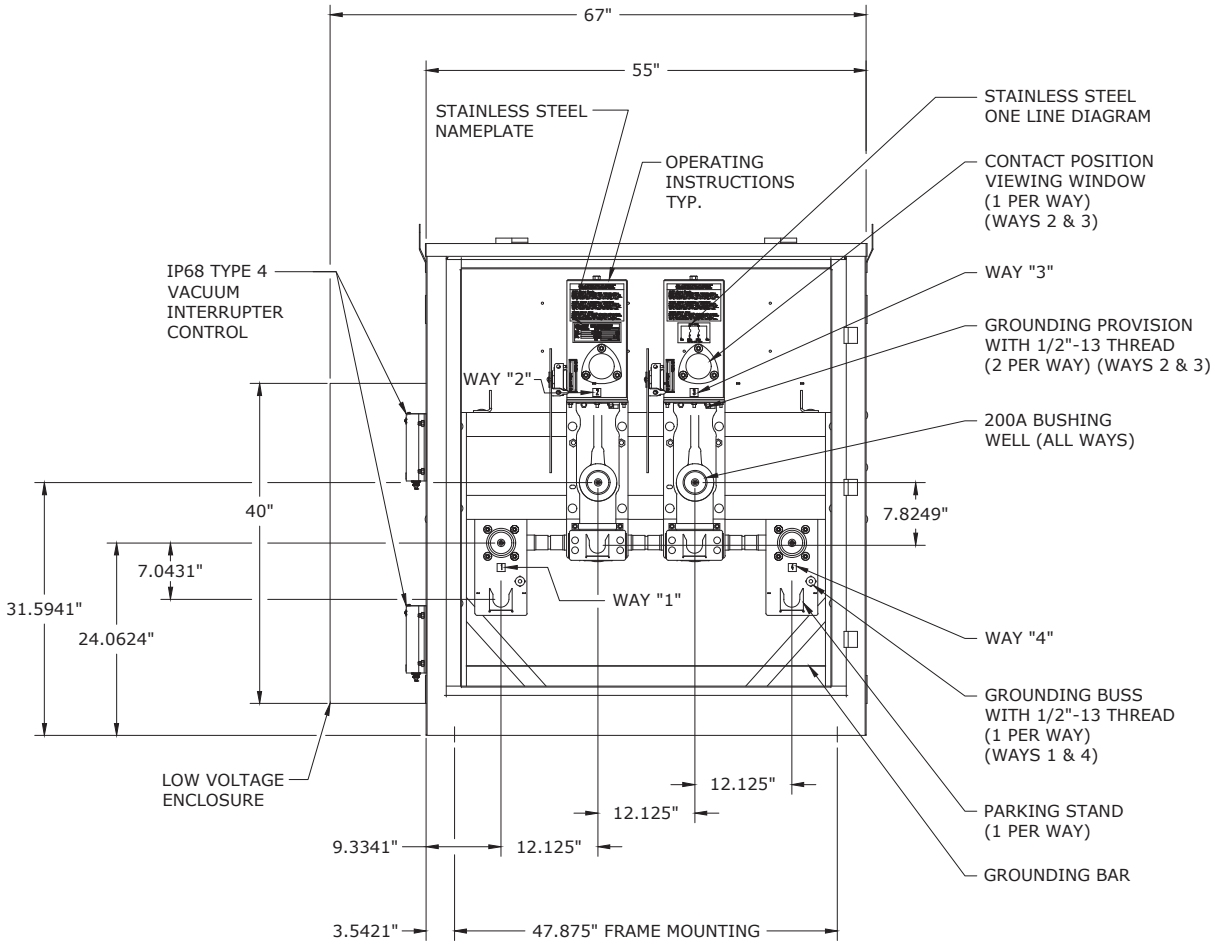
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

G&W 15KV FAULT INTERRUPTER PAD-MOUNTED 4-WAY SOLID DIELECTRIC SWITCHGEAR FOR COASTAL/ SUBMERSIBLE APPLICATIONS WITH TYPE 4 CONTROL - CONTROL DETAIL

DEC	DEM	DEP	DEF
	X		X

28.04-119C



FRONT VIEW
(OPEN CABINET)

NOTES:

1. SEE DWG. 28.04-121B FOR SIDE VIEW AND CONNECTION DIAGRAM.
2. SEE DWG. 28.04-121C FOR INSTALLATION DETAILS.
3. SEE DWG. 28.04-121D FOR NOTES.

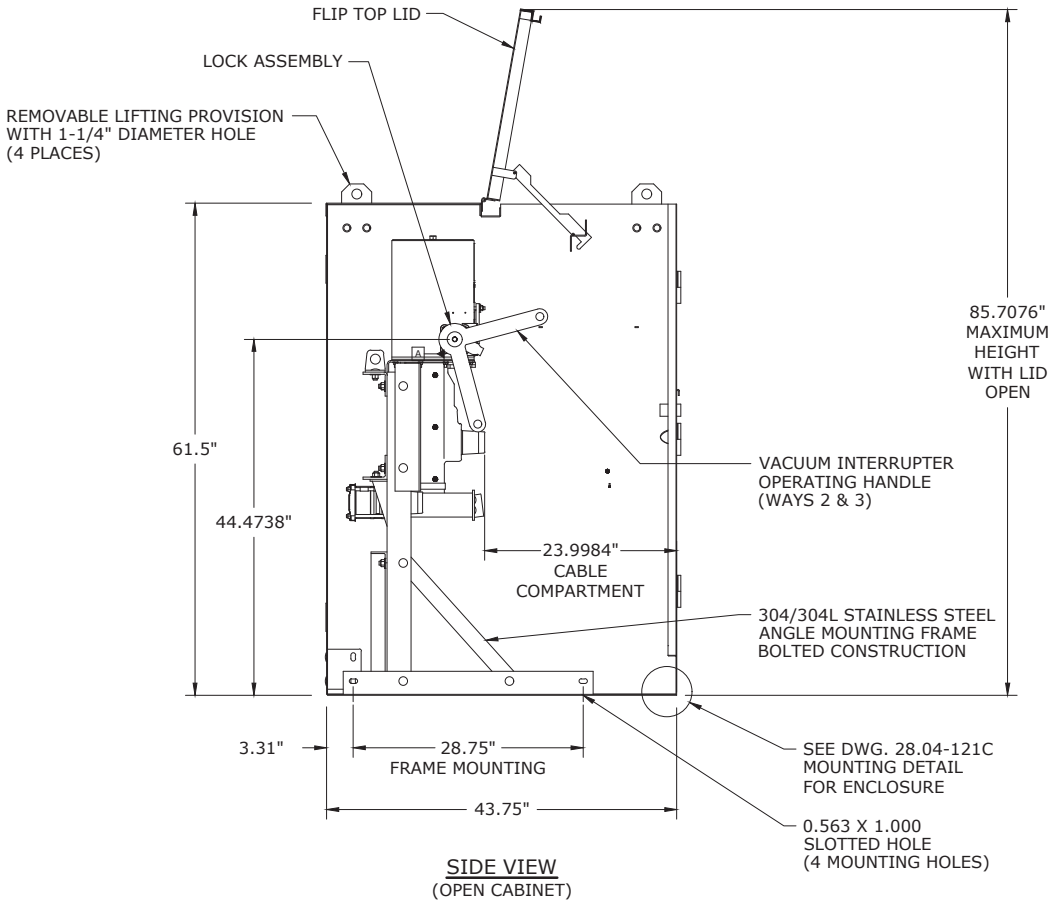
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SOLID DIELECTRIC SINGLE-PHASE WITH SUBMERSIBLE TYPE 4 CONTROL

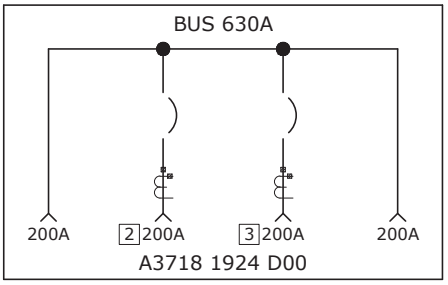
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121A



SIDE VIEW
(OPEN CABINET)



WIRING DIAGRAM

NOTES:

1. SEE DWG. 28.04-121A FOR FRONT VIEW.
2. SEE DWG. 28.04-121C FOR INSTALLATION DETAILS.
3. SEE DWG. 28.04-121D FOR NOTES.
4. SEE DWG. 28.04-121F FOR CONTROL DETAIL.
5. SEE DWG. 28.04-121G FOR GROUNDING DETAIL.

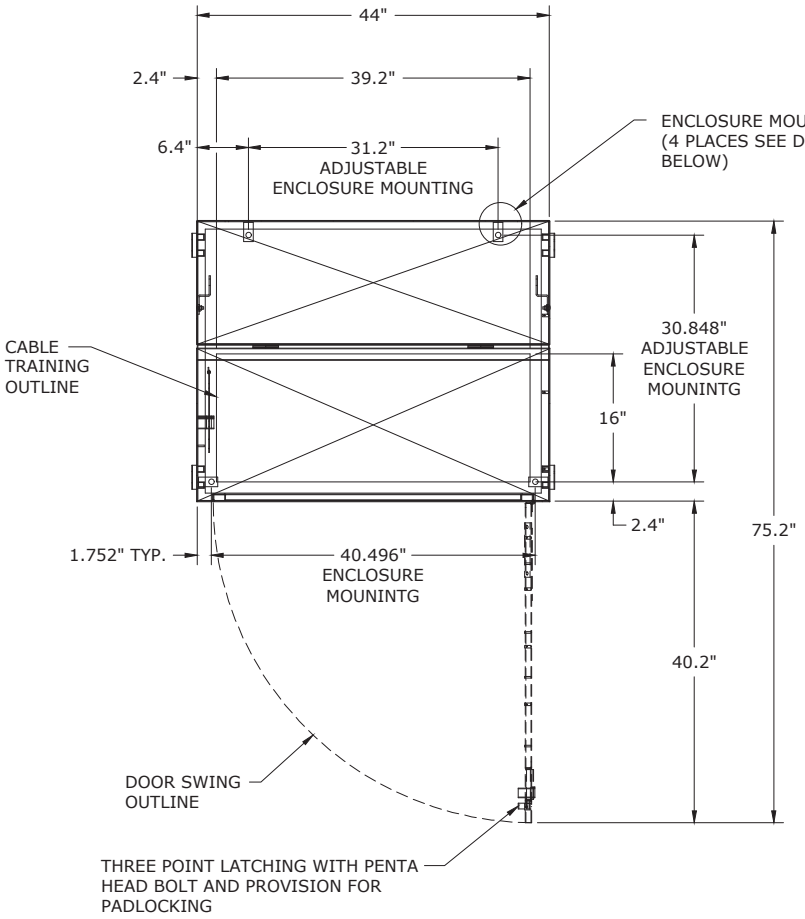
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SOLID DIELECTRIC SINGLE-PHASE WITH SUBMERSIBLE TYPE 4 CONTROL

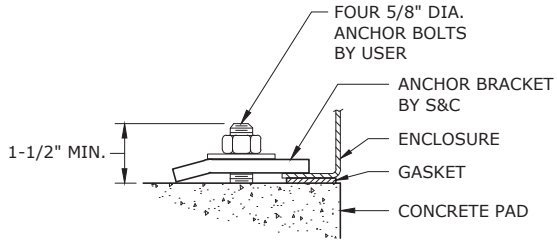
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121B



ANCHOR BOLT PLAN



ANCHOR BOLT DETAIL

NOTES:

1. SEE DWG. 28.04-121A FOR FRONT VIEW.
2. SEE DWG. 28.04-121B FOR SIDE VIEW AND WIRING DIAGRAM.
3. SEE DWG. 28.04-121D FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED
SOLID DIELECTRIC SINGLE-PHASE
WITH SUBMERSIBLE TYPE 4 CONTROL

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121C

NOTES:

1. DEC/DEM INSTALL ONE 5/8" X 8' GROUND ROD IN EACH CORNER OF THE MOUNTING BOX OR CABLE PIT TO SUPPORT THE #4 CU GROUND LOOP.

2. DEF/DEP INSTALL FOUR 5/8" X 5' GROUND ROD SECTIONS (CONNECTED VERTICALLY) IN ONE CORNER OF THE SWITCHGEAR MOUNTING BOX AND ONE 5/8" X 5' GROUND ROD IN THE OTHER 3 CORNERS OF THE MOUNTING BOX TO SUPPORT THE #4 CU GROUND LOOP.

3. BUILD A 2/0 GROUND LOOP AND ATTACH #4 CU CONDUCTOR TO EACH OF THE SWITCHGEAR GROUNDING PAD AND GROUNDING BARS IF PROVIDED ON EQUIPMENT. SEE DWG. 28.04-121G FOR DETAIL.

4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR #4 GROUND LOOP.

8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

11. SEE DWG. 28.04-121A FOR FRONT VIEW.

12. SEE DWG. 28.04-121B FOR SIDE VIEW AND WIRING DIAGRAM.

13. SEE DWG. 28.04-121C FOR INSTALLATION DETAILS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SOLID DIELECTRIC SINGLE-PHASE WITH SUBMERSIBLE TYPE 4 CONTROL

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121D

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-1P-15KV-2B/200-2VFI/200-SD-SUB-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			1571807	1	SWITCHGEAR, 15/25KV FAULT INTERRUPTER, SINGLE-PHASE PAD MOUNT , SUBMERSIBLE, WITH TYPE 4 CONTROL
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL, WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-FG-1P-GW-F	1	1572029	1	STRUCTURE PAD SWITCHGEAR FIBERGLASS 58IN X 45IN X 32IN FOR SINGLE PHASE G&W
-	GND-EQUIP-4-RING-1P-F	1	933371	1	CONNECTOR, ELECTRICAL, PARALLEL GROOVE, 1/0 AWG 19 STR, 2 AWG 7 STR COND, 0.373"-0.292" WIRE SIZE, CU COMP, H SECTION
			4003399	3	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG COND., COMP 1-BOLT
			4022335	10	WIRE/CABLE, ELECTRICAL, BARE, SOL SOFT DRAWN, 4 AWG, CU
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-F	4	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	ELBOW-INS-AL-200A-15KV-LB-F	4	831048	1	BUSHING, ELECTRICAL CONDUCTOR, TRANSFORMER, 15KV, 200A, LOADBREAK, INSERT, W/ FAULT CLOSE RATING
SEE NOTE 2	ARR-ELBOW-10KV-F	VARIES	1000572	1	ARRESTER, ELECTRICAL, 8.4KV
			4003399	1	CONNECTOR, 1/0 AWG
-	ELBOW-VARIES	4	VARIES	1	LOADBREAK ELBOW SEE SECTION 26
SEE NOTE 1	FCI-UG-1P-200-CURR-FLAG-F	1	4004655	1	FAULT CURRENT INDICATOR, UNDERGROUND, SINGLE-PHASE, 200 AMPS CURRENT FLAG, WITHOUT BATTERY

NOTES:

1. INSTALL FAULT INDICATOR ON OUTGOING UNPROTECTED 200 AMP CABLE.

2. INSTALL ELBOW ARRESTERS IF OPEN POINT.

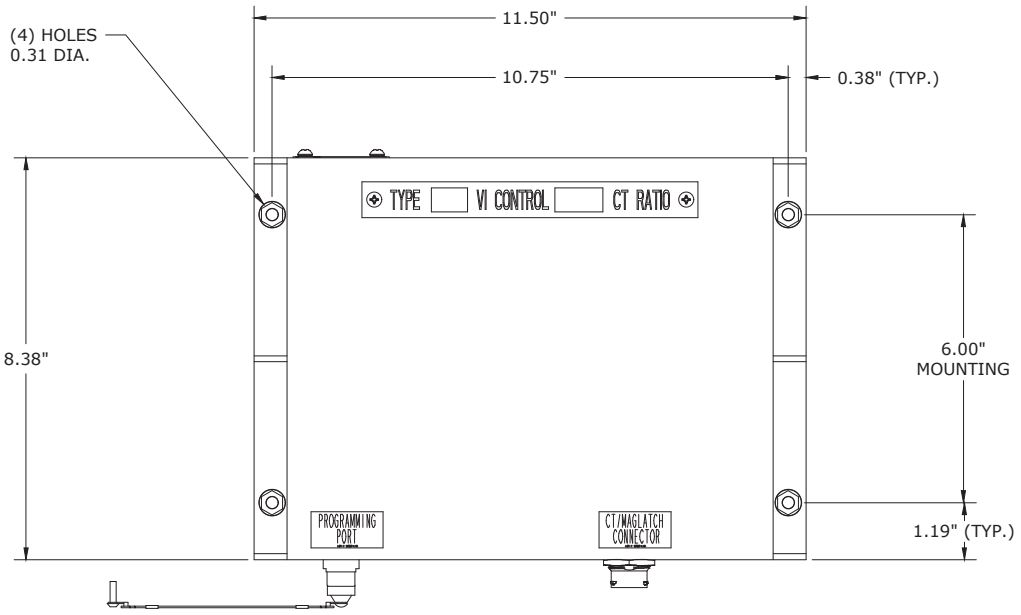
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

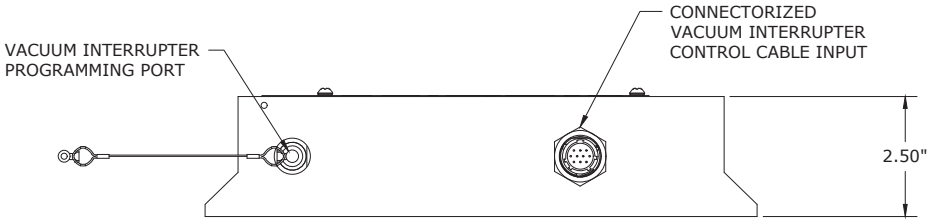
G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SOLID DIELECTRIC SINGLE-PHASE WITH SUBMERSIBLE TYPE 4 CONTROL

DEC	DEM	DEP	DEF
			X

28.04-121E



FRONT VIEW



BOTTOM VIEW

NOTES:

1. CONTACT PQRI TECH/DPAC FOR PROGRAMMING OF OVERCURRENT CONTROL BASED ON THE SITE'S SPECIFIC APPLICATION.

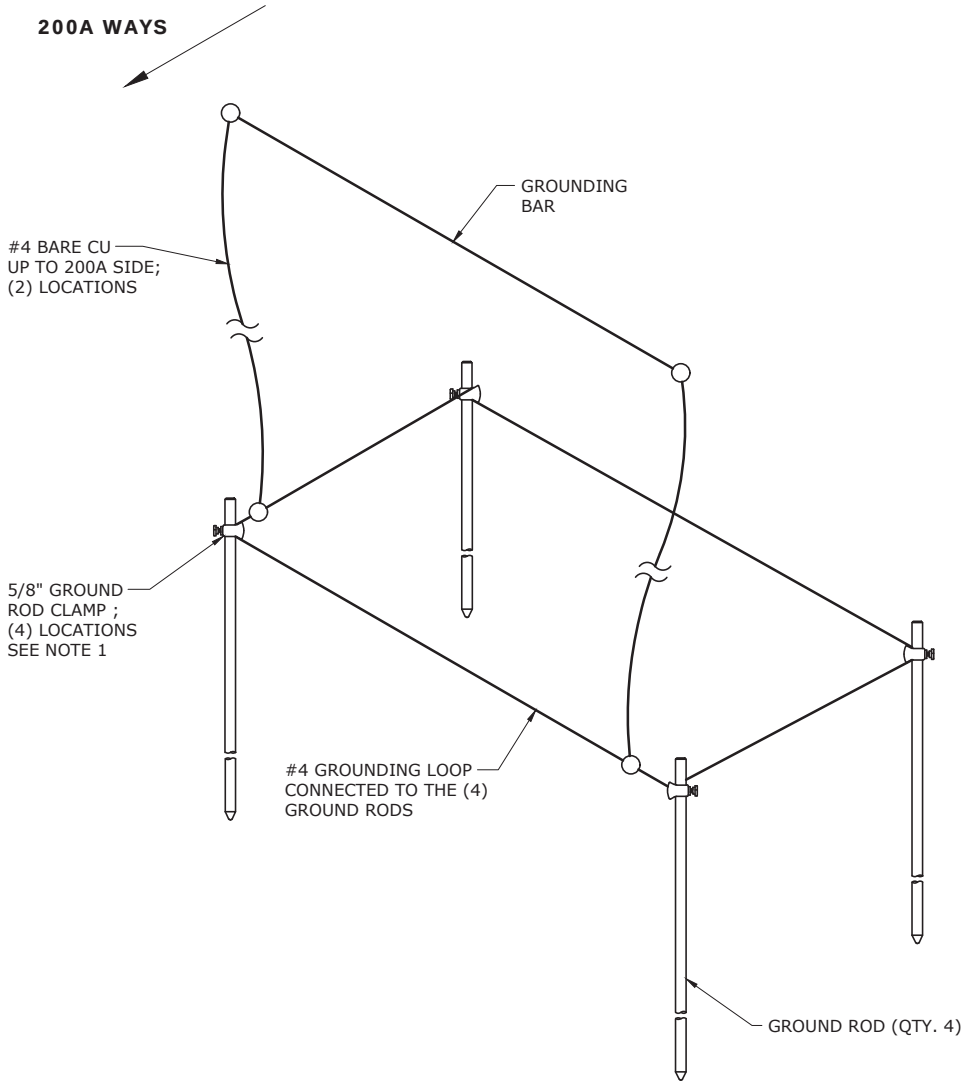
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SINGLE-PHASE SOLID DIELECTRIC SWITCHGEAR WITH SUBMERSIBLE TYPE 4 CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121F



NOTES:

1. GROUND WIRE MUST BE INSTALLED ON OPPOSITE SIDE OF SET SCREW.

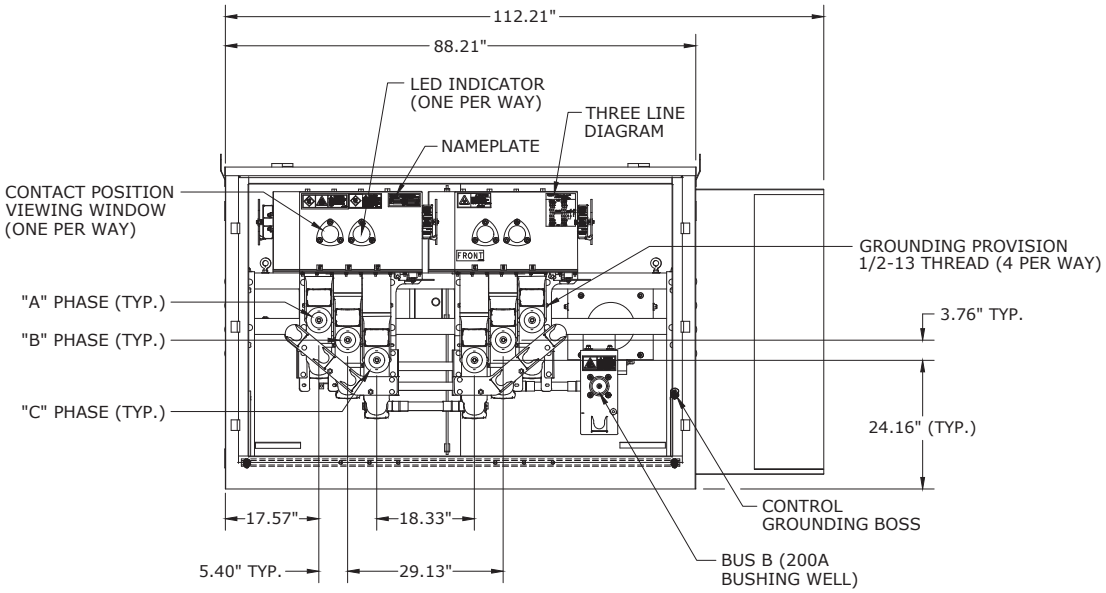
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15/25KV FAULT INTERRUPTER PAD-MOUNTED SINGLE-PHASE SOLID DIELECTRIC SWITCHGEAR WITH SUBMERSIBLE TYPE 4 CONTROL

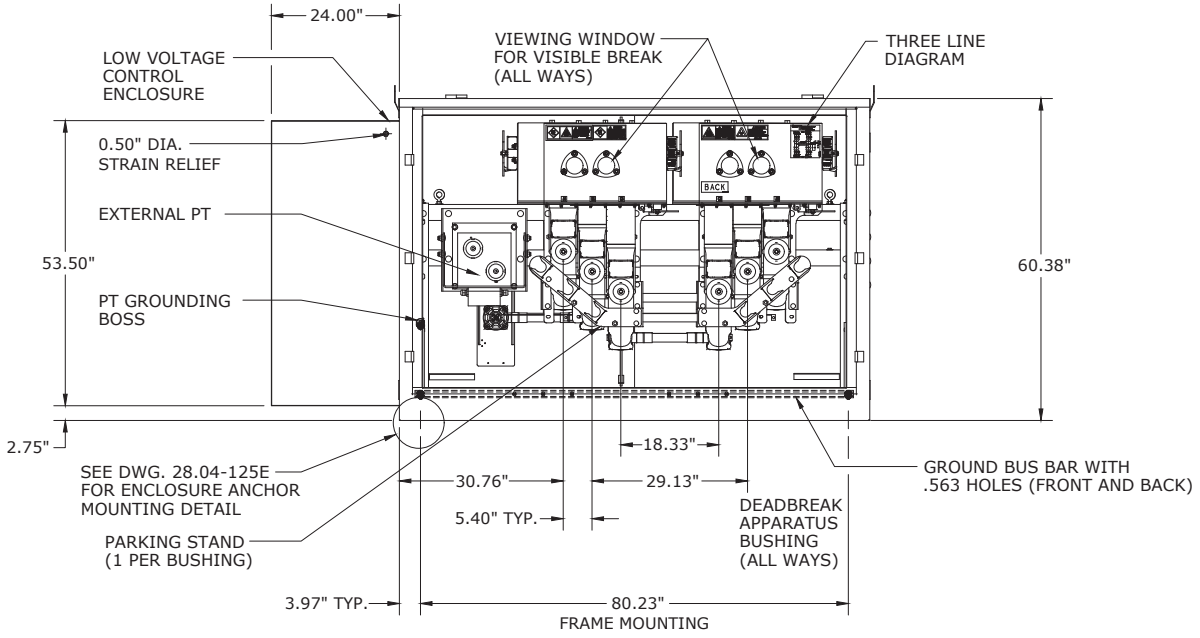
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-121G



FRONT VIEW
(OPEN CABINET)



BACK VIEW
(OPEN CABINET)

NOTES:

1. SEE DWG. 28.04-125B FOR SECTION VIEW AND WIRING DIAGRAM.
2. SEE DWG. 28.04-125C FOR PLAN VIEW AND ENCLOSURE MOUNTING ANCHOR DETAIL.
3. SEE DWG. 28.04-125D FOR NOTES.
4. SEE DWG. 28.04-125E FOR FRONT VIEW AND SIDE VIEW.
5. SEE DWG. 28.04-125F FOR CONTROL ENCLOSURE FRONT AND BOTTOM VIEWS.

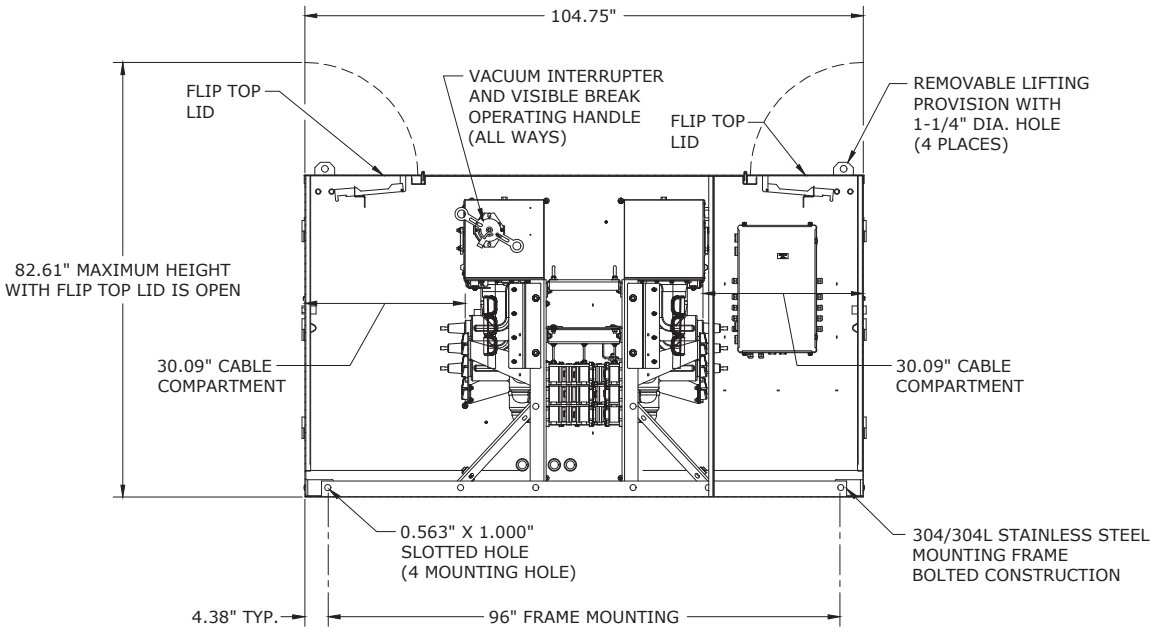
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC 4-WAY MAGNETIC ACTUATED SWITCH WITH NON-SUBMERSIBLE SEL 487 RELAY

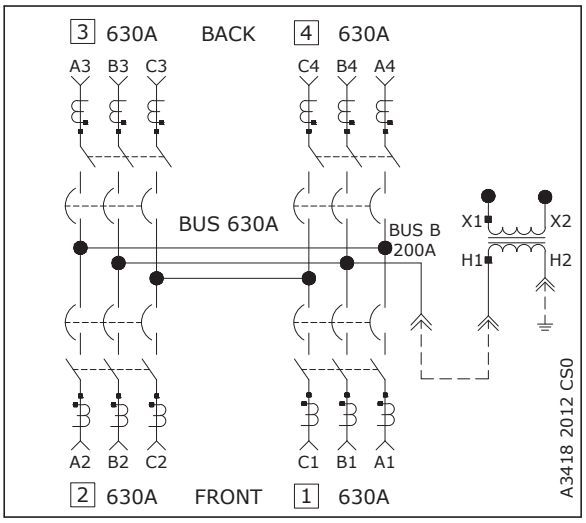
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-125A



SECTION 'A'-'A'
(OPEN CABINET)



WIRING DIAGRAM

NOTES:

1. SEE DWG. 28.04-125A FOR FRONT AND BACK VIEWS.
2. SEE DWG. 28.04-125C FOR PLAN VIEW AND ENCLOSURE MOUNTING ANCHOR DETAIL.
3. SEE DWG. 28.04-125D FOR NOTES.
4. SEE DWG. 28.04-125E FOR FRONT VIEW AND SIDE VIEW.
5. SEE DWG. 28.04-125F FOR CONTROL ENCLOSURE FRONT AND BOTTOM VIEWS.

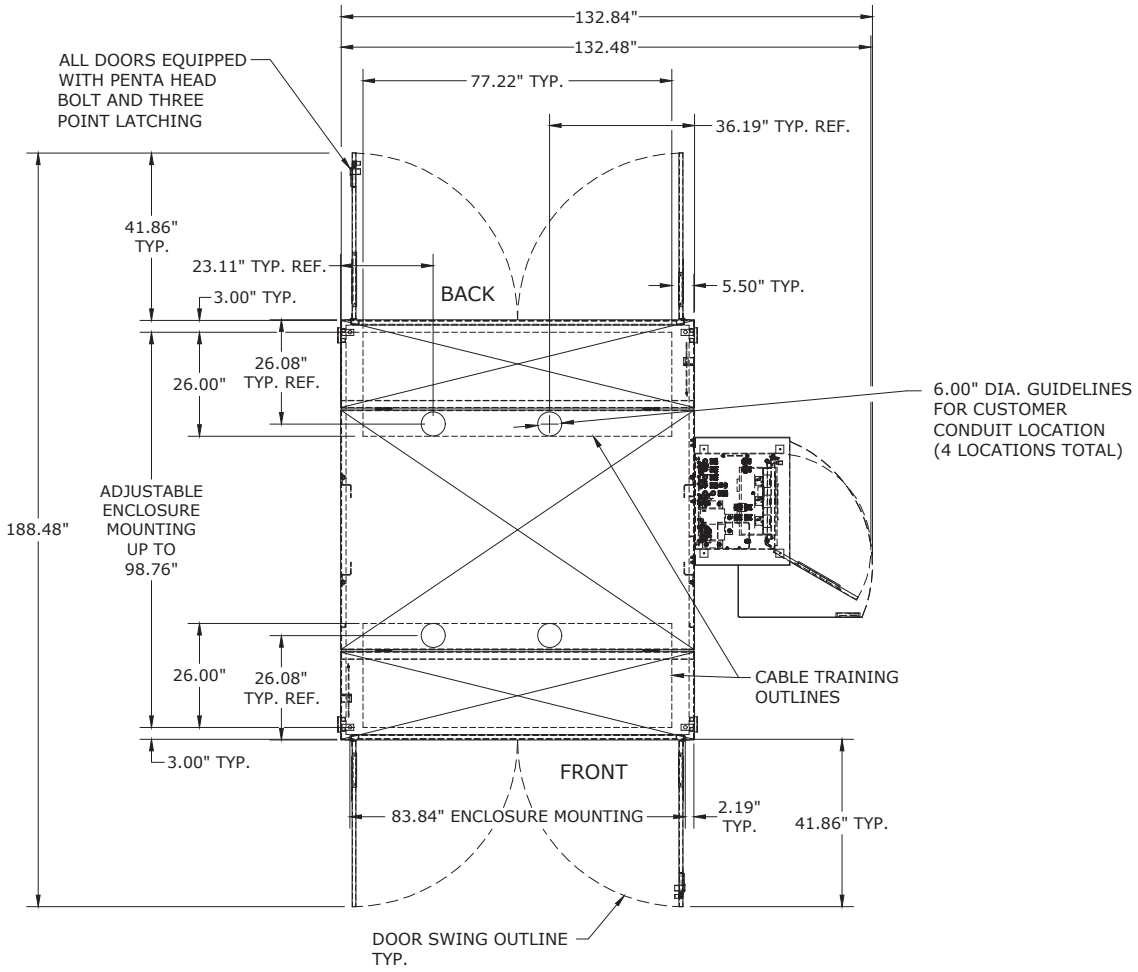
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC 4-WAY MAGNETIC ACTUATED SWITCH WITH NON-SUBMERSIBLE SEL 487 RELAY

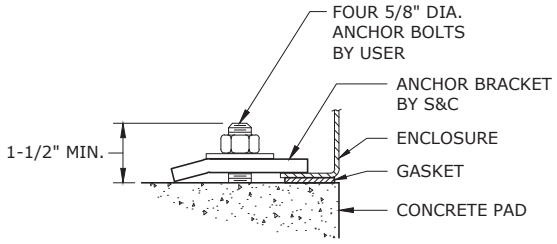
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-125B



PLAN VIEW
(OPEN CABINET)



ANCHOR BOLT DETAIL

NOTES:

1. SEE DWG. 28.04-125A FOR FRONT AND BACK VIEWS.
2. SEE DWG. 28.04-125B FOR SIDE VIEW AND WIRING DIAGRAM.
3. SEE DWG. 28.04-125D FOR NOTES.
4. SEE DWG. 28.04-125E FOR FRONT VIEW AND SIDE VIEW.
5. SEE DWG. 28.04-125F FOR CONTROL ENCLOSURE FRONT AND BOTTOM VIEWS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC
4-WAY MAGNETIC ACTUATED SWITCH
WITH NON-SUBMERSIBLE SEL 487 RELAY

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-125C

NOTES:

1. ALL WAYS ARE EQUIPPED WITH TRIDENT-SR MAGNETIC ACTUATOR. EACH TRIDENT-SR IS EQUIPPED WITH A MANUAL TRIP AND CLOSE HANDLE. EACH HANDLE IS EQUIPPED WITH PADLOCKING PROVISIONS.

2. MOUNTING INFORMATION: THE FRAME OF THE SWITCH MUST BE ANCHORED TO THE BOX PAD. THE FRAME IS EQUIPPED WITH 4 SLOTTED ANCHORING HOLES, EACH MEASURING 9/16" X 1". THE LOCATIONS OF THESE HOLES, REFERRED AS TO "FRAME MOUNTING" ARE SHOWN IN THE BACK VIEW ON DWG. 28.04-125A, AND SECTION 'A'-'A' ON DWG. 28.04-125B. THE ENCLOSURE SHOULD BE SECURED TO THE BOX PAD TO PROVIDE IT WITH ADDITIONAL STABILITY. THE ENCLOSURE IS SHIPPED WITH 4 SECURING BRACKETS THAT ARE TO BE USED FOR THIS PURPOSE. THE SECURING BRACKETS CAN BE INSTALLED ANYWHERE ALONG THE INNER EDGE OF THE ENCLOSURE. SEE ANCHOR BOLT DETAIL ON DWG. 28.04-125C AND PLAN VIEW ABOVE FOR MORE DETAILS ABOUT SECURING THE ENCLOSURE TO THE BOX PAD.

3. THE SWITCH IS EQUIPPED WITH ONE ABB TYPE VIL-95 PT MOUNTED WITHIN THE SWITCH ENCLOSURE. THE PT IS DESIGNED FOR USE ON 7200V PHASE TO GROUND SYSTEMS AND HAVE 60:1 RATIOS, WITH 1500VA OUTPUTS. THE PT PRIMARY IS TO BE CONNECTED UTILIZING CABLE AND FUSED ELBOWS. THE H1 BUSHING ON THE PRIMARY SIDE OF THE PT, MUST BE CONNECTED TO THE BUS B BUSHING ON THE SWITCH AND THE H2 BUSHING ON THE PRIMARY SIDE OF THE PT TO GROUND.

4. DEC/DEM INSTALL ONE 5/8" X 8' GROUND ROD IN EACH CORNER OF THE MOUNTING BOX OR CABLE PIT TO SUPPORT THE #2/0 CU GROUND LOOP.

5. DEF/DEP INSTALL FOUR 5/8" X 5' GROUND ROD SECTIONS (CONNECTED VERTICALLY) IN ONE CORNER OF THE SWITCHGEAR MOUNTING BOX AND ONE 5/8" X 5' GROUND ROD IN THE OTHER 3 CORNERS OF THE MOUNTING BOX TO SUPPORT THE #2/0 CU GROUND LOOP.

6. BUILD A 2/0 GROUND LOOP AND ATTACH #2/0 CU CONDUCTOR TO EACH OF THE SWITCHGEAR GROUNDING PAD AND GROUNDING BARS IF PROVIDED ON EQUIPMENT. SEE DWG. 28.04-100 FOR DETAIL.

7. T-BODY CONNECTIONS INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 CU GROUND LOOP.

8. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

9. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

10. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

11. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.

12. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

13. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

14. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

15. SEE DWG. 28.04-125A FOR FRONT AND BACK VIEWS.

16. SEE DWG. 28.04-125B FOR SIDE VIEW AND WIRING DIAGRAM.

17. SEE DWG. 28.04-125C FOR PLAN VIEW AND ENCLOSURE MOUNTING ANCHOR DETAIL.

18. SEE DWG. 28.04-125E FOR FRONT VIEW AND SIDE VIEW.

19. SEE DWG. 28.04-125F FOR CONTROL ENCLOSURE FRONT AND BOTTOM VIEWS.

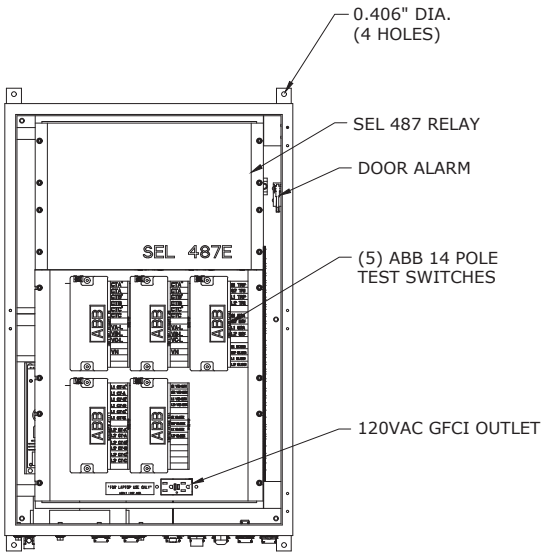
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

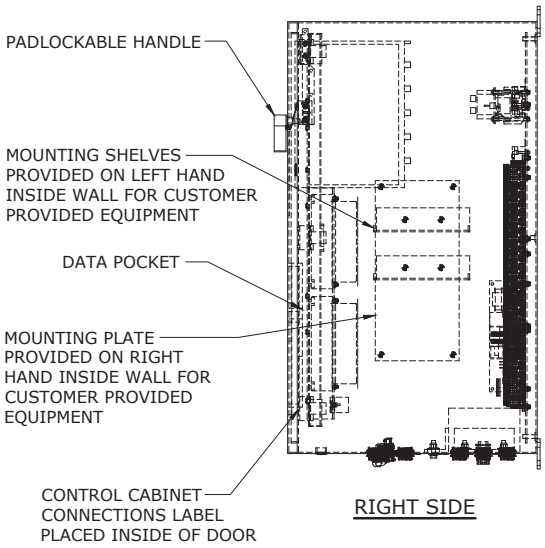
G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC 4-WAY MAGNETIC ACTUATED SWITCH WITH NON-SUBMERSIBLE SEL 487 RELAY

DEC	DEM	DEP	DEF
X	X	X	X

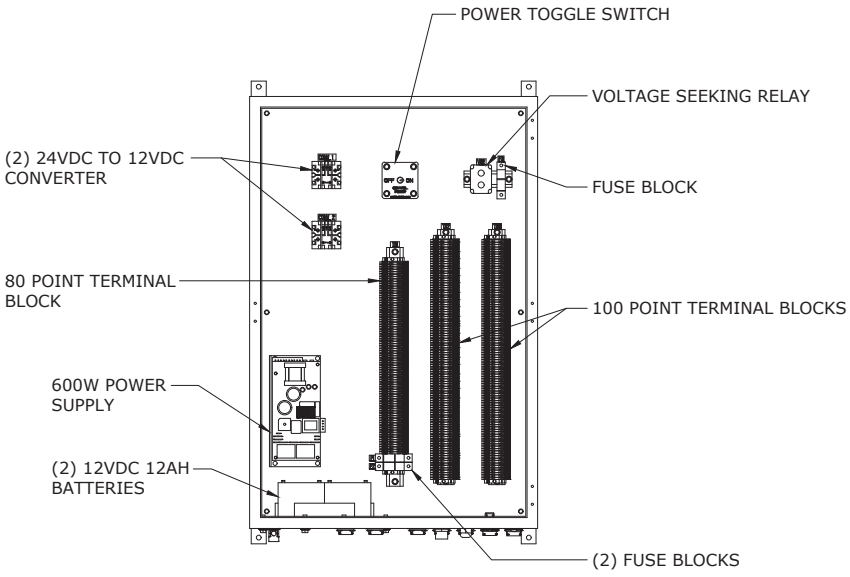
28.04-125D



FRONT VIEW
(DOORS HIDDEN FOR CLARITY)



RIGHT SIDE



FRONT VIEW
(DOORS AND SWING FRAME HIDDEN FOR CLARITY)

NOTES:

1. SEE DWG. 28.04-125A FOR FRONT AND BACK VIEWS.
2. SEE DWG. 28.04-125B FOR SIDE VIEW AND WIRING DIAGRAM.
3. SEE DWG. 28.04-125C FOR PLAN VIEW AND ENCLOSURE MOUNTING ANCHOR DETAIL.
4. SEE DWG. 28.04-125D FOR NOTES.
5. SEE DWG. 28.04-125F FOR CONTROL ENCLOSURE FRONT AND BOTTOM VIEWS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC
4-WAY MAGNETIC ACTUATED SWITCH
WITH NON-SUBMERSIBLE SEL 487 RELAY

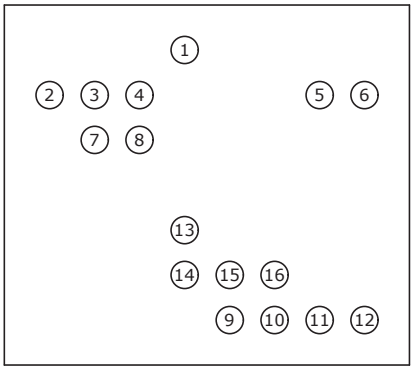
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

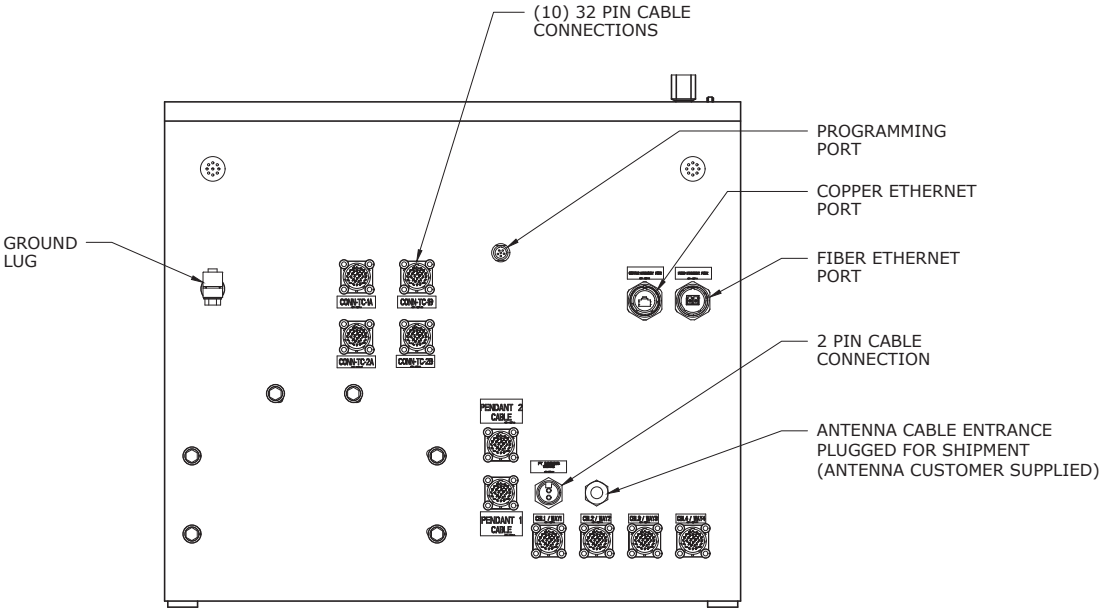
28.04-125E

LEGEND:

1 PROGRAMMING PORT
2 GOUND BOSS
3 CONNECTOR TEST CABLE 1A (BLACK)
4 CONNECTOR TEST CABLE 1B (WHITE)
5 COPPER ETHERNET PORT
6 FIBER ETHERNET PORT
7 CONNECTOR TEST CABLE 2A (BLACK)
8 CONNECTOR TEST CABLE 2B (WHITE)
9 WAY 1 CABLE (RED)
10 WAY 2 CABLE (BLUE)
11 WAY 3 CABLE (YELLOW)
12 WAY 4 CABLE (GREEN)
13 PENDANT 1 (ORANGE)
14 PENDANT 2 (BROWN)
15 POTENTIAL TRANSFORMER
16 ANTENNA CABLE ENTRANCE



B2837 0042 JG0



CONTROL ENCLOSURE BOTTOM VIEW

NOTES:

1. SEE DWG. 28.04-125A FOR FRONT AND BACK VIEWS.
2. SEE DWG. 28.04-125B FOR SIDE VIEW AND WIRING DIAGRAM.
3. SEE DWG. 28.04-125C FOR PLAN VIEW AND ENCLOSURE MOUNTING ANCHOR DETAIL.
4. SEE DWG. 28.04-125D FOR NOTES.
5. SEE DWG. 28.04-125E FOR FRONT VIEW AND SIDE VIEW.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC 4-WAY MAGNETIC ACTUATED SWITCH WITH NON-SUBMERSIBLE SEL 487 RELAY

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.04-125F

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-PAD-15KV-4VFI/600-SD-ATO-MA-3S-F	1	4005953	4	LOCK, PAD, KEYED ALIKE, ROTARY, HASP, STD
			1571792	1	SWITCHGEAR, PAD MOUNT, SOL DIELECTRIC, 15KV, 95KV BIL, 600A, 4 WAY VACUUM FAULT INTERRUPTER, STAINLESS STEEL, FRONT AND BACK ACCESS, MAGNETIC ACTUATOR
			4161096	2	MARKER, SAFETY, KEEP OUT, ONE CALL, CLEARANCE, 10" X 7", LABEL, WARNING, F/ SWITCHGEAR
-	STRUCT-PAD-SG-FGC-GW-15KV-MA-F	1	1570246	1	BASE, CABINET, 105" WD X 112" DP X 36" HT, FIBERCRETE, 82" X 90" OPENING, W/ (4) BOLTS, (4) HOLD DOWN CLAMPS
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE CU, CLASS B
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
-	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG COND., COMP 1-BOLT
-	ELBOW-T-VARIES	12	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
-	ELBOW-1/0AL-200A-15KV-LB-FUSE-F	1	4173497	1	CONNECTOR, ELECTRICAL, FUSED LOADBREAK ELBOW, 1/0 AWG SOL
-	FUSE-LINK-40-CL-15KV-ELBOW-F	1	4173496	1	FUSE, CURRENT LIMITING FULL RANGE, 40A, 8.3KV, LOADBREAK ELBOW
-	ELBOW-1/0-AL-200A-15KV-BOND-F	1	1539241	1	CONNECTOR, ELECTRICAL LOADBREAK ELBOW, 1/0 AWG
			933800	1	CONNECTOR, ELECTRICAL PARALLEL GROOVE, #1 STR-4/0 AWG
-	ELBOW-INS-AL-200A-15KV-LB-F	2	831048	1	BUSHING, ELECTRICAL, CONDUCTOR, TRANSFORMER, 15KV, 200A, LOADBREAK, INSERT, W/ FAULT CLOSE RATING

NOTES:

1. ELBOW ARRESTERS MUST BE INSTALLED ON EACH T-BODY OF OPEN POINT AND ON T-BODIES OF ONE ADDITIONAL SOURCE SIDE WAY.

2. SWITCHGEAR INCLUDES (6) LINDSEY VOLTAGE SENSORS.

DUKE ENERGY.

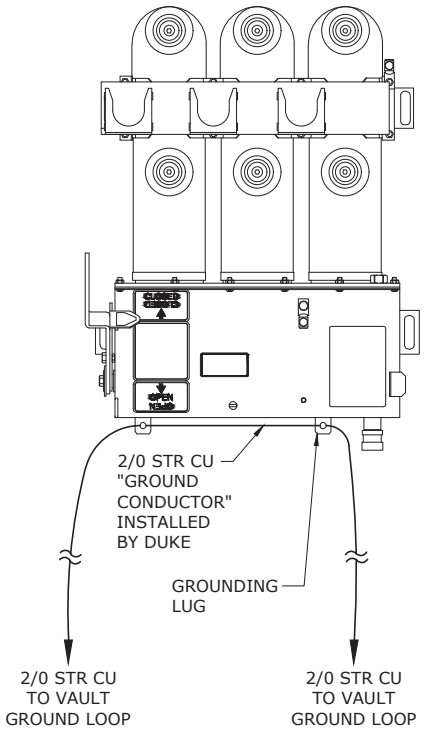
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATO PAD-MOUNTED SOLID DIELECTRIC 4-WAY MAGNETIC ACTUATED SWITCH WITH NON-SUBMERSIBLE SEL 487 RELAY

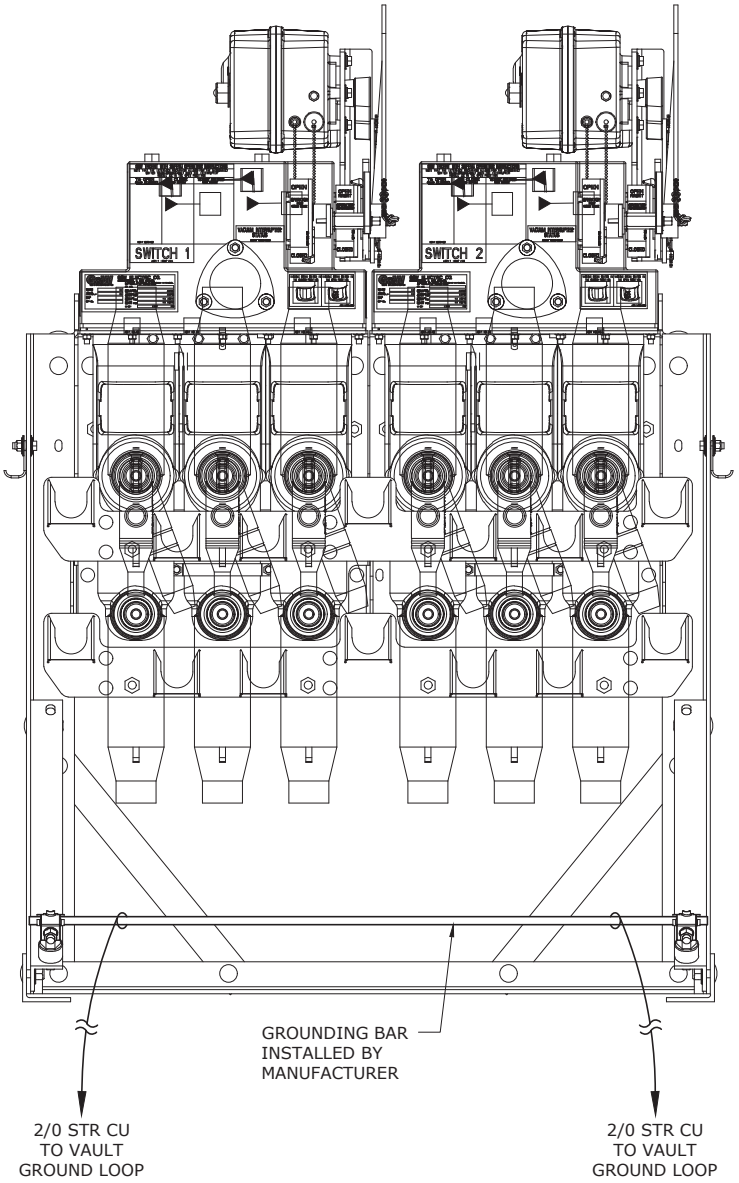
DEC	DEM	DEP	DEF
			X

28.04-125G

SOLID DIELECTRIC SWITCHGEAR
WITHOUT GROUNDING BAR



SOLID DIELECTRIC SWITCHGEAR
WITH GROUNDING BAR



NOTES:

1. TWO CONNECTION POINTS ARE REQUIRED FROM THE SWITCHGEAR GROUNDING BAR OR DUKE INSTALLED GROUNDING CONDUCTOR TO THE VAULT GROUND LOOP.

2. ATTACH BRAIDS OR NEUTRAL STRANDS OF CABLE ACCESSORIES TO THE DUKE INSTALLED "GROUND CONDUCTOR" OR MANUFACTURER INSTALLED GROUND BAR.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

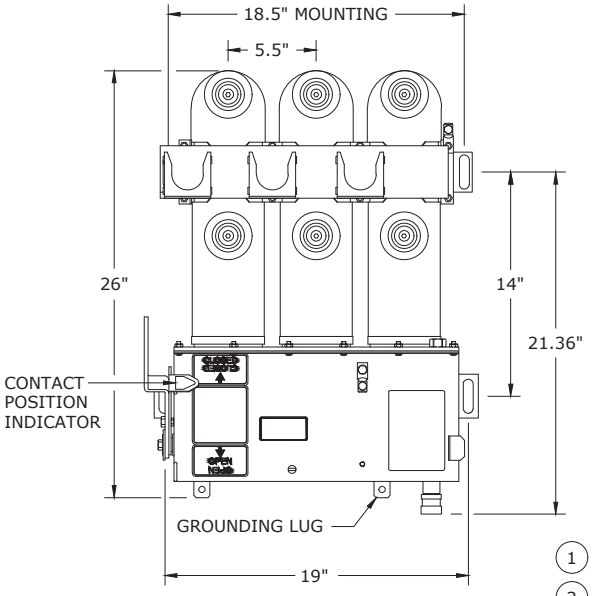
VAULT STYLE SWITCHGEAR GROUNDING

DUKE ENERGY.

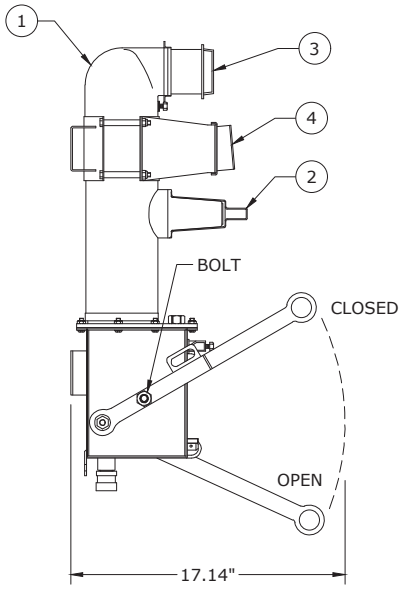
DEC	DEM	DEP	DEF
X	X	X	X

28.05-100

THREE-PHASE LOADBREAK SWITCH
200 AMP ON END

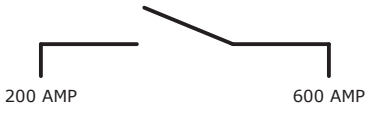


FRONT VIEW



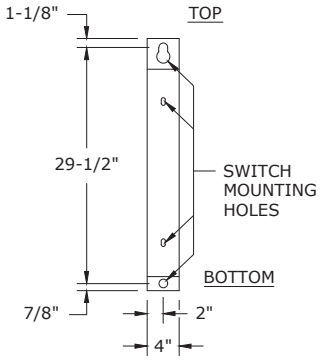
SIDE VIEW

1. THREE-PHASE SWITCH
2. 600 AMP BUSHING INTERFACE
3. 200 AMP BUSHING WELL INTERFACE
4. PARKING STAND

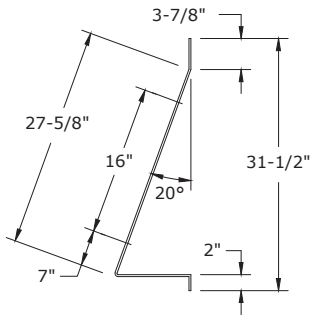


ONE LINE DIAGRAM

SWITCH MOUNTING BRACKET



SIDE VIEW



FRONT VIEW

MOUNT SWITCH ON TWO BRACKETS SPACED 19" ON CENTER

NOTES:

1. ELASTIMOLD THREE-PHASE 200 AMP LOADBREAK SWITCH TO BE USED AS THE HIGHSIDE DISCONNECT SWITCH FOR NETWORK TRANSFORMERS. THIS SWITCH IS ONLY APPROVED FOR USE IN THIS APPLICATION.
2. LINE SIDE CABLES WILL BE TERMINATED WITH 600 AMP BOLTED T-BODY AND INSTALLED ON 600 AMP BUSHING INTERFACE.
3. LOAD SIDE CABLES WILL BE TERMINATED WITH 200 AMP LOAD BREAK ELBOW AND INSTALLED ON 200 AMP BUSHING INSERT.
4. SWITCH TO BE INSTALLED ON TWO SWITCH MOUNTING BRACKETS. BRACKETS TO BE INSTALLED ON VAULT WALL 19" ON CENTER.
5. INSTALL #2/0 SD BC FROM GROUNDING LUGS ON SWITCH TO 4/0 CU GROUND LOOP. GROUND ALL PRIMARY CABLE CONCENTRIC NEUTRAL TO 4/0 CU GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
6. SECURE SWITCH TO MOUNTING BRACKET USING 2-1/2" X 2" SS BOLTS.

DUKE ENERGY.

3					
2					
1					
0	1/31/19	DANNA	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

ELASTIMOLD 15KV THREE-PHASE LOADBREAK SWITCH
200 AMP ON END SUBMERSIBLE

DEC	DEM	DEP	DEF
			X

28.05-101A

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-MOD-15KV-1VI/600-1B/200-SD-3S-F	1	4188265	1	SWITCHGEAR MODULAR 15KV 1 600A VACUUM INTERRUPTER WAY 1 200A BUSHING WAY SOLID DIELECTRIC INSUL DEAD FRONT 304L SS
-	ELBOW-T-VARIES	3	VARIES	1	ELBOW T-BODY VARIES AL 600A 15KV NON-LOAD BREAK
-	ELBOW-1/0-AL-200A-15KV-LB-F	3	4004699	1	CONNECTOR, ELECTRICAL, LOADBREAK ELBOW, 1/0 AWG ALUM COND 15KV 200A, W/ PROBE, F/ 175 MIL CABLE W/O TEST
			50124557	1	KIT ACCESSARY 15KV CABLE SIZE 1/0 SPRING GROUND STRAP
-	NWK-STRUCT-BKT-SG-MVS-F	2	4188268	1	BRACKET, SWITCH, MVS, NETWORK
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	11	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"

NOTES:

1. FOR NEW VAULT ONLY.

2. FOR NEW AND EXISTING VAULTS CONNECT 2/0 COPPER CONDUCTOR TO EITHER SIDE OF EQUIPMENT GROUNDING BAR AND ATTACH TO EXISTING 4/0 CU GROUND LOOP IN THE VAULT. SEE DWG. 28.05-100.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

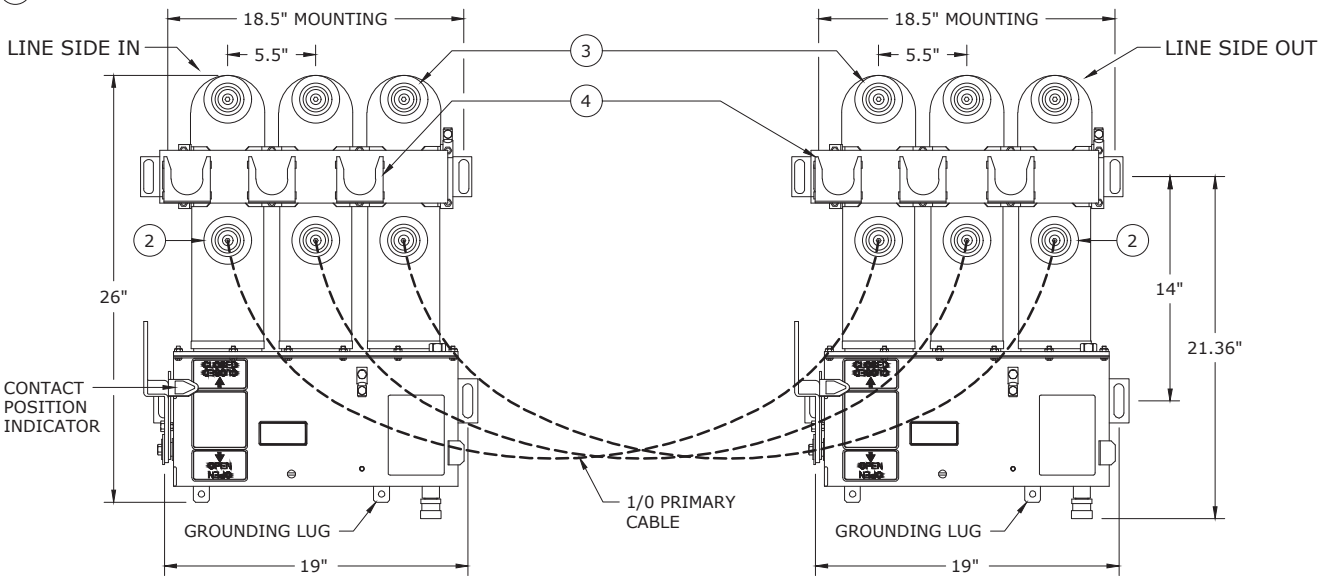
ELASTIMOLD 15KV THREE-PHASE LOADBREAK SWITCH
200 AMP ON END SUBMERSIBLE
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

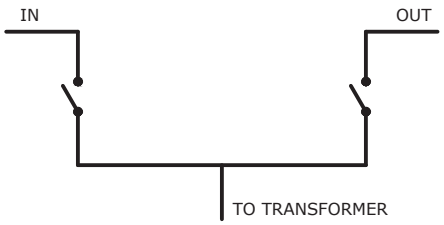
28.05-101B

1. THREE-PHASE SWITCH (QTY. 2)
2. 600 AMP BUSHING INTERFACE
3. 200 AMP BUSHING WELL INTERFACE
4. PARKING STAND

THREE-PHASE LOADBREAK SWITCH
200 AMP ON END

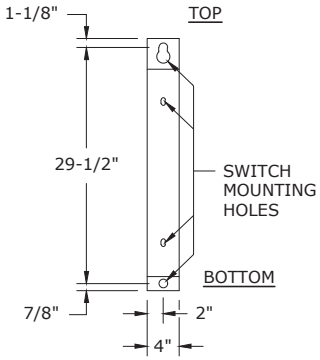


FRONT VIEW

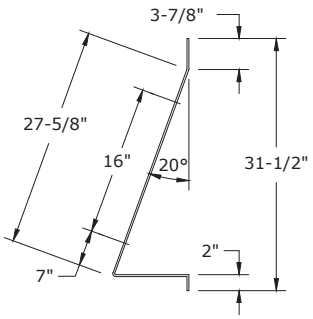


ONE LINE DIAGRAM

SWITCH MOUNTING BRACKET



FRONT VIEW



SIDE VIEW

MOUNT SWITCH ON THREE BRACKETS SPACED 19" ON CENTER
ATTACH BOTH SWITCHES TO CENTER BRACKET

NOTES:

1. ELASTIMOLD THREE-PHASE 200 AMP LOADBREAK SWITCH TO BE USED AS THE HIGHSIDE DISCONNECT SWITCH FOR NETWORK TRANSFORMERS. THIS SWITCH IS ONLY APPROVED FOR USE IN THIS APPLICATION.
2. LINE SIDE CABLES WILL BE TERMINATED WITH 200 AMP LOADBREAK ELBOWS AND INSTALLED ON 200 AMP BUSHING INTERFACE.
3. LOAD SIDE CABLES WILL BE TERMINATED WITH 600 AMP LOAD BOLTED T-BODY AND INSTALLED ON 600 AMP BUSHING INSERT. 200 AMP INTERFACE ON BACK OF 600 AMP T-BODY WILL BE INTERFACE FOR 200 AMP LOADBREAK ELBOW FOR TAP FEED TO TRANSFORMER.
4. SWITCH TO BE INSTALLED ON TWO SWITCH MOUNTING BRACKETS. BRACKETS TO BE INSTALLED ON VAULT WALL 19" ON CENTER.
5. INSTALL #2/0 SD BC FROM GROUNDING LUG ON SWITCH TO 4/0 CU GROUND LOOP. GROUND ALL PRIMARY CABLE CONCENTRIC NEUTRAL TO 4/0 CU GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
6. SECURE SWITCH TO MOUNTING BRACKET USING 2-1/2" X 2" SS BOLTS.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

ELASTIMOLD 15KV THREE-PHASE LOADBREAK TAP SWITCH CONFIGURATION, 200 AMP SUBMERSIBLE

DEC	DEM	DEP	DEF
			X

28.05-103A

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-MOD-15KV-1VI/600-1B/200-SD-3S-F	2	4188265	1	SWITCHGEAR MODULAR 15KV 1 600A VACUUM INTERRUPTER WAY 1 200A BUSHING WAY SOLID DIELECTRIC INSUL DEAD FRONT 304L SS
-	ELBOW-T-VARIES	6	VARIES	1	ELBOW T-BODY VARIES AL 600A 15KV NON-LOAD BREAK
-	ELBOW-1/0-AL-200A-15KV-LB-F	6	4004699	1	CONNECTOR, ELECTRICAL, LOADBREAK ELBOW, 1/0 AWG ALUM COND 15KV 200A, W/ PROBE, F/ 175 MIL CABLE W/O TEST
			50124557	1	KIT ACCESSARY 15KV CABLE SIZE 1/0 SPRING GROUND STRAP
-	NWK-STRUCT-BKT-SG-MVS-F	4	4188268	1	BRACKET, SWITCH, MVS, NETWORK
SEE NOTE 1	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 2	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	4	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"

NOTES:

1. FOR NEW VAULT ONLY.

2. FOR NEW AND EXISTING VAULTS CONNECT 2/0 COPPER CONDUCTOR TO EITHER SIDE OF EQUIPMENT GROUNDING BAR AND ATTACH TO EXISTING 4/0 CU GROUND LOOP IN THE VAULT. SEE DWG. 28.05-100.

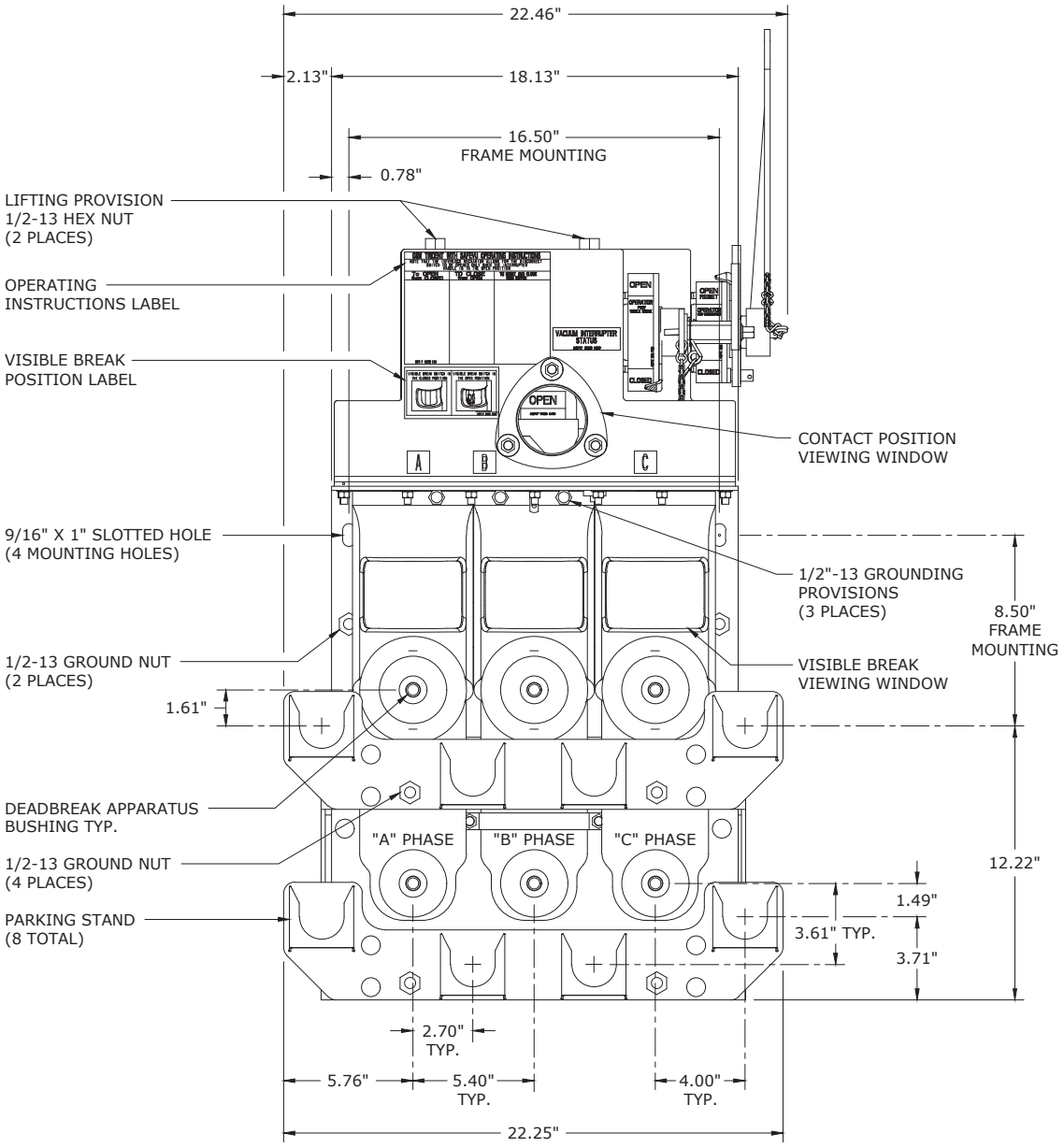
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

ELASTIMOLD 15KV THREE-PHASE LOADBREAK
TAP SWITCH CONFIGURATION, 200 AMP SUBMERSIBLE
BILL OF MATERIALS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-103B



FRONT VIEW

NOTES:

1. SEE DWG. 28.05-105B FOR RIGHT SIDE VIEW.

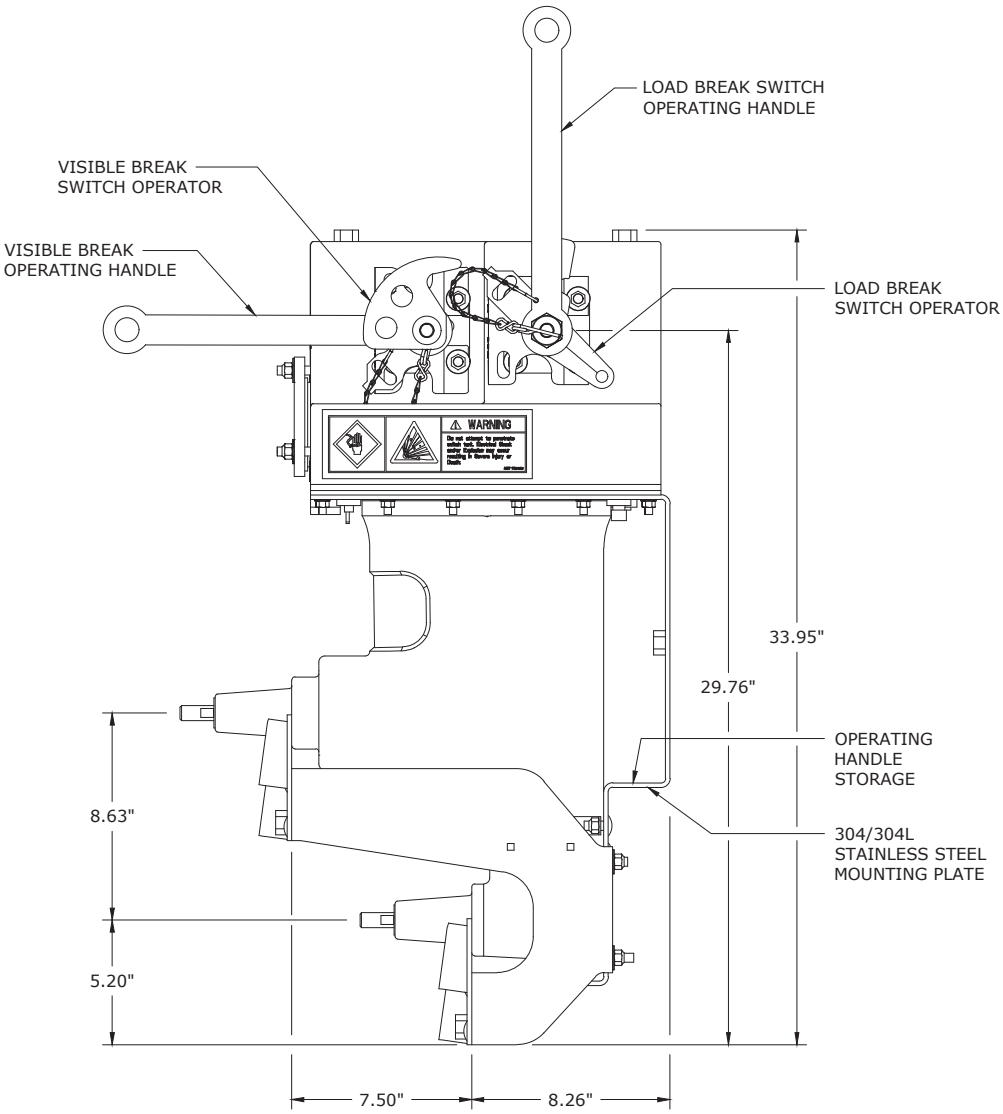
2. SEE DWG. 28.05-105C FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV LOAD BREAK TWO-WAY VAULT MOUNT SUBMERSIBLE

DEC	DEM	DEP	DEF
X	X	X	X

28.05-105A



RIGHT SIDE VIEW

NOTES:

1. SWITCH EQUIPPED WITH EXTERNAL INTERLOCKS TO PROVIDE OPERATION SEQUENCE. INTERNAL INTERLOCK PREVENTS OPENING OF DISCONNECT SWITCH UNLESS INTERRUPTER IS OPENED.

2. MOUNTING INFORMATION: THE SWITCH MUST BE SECURED VIA THE ANCHORING PROVISIONS PROVIDED FOR THIS PURPOSE. THE FRAME IS EQUIPPED WITH (4) SLOTTED ANCHORING HOLES, EACH MEASURING 9/16" X 1". THE LOCATIONS OF THESE HOLES, REFERRED TO AS "FRAME MOUNTING", ARE SHOWN IN THE FRONT VIEW.

3. SEE DWG. 28.04-105A FOR RIGHT SIDE VIEW.

4. SEE DWG. 28.04-105C FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV LOAD BREAK TWO-WAY
VAULT MOUNT SUBMERSIBLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-105B

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.
4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.
5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.
6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.
7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.
8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.
9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.
10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.
11. SEE DWG. 28.05-105A FOR FRONT VIEW.
12. SEE DWG. 28.05-105B FOR RIGHT SIDE VIEW.
13. SEE DWG. 28.05-105D FOR BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV LOAD BREAK TWO-WAY
VAULT MOUNT SUBMERSIBLE

DEC	DEM	DEP	DEF
X	X	X	X

28.05-105C

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-15KV-1VI/600-1B/600-SD-F	1	1545736	1	SWITCHGEAR, MULTI-WAY VAULT, SOL DIELECTRIC, 15KV, 600A, 3PH, TRIDENT W/ SAFEVU, FRONT ACCESS, WALL MOUNT, 1UNIT, IN/OUT
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 3	ELBOW-T-VARIES	6	-		TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
-	FCI-UG-3P-1200-CURR-LDIAL-F	1	4004667	1	INDICATOR, FAULT, 3-PH UG, 1200A TRIP, CURRENT RESET, MODIFIED 99MS INRUSH RESTRAINT, 24MS TRIP DELAY, SCADA

NOTES:

1. NEW VAULT ONLY.

2. ONLY IF NORMAL OPEN POINT EXISTS, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.

3. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATE A VISIBLE OPEN WINDOW. OTHER OPTION IS USING A 600-200 AMP BUSHING ADAPTER (ITEM # 1563341) AND LOADBREAK ELBOW.

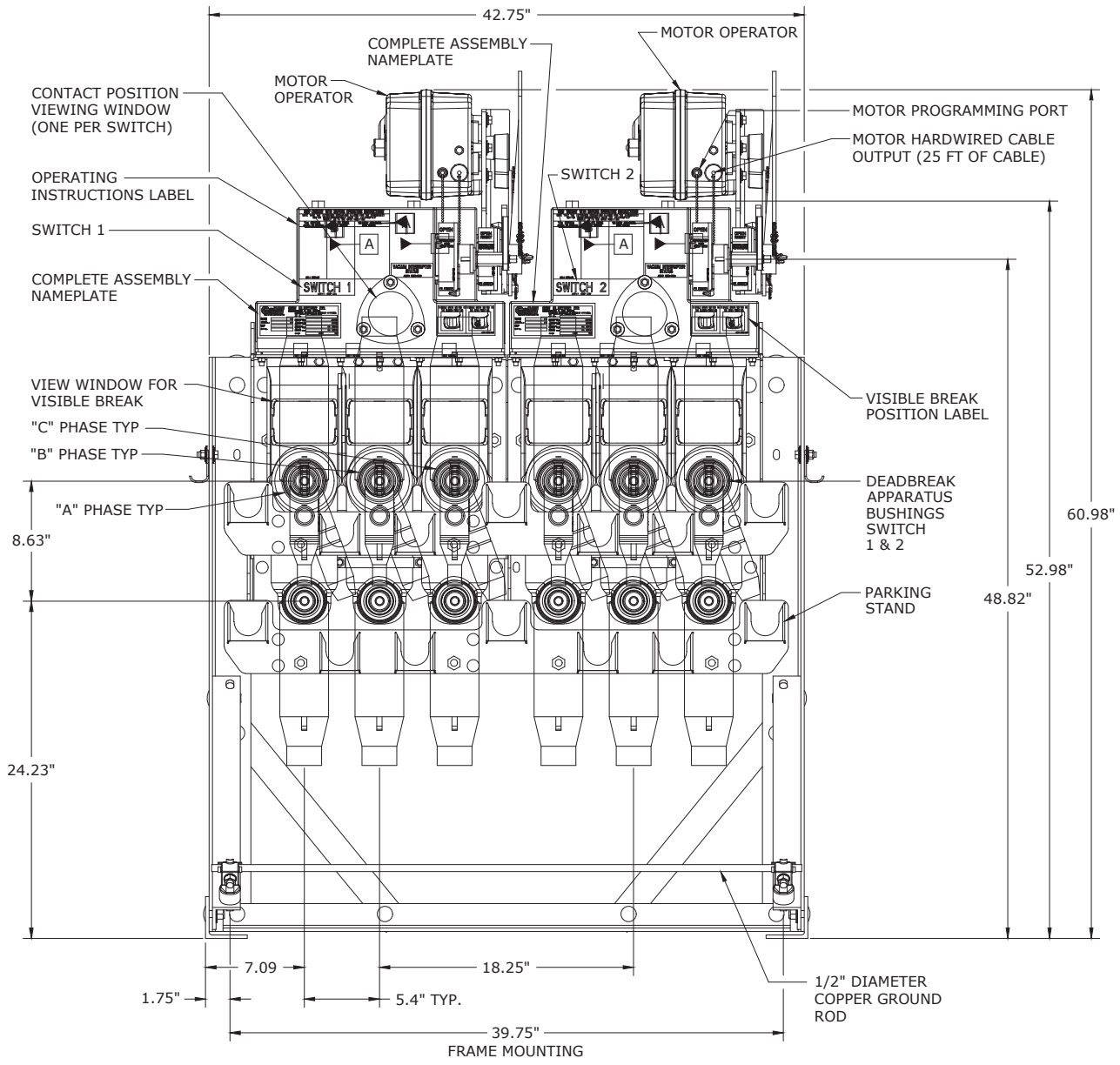
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV LOAD BREAK TWO-WAY VAULT MOUNT SUBMERSIBLE BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.05-105D



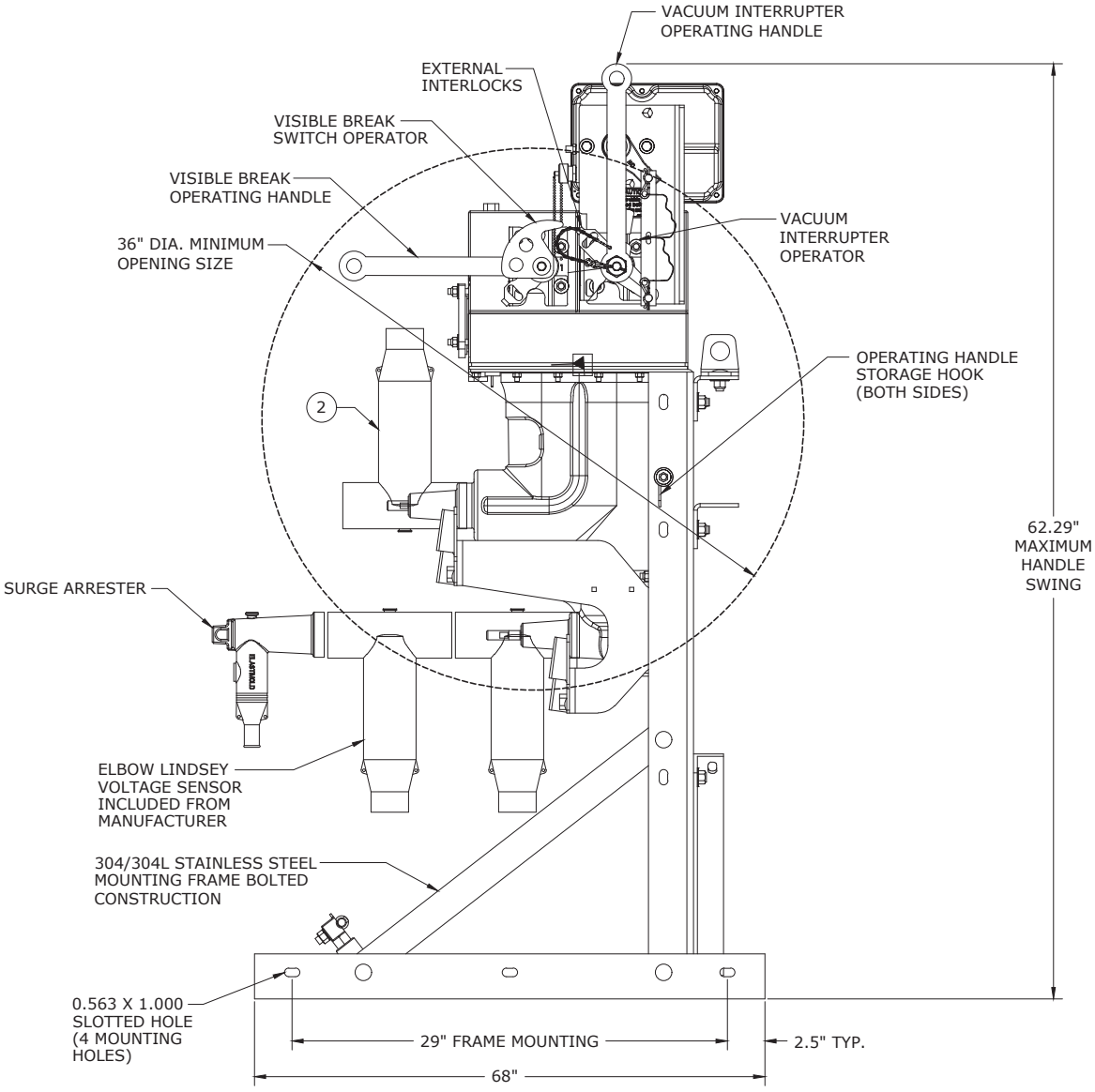
FRONT VIEW

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FOUR-WAY SAFEVU ATS/ATO VAULT-MOUNTED COMPACT VERSION WITH NON-SUBMERSIBLE SEL 451

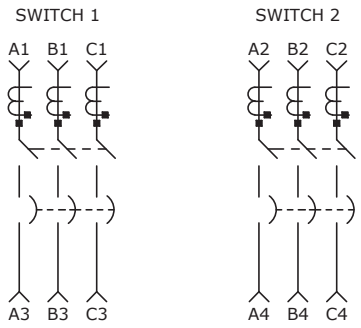
DEC	DEM	DEP	DEF
			X

28.05-107



SIDE VIEW

SHOWN AS SOURCE ON
BOTTOM SET OF BUSHINGS



THREE-LINE DIAGRAM

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FOUR-WAY SAFEVU ATS/ATO VAULT-MOUNTED COMPACT VERSION WITH NON-SUBMERSIBLE SEL 451

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-109

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.

4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

7. ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.

8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

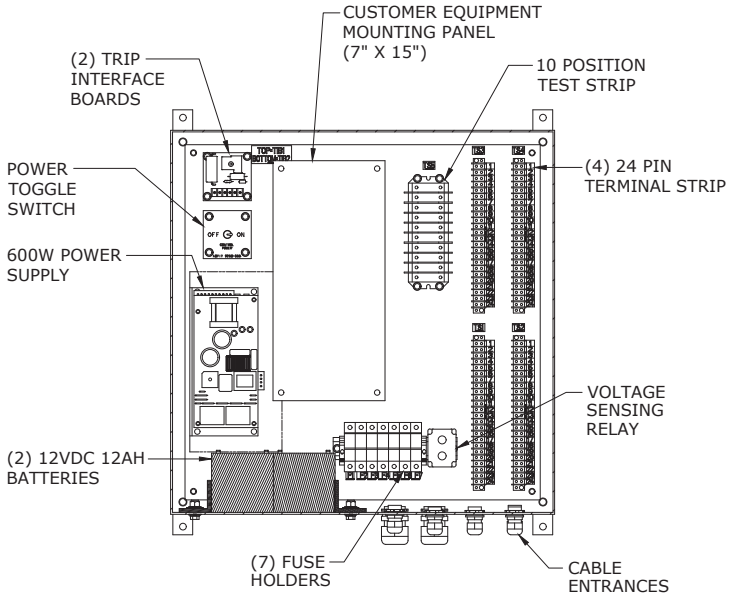
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV FOUR-WAY SAFEVU ATS/ATO
VAULT-MOUNTED WITH NON-SUBMERSIBLE SEL 451
NOTES

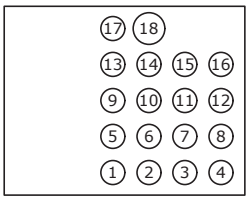
DEC	DEM	DEP	DEF
			X

28.05-111



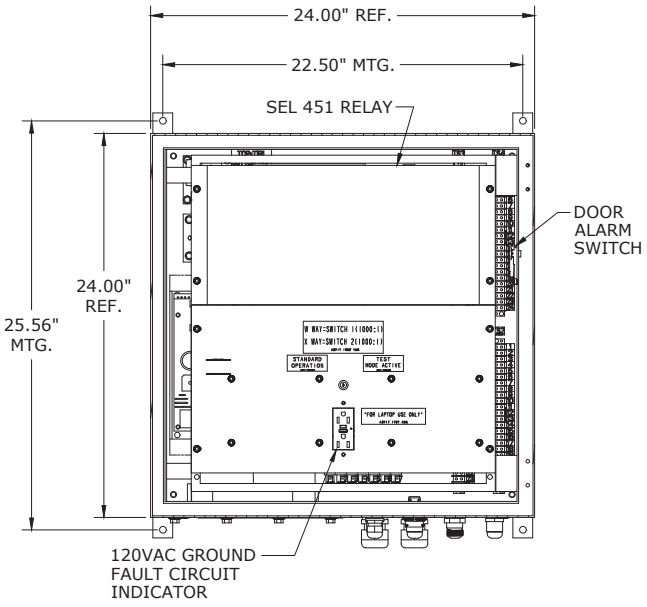
PLAN VIEW

(DOOR AND SWING FRAME HIDDEN FOR CLARITY)



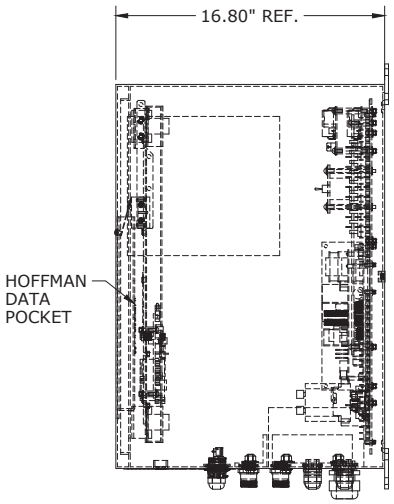
CONTROL PORT

CONTROL PORT LEGEND	
1	CUSTOMER 120VAC INPUT
2	CUSTOMER 120VAC OUTPUT
3	SWITCH 1 A PHASE VOLTAGE SENSING
4	SWITCH 1 B PHASE VOLTAGE SENSING
5	SWITCH 1 C PHASE VOLTAGE SENSING
6	SWITCH 2 A PHASE VOLTAGE SENSING
7	SWITCH 2 B PHASE VOLTAGE SENSING
8	SWITCH 2 C PHASE VOLTAGE SENSING
9	SWITCH 1 INTERNAL FEEDBACK
10	SWITCH 1 MOTOR
11	SWITCH 1 AUX/VISIBLE BREAK CONTACT
12	SWITCH 1 CURRENT TRANSFORMER/ MAGLATCH
13	SWITCH 2 INTERNAL FEEDBACK
14	SWITCH 2 MOTOR
15	SWITCH 2 AUX/VISIBLE BREAK CONTACT
16	SWITCH 2 CURRENT TRANSFORMER/ MAGLATCH
17	GROUND
18	ETHERNET



FRONT VIEW

(DOOR HIDDEN FOR CLARITY)



SIDE VIEW

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

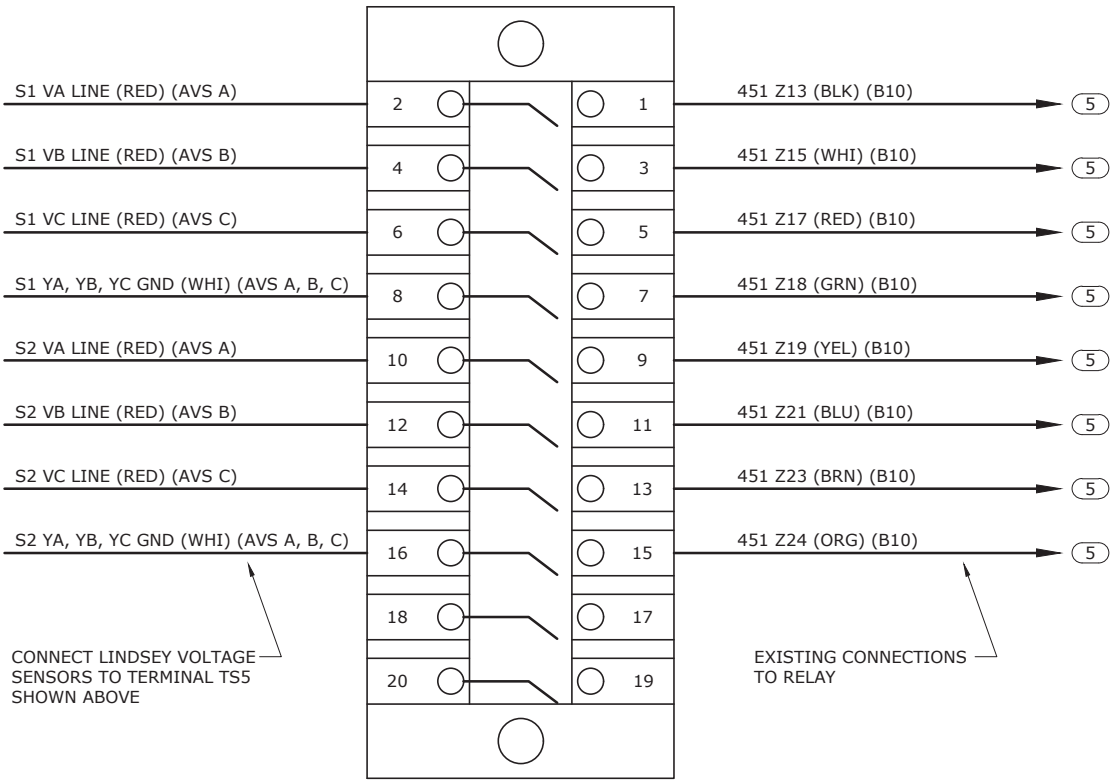
G&W 15KV FOUR-WAY SAFEVU ATS/ATO
CONTROL ENCLOSURE AND PORT
LEGEND

DUKE ENERGY.

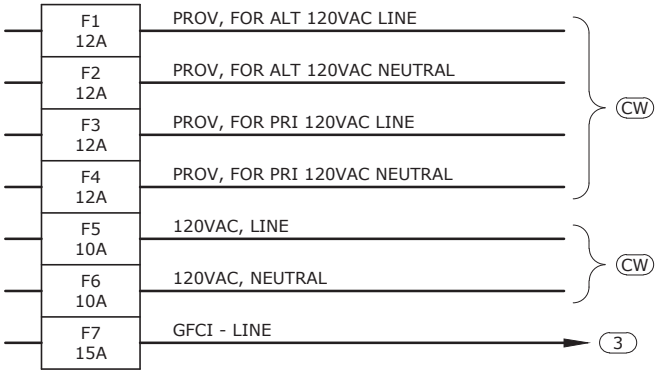
DEC	DEM	DEP	DEF
			X

28.05-113

TS5



10 POSITION TEST STRIP



7 POSITION FUSE HOLDER

NOTES:

1. POWER TO CONTROL IS FED FROM AN EXTERNAL 120V SUPPLY.
2. CONNECT POWER IN TO FUSE TERMINAL F3 AND F4.
3. CONNECT POWER OUT TO COMMUNICATION CABINET TO F5 AND F6.
4. F1 AND F2 NOT USED WITH EXTERNAL CONNECTION TO ONE SOURCE.
5. BOND CONTROL CABINET TO SWITCH GROUND.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV FOUR-WAY SAFEVU ATS/ATO CONTROL ENCLOSURE AND PORT TERMINAL BLOCK

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-115

NOTES	BILL OF MATERIALS				
	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-15KV-1VF1/600-1B/600-SD-ATO-F	1	1535350	1	SWITCHGEAR, AUTO TRANSFER, SOL DIELECTRIC, 15KV, 3PH, 2-WAY FRONT ACCESS, VISIBLE OPEN, 600A BUSHINGS
-	ELBOW-T-VARIES	12	VARIES	1	ELBOW T-BODY (VARIES) AL 600A 15KV NON-LOADBREAK
SEE NOTE 1	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLYMER, LOADBREAK ELBOW, DEAD FRONT PAD-MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	ELBOW-T-SENS-VOLT-200A-15KV-F (COMES WITH SWITCHGEAR)	6	1543539	1	SENSOR, 200A, T-BODY, 1400:1 VOLTAGE RATIO DIVIDER, 25' CABLE 15KV, 95KV, BIL
-	GND-SG-2/0-RING-F	2	933800	2	CONNECTOR, ELECTRICAL, PARALLEL GROOVE, #1 STR 4/0 AWG STR #6 SOL-4/0 AWG STR CONDUCTOR BRONZE CONNECTOR
			50129890	4	COUPLING ROD GROUND 5/8" BRONZE NON-THREADED
			1502506	20	WIRE/CABLE ELECTRICAL BARE, SOL SD, 2/0 AWG, CU CONDUCTOR 125' SPOOLS
SEE NOTE 2	ELBOW-WELL-REDR-600A-200A-15KV-F	6	4004744	1	WELL, BUSHING, 15/25KV 600A, FEMALE LOADBREAK ELBOW 15/25KV 600A ADAPTER

NOTES:

1. INSTALL ELBOW ARRESTERS ON SOURCE WAYS.
2. INSTALL REDUCING WELL INTO BACK OF SOURCE SIDE T-BODIES FOR INSTALLATION OF LINDSEY VOLTAGE SENSORS.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

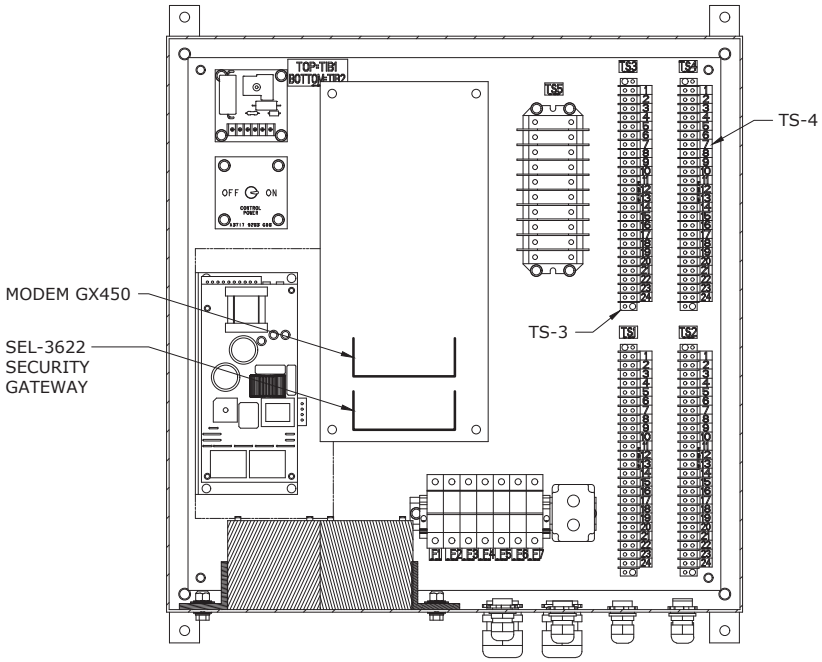
G&W 15KV FOUR-WAY SAFEVU ATS/ATO
CONTROL ENCLOSURE AND PORT
BILL OF MATERIALS

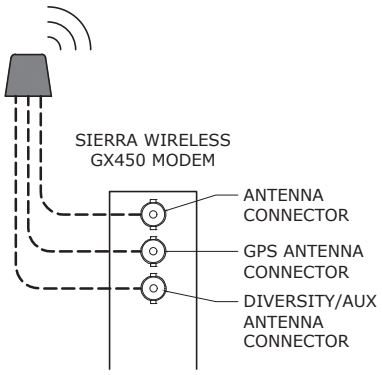
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-117

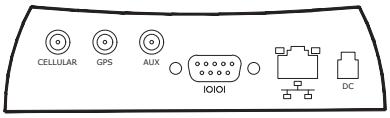
CONTROL CABINET





ANTENNA

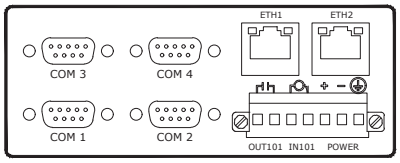
MODEM GX450



CELLULAR, GPS, AND AUX TO ANTENNA (ANTENNA WIRES)
ETH TO SEL-3622 ETH-1 (CAT-5E)

POWER:	RED	TO (+) 24VDC	TS4-21 PIN
	WHITE	TO (+) 24VDC	TS4-21 PIN
	BLACK	TO (-) 0VDC	TS4-23 PIN

SECURITY GATEWAY SEL-3622



(REAR)

ETH-1 TO MODEM ETH (CAT-5E)
ETH-2 TO SEL 451 ETH2 (CAT-5E)

POWER:	(+) TO	TO (+) 24VDC	TS4-20 PIN
	(-) TO	TO (-) 0VDC	TS4-22 PIN
	GROUND	TO GROUND	TS4-24 PIN

NOTES:

1. ANTENNA, MODEM AND SECURITY GATEWAY TO BE INSTALLED DURING PROVISIONING/COMMISSIONING.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATS/ATO SAFEVU
COMMUNICATIONS CONNECTIONS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-119

CONTROL/ COMMUNICATION CABINET FOR TWO WAY SWITCH

SWING PANEL DETAIL

BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
CTRL-SG-VLT-COMM-S3505-2WAY-F	1	1549520	1	ENCLOSURE COMMUNICATION CONTROLLER NEMA 4X 24" WD X 24" HT X 12" DP METAL WHITE 3-POINT LATCH FOR SEL 451 AST. INCLUDES FROM MANUFACTURER: SECURITY GATEWAY SEL 3622 RTAC SEL-3505-3 ANNUNCIATOR
-	*	1517091	1	MODEM BUNDLE PACKAGE PRICE PROVISIONED VERIZON 4G LTE DC CABLE VERIZON ACTIVATED W/ SIMS CARD PURCHASE
-	*	4206198	1	ANTENNA MODEM SMA CONNECTOR W/ 15' CABLE
CTRL-CABLE-16-TCU-XLPE-7/C-LSZH-F	30	4206736	1	WIRE/CABLE ELECTRICAL CONTROL 7 CONDUCTOR TINNED CU CONDUCTOR 600V XLP INSULATION
CTRL-CABLE-10-CU-DX-PWR-F	20	4003512	1	WIRE/CABLE ELECTRICAL STREET LIGHT 2 CONDUCTOR 10 AWG CU CONDUCTOR STR XLPE INSULATION
GND-EQUIP/EQUIP-6-BOND-F	10	234664	1	WIRE/CABLE ELECTRICAL BARE SOL SD 6 AWG CU
COMM-CABLE-6IN-RIBBON-DB25-MM-F	2	1560266	1	CABLE 6" LG PLASTIC RIBBON C780 EIA-232 EXTENSION CABLE
COMM-XCVR-SEL2812MT-DB9/2ST-MF-F	1	50129197	1	SEL-2812MTX0 FIBER-OPTIC TRANSCEIVER
COMM-XCVR-SEL2812MR-DB9/2ST-MF-F	1	50129198	1	SEL-2812MRX0 FIBER-OPTIC TRANSCEIVER
COMM-CABLE-49FT-FIBER-DX-ST-MM-F	1	1560022	1	CABLE FIBER OPTIC SEL C805D020SSX0015

* TO BE INSTALLED DURING PROVISIONING/COMMISSIONING

NOTES:

1. SEE DWG. 28.05-123 FOR CABINET CONNECTIONS.
2. THE PLACEMENT OF THE CONTROL/ COMMUNICATION CABINET WILL BE RELATIVE TO THE TWO WAY SWITCH. LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS, OR OTHER NEARBY EQUIPMENT. PLACE IN LOCATION FOR EASY ACCESS. GIVE CONSIDERATION TO OTHER ACTIVITY AT THE SITE.
3. 120 VOLT POWER TO COMMUNICATION BOX MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY.
4. CONTROL/ COMMUNICATIONS CABINET MUST BE BONDED TO GROUND.

DUKE ENERGY.

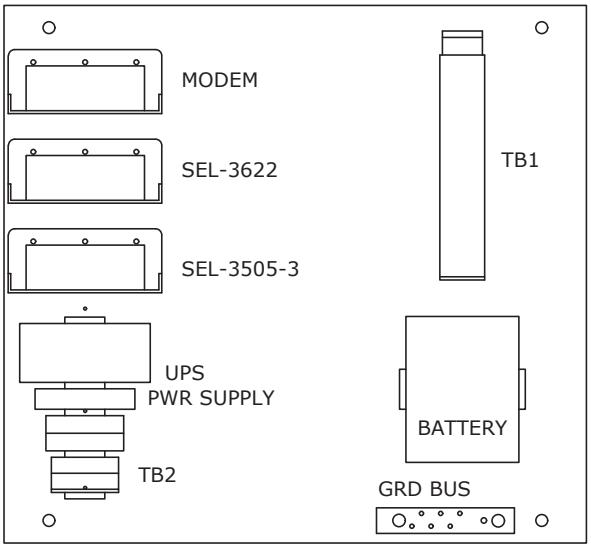
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATS/ATO SAFEVU
EXTERNAL CONTROL/
COMMUNICATIONS CABINET

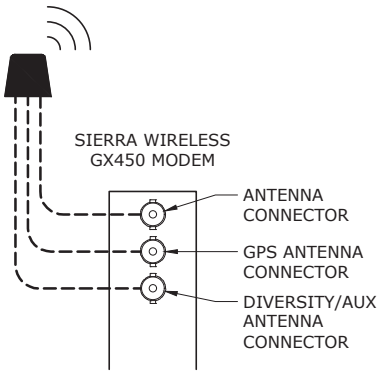
DEC	DEM	DEP	DEF
			X

28.05-121

CONTROL/COMMUNICATIONS CABINET

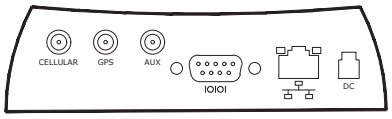


SUB-PANEL DETAIL



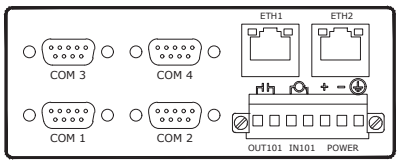
ANTENNA

MODEM GX450



CELLULAR, GPS, AND AUX TO ANTENNA (ANTENNA WIRES)
ETH TO SEL-3622 ETH-1 (CAT-5E)

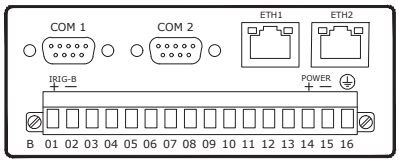
SEL-3622 SECURITY GATEWAY



(REAR)

ETH-1 TO MODEM ETH (CAT-5E)
ETH-2 TO SEL 3505-3 ETH2 (CAT-5E)

SEL-3505-3 RTAC



(REAR)

ETH-1 TO SEL-3622 ETH-2 (CAT-5E)
COM 1 TO SEL-451 RELAY
COM1- SEL CABLE C780 - SEL 2812MTX0 FIBER OPTIC TRANSCEIVER - FIBER OPTIC CABLE SEL C805D020SSX0015 - SEL 2812MRX0 - 451 RELAY
COM2 TO ANNUNCIATOR PORT 3 (SEL C273A CABLE)

EMERGENCY TRIP	FROM TERMINAL 18 ON TB1 TO TERMINAL 22 ON TS3 (INSIDE CONTROL CABINET) FROM TERMINAL 19 ON TB1 TO TERMINAL 23 ON TS3 (INSIDE CONTROL CABINET) FROM TERMINAL 20 ON TB1 TO TERMINAL 24 ON TS3 (INSIDE CONTROL CABINET)
POWER	FROM TERMINAL 1 ON TB2 TO 120 VAC (LINE-POWER SOURCE) FROM TERMINAL 2 ON TB2 TO 0 VAC (NEUTRAL-POWER SOURCE)
GROUND	CONNECT CABINET GROUND TO SYSTEM GROUND

NOTES:

1. SEE DWG. 28.05-121 FOR COMMUNICATIONS ENCLOSURE.

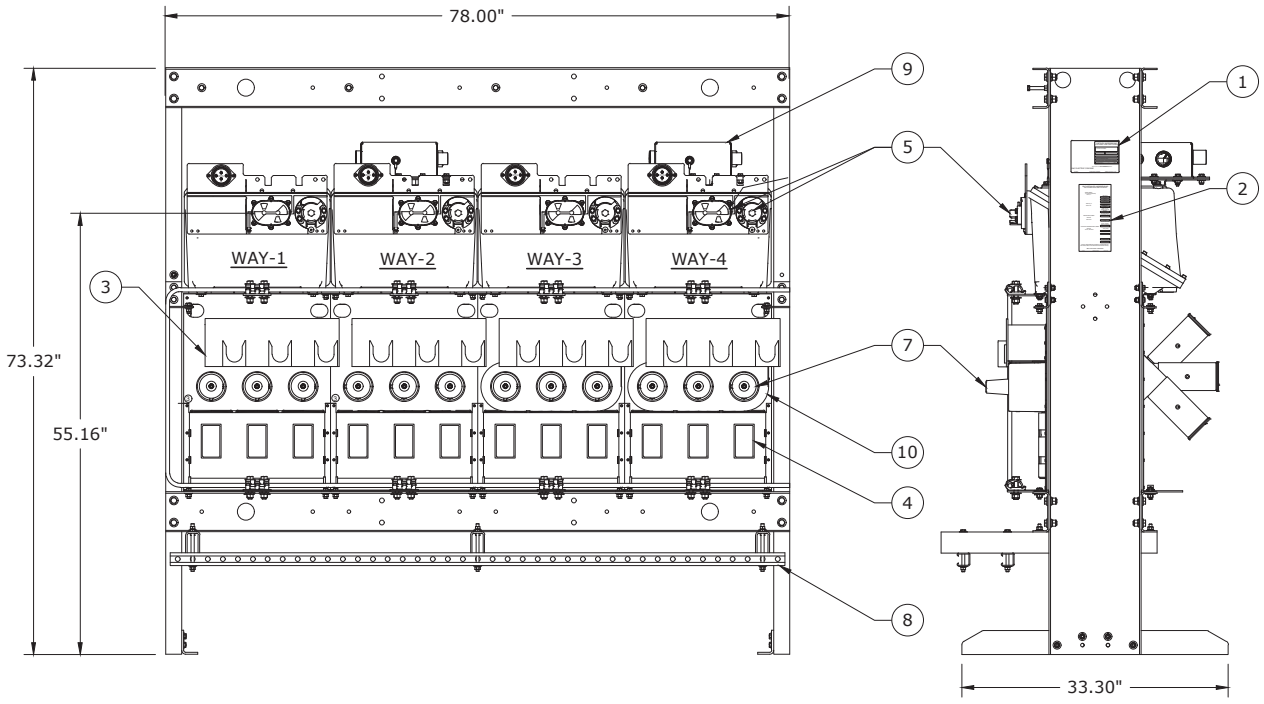
DUKE ENERGY.

3				
2				
1				
0	1/31/19	BRAVO	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV ATS/ATO SAFEVU EXTERNAL CONTROL/ COMMUNICATIONS CABINET CONNECTIONS

DEC	DEM	DEP	DEF
			X

28.05-123

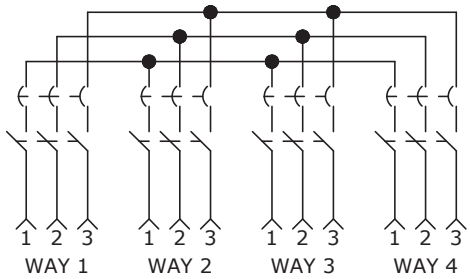


TERMINATION VIEW

SIDE VIEW

FEATURES:

1. NAMEPLATE
2. RATING LABELS
3. 600 AMPERE THREE-POLE FAULT INTERRUPTER
4. ISOLATING DISCONNECT VIEWING WINDOW
5. OPERATING MECHANISM WITH OPEN/RESET AND CLOSE INDICATORS, AND MIMIC BUS (GREEN: OPEN; RED: CLOSED)
6. MANUAL HANDLE (IN STORAGE POSITION) SEE DWG. 28.05-127B
7. 600 AMPERE BUSHINGS WITH STUDS
8. CABLE SUPPORT BRACKETS (SHIPPED DISASSEMBLED)
9. S&C OVERCURRENT CONTROL
10. CURRENT TRANSFORMER



CONNECTION DIAGRAM MODEL 404
WAYS 1 & 2 ARE SOURCE
WAYS 3 & 4 ARE LOAD

NOTES:

1. SEE DWG. 28.05-127B FOR ANCHOR BOLT PLAN.

2. SEE DWG. 28.05-127C FOR NOTES.

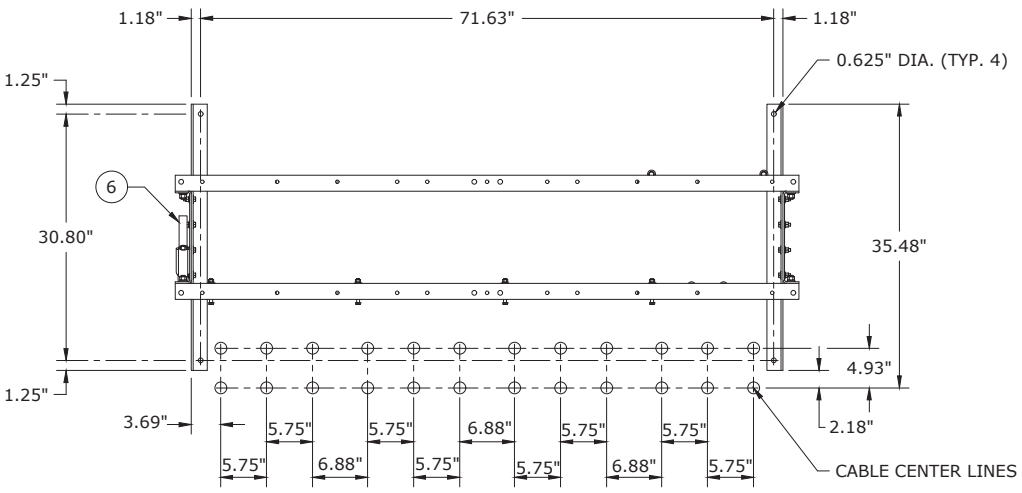
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED VISTA SD MODEL 404 WITH SUBMERSIBLE S1000 OVERCURRENT CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-127A



ANCHOR BOLT PLAN

NOTES:

1. SEE DWG. 28.05-127A FOR TERMINATION VIEW, SIDE VIEW AND CONNECTION DIAGRAM.

2. SEE DWG. 28.05-127C FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED VISTA SD MODEL 404 WITH SUBMERSIBLE S1000 OVERCURRENT CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-127B

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.
4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.
5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.
6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.
7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.
8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.
9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.
10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.
11. SEE DWG. 28.05-127A FOR TERMINATION VIEW, SIDE VIEW AND CONNECTION DIAGRAM.
12. SEE DWG. 28.05-127B FOR ANCHOR BOLT PLAN.
13. SEE DWG. 28.05-127D FOR BILL OF MATERIALS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED VISTA SD MODEL 404 WITH SUBMERSIBLE S1000 OVERCURRENT CONTROL - NOTES

DEC	DEM	DEP	DEF
X	X	X	X

28.05-127C

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-25KV-2VFI/600-2VFI/600-SD-SUB-3S-F	1	1540166	1	SWITCHGEAR, VAULT MOUNT, SOL DIELECTRIC, 25KV, 125KV BIL, 600A, 12.5KA INTERRUPTING CAPACITY, 3PH, FOUR-WAY
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT, DEAD FR
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 3	ELBOW-T-VARIES	12	-	1	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
	MOTORS AND PENDANTS – IF NEEDED				
-	SG-MOTOR-VFI-SD-SUB-VISTA-F	VARIES	1520705	1	MOTOR
	CTRL-SG-PENDANT-SUB-SD-VISTA-F	VARIES	1520709	1	PENDANT

NOTES:

1. NEW VAULT ONLY.
2. ONLY IF NORMAL OPEN POINT EXISTS, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.
3. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATES A VISIBLE OPEN WINDOW. OTHER OPTION IS USING A 600-200AMP BUSHING ADAPTER (ITEM # 1563341) AND LOADBREAK ELBOW.

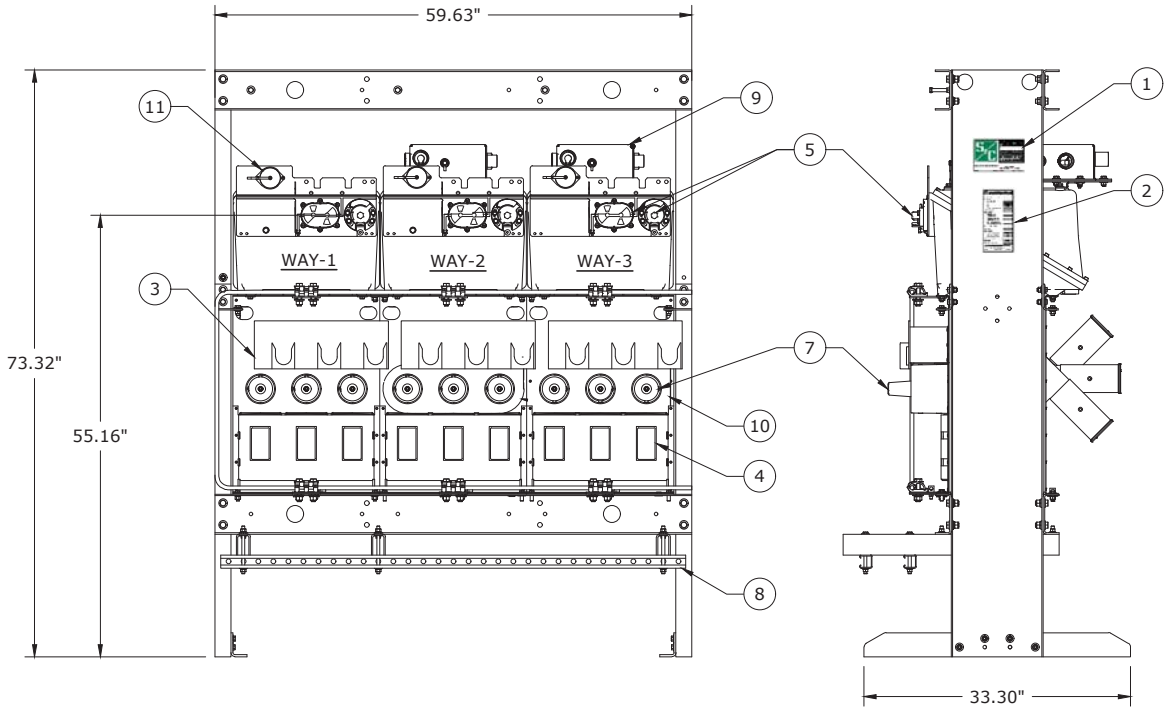
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15/25KV FAULT INTERRUPTER FOUR-WAY
SOLID DIELECTRIC VAULT SWITCHGEAR
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.05-127D

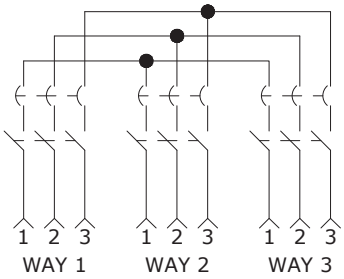


TERMINATION VIEW

SIDE VIEW

FEATURES:

1. NAMEPLATE
2. RATING LABELS
3. 600 AMPERE THREE-POLE FAULT INTERRUPTER
4. ISOLATING DISCONNECT VIEWING WINDOW
5. OPERATING MECHANISM WITH OPEN/RESET AND CLOSE INDICATORS, AND MIMIC BUS (GREEN: OPEN; RED: CLOSED)
6. MANUAL HANDLE (IN STORAGE POSITION) SEE DWG. 28.05-139B
7. 600 AMPERE BUSHINGS WITH STUDS
8. CABLE SUPPORT BRACKETS (SHIPPED DISASSEMBLED)
9. S&C OVERCURRENT CONTROL
10. CURRENT TRANSFORMER
11. POTENTIAL INDICATION FEATURE WITH PROVISION FOR LOW VOLTAGE PHASING (OPTIONAL)



CONNECTION DIAGRAM MODEL 303

WAYS 1 & 2 ARE SOURCE
WAYS 3 & 4 ARE LOAD

NOTES:

1. SEE DWG. 28.05-139B FOR ANCHOR BOLT PLAN.
2. SEE DWG. 28.05-139C FOR NOTES.

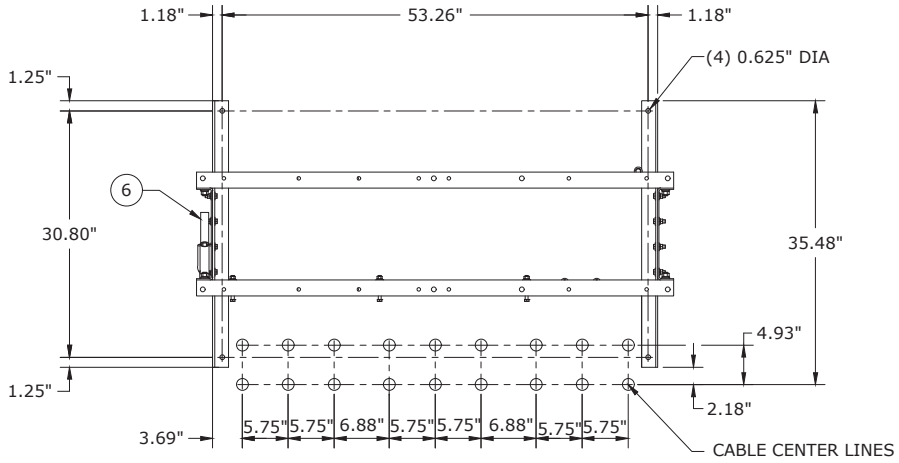
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED VISTA SD MODEL 303 WITH SUBMERSIBLE S1000 CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-139A



ANCHOR BOLT PLAN

NOTES:

1. SEE DWG. 28.05-139A FOR TERMINATION VIEW, SIDE VIEW AND CONNECTION DIAGRAM.

2. SEE DWG. 28.05-139C FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED
VISTA SD MODEL 303 WITH
SUBMERSIBLE S1000 CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-139B

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.

4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.

8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

11. SEE DWG. 28.05-139A FOR TERMINATION VIEW, SIDE VIEW AND CONNECTION DIAGRAM.

12. SEE DWG. 28.05-139B FOR ANCHOR BOLT PLAN.

13. SEE DWG. 28.05-139D FOR BILL OF MATERIALS.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15/25KV FAULT INTERRUPTER VAULT-MOUNTED
VISTA SD MODEL 303 WITH
SUBMERSIBLE S1000 CONTROL - NOTES

DEC	DEM	DEP	DEF
X	X	X	X

28.05-139C

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-25KV-2VFI/600-1VFI/600-SD-SUB-3S-F	1	1527489	1	SWITCHGEAR, VAULT MOUNT, SOL DIELECTRIC, 27KV, 125KV BIL, 600A, 12.5KA INTERRUPTING CAPACITY, 3PH
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 3	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26
	MOTORS AND PENDANTS – IF NEEDED				
-	SG-MOTOR-VFI-SD-SUB-VISTA-F	VARIES	1520705	1	MOTOR
	CTRL-SG-PENDANT-SUB-SD-VISTA-F	VARIES	1520709	1	PENDANT

NOTES:

1. NEW VAULT ONLY.
2. ONLY IF NORMAL OPEN POINT EXISTS, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.
3. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATES A VISIBLE OPEN WINDOW. OTHER OPTION IS USING A 600-200AMP BUSHING ADAPTER (ITEM # 1563341) AND LOADBREAK ELBOW.

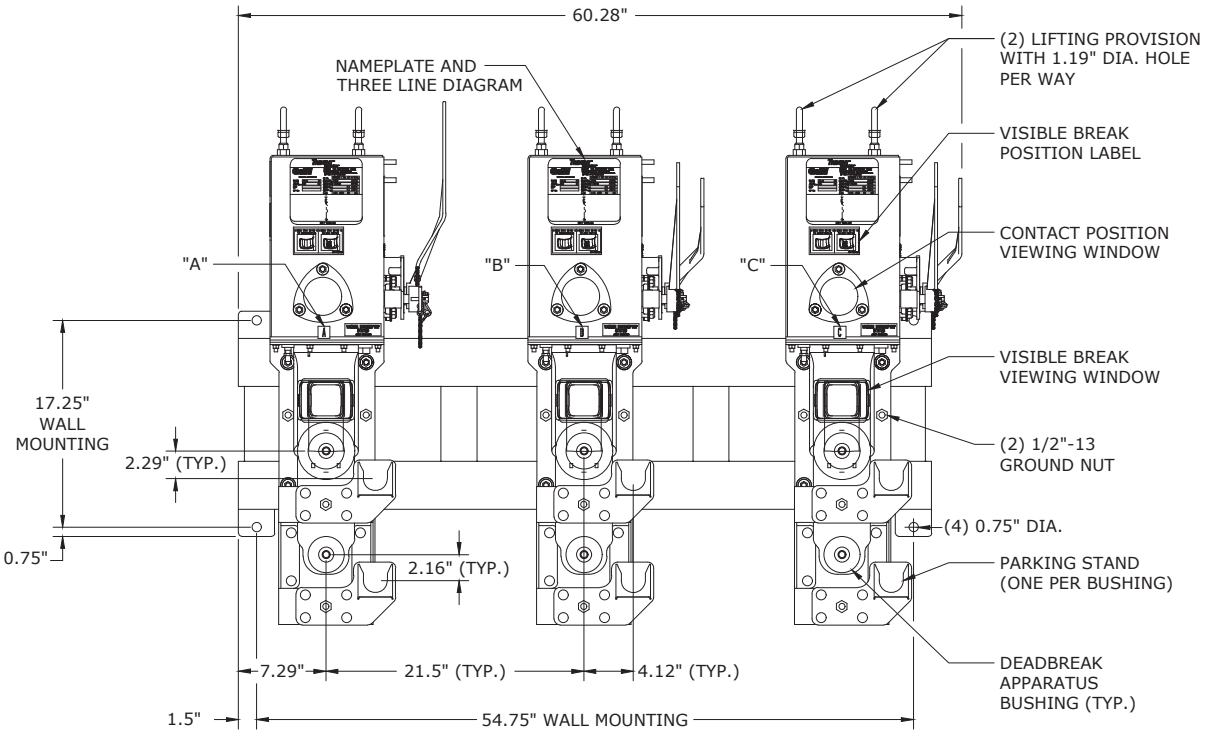
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

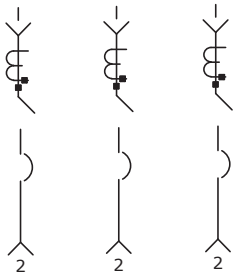
S&C 15/25KV FAULT INTERRUPTER VAULT MOUNTED VISTA SD MODEL 303 WITH SUBMERSIBLE S1000 CONTROL

DEC	DEM	DEP	DEF
			X

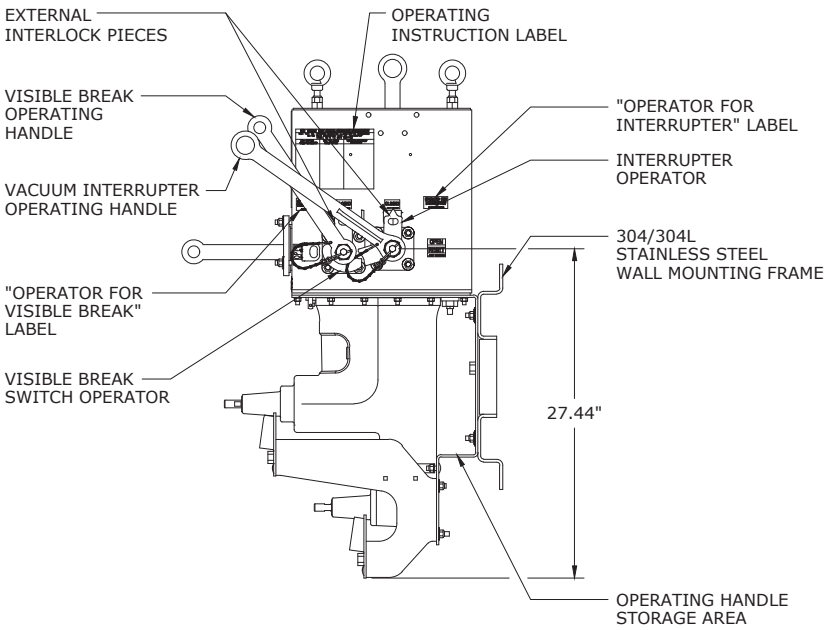
28.05-139D



FRONT VIEW



ONE LINE DIAGRAM



RIGHT SIDE VIEW

NOTES:

1. SEE DWG. 28.05-141B FOR NOTES.
2. SEE DWG. 28.05-141C FOR TYPE 4 CONTROL BOX FRONT AND BOTTOM VIEWS.
3. SEE DWG. 28.05-141D FOR JUNCTION BOX FRONT AND BOTTOM VIEWS.
4. SEE DWG. 28.05-141E FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV THREE-PHASE INTERRUPTER WITH SINGLE PHASE TRIP CAPABILITY VAULT-MOUNTED SOLID DIELECTRIC 2-WAY TYPE 4 SUBMERSIBLE CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-141A

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.

3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.

4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.

5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.

6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.

7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.

8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.

9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.

10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.

11. SEE DWG. 28.05-141A FOR TERMINATION VIEW, SIDE VIEW AND ONE LINE DIAGRAM.

12. SEE DWG. 28.05-141C FOR TYPE 4 CONTROL BOX FRONT AND BOTTOM VIEWS.

13. SEE DWG. 28.05-141D FOR JUNCTION BOX FRONT AND BOTTOM VIEWS.

14. SEE DWG. 28.05-141E FOR BILL OF MATERIALS.

15. ALL WAYS ARE EQUIPPED WITH INTERNAL SPRING OPERATOR AND EXTERNAL PROVISIONS FOR LOCKING IN ALL POSITIONS.

16. SWITCH IS EQUIPPED WITH EXTERNAL INTERLOCKS TO PROVIDE OPERATION SEQUENCE. INTERNAL INTERLOCK PREVENTS OPENING OF DISCONNECT SWITCH UNLESS INTERRUPTER IS OPENED.

17. MOUNTING INFORMATION: THE SWITCH MUST BE SECURED VIA THE ANCHORING PROVISIONS PROVIDED FOR THIS PURPOSE. THE FRAME IS EQUIPPED WITH (4) ANCHORING HOLES, EACH MEASURING 0.75". THE LOCATION OF THESE HOLES, REFERRED TO AS "WALL MOUNTING", ARE SHOWN IN THE FRONT VIEW.

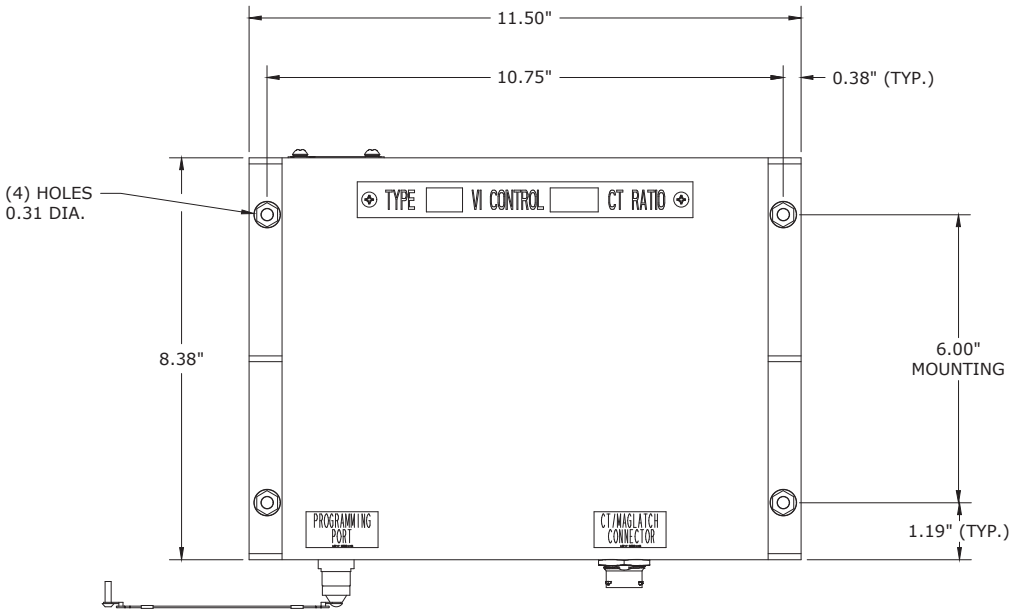
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

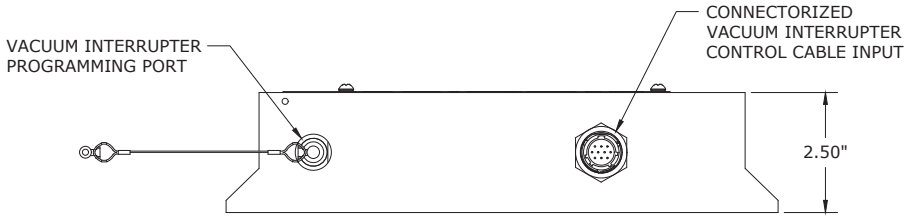
G&W 15KV THREE-PHASE INTERRUPTER WITH SINGLE PHASE TRIP CAPABILITY VAULT-MOUNTED SOLID DIELECTRIC 2-WAY TYPE 4 SUBMERSIBLE CONTROL

DEC	DEM	DEP	DEF
			X

28.05-141B



FRONT VIEW



BOTTOM VIEW

NOTES:

1. CONTACT PQRI TECH/DPAC FOR PROGRAMMING OF OVERCURRENT CONTROL BASED ON THE SITE'S SPECIFIC APPLICATION.
2. SEE DWG. 28.05-141A FOR TERMINATION VIEW, SIDE VIEW, AND ONE LINE DIAGRAM.
3. SEE DWG. 28.05-141B FOR NOTES.
4. SEE DWG. 28.05-141D FOR JUNCTION BOX.
5. SEE DWG. 28.05-141E FOR BILL OF MATERIALS.

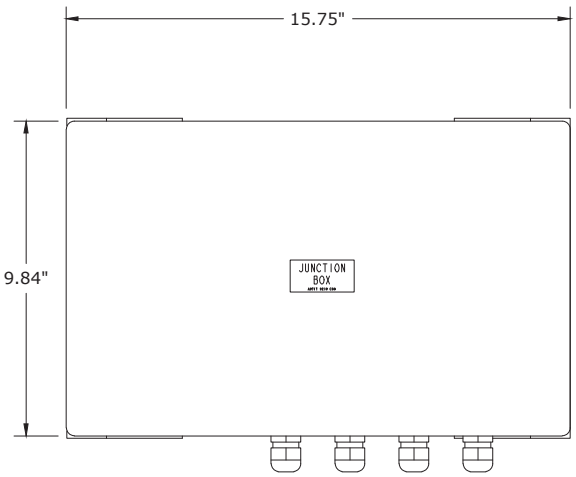
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV THREE-PHASE INTERRUPTER WITH SINGLE-PHASE TRIP CAPABILITY VAULT-MOUNTED SOLID DIELECTRIC 2-WAY TYPE 4 SUBMERSIBLE CONTROL

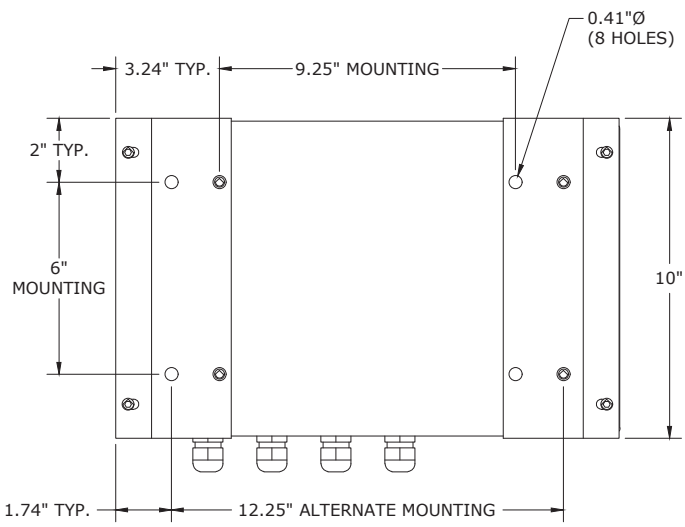
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

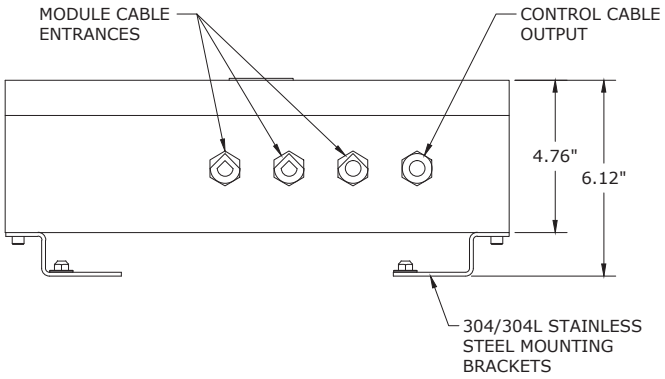
28.05-141C



FRONT VIEW
JUNCTION BOX



BACK VIEW
JUNCTION BOX



BOTTOM VIEW
JUNCTION BOX

NOTES:

1. SEE DWG. 28.05-141A FOR TERMINATION VIEW, SIDE VIEW AND ONE LINE DIAGRAM.
2. SEE DWG. 28.05-141B FOR NOTES.
3. SEE DWG. 28.05-141C FOR TYPE 4 CONTROL BOX FRONT AND SIDE VIEWS.
4. SEE DWG. 28.05-141E FOR BILL OF MATERIALS.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV THREE-PHASE INTERRUPTER WITH SINGLE-PHASE TRIP CAPABILITY VAULT-MOUNTED SOLID DIELECTRIC 2-WAY TYPE 4 SUBMERSIBLE CONTROL

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-141D

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-15KV-1VFI/600-1B/600-SD-F	1	1572050	1	SWITCHGEAR, VAULT MOUNT, SOL DIELECTRIC, 15KV, 95KV BIL, 600A 3PH,FAULT INTERRUPTER W/ 1PH TRIP, TYPE 4 CONTROL, TWO-WAY
SEE NOTE 3	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 4	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26

NOTES:

1. NEW VAULT ONLY.
2. ONLY IF NORMAL OPEN POINT EXISTS, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.
3. FOR EXISTING VAULTS CONNECT 2/0 COPPER CONDUCTOR TO EITHER SIDE OF EQUIPMENT GROUNDING BAR AND ATTACH TO EXISTING 4/0 CU GROUND ELECTRODE CONDUCTOR IN THE VAULT.
4. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATE A VISIBLE OPEN WINDOW. OTHER OPTIONS IS USING A 600-200AMP BUSHING ADAPTER (ITEM 1563341) AND LOADBREAK ELBOW.

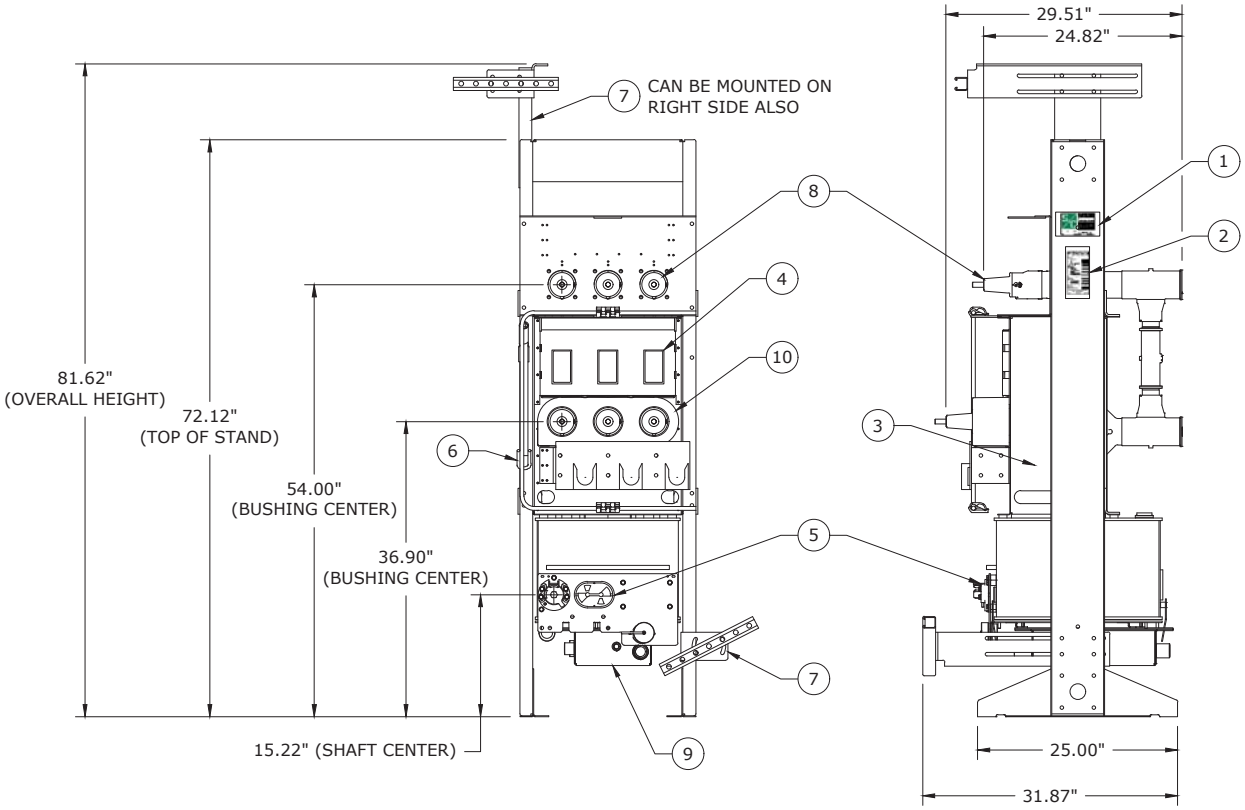
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV THREE-PHASE FAULT INTERRUPTER WITH SINGLE-PHASE TRIP CAPABILITY VAULT MOUNTED SOLID DIELECTRIC 2-WAY TYPE 4 SUBMERSIBLE CONTROL

DEC	DEM	DEP	DEF
			X

28.05-141E

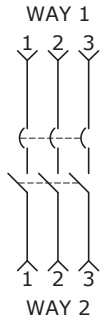


TERMINATION VIEW

SIDE VIEW

FEATURES:

1. NAMEPLATE
2. RATING LABELS
3. 600 AMPERE THREE-POLE FAULT INTERRUPTER
4. ISOLATING DISCONNECT VIEWING WINDOW
5. OPERATING MECHANISM WITH OPEN/RESET AND CLOSE INDICATORS, AND MIMIC BUS (GREEN: OPEN/RESET; RED: CLOSED)
6. MANUAL HANDLE (IN STORAGE POSITION)
7. CABLE SUPPORT BRACKETS (SHIPPED DISASSEMBLED)
8. 600 AMPERE BUSHINGS WITH STUDS
9. S&C OVERCURRENT CONTROL
10. CURRENT TRANSFORMER



CONNECTION DIAGRAM MODEL 101

NOTES:

1. SEE DWG. 28.05-143B FOR ANCHOR BOLT PLAN.

2. SEE DWG. 28.05-143C FOR NOTES.

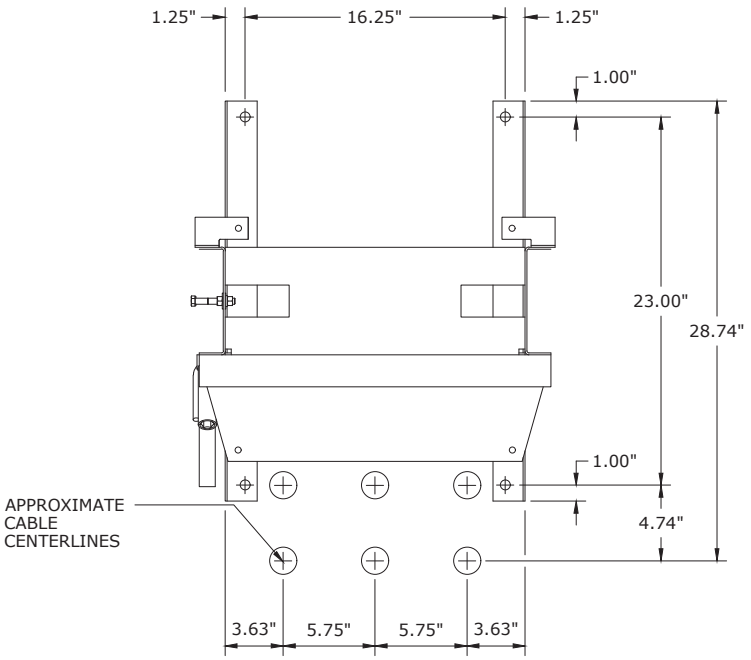
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15/25KV FAULT INTERRUPTER
VAULT-MOUNTED VISTA SD MODEL 101
WITH SUBMERSIBLE S1000 CONTROL OVERCURRENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-143A



ANCHOR BOLT PLAN

NOTES:

1. SEE DWG. 28.05-143A FOR FRONT VIEW, SIDE VIEW AND WIRING DIAGRAM.

2. SEE DWG. 28.05-143C FOR NOTES.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

S&C 15/25KV FAULT INTERRUPTER
VAULT-MOUNTED VISTA SD MODEL 101
WITH SUBMERSIBLE S1000 CONTROL OVERCURRENT

DEC	DEM	DEP	DEF
X	X	X	X

28.05-143B

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP. SEE DWG. 28.05-100 FOR DETAIL.
3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.
4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.
5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.
6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.
7. IF ARRESTERS ARE REQUIRED ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.
8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.
9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.
10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.
11. SEE DWG. 28.05-143A FOR FRONT VIEW, SIDE VIEW AND CONNECTION DIAGRAM.
12. SEE DWG. 28.05-143B FOR ANCHOR BOLT PLAN.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

S&C 15/25KV FAULT INTERRUPTER
VAULT-MOUNTED VISTA SD MODEL 101
WITH SUBMERSIBLE S1000 CONTROL - NOTES

DEC	DEM	DEP	DEF
X	X	X	X

28.05-143C

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-27KV-1VFI/600-SD-SUB-STAND-3S-F	3	1525091	1	SWITCHGEAR, VAULT MOUNT, SOL DIELECTRIC, 27KV, 125KV BIL, 600A, 12.5KA INTERRUPTING CAPACITY, 3PH
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 3	ELBOW-T-VARIES	6	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26

NOTES:

1. NEW VAULT ONLY.

2. ONLY IF NORMAL OPEN POINT EXISTS, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.

3. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATE A VISIBLE OPEN WINDOW. OTHER OPTION IS USING A 600-200AMP BUSHING ADAPTER (ITEM #1563341) AND LOADBREAK ELBOW.

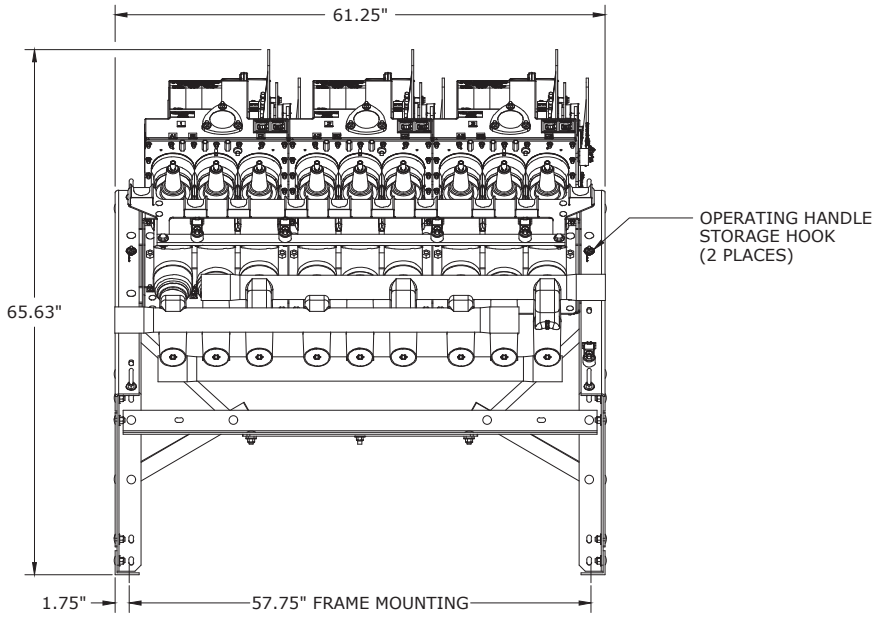
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

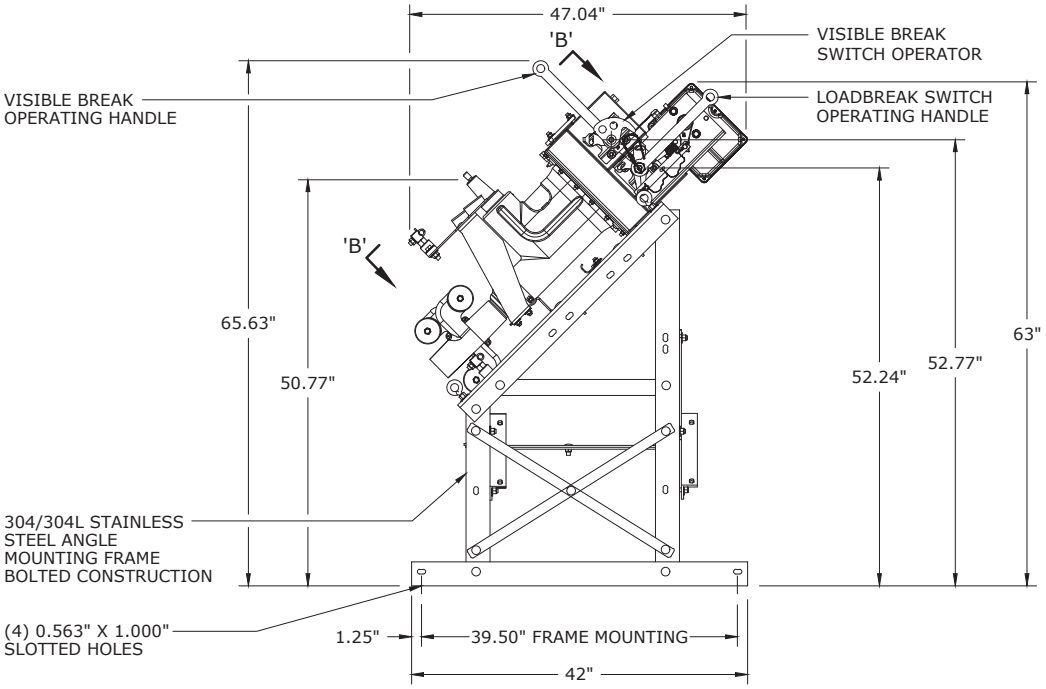
S&C 15/25KV FAULT INTERRUPTER
VAULT-MOUNTED VISTA SD MODEL 101
WITH SUBMERSIBLE S1000 CONTROL OVERCURRENT

DEC	DEM	DEP	DEF
			X

28.05-143D



FRONT VIEW



RIGHT SIDE VIEW

NOTES:

1. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
2. SEE DWG. 28.05-145C FOR NOTES.
3. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
4. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
5. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
6. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
7. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

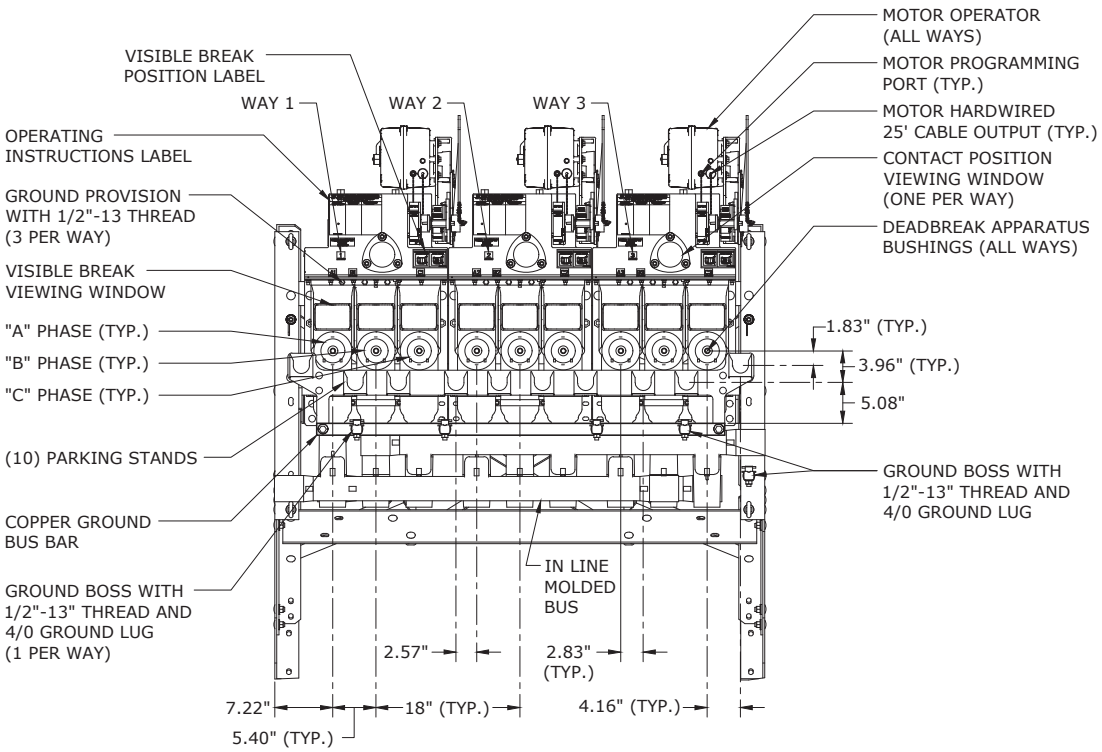
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH

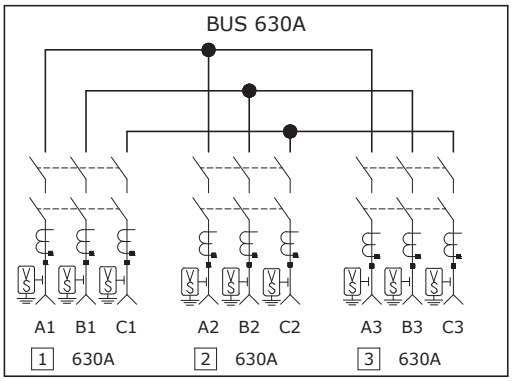
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-145A



SECTION 'B'-'B'



THREE-LINE DIAGRAM

NOTES:

1. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
2. SEE DWG. 28.05-145C FOR NOTES.
3. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
4. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
5. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
6. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
7. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH

DEC	DEM	DEP	DEF
			X

28.05-145B

NOTES:

1. ALL WAYS EQUIPPED WITH INTERNAL SPRING OPERATOR AND EXTERNAL PROVISIONS FOR PADLOCKING IN IN ALL POSITIONS.
2. SWITCH IS EQUIPPED WITH EXTERNAL INTERLOCKS TO PROVIDE OPERATION SEQUENCE. INTERNAL INTERLOCK PREVENTS OPENING OF DISCONNECT SWITCH UNLESS INTERRUPTER IS OPENED.
3. SWITCH MUST BE BOLTED DOWN USING 1/2" HARDWARE ON ALL CORNERS OF FRAME TO PREVENT SWITCH FROM TIPPING.
4. THE SWITCH MUST BE SECURED VIA THE ANCHORING PROVISIONS PROVIDED FOR THIS PURPOSE. THE FRAME IS EQUIPPED WITH (4) SLOTTED ANCHORING HOLES, EACH MEASURING 0.563" X 1.000". THE LOCATIONS OF THESE HOLES REFERRED TO AS "FRAME MOUNTING" ARE SHOWN IN THE FRONT VIEW AND RIGHT VIEW.
5. SWITCH IS EQUIPPED WITH ONE NEMA 6P JUNCTION BOX FOR ALTERNATE POWER. JUNCTION BOX INCLUDES WATER PROOF CONNECTION TO CONTROL AND MALE 120VAC RECEPTACLE.
6. INSTALL (4) 5' SECTIONS OF GROUND RODS THROUGH GROUNDING PROVISION IN VAULT FLOOR.
7. BUILD A GROUND LOOP BY ATTACHING 2/0 CU CONDUCTOR TO EACH END OF THE SWITCH GROUNDING BAR.
8. BOND SWITCHGEAR GROUND BAR TO 5/8" GROUND RODS.
9. T-BODY CONNECTIONS INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR.
10. IF SWITCH HAS A NORMALLY OPEN 600 AMP SWITCH, ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH.
11. IF ARRESTERS ARE REQUIRED, ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCH GROUNDING BAR.
12. IF THE CONTROL AND SWITCH ARE MOUNTED SEPARATELY BUT WITHIN 6' OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CONDUCTOR.
13. INSTALL INSULATING CAPS ON ALL UNUSED 600 AMPS BUSHINGS.
14. USE FAULT INDICATORS ON CABLE CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES.
15. CONTROL WILL USE EXTERNAL POWER SUPPLY FROM NETWORK.
16. SCADA CONTROLLED DEVICE.
17. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
18. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
19. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
20. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
21. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
22. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
23. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
24. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

DUKE ENERGY.

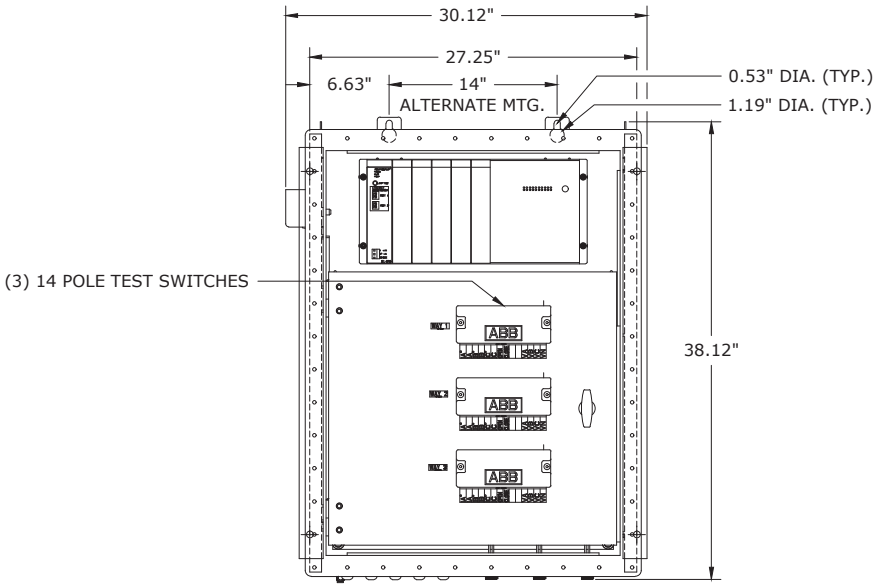
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH

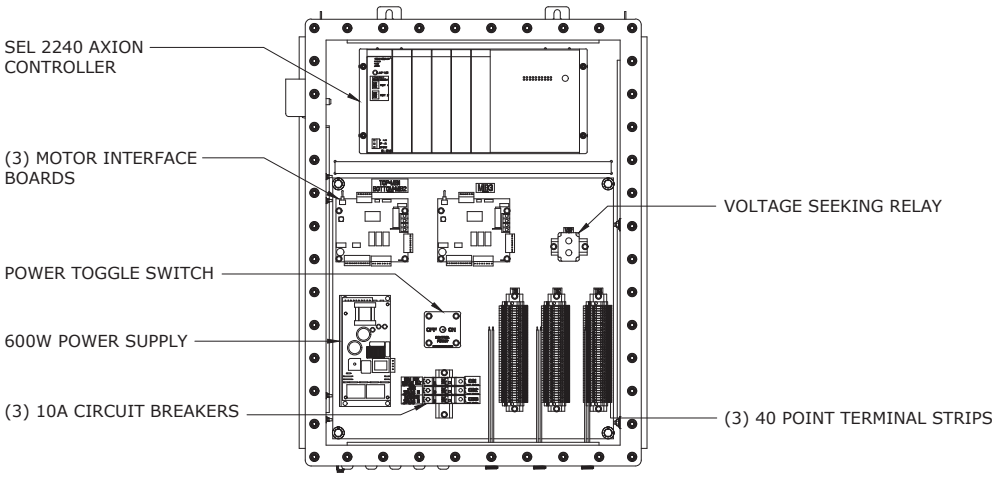
NOTES

DEC	DEM	DEP	DEF
			X

28.05-145C



CONTROL ENCLOSURE VIEW
(WITH FRONT COVER REMOVED FOR CLARITY)



CONTROL ENCLOSURE VIEW
(WITH FRONT COVER AND SWING PANEL REMOVED FOR CLARITY)

NOTES:

1. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
2. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
3. SEE DWG. 28.05-145C FOR NOTES.
4. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
5. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
6. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
7. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

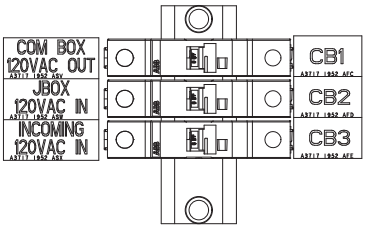
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

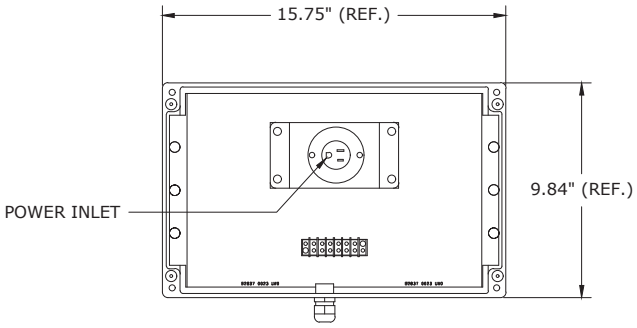
G&W 15KV VAULT MOUNTED THREE-WAY SWITCH
CONTROL CABINET WITH AXION RELAY

DEC	DEM	DEP	DEF
			X

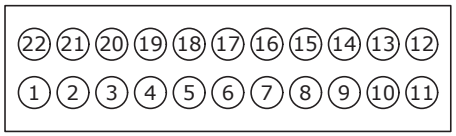
28.05-145D



POWER DETAIL



ALTERNATE POWER JUNCTION BOX



CONTROL BOX BOTTOM VIEW

LEGEND

1. GROUND BUS
2. 120 VAC POWER FROM JUNCTION BOX (ALT)
3. WAY 1 CURRENT TRANSFORMER
4. WAY 2 CURRENT TRANSFORMER
5. WAY 3 CURRENT TRANSFORMER
6. WAY 1 MOTOR INTERNAL FEEDBACK STATUS
7. WAY 1 AUXILIARY/ VISIBLE BREAK CONTACT
8. WAY 2 MOTOR INTERNAL FEEDBACK STATUS
9. WAY 2 AUXILIARY/ VISIBLE BREAK CONTACT
10. WAY 3 MOTOR INTERNAL FEEDBACK STATUS
11. WAY 3 AUXILIARY/ VISIBLE BREAK CONTACT
12. WAY 3 VOLTAGE SENSING
13. WAY 3 MOTOR CONNECTION
14. WAY 2 VOLTAGE SENSING
15. WAY 2 MOTOR CONNECTION
16. WAY 1 VOLTAGE SENSING
17. WAY 1 MOTOR CONNECTION
18. CUSTOMER 120 VAC OUTPUT TO COMM BOX
19. CUSTOMER 120 VAC INPUT FROM NETWORK
20. ETHERNET CONNECTION-FIBER
21. SPARE STRAIN RELIEF
22. SPARE STRAIN RELIEF

NOTES:

1. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
2. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
3. SEE DWG. 28.05-145C FOR NOTES.
4. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
5. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
6. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
7. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

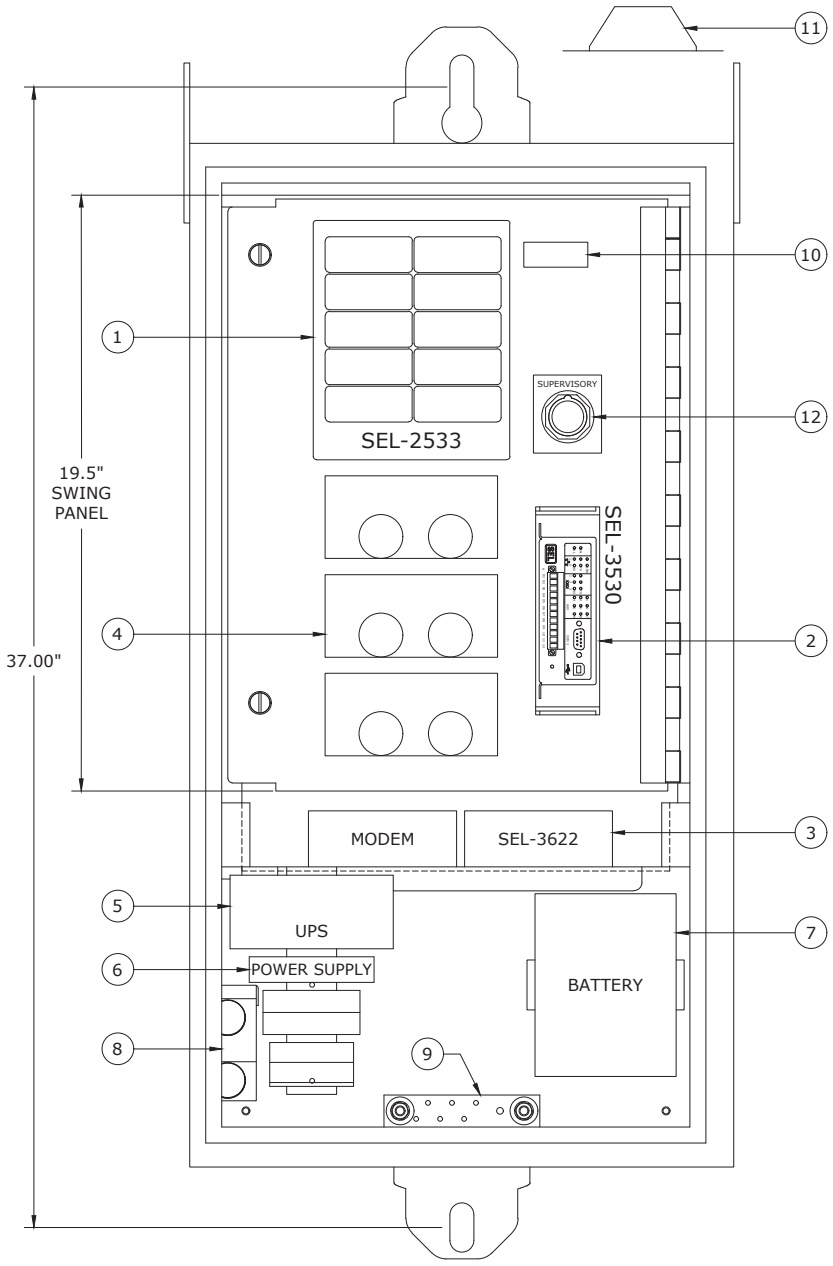
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH CONTROL CABINET CONNECTIONS

DEC	DEM	DEP	DEF
			X

28.05-145E



1	ANNUNCIATOR SEL 2533
2	AUTOMATION CONTROLLER SEL 3505-3
3	SECURITY GATEWAY SEL 3622
4	CONTROL SWITCH MODULE SEL 9510
5	POWER SUPPLY, TRIO UPS
6	CONVERTER MINI-PS-12
7	BATTERY
8	DUPLEX RECEPTACLE GFCI
9	GROUNDING BUS
10	DOOR SWITCH
11	ANTENNA
12	SUPERVISORY PUSHBUTTON

FRONT VIEW
(EXTERIOR DOOR REMOVED)

NOTES:

1. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
2. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
3. SEE DWG. 28.05-145C FOR NOTES.
4. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
5. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
6. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
7. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.
9. CABINET COULD BE MOUNTED ON A FIBERGLASS POLE.

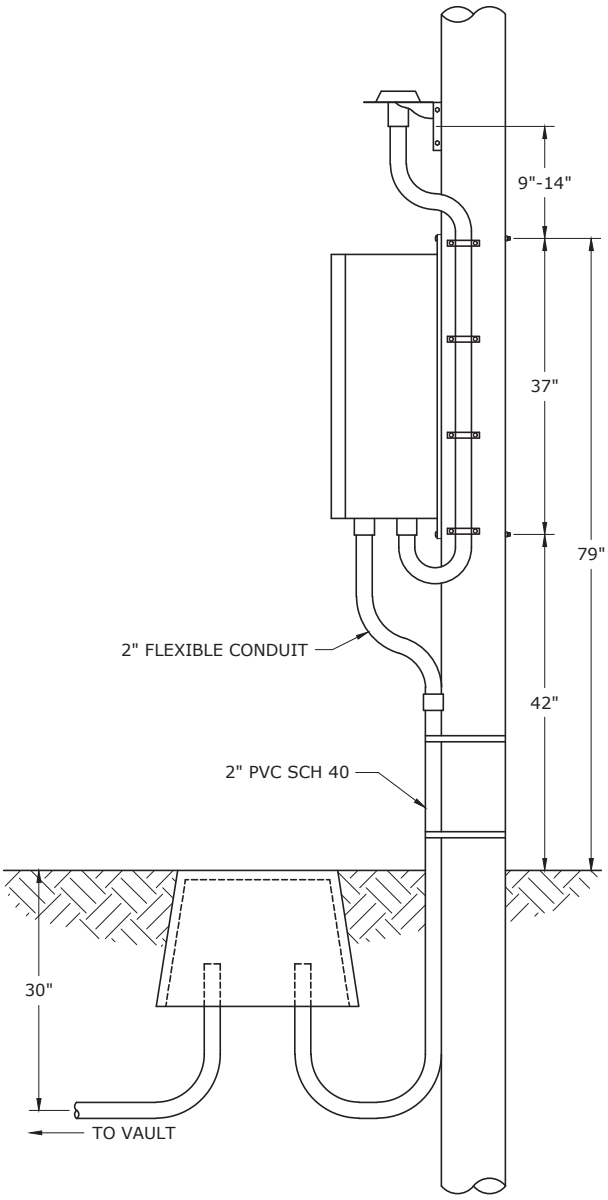
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH
CONTROL / COMMUNICATIONS CABINET

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

28.05-145F



CABINET INSTALLATION SIDE VIEW

NOTES:

1. FOR MOUNTING CONTROL/COMM BOX ON FIBERGLASS POLE USE CU POLE-FG-10-CTRL-F. SEE DWG. 28.02-144 FOR CABINET INSTALLATION.
2. RUN POWER, GROUND AND FIBER USE EXISTING CONDUIT FROM VAULT TO CONTROL/COMMUNICATIONS BOX.
3. SEE DWG. 28.05-145I NOTE 1 FOR ALTERNATE MOUNTING ON FIBERGLASS POLE.
4. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
5. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
6. SEE DWG. 28.05-145C FOR NOTES.
7. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
8. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
9. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
10. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
11. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

DUKE ENERGY.

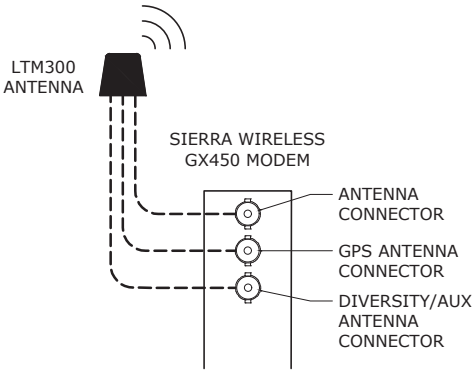
REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH CONTROL/COMMUNICATIONS CABINET INSTALLATION

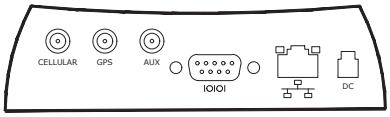
DEC	DEM	DEP	DEF
			X

28.05-145G

ANTENNA

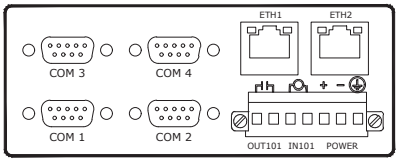


MODEM GX450



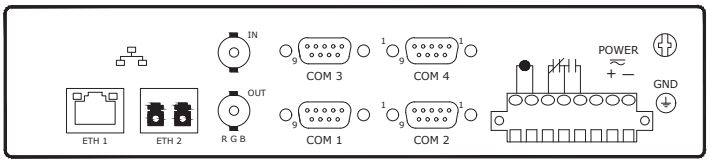
CELLULAR, GPS, AND AUX TO ANTENNA (ANTENNA WIRES)
ETH TO SEL-3622 ETH-1 (CAT-5E)

SEL-3622 SECURITY GATEWAY



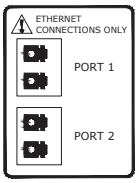
ETH-1 TO MODEM ETH (CAT-5E)
ETH-2 TO SEL 3530-4 ETH 1 (CAT-5E)

SEL-3530-4 RTAC



ETH-1 TO SEL-3622 ETH-2 (CAT-5E)
ETH-2 TO AXION SEL-2240 PORT 1 (SEL-C808-FIBER)
COM1 TO ANNUNCIATOR PORT 3 (SEL-C273A CABLE)

AXION SEL-2240



PORT 1 TO AXION SEL-3530-4 ETH 2 (SEL-C808-FIBER)

POWER TO ENCLOSURE

FROM TERMINAL 1 ON TB2 TO TS1 PIN 35 ON SWITCH CONTROL (120VAC-L OUT)
FROM TERMINAL 1 ON TB2 TO TS1 PIN 36 ON SWITCH CONTROL (120VAC-N OUT)

NOTES:

1. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
2. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
3. SEE DWG. 28.05-145C FOR NOTES.
4. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
5. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
6. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
7. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
8. SEE DWG. 28.05-145I FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH CONTROL/COMMUNICATIONS CABINET CONNECTIONS

DEC	DEM	DEP	DEF
			X

28.05-145H

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-15KV-3VI/600-SD-MO-F	1	1549411	1	SWITCHGEAR, 3-WAY VAULT, SOL DIELECTRIC, 15KV, 600A BUSHING, MOTOR OPERATED, W/ SEL-2240 AXION AUTO
-	CTRL-SG-VLT-COMM-S3530-3WAY-F	1	1567637	1	CONTROL/COMMUNICATION CABINET FOR 3 WAY SWITCH
			938975	2	WASHER, SQ CURVED, 3", 13/16" ID, 3" OD, 1/4" THK, GALV STEEL
			930030	2	WASHER, LOCK, DBL COIL SPRING, 5/8", GALV STEEL
-	HDWR-MACH-SM-12IN-GALV-F	2	931563	1	BOLT, MACHINE, SQ, NUT, 5/8" X 12"
-	-	*	1517091	1	MODEM, CELLULAR, W/DC POWER CABLE
-	-	*	4206198	1	ANTENNA, MODEM, SMA CONNECTOR W/ 15' CABLE
-	-	*	1523226	1	KIT, MOUNTING, F/ ANTENNA MOBILE MARK LTM300, W/ POLE BRACKET, 8" GROUND PLANE, FLEX CONDUIT, FITTING & STRAP
-	COND-COIL-2IN-FLEX-F	3	900113	1 FT	CONDUIT, FLEXIBLE, 2", 250' LG, GRAY PVC, COVERED, PLAIN, 2.045" ID X 2.375" OD
-	COND-HUB-2IN-FLEX-MALE-F	1	1564270	1	CONNECTOR, CABLE/CONDUIT, FLEXIBLE, ETP, LA150, 2" STRAIGHT
-	COND-STICK-2IN-PVC-SCH40-F	3	4005380	1 FT	CONDUIT, 2", 20' LG, SCH 40, PVC, W/ COUPLINGS OR BELLED END PER FPC SPEC MS-117. STD PACKAGE IS 2800 FEET
-	COND-CPLG-2IN-PVC-F	2	5011966	1	COUPLING, CONDUIT, STD RIGID, 2", SOCKET, PVC, STD PKG/25
-	COND-BEND-2IN-PVC-90DEG-R18-F	2	4005433	1	ELBOW, CONDUIT, 2", PVC, 90 DEG, 24" RADIUS
-	PED-HH-MD-POLY-F	1	4005455	1	BOX, ELECTRICAL, SECONDARY JUNCTION, 11" X 18", POLYCRETE, LIGHT TRAFFIC RATED (NOT F/ STREET)
-	CONN-UG-HH-SUB-350-4POS-F	2	4004778	1	CONNECTOR UG HANDHOLE SUBMERSIBLE 350-10 LINE TO 4 POSITION SINGLE SET SCREW
-	CTRL-CABLE-10-CU-DX-PWR-F	60	4003512	1	WIRE/CABLE, ELECTRICAL, STREET LIGHT, 2 CONDUCTOR, 10 AWG, CU CONDUCTOR, STR, XLPE INSULATION, 500' REEL
-	GND-EQUIP/EQUIP-6-BOND-F	60	234664	1	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, PER DUKE POWER SPEC CS-26 DATED, 25
-	POLE-BAND-STRAP-SM-STL-F	2	1490605	1	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 316 SS, 1800 LB
-	POLE-BAND-STRAP-BUCKLE-SM-STL-F	2	1490606	1	BUCKLE, BANDING, 3/4" WD, SS, MRO ITEM ONLY
SEE NOTE 11	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER CLASS B
-	ELBOW-T-VARIES	9	-	1	TERMINATOR, ELBOW 600 A 15KV, SEE SECTION 26
SEE NOTE 10	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEADFRONT, PAD-MOUNTED DEADFRONT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT

* INSTALLED DURING PROVISIONING/ COMMISSIONING

NOTES:

1. FOR MOUNTING CONTROL/COMM BOX ON FIBERGLASS POLE USE CU POLE-FG-10-CTRL-F. SEE DWG. 28.02-144 FOR CABINET INSTALLATION.
2. SEE DWG. 28.05-145A FOR FRONT AND RIGHT SIDE VIEWS.
3. SEE DWG. 28.05-145B FOR WIRING DIAGRAM AND SECTION 'B'-'B'.
4. SEE DWG. 28.05-145C FOR NOTES.
5. SEE DWG. 28.05-145D FOR CONTROL ENCLOSURE VIEWS.
6. SEE DWG. 28.05-145E FOR POWER DETAIL, ALTERNATE POWER JUNCTION BOX AND CONTROL BOX BOTTOM VIEW.
7. SEE DWG. 28.05-145F FOR CONTROL/COMMUNICATIONS ENCLOSURE DETAILS.
8. SEE DWG. 28.05-145G FOR CONTROL/COMMUNICATIONS CABINET POLE INSTALLATION.
9. SEE DWG. 28.05-145H FOR CONTROL/COMMUNICATIONS CABINET CONNECTIONS.
10. INSTALL ARRESTERS IF SWITCH HAS A NORMAL OPEN POINT. ARRESTERS TO BE INSTALLED ON OPEN POINT AND ON ONE ADDITIONAL WAY.
11. FOR EXISTING VAULTS.

DUKE ENERGY.

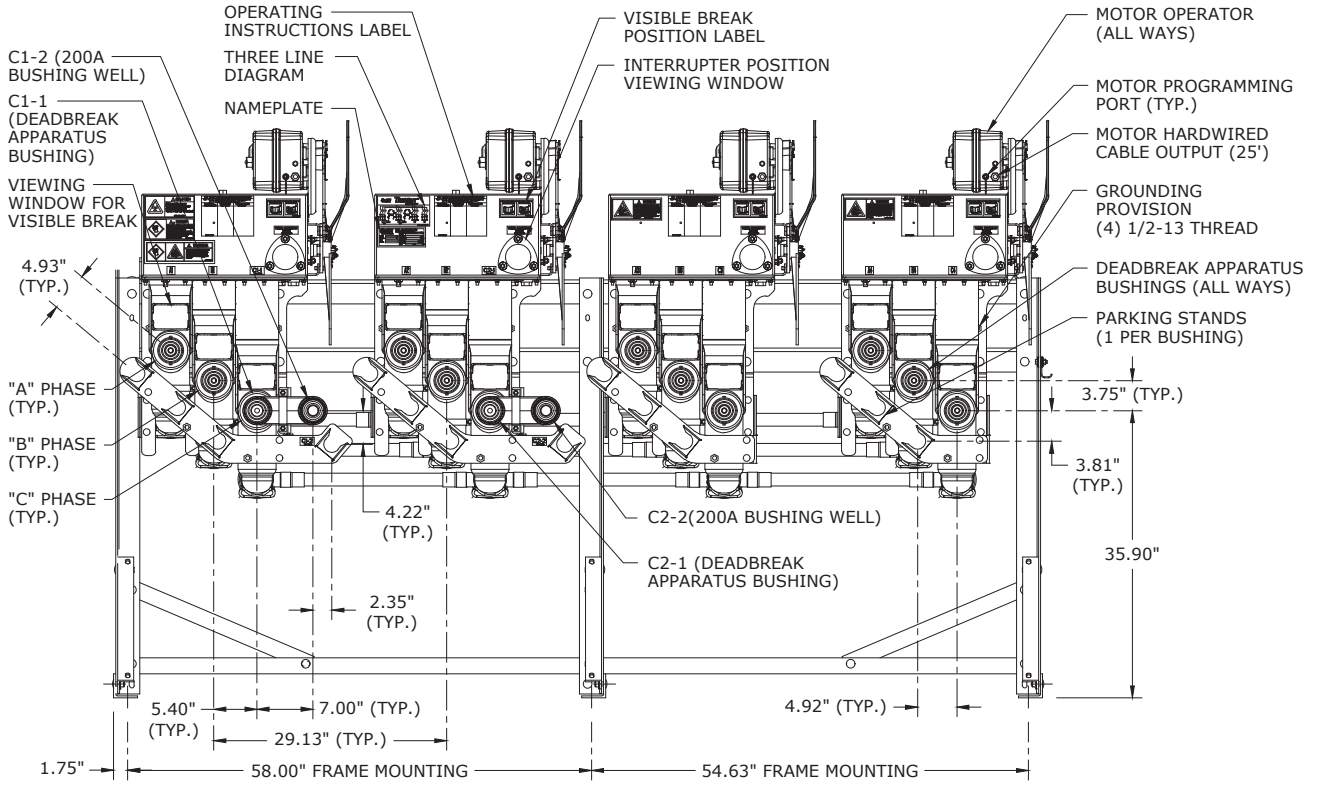
3					
2					
1					
0	1/31/19	DANNA	EANES	ADCOCK	
REVISED		BY	CHK'D	APPR.	

G&W 15KV VAULT MOUNTED THREE-WAY SWITCH

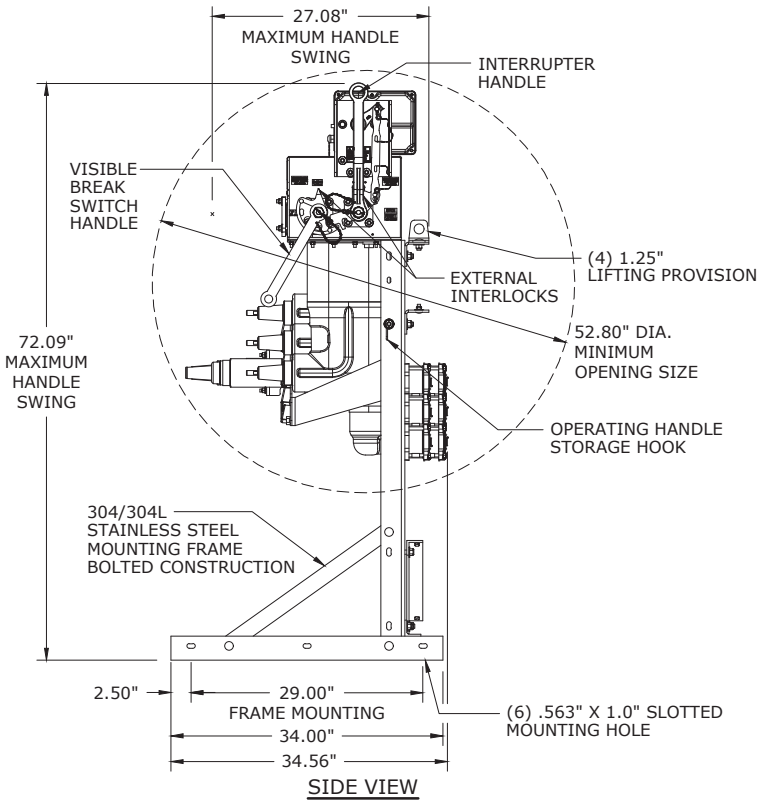
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

28.05-145I



TERMINATION VIEW



SIDE VIEW

NOTES:

1. SEE DWG. 28.05-147B FOR WIRING DIAGRAM AND NOTES.
2. SEE DWG. 28.05-147C FOR NOTES.
3. SEE DWG. 28.05-147D FOR CONTROL ENCLOSURE AND PENDANT CONTROL ENCLOSURE.
4. SEE DWG. 28.05-147E FOR CONTROL BILL OF MATERIALS.

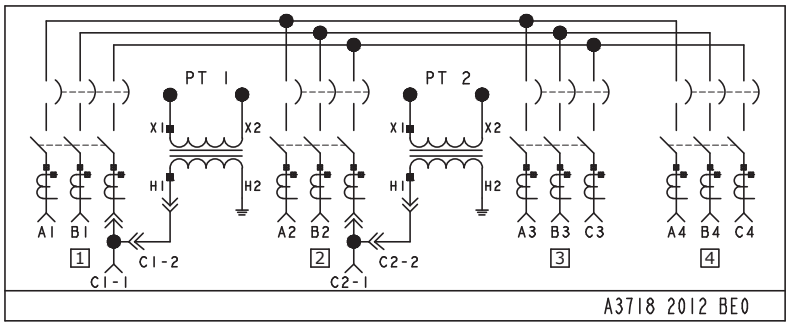
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT-MOUNTED SOLID DIELECTRIC ATO WITH 2 SUBMERSIBLE SEL 451 CONTROLS

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.05-147A



WIRING DIAGRAM

WAYS 1 & 2 ARE SOURCE

WAYS 3 & 4 ARE LOAD

ALL WAYS ARE EQUIPPED WITH INTERNAL SPRING OPERATORS AND EXTERNAL PROVISIONS FOR PADLOCKING IN ALL POSITIONS.

SWITCH IS EQUIPPED WITH A HANDHELD PENDANT CONTROL. THE PENDANT CONTROL IS EQUIPPED WITH A NEMA 4X FIBERGLASS ENCLOSURE. PUSH BUTTONS FOR OPEN AND CLOSE OPERATION, OPERATION SELECTOR SWITCH, AUTO/MANUAL MODE SELECTION, LOCAL/REMOTE SELECTION, AC POWER STATUS, CLOSED AND OPEN/TRIP INDICATION AND LEDS FOR OPERATING MODES. THE PENDANT CONTROL IS CONNECTED TO THE AUTOMATIC TRANSFER/MOTOR CONTROL USING 50 FT HARDWIRED CABLES.

SWITCH IS EQUIPPED WITH EXTERNAL INTERLOCKS TO PROVIDE OPERATION SEQUENCE. INTERNAL INTERLOCK PREVENTS OPENING OF DISCONNECT SWITCH UNLESS INTERRUPTER IS OPENED.

SWITCH MUST BE BOLTED DOWN USING 1/2" HARDWARE ON ALL CORNERS OF FRAME TO PREVENT SWITCH FROM TIPPING.

MOUNTING INFORMATION: THE SWITCH MUST BE SECURED VIA THE ANCHORING PROVISIONS PROVIDED FOR THIS PURPOSE. THE FRAME IS EQUIPPED WITH (6) SLOTTED ANCHORING HOLES, EACH MEASURING 9/16" X 1". THE LOCATIONS OF THESE HOLES, REFERRED TO AS "FRAME MOUNTING", ARE SHOWN IN THE FRONT VIEW AND SIDE VIEW.

NOTES:

1. SEE DWG. 28.05-147A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 28.05-147C FOR NOTES.
3. SEE DWG. 28.05-147D FOR CONTROL ENCLOSURE AND PENDANT CONTROL ENCLOSURE.
4. SEE DWG. 28.05-147E FOR CONTROL BILL OF MATERIALS.

DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT-MOUNTED SOLID DIELECTRIC ATO WITH 2 SUBMERSIBLE SEL 451 CONTROLS

DEC	DEM	DEP	DEF
X	X	X	X

28.05-147B

NOTES:

1. BOND THE SWITCHGEAR STRUCTURE TO THE VAULT GROUND LOOP BY ATTACHING A 2/0 CU CONDUCTOR TO EACH END OF THE SWITCHGEAR GROUNDING BAR(S) AND VAULT GROUND LOOP. FOR DETAIL.
2. FOR MODULAR GEAR BOND TO A PIECE OF 2/0 CU TO EACH WAY OF THE SWITCHGEAR AND ATTACH EACH END TO THE VAULT GROUND LOOP.
3. T-BODY CONNECTIONS FOR LC SHIELDED OR FLAT STRAP CABLE INCLUDE TWO GROUND BRAID LEADS. ATTACH EACH LEAD TO THE SWITCHGEAR GROUNDING BAR OR VAULT GROUND LOOP. ATTACH THE DRAIN WIRE ON THE T-BODY GROUND BRAID TO THE GROUNDING EYE ON THE T-BODY.
4. LOAD-BREAK ELBOW GROUND BRAIDS SHALL BE CONNECTED TO THE GROUNDING BAR OR 2/0 GROUND LOOP. ATTACH THE DRAIN WIRE TO THE GROUNDING EYE ON THE ELBOW. GROUND THE BUSHING INSERT USING EXCESS BLEEDER WIRE OR STOCK DRAIN WIRE.
5. FOR CONCENTRIC NEUTRAL CABLE EXTEND ONE STRAND TO THE ELBOW OR T-BODY. THE REMAINING STRANDS SHOULD BE BUNDLED TOGETHER AND ATTACHED TO THE GROUND BAR.
6. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF A NORMALLY OPEN SWITCH AND AT THE END OF A RADIAL FEED.
7. ATTACH ELBOW ARRESTER GROUND LEAD TO THE SWITCHGEAR GROUNDING BAR OR 2/0 GROUND LOOP.
8. IF THE CONTROL AND SWITCHGEAR ARE MOUNTED SEPARATELY BUT WITHIN 6 FT. OF EACH OTHER, BOND THE CONTROL AND SWITCHGEAR USING #6 CU CONDUCTOR.
9. INSTALL INSULATING CAPS ON ALL UNUSED 200 AND 600 AMP BUSHINGS.
10. USE OF FAULT INDICATORS ON CABLES CONNECTED TO NON-FAULT INTERRUPTING 600 AMP SWITCHES IS STANDARD FOR DEF; OPTIONAL FOR DEC/DEM/DEP.
11. SEE DWG. 28.05-147A FOR FRONT VIEW, SIDE VIEW AND CONNECTION DIAGRAM.
12. SEE DWG. 28.05-147B FOR ANCHOR BOLT PLAN.
13. SEE DWG. 28.05-147D FOR CONTROL ENCLOSURE AND PENDANT CONTROL ENCLOSURE.
14. SEE DWG. 28.05-147E FOR CONTROL BILL OF MATERIALS.

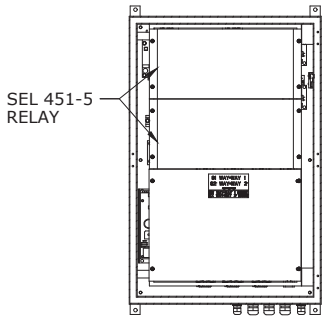
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

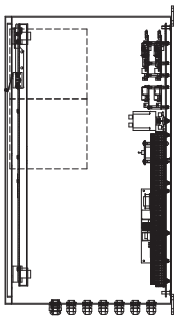
G&W 15KV VAULT-MOUNTED SOLID DIELECTRIC ATO WITH 2 SUBMERSIBLE SEL 451 CONTROLS

DEC	DEM	DEP	DEF
X	X	X	X

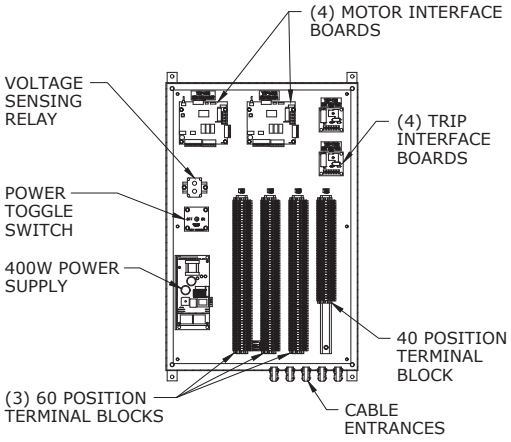
28.05-147C



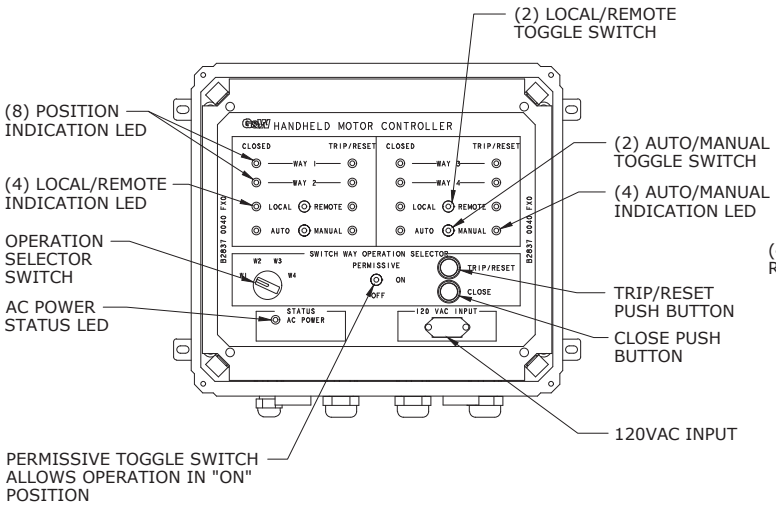
CONTROL ENCLOSURE
FRONT VIEW
(WITH DOOR NOT SHOWN
FOR CLARITY)



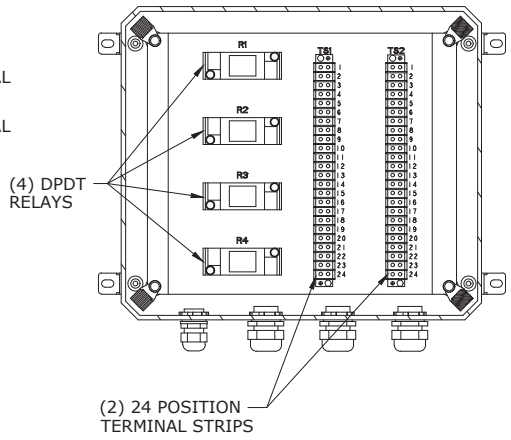
CONTROL ENCLOSURE
RIGHT SIDE VIEW



CONTROL ENCLOSURE VIEW
(WITH DOOR AND SWING PANEL
NOT SHOWN FOR CLARITY)
CONTROL WEIGHT APPROX: 200 LBS



PENDANT CONTROL ENCLOSURE VIEW
(WITH LID HIDDEN FOR CLARITY)



PENDANT CONTROL ENCLOSURE VIEW
(WITH LID AND TOP PANEL HIDDEN FOR CLARITY)

NOTES:

1. SEE DWG. 28.05-147A FOR FRONT AND SIDE VIEWS.
2. SEE DWG. 28.05-147B FOR WIRING DIAGRAM AND NOTES.
3. SEE DWG. 28.05-147C FOR NOTES.
3. SEE DWG. 28.05-147E FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

G&W 15KV VAULT-MOUNTED SOLID DIELECTRIC ATO
WITH 2 SUBMERSIBLE SEL 451 CONTROLS

DEC	DEM	DEP	DEF
X	X	X	X

28.05-147D

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	SG-VLT-15KV-2VFI/600-2VFI/600-SD-ATO-SUB-3S-F	1	1526170	1	SWITCHGEAR, AUTO TRANSFER, SOL DIELECTRIC, 15KV, 95KV BIL, 600A, 12.5KV INTERRUPTING CAPACITY, 3PH
-	GND-EQUIP-2/0-RING-3P-F	1	4022861	4	CONNECTOR, ELECTRICAL, COMP, 1/0-2/0 AWG (0.368-0.414) STR SIDE A- 2-2/0 AWG (0.414) STR CU SIDE B CONDUCTOR
			1502506	40	WIRE/CABLE, 2/0 AWG, CU, SOFT DRAWN, 19 STR, BARE COPPER, CLASS B
SEE NOTE 1	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 1	GND-ROD-UG-2/0-F	1	1572106	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 3/0 STR COND TO 5/8" GROUND ROD, CU
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD, THREADLESS, MFR ID TO BE STAMPED WITHIN 12"
SEE NOTE 2	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY LOADBREAK ELBOW, DEAD FRONT PAD MOUNT
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
SEE NOTE 3	ELBOW-T-VARIES	12	-	-	TERMINATOR, ELBOW 600A 15KV- SEE SECTION 26

NOTES:

1. NEW VAULT ONLY.

2. ARRESTERS ARE TO BE INSTALLED ON BOTH SIDES OF AN OPEN SWITCH.

3. DEADBREAK T-BODY CONNECTIONS CAN BE USED FOR LOAD SIDE CONNECTIONS WITH SWITCHGEAR THAT INCORPORATES A VISIBLE OPEN WINDOW. OTHER OPTION IS USING A 600-200AMP BUSHING ADAPTER (ITEM # 1563341) AND LOADBREAK ELBOW.

DUKE ENERGY.

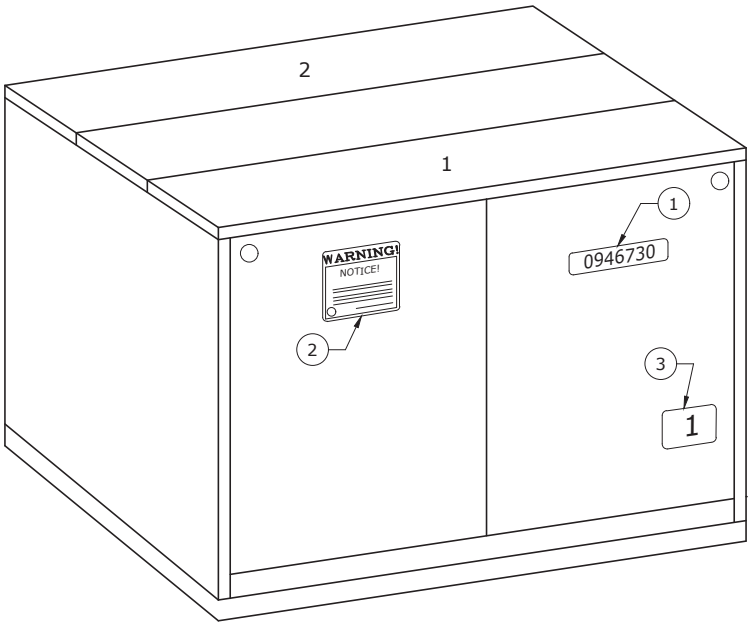
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

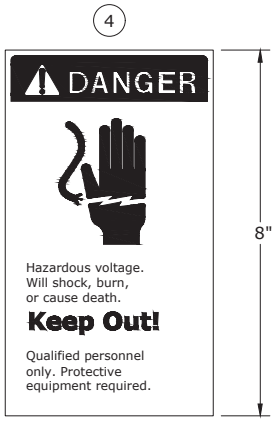
G&W 15KV VAULT-MOUNTED SOLID DIELECTRIC ATO WITH 2 SUBMERSIBLE SEL 451 CONTROLS

DEC	DEM	DEP	DEF
			X

28.05-147E

PAD-MOUNTED RECLOSER TAGGING AND LABELING





DANGER LABEL
ITEM # 4027964
INTERIOR MOUNTING ONLY

POSITION 1: SOURCE - 600 AMPS - A1-1, B1-1, C1-1 BUSHINGS
POSITION 2: LOAD - 600 AMPS - A2, B2, C2 BUSHINGS

NOTES:

1. INSTALL EQUIPMENT ID NUMBER ON OUTSIDE OF THE PAD-MOUNTED RECLOSER IN A PLACE THAT CAN BE EASILY READ FROM THE STREET OR ACCESS POINT.

2. INSTALL WARNING-NOTICE STICKER ON THE OUTSIDE OF THE DOOR, 1 EACH ON BOTH SIDES OF THE RECLOSER (ITEM # 4161096).

3. INSTALL POSITION NUMBERS ON THE OUTSIDE OF THE DOOR AS SHOWN.

4. ADD "DANGER LABEL" (ITEM # 4027964) ON INSIDE OF EACH COMPARTMENT DOOR FOR ALL PAD-MOUNTED RECLOSER.

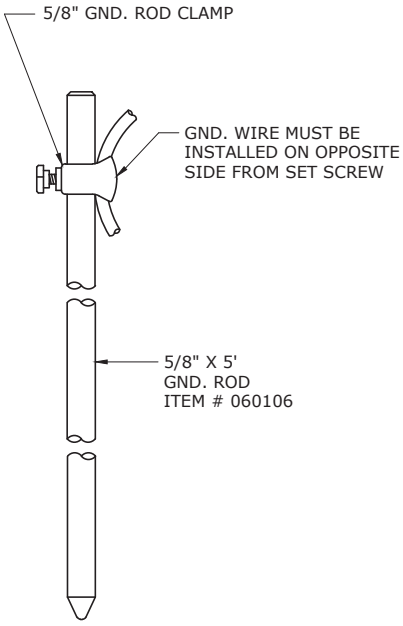
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

LOCATION OF WARNING, DANGER AND
LOCID LABELS FOR 15KV PAD-MOUNTED RECLOSER

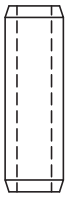
DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

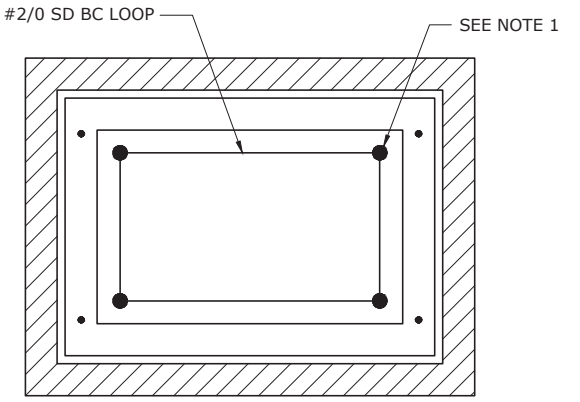
28.15-101A



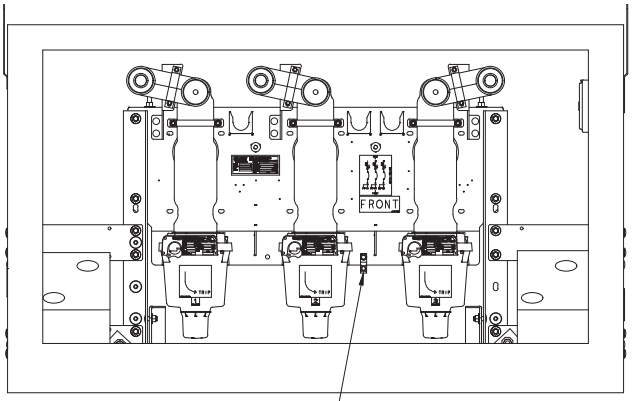
GROUND ROD



5/8" COUPLING



VAULT PAD



NOTES:

1. INSTALL A GROUND ROD IN EACH CORNER OF THE VAULT PAD. ONE OF THE INSTALLATIONS IS TO BE A DEEP DRIVEN ROD USING FOUR 5' SECTIONS.

2. RUN A LOOP OF #2/0 SOFT DRAWN BARE COPPER INSIDE THE VAULT PAD, LOOPING THE CONDUCTOR THROUGH THE GROUND ROD CLAMP IN EACH CORNER.

3. CONNECT THE LOOPED GROUND BUSS CONDUCTOR TO THE RECLOSER GROUNDING LUG USING A SHORT PIECE OF 2/0 COPPER. (GROUNDING LUG SHOWN IN THE RECLOSER).

4. AT EACH CABLE LOCATION, ATTACH THE CABLE NEUTRAL TO THE GROUNDING LOOP WITH A SPLIT BOLT CONNECTOR.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

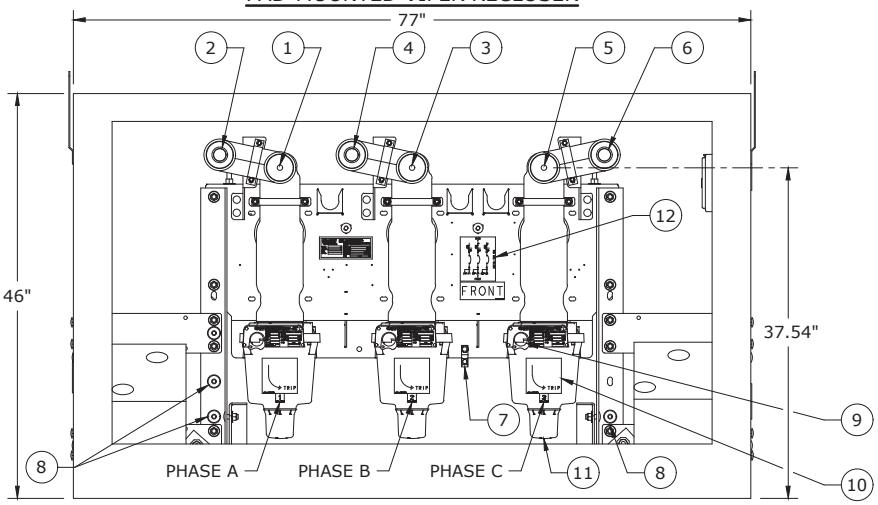
GROUNDING DETAILS FOR 15KV PAD-MOUNTED RECLOSER

DUKE ENERGY.

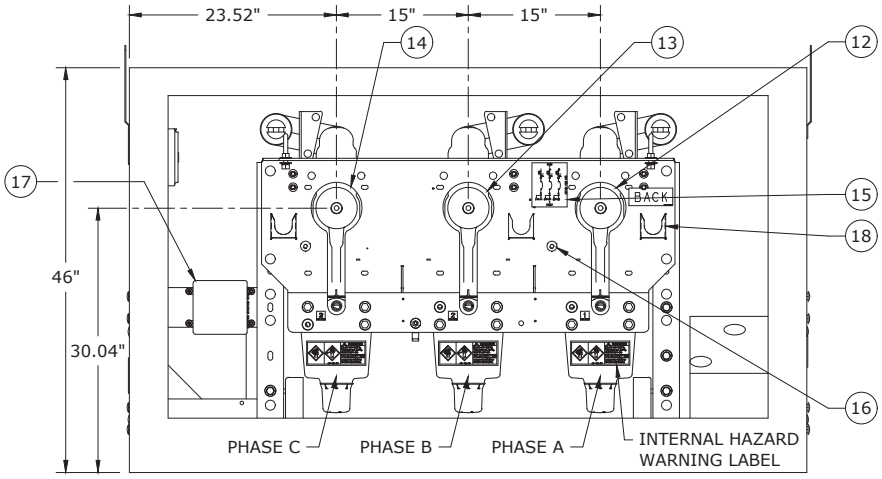
DEC	DEM	DEP	DEF
		X	X

28.15-101B

PAD-MOUNTED VIPER RECLOSER

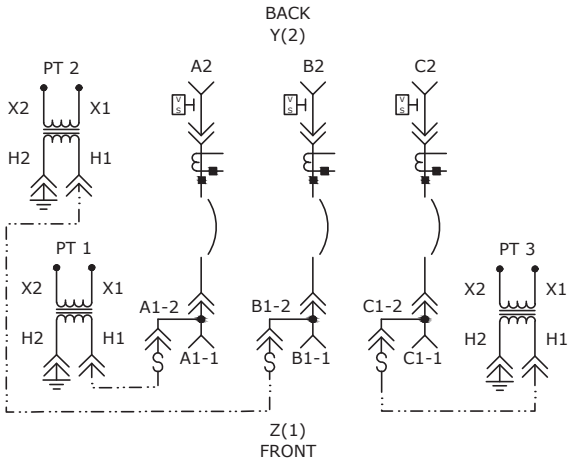


FRONT VIEW



BACK VIEW

LEGEND	
BUBBLE NUMBER	DESCRIPTION
1	PHASE A1-1 600 AMP (SOURCE)
2	PHASE A1-2 200 AMP (PT1)
3	PHASE B1-1 600 AMP (SOURCE)
4	PHASE B2-2 200 AMP (PT2)
5	PHASE C1-1 600 AMP (SOURCE)
6	PHASE C1-2 200 AMP (PT3)
7	GROUNDING LUG #2-4/0 COPPER
8	PT1, PT2, PT3 SECONDARY GROUNDING LUG
9	MANUAL TRIP LEVER
10	MANUAL TRIP LABEL
11	CONTACT POSITION INDICATOR RED-CLOSE, GREEN-OPEN
12	PHASE A2 600 AMP (LOAD)
13	PHASE B2 600 AMP (LOAD)
14	PHASE C2 600 AMP (LOAD)
15	THREE LINE DIAGRAM
16	GROUND LUG 1/2" THREAD
17	JUNCTION BOX RECLOSER CONTROL CABLE AND HARDWARE
18	PARKING STAND- ONE PER BUSHING



THREE LINE DIAGRAM

NOTES:

1. LEGEND ON THIS DRAWING IS ASSOCIATED WITH BUBBLE NUMBERS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

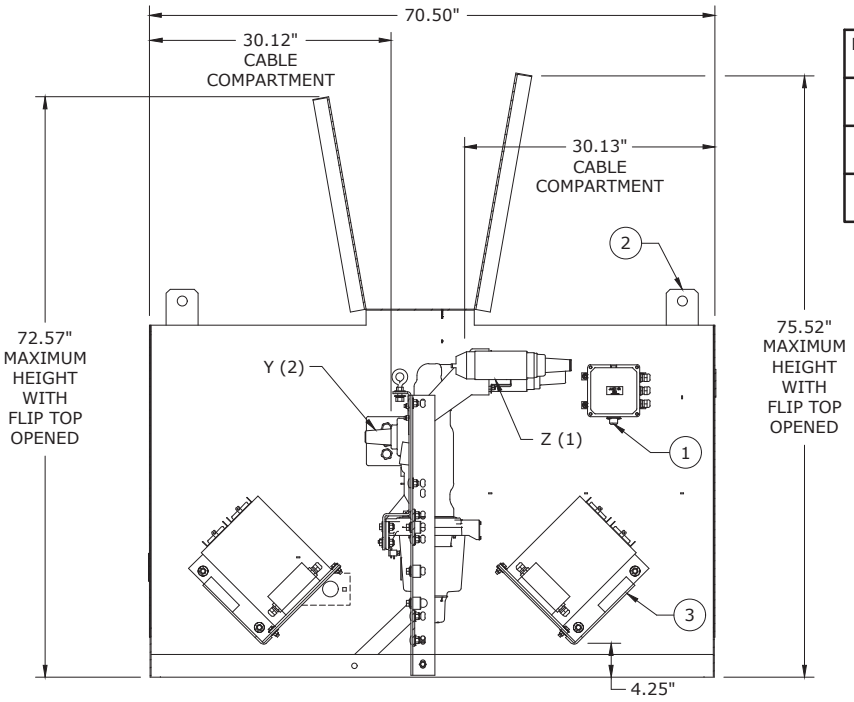
15KV PAD-MOUNTED VIPER ST RECLOSER

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

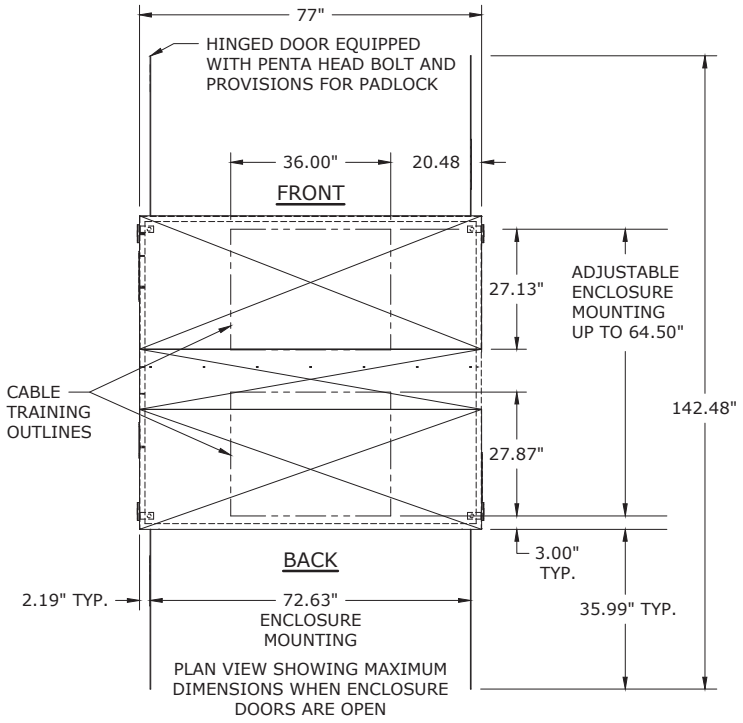
28.15-101C

PAD-MOUNTED VIPER RECLOSER



BUBBLE #	DESCRIPTION
1	CONNECTORIZED PT JUNCTION BOX.
2	LIFTING PROVISIONS (4) WITH 1.25" DIAMETER HOLE.
3	EXTERNAL PT.

LATERAL VIEW



PLAN VIEW

NOTES:

1. SEE DWG. 28.15-101C FOR FRONT AND BACK VIEWS.

2. SEE DWG. 28.15-101E FOR BILL OF MATERIALS AND NOTES

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

15KV PAD-MOUNTED
VIPER ST RECLOSER

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.15-101D

USE PROPER SAFETY PROCEDURES
BEFORE WORKING ON PAD-MOUNTED RECLOSER OR CABLE, GROUND IT.

BILL OF MATERIALS

NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	REC-VST-800-ELEC-27KV-3P-PM-F	1	1537122	1	RECLOSER VIPER-ST 800A ELECTRONIC CONTROL 27KV THREE PHASE
	*	-	4198818	1	CORD, CONTROL, 32 PIN, F/ VIPER RECLOSER SYSTEM
	*	-	4203968	1	CORD, CONTROL, 40' LG, 8 PIN PT, ARMORED CABLE, F/ RECLOSER
	*	-	1539240	3	TRANSFORMER, INSTRUMENT, POWER, 60:1 RATIO, 7.2/12.47KV
-	ELBOW-INS-AL-200A-15KV-LB-F	3	831048	1	BUSHING, ELECT COND, TRANSFORMER, 15KV, 200A, LOADBREAK, INS
-	ELBOW-FTB-4/0-AL-200A-15KV-LB-ROT-F	3	4004689	1	BUSHING, ELECT CONDUCTOR, FEED THRU, 15KV, 2 WAY, INSERT
-	ELBOW-1/0-AL-200A-15KV-LB-FUSE-F	3	4173497	1	CONNECTOR, ELECTRICAL, FUSED LOADBREAK ELBOW, 1/0 AWG SOL
-	FUSE-LINK-40-CL-15KV-ELBOW-F	3	4173496	1	FUSE, CURRENT LIMITING FULL RANGE 40A, 8.3KV LOADBREAK ELBOW
-	ELBOW-1/0-AL-200A-15KV-LB-F	3	4004699	1	CONNECTOR, ELECTRICAL, LOADBREAK ELBOW, 1/0 AWG ALUM COND
			50124557	1	KIT, ACCESSORY, 15KV CABLE SIZE 1/0, SPRING, GROUND STRAP
SEE NOTE 17	ELBOW-1/0-AL-200A-15KV-BOND-F	3	1539241	1	CONNECTOR, ELECTRICAL, LOADBREAK ELBOW, 1/0 AWG CONDUCTOR
			933800	1	CONNECTOR, ELECT, PARALLEL GROOVE (GENERAL), #1 STR - 4/0 AWG
-	CABLE-PRI-1/0-AL-TRXLPE-LC-15KV-F	15	4205784	1	WIRE/CABLE ELEC MED V, UG OH, 3 COND, 1/0 AWG, ALUM COND, SOL
-	ELBOW-T-1000-AL-600A-15KV-NLB-F	6	4158000	1	KIT, SHIELD GROUNDING, ELBOW, EALC. F/ 600 A MED V ELBOWS
			4004719	1	KIT, TEST & GROUND CONNECTOR, TERMINATOR, ELBOW 600A, 15KV
			111206	1	HOUSING, CABLE T, 25KV, 600A, SHIELDED, W/ GROUNDING EYE
			4004733	1	ADAPTER CABLE, STRESS RELIEF CABLE F/USE ON 1000 MCM FULL STR
			4004743	1	CONNECTOR, ELECTRICAL, TERMINAL, SPADE, 1000 MCM COND, ALUM
SEE NOTE 4	ARR-ELBOW-10KV-F	6	1000572	1	ARRESTER, ELECTRICAL, DISTRIBUTION, 8.4KV, SURGE, 10KV, POLY
			4003399	1	CONNECTOR, ELECTRICAL, VISE, 1/0 AWG CONDUCTOR, COMP 1-BOLT
-	GND-SG-2/0-RING-F	1	933800	2	CONNECTOR, ELECTRICAL, PARA. GROOVE, #1 STR 4/0 AWG STR #6
			50129890	4	COUPLING ROD GROUND 5/8" BRONZE NON THD
			1502506	20	WIRE/CABLE ELECT BARE, SOL SD, 2/0 AWG, CU COND, 125' SPOOLS
-	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, ROD, GROUND, 5/8", BRZ, NON THD
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	GND-ROD-UG-F	4	932539	1	CLAMP, GROUNDING, CABLE TO ROD, 8 SOL - 1/0 STR COND TO 5/8"
			4185013	1	ROD, GROUND, 5/8" DIA, 60" LG, 10 MIL MIN THK CU COATING CLAD
-	STRUCT-PAD-SG-CTE-MD-PME-F	1	4004772	1	BOX, MOUNTING, F/ PME SWITCH GEAR. THIS BOX WILL MOUNT PME 9
-	ELBOW-COV-INSL-200A-15KV-F	3	4004688	1	COVER, INSULATING, F/ 15KV LOADBREAK BUSHING INSERT, W/ 42 INCH GROUNDING LEAD

* PROVIDED WITH RECLOSER FROM MANUFACTURER

NOTES:

1. APPROXIMATE WEIGHT OF PAD-MOUNTED RECLOSER IS 1550 LBS.
2. FITS MOUNTING BOX (ITEM # 4004772).
3. DEAD FRONT CONSTRUCTION. LINE PRIMARY CABLES (SOURCE AND LOAD) WILL BE TERMINATED WITH 600 AMP BOLTED DEADBREAK (NO VOLTAGE AND CURRENT) ELBOW T-BODY, AND INSTALLED ON 600 AMP BUSHING INTERFACE.
4. INSTALL 6 ARRESTERS WHEN RECLOSER IS A NORMAL OPEN POINT. OTHERWISE INSTALL 3 ARRESTERS ON THE SOURCE SIDE CABLES.
5. WHEN ELBOWS, INSERTS, AND ANY OTHER ACCESSORIES ARE CONNECTED TO THE SWITCH, THE RATING OF EACH CONNECTED ASSEMBLY WILL BE THAT OF THE LOWEST RATED COMPONENT OF THE ASSEMBLY.
6. RECLOSER IS EQUIPPED WITH 3 DISCONNECT LINKS ON PHASE A1-2, B1-2, C1-2. EACH DISCONNECT LINK PROVIDES A 200 AMP BUSHING CONNECTION FOR THE H1 BUSHING WELL OF THE EXTERNAL PT. REPLACE EXISTING 27KV BUSHING INSERT WITH 15KV BUSHING INSERT.
7. PT'S CABLES WILL BE TERMINATED WITH 200 AMP FUSED ELBOWS (RECLOSER SIDE) AND 200 AMP LOAD BREAK ELBOWS (PT SIDE) AND INSTALLED ON 200 AMP BUSHING INSERTS.
8. INSTALL #2/0 SD BC FROM GROUNDING LUG ON RECLOSER TO GROUNDING LOOP.
9. CONNECT T-BODY GROUND BRAIDS TO THE RECLOSER PAD GROUNDING LOOP.
10. CABLE CAN BE ENERGIZED WHEN RECLOSER IS OPEN.
11. RECLOSER IS SCADA OPERATED AND MONITORED.
12. SEE DWG. 28.15-101A FOR LABELS - POSITION NUMBERS (1 FOR SOURCE SIDE AND 2 FOR LOAD SIDE).
13. SEE DWG. 28.15-101B FOR GROUNDING DETAILS.
14. SEE DWG. 28.15-101H FOR GROUNDING DETAILS OF EXTERNAL PT'S.
15. SEE DWG. 24.05-150 FOR MOUNTING BOX AND CABLE CONDUIT PLACEMENT.
16. SEE DWGS. 28.15-101C AND 28.15-101D FOR DESIGN SPECIFICATIONS.
17. THIS ITEM WILL BE USED TO GROUND ONE SIDE OF THE POTENTIAL TRANSFORMERS.

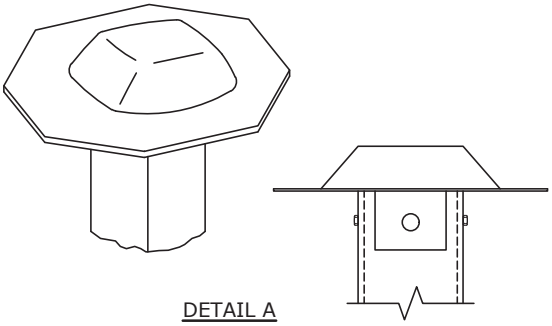
DUKE ENERGY.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

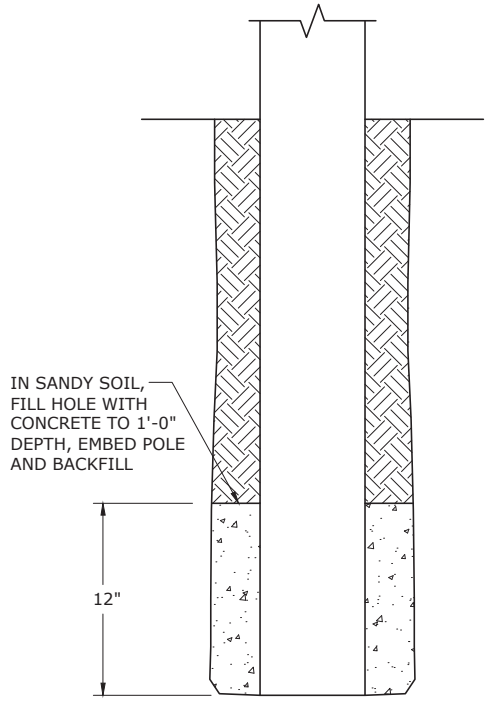
PAD-MOUNTED VIPER ST RECLOSER

DEC	DEM	DEP	DEF
			X

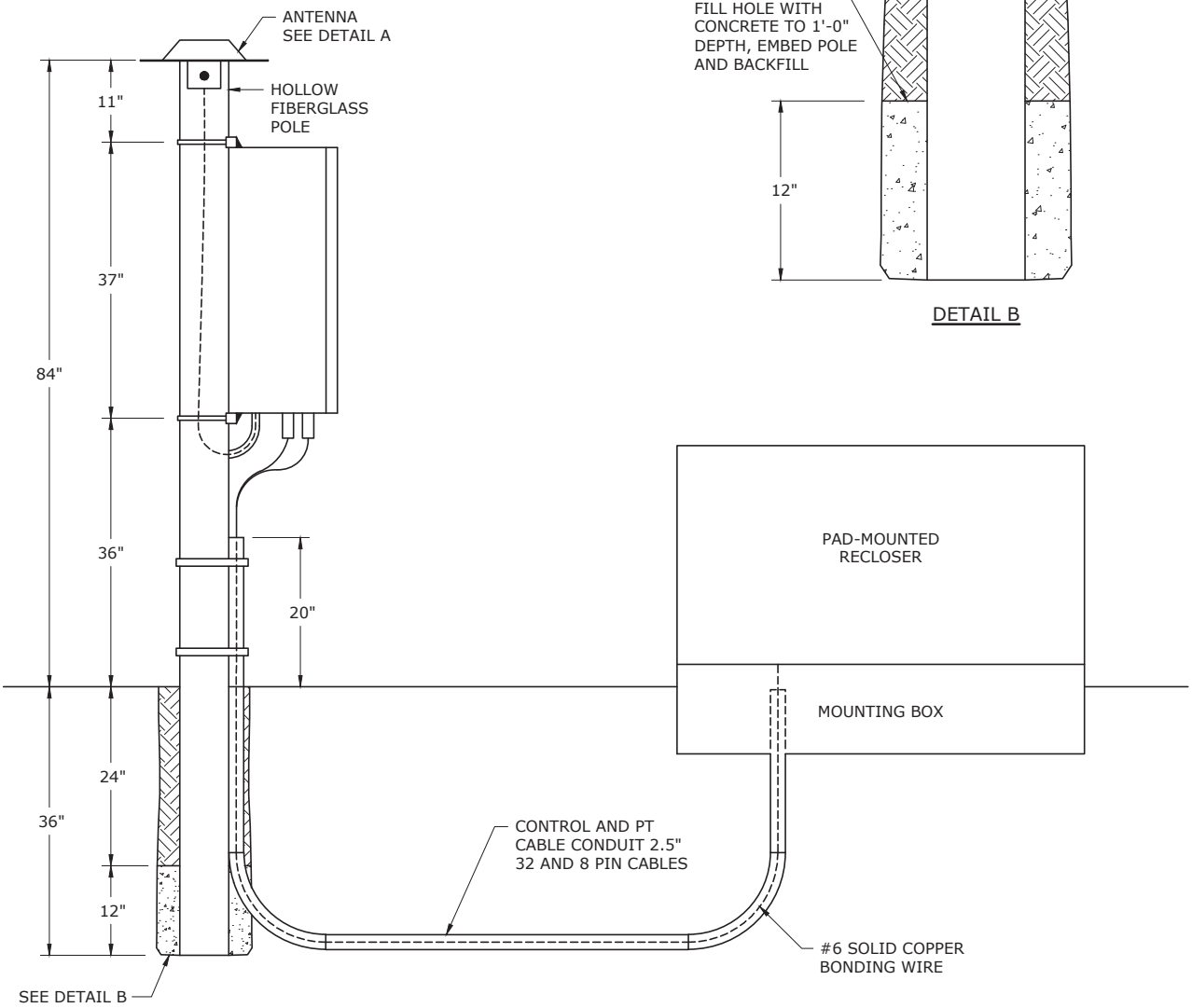
28.15-101E



DETAIL A
GROUND PLANE AND ANTENNA
BOLTED TO TOP OF POLE



DETAIL B



NOTES:

1. THE LOCATION OF THE CONTROL BOX AND POST WILL BE RELATIVE TO THE PAD-MOUNTED RECLOSER. LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE RECLOSER, OR OTHER NEARBY EQUIPMENT. PLACE IN LOCATION FOR EASY ACCESS. GIVE CONSIDERATION TO OTHER ACTIVITY AT THE SITE SUCH AS MOWING.
2. CONTROL MUST BE BONDED TO PAD-MOUNTED RECLOSER GROUND.
3. PULL CONTROL CABLE, 8 PIN PT CABLE AND GROUND IN 2-1/2" CONDUIT FROM CONTROLLER TO PAD-MOUNTED RECLOSER.
4. THE CABINET CONTROL IS POWERED BY EXTERNAL PTS FROM INSIDE THE PAD-MOUNTED RECLOSER. NO ADDITIONAL POWER SOURCE IS REQUIRED.
5. SEE DWG. 28.15-101G FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED RECLOSER
CONTROL CABINET INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

28.15-101F

BILL OF MATERIALS					
NOTES	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	CTRL-RECL-S651R-VST-F	1	4198843	1	CONTROL, RECLOSER, F/ VIPER ST, W/ 3622 SECURITY GATEWAY INCLUDES ACCESSORY SHELF, CUSTOM WIRING F/ 3 PT
-	*	-	4204003	1	ROUTER, SECURITY GATEWAY, 12/24VDC POWER SUPPLY, (2) 10/100BASE-T ETHERNET CONNECTION, W/ FIRMWARE VERSION
-	**	-	4206196	1	MODEM, CELLULAR, W/ DC POWER CABLE, RUGGEDIZED SIM, 5 YEAR WARRANTY
-	**	-	4206198	1	ANTENNA, MODEM, SMA CONNECTOR, W/ 15' CABLE
-	POLE-FG-10-CTRL-F	1	1539295	1	POLE, RECLOSER CONTROL MOUNTING, 4" SQ X 10" HT, FIBERGLASS W/ HARDWARE, ANTENNA GROUND PLANE, BRACKETS
-	COND-STICK-2 1/2IN-PVC-SCH40-F	30	61356	1	CONDUIT, RIGID, HEAVY WALL, 2-1/2", 10' LG, SCH 40, PVC, BELLED ONE END, RATED F/ 90 DEG C CONDUCTOR, 2.414" I
-	COND-BEND-2 1/2IN-PVC-90DEG-R36-F	2	67260	1	COUPLING, CONDUIT, RIGID, 2-1/2", SLIP-ON, GRAY PVC UL APPROVED
			4005399	1	ELBOW, CONDUIT, 2-1/2", BELLED END, PVC, 90 DEG, 36" RADIUS BEND, SCH 40, W/ COUPLING OR BELLED END, PER FPC
-	GND-EQUIP-6-UG-F	1	234664	5	WIRE/CABLE, ELECTRICAL, BARE, SOL SD, 6 AWG, CU, PER DUKE POWER SPEC CS-26 DATED, 25, 200' MIN F/ FREIGHT ALLOW
			933366	1	CONNECTOR, ELECTRICAL, COMP H-TAP, 1/0 AWG 6 X 1 STR ACSR 2 AWG 7 STR AA CONDUCTOR, ALUM CONNECTOR
-	POLE-BAND-STRAP-BUCKLE-SM-STF-F	1	1490605	2	BAND, STRAPPING, 3/4" WD, 100' LG, 0.03" THK, 316 SS, 1800 LB
	POLE-BAND-STRAP-SM-STL-F	1	1490606	2	BUCKLE, BANDING, 3/4" WD, SS, MRO ITEM ONLY

* PROVIDED FROM MANUFACTURER

** PROVIDED DURING PROVISIONING

NOTES:

1. SEE DWG. 28.15-101F FOR POLE, FOUNDATION, AND DESIGN SPECIFICATIONS.

2. SEE DWGS. 28.15-101C AND 28.15-101D FOR PAD-MOUNTED RECLOSER DESIGN SPECIFICATION.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK

PAD-MOUNTED RECLOSER

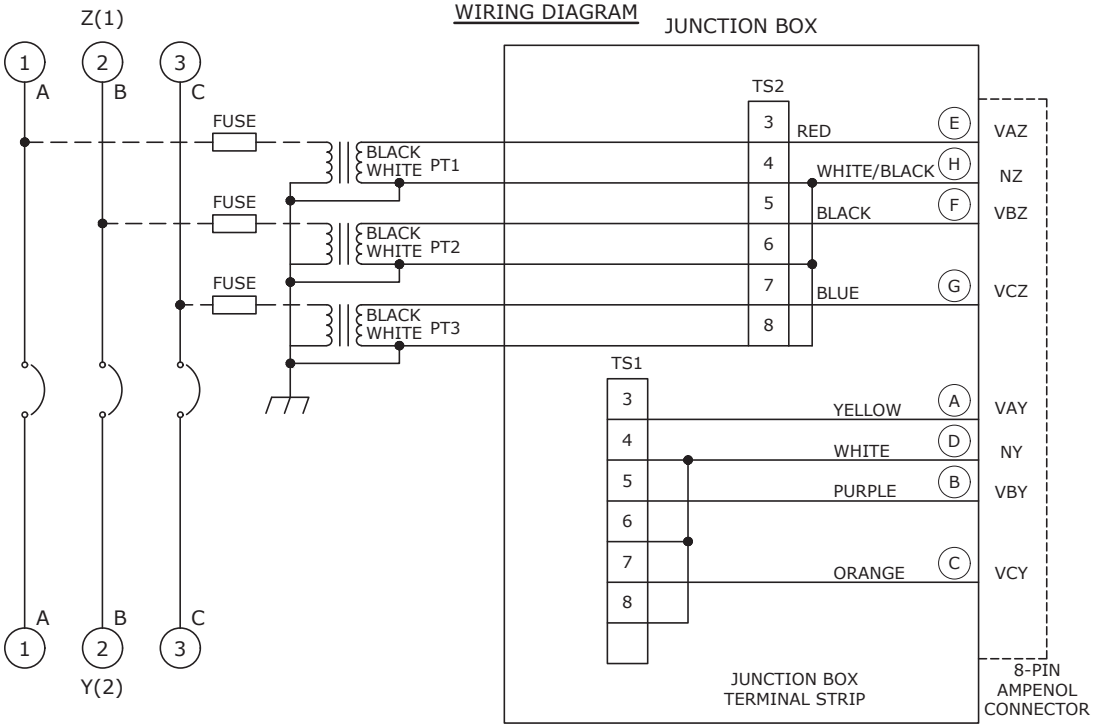
CONTROL CABINET INSTALLATION

DUKE ENERGY.

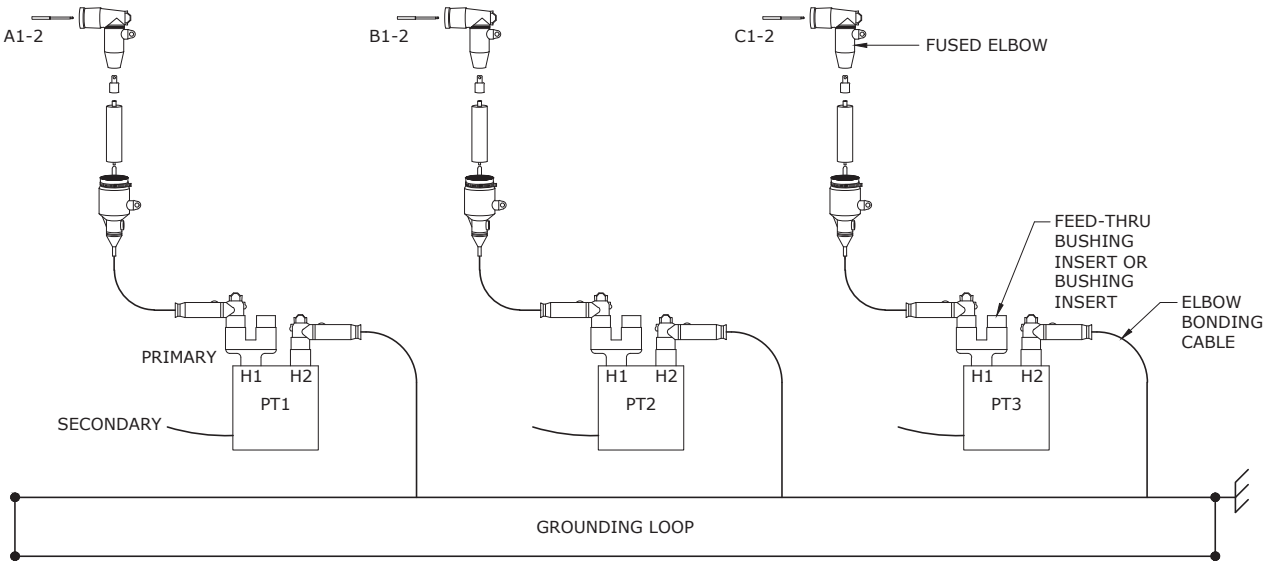
DEC	DEM	DEP	DEF
			X

28.15-101G

WIRING DIAGRAM



PTS PRIMARY WIRING



NOTES:

1. RECLOSER IS EQUIPPED WITH 3 EXTERNAL ABB TYPE VIL PT'S.
2. RECLOSER IS EQUIPPED WITH 3 DISCONNECT LINKS ON PHASE (A1-2, B1-2, C1-2). EACH DISCONNECT LINK PROVIDES A 200 AMP BUSHING CONNECTION FOR THE H1 BUSHING WELL OF THE EXTERNAL PT.
3. ATTACH THE GROUNDING ELBOW END CABLE TO THE GROUNDING LOOP WITH A SPLIT BOLT CONNECTOR.
4. ENSURE THE BAIL TABS OF PT ARE CONNECTED TO GROUND.
5. SEE DWG. 28.15-101E FOR BILL OF MATERIALS.

3				
2				
1				
0	1/31/19	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

WIRING DIAGRAM FOR PT CLUSTER PAD-MOUNTED VIPER ST RECLOSER

DEC	DEM	DEP	DEF
X		X	X

28.15-101H

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/31/17	KATIGBAK	BURLISON	ADCOCK
0	11/30/10	CECCONI	GUINN	ELKINS

SECTION 29 - NETWORKS, VAULTS AND TRANSCLOSURES
TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

29.14 NETWORK PROTECTORS

29.14 MANHOLES, COVERS, AND RISERS

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE

29.03 TRANSCLOSURES AND VAULT LAYOUT

STANDARD PROCEDURES BULLETIN

A TRANSFORMER VAULT IS AN ENCLOSED COMPARTMENT WITHIN A BUILDING OR BELOW GROUND LEVEL ESPECIALLY DESIGNED FOR THE TYPE TRANSFORMERS SPECIFIED BY THE COMPANY.

A TRANSFORMER ENCLOSURE IS A SPECIAL COMPARTMENT SUITABLE FOR INSTALLING COMPANY'S STANDARD TRANSFORMERS. SUCH ENCLOSURE MAY UTILIZE THE CUSTOMER'S BUILDING WALL(S) AS ONE OR MORE SIDES OF THE ENCLOSURE.

ALL ENCLOSURES MUST HAVE A REMOVABLE COVER APPROVED BY THE ENGINEER EXCEPT THOSE LOCATED IN IN ISOLATED OR PROTECTED AREAS WHERE, IN THE WRITTEN OPINION OF THE ENGINEER, THERE IS NO REASONABLY FORESEEABLE DANGER OF ACCESS BY MINORS, WORKMEN AND OTHER MEMBERS OF THE PUBLIC.

ONLY AUTHORIZED COMPANY PERSONNEL SHALL HAVE ACCESS TO TRANSFORMER VAULTS OR ENCLOSURES AND ALL ENTRY DOORS SHALL BE KEPT LOCKED UNLESS ATTENDED.

ENTRY DOORS SHALL HAVE A STURDY HASP SUITABLE FOR COMPANY'S STANDARD LOCK OR LOCK TUMBLERS WITHIN THE DOOR TO ACCOMMODATE COMPANY'S STANDARD KEY. SELF-LOCKING DOORS AND DOORS WITH LOCK TUMBLERS SHALL BE READILY OPENED FROM THE INSIDE WITHOUT A KEY.

COMPANY'S STANDARD "DANGER HIGH VOLTAGE" SIGN SHALL BE AFFIXED TO THE OUTSIDE OF ALL ENTRY DOORS OF TRANSFORMER VAULTS INSIDE OF BUILDINGS AND OF TRANSFORMER ENCLOSURES. THIS SIGN SIGN SHOULD BE SECURELY AFFIXED AND MAINTAINED AT A PLACE EASILY SEEN.

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

TRANSFORMER VAULTS

AND ENCLOSURES

Duke Energy®

FLA

DWG. 29.00-04

GENERAL

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 THE TRANSFORMER(S) WILL BE FUSED WITH CURRENT LIMITING FUSES. AS MENTIONED IN THE FUSE SECTION ABOVE, THIS CURRENT LIMITING FUSE (CL) REDUCES THE AMOUNT OF I-SQUARED TIME LET-THROUGH CURRENT AVAILABLE TO A PRIMARY FAULT WITHIN THE TRANSFORMER TANK. THE LESS FLAMMABLE DIELECTRIC, COOPER "FR3", 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.

TRANSFORMERS

SPECIAL THREE-PHASE VAULT TRANSFORMERS ARE AVAILABLE. THESE TRANSFORMERS ARE STAINLESS STEEL UNITS AND ARE FILLED WITH LESS-FLAMMABLE FLUID. THEY ARE ALSO FULLY RATED FOR OPERATION IN A 50°C AMBIENT ENVIRONMENT.

FOR VAULT TRANSFORMER BANKS CONSISTING OF BANKED SINGLE-PHASE UNITS, STANDARD SINGLE-PHASE DOUBLE BUSHING TRANSFORMERS CAN BE USED PROVIDING THEY ARE MODIFIED. USE A STANDARD STAINLESS STEEL UNIT WHEN AVAILABLE. THESE UNITS SHOULD BE DRAINED AND FLUSHED OF THE EXISTING MINERAL OIL AND FILLED WITH A LESS-FLAMMABLE FLUID SUCH AS FR3. ARRANGEMENTS SHOULD BE MADE WITH THE TRANSFORMER SHOP TO HAVE THIS DONE. THE TRANSFORMERS SHOULD ALSO BE CONVERTED FROM LIVE BUSHINGS TO BUSHING WELLS IN THE TRANSFORMER SHOP. THE TRANSFORMERS SHOULD BE DERATED FOR OPERATION IN THE HIGHER AMBIENT TEMPERATURE CONDITIONS BY 1.5% FOR EACH 1°C ABOVE A 30°C AMBIENT.

FUSES

FULL RANGE CURRENT LIMITING SUBMERSIBLE FUSES ARE AVAILABLE FOR USE IN VAULTS.

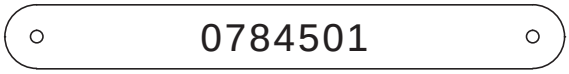
3				
2				
1				
0	10/19/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VAULTS INSIDE OR ON TOP OF BUILDINGS

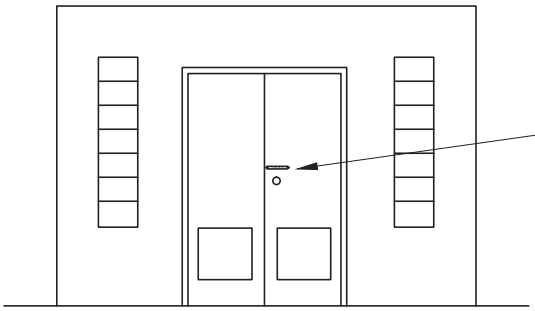
Duke Energy®

FLA

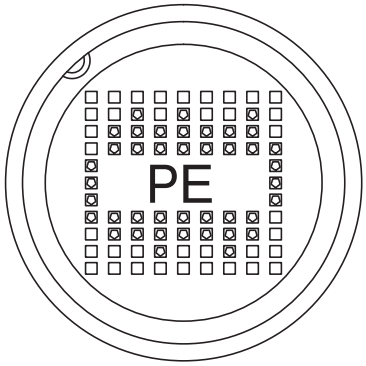
DWG. 29.00-06



INSTALL DIS-ID NUMBERS (CN 44034_) ON BACKING PLATE (CN 440006) AND PLACE ON EQUIPMENT AS INDICATED BELOW.

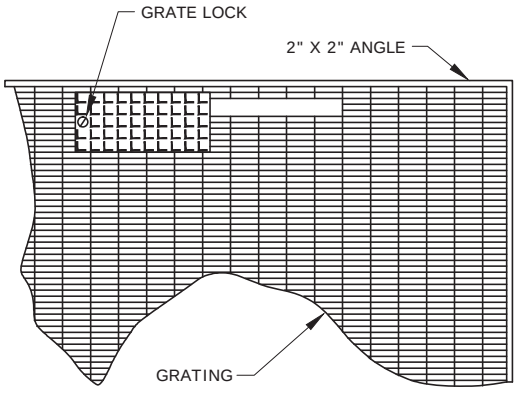


INSTALL ON FRONT OF DOOR AS SHOWN. ADDITIONAL ID NUMBER PLATES SHOULD BE INSTALLED ON INSIDE OF DOOR.



INSTALL DIS-ID NUMBER PLATE ON INSIDE OF MANHOLE.

MANHOLES AND SWITCH MANHOLES
STREET AND ALLEY VAULTS



INSTALL DIS-ID NUMBER PLATE ON INSIDE OF SIDEWALK VAULT.

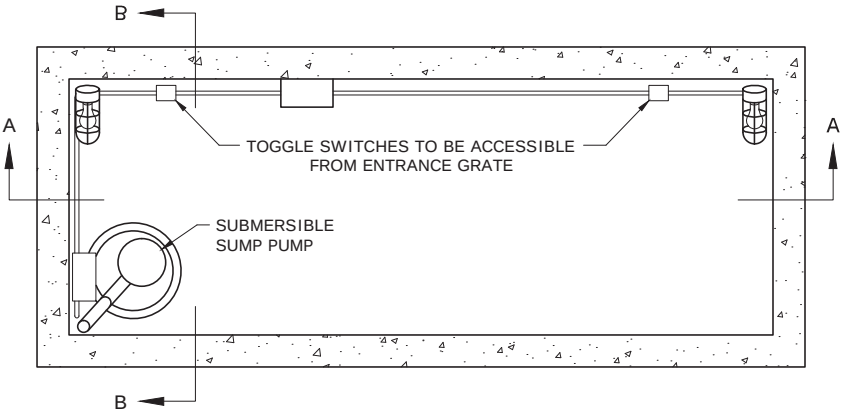
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION OF COORDINATE NUMBERS

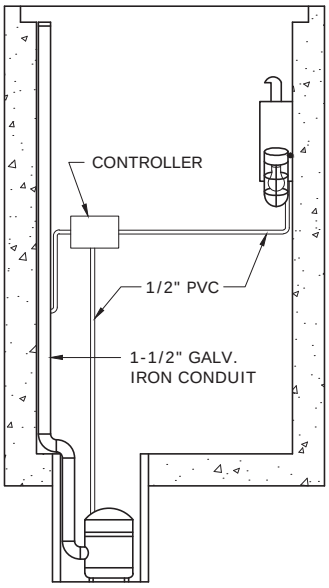
Duke Energy®

FLA

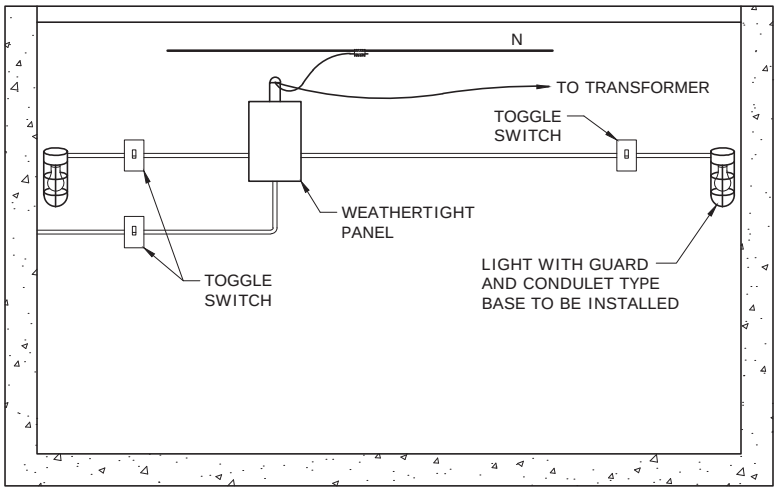
DWG. 29.00-08



PLAN VIEW



SECTION B-B



SECTION A-A

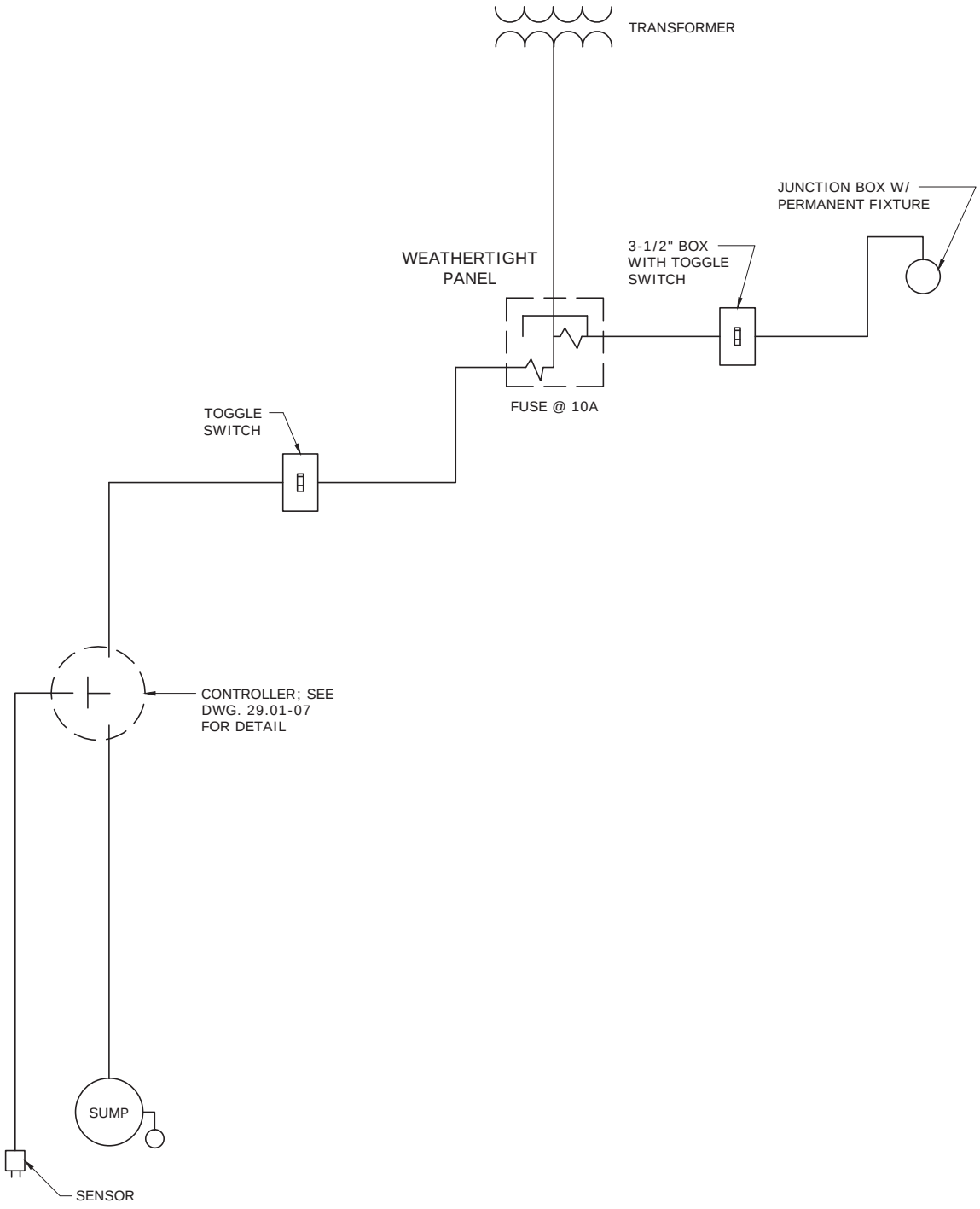
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

SIDEWALK AREA VAULT
LIGHTS AND SUMP PUMP
TYPICAL INSTALLATION

Duke Energy®

FLA

DWG. 29.01-07



NOTES:

1. GROUND ALL METAL PARTS (SUMP, LIGHTS, AND PANEL).

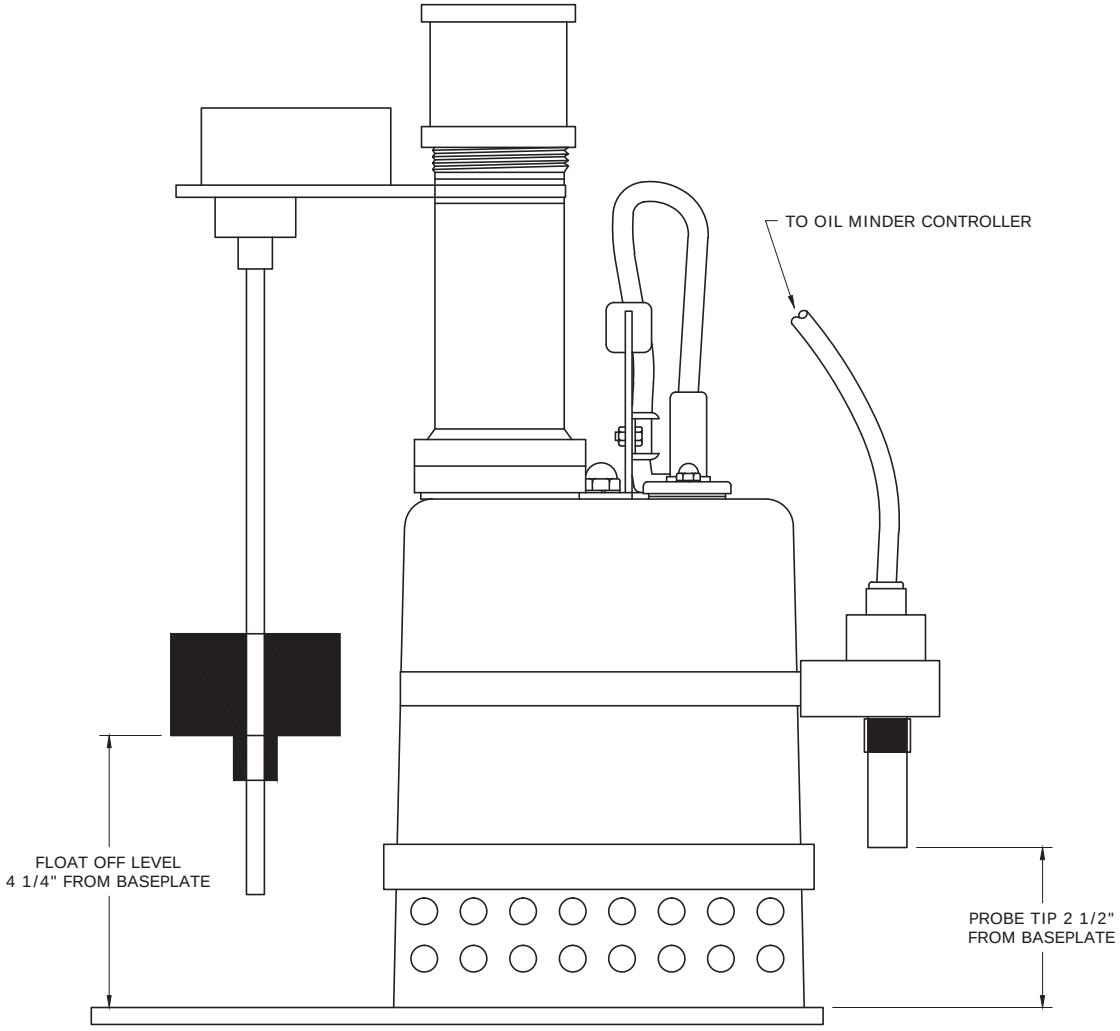
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

ELECTRICAL SCHEMATIC FOR SIDEWALK VAULT

Duke Energy®

FLA

DWG. 29.01-09



EBARA OIL MINDER PUMP
CU NTOM1QTHPF
CN 328763
MODEL 32P76706.35
INCLUDES FLOAT
OIL PROBE COMES WITH OIL MINDER

TITON (EBARA PUMP)
WITH VERTICAL FLOAT MOUNT
1/3 HP 115 VOLT
31 GPM

NOTES:

1. USE PUMP WITH STANCOR OIL MINDER CONTROLLER. SEE DWG. 29.01-13.

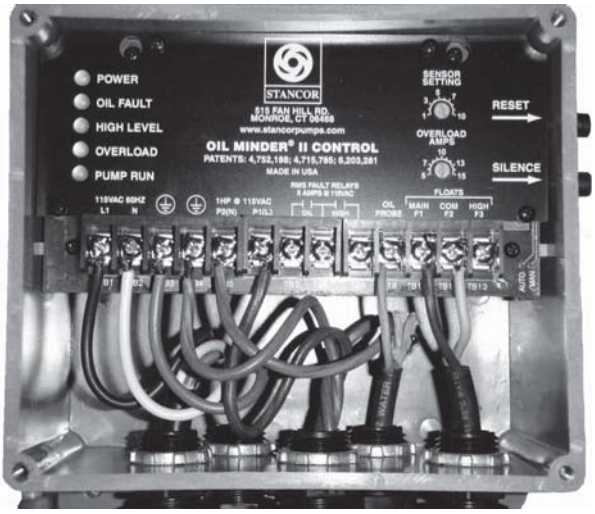
2. OIL-MINDER PROBE TIP MUST BE BELOW FLOAT OFF LEVEL. ADJUST FLOAT ACCORDINGLY.

REVISED		BY	CK'D	APPR.
3				
2				
1	8/7/14	DANNA	DANNA	ADCOCK
0	10/5/10	DANNA	GUINN	ELKINS

OIL MINDER SYSTEM

DEC	DEM	DEP	DEF
			X

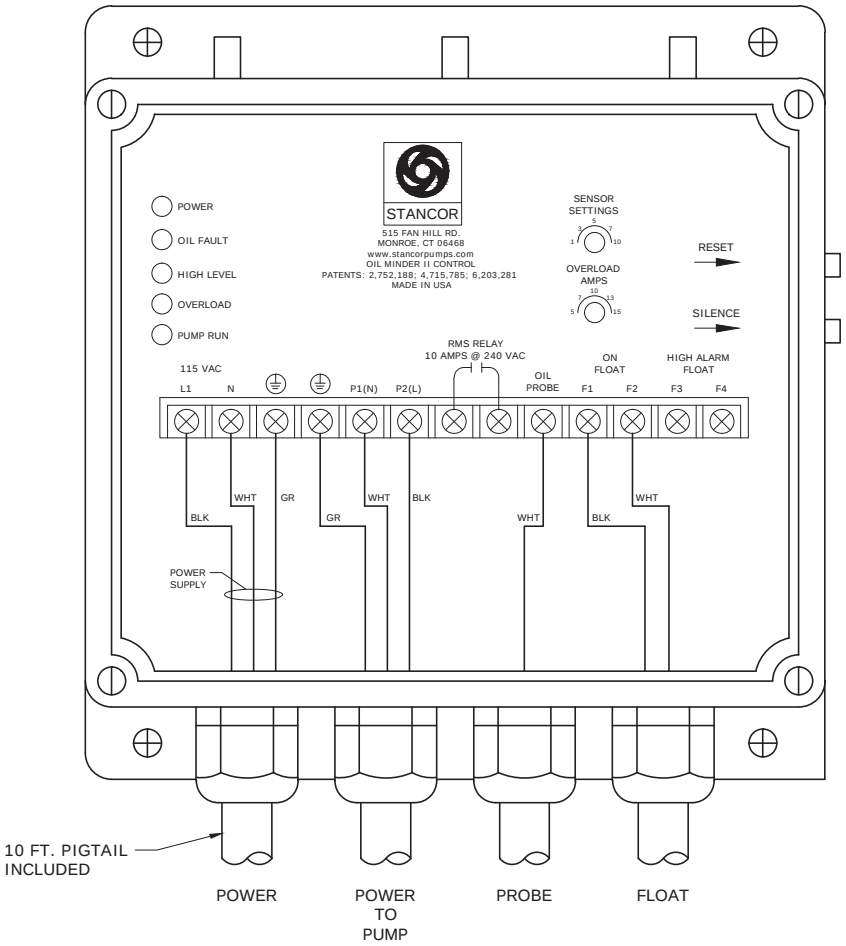
29.01-11



OIL MINDER CONTROL BOX

CU NTOMCNTRL1QTHPF

CN 328767



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

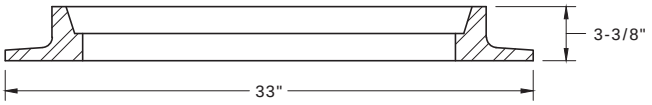
STANCOR OIL MINDER SYSTEM

OM-2000 CONTROLLER

Duke Energy®

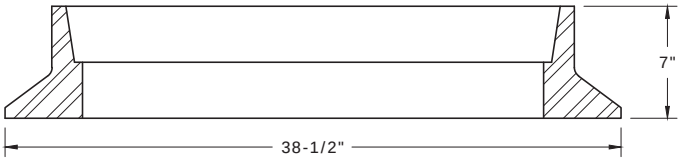
FLA

DWG. 29.01-13



CAST IRON RING FOR USE ON TOP OF MANHOLE, 3-3/8" HIGH

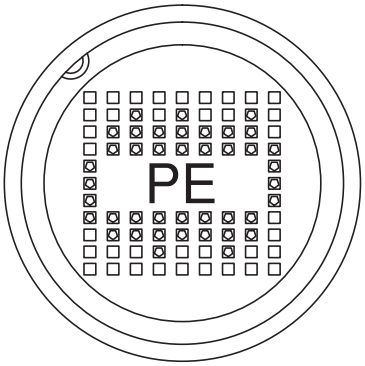
CU NCKMH3SF
CN 9220176326



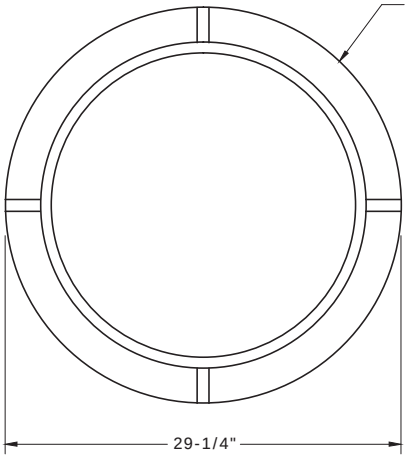
CAST IRON RING FOR USE ON TOP OF MANHOLE, 7" HIGH

CU NCKMH7SF
CN 9220176327

CU CVRMH29SF, CN 9220176401
MANHOLE COVER, 29-1/4" DIAMETER
CAST IRON - FITS CN 9220176326 AND CN 9220176327



MANHOLES AND SWITCH MANHOLES
STREET AND ALLEY VAULTS



MANHOLE EXTENSION RING

CU NCKMH1SF
CN 320795

NOTES:

1. OTHER SIZE EXTENSION RINGS AVAILABLE BY SPECIAL ORDER THROUGH DISTRIBUTION STANDARDS.

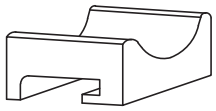
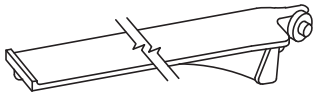
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

VAULT MANHOLE COVER AND RING

Duke Energy®

FLA

DWG. 29.01-15

CABLE RACKING EQUIPMENT				
		TYPE	CATALOG NUMBER	COMPATIBLE UNIT
	RACK, CABLE SUPPORT	33-1/3" GALVANIZED STEEL	320774	NTRK33P33F
	INSULATOR, PORCELAIN STEP	SINGLE HOOK 2-1/6" X 1-3/4" X 3", GROOVE RADIUS 1-7/16"	080103	NTISF
	STEPS, CABLE SUPPORT - GALVANIZED IRON	11-7/8" - 12-1/4" LENGTH	320526	NTSS12F
		14-7/8" TO 15-1/4" LENGTH	320528	NTSS15F

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

CABLE RACKING EQUIPMENT

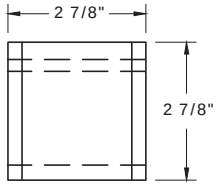
CATALOG NUMBERS

Duke Energy®

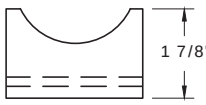
FLA

DWG. 29.07-03

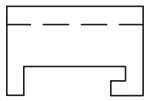
PORCELAIN INSULATOR



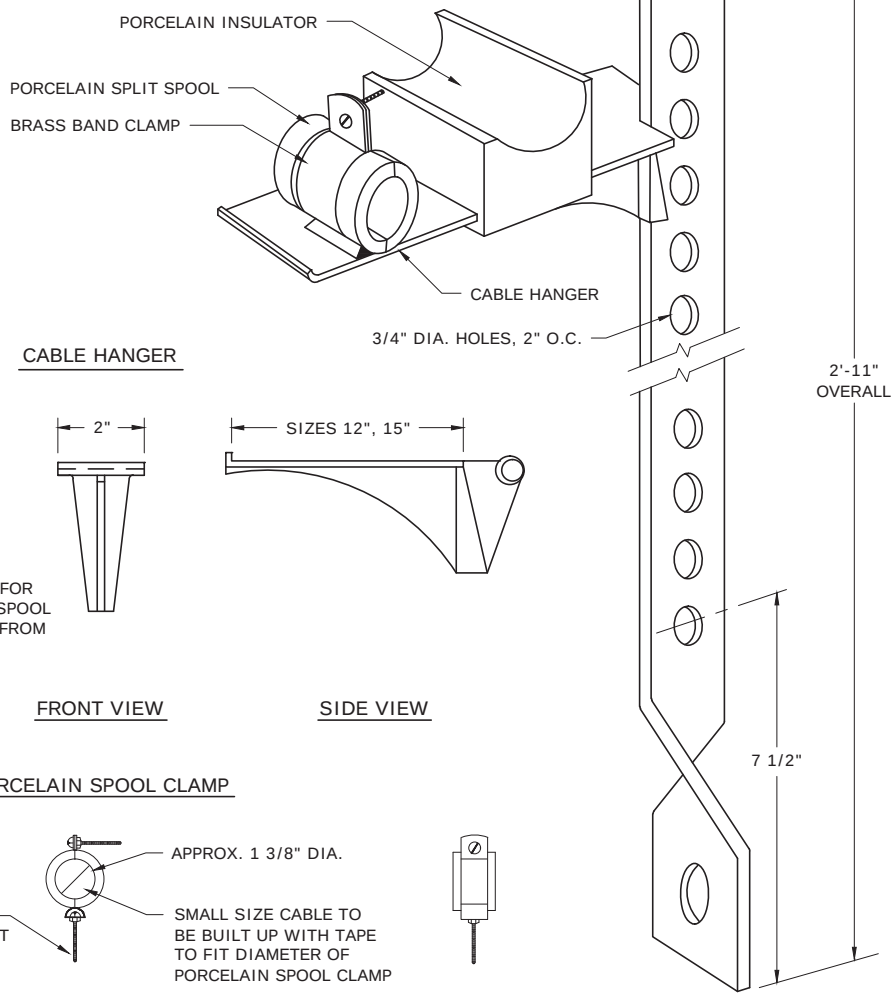
TOP VIEW



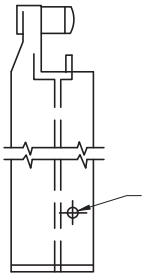
FRONT VIEW



SIDE VIEW



CABLE HANGER

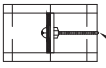


TOP VIEW

FRONT VIEW

SIDE VIEW

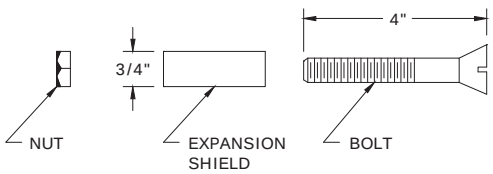
PORCELAIN SPOOL CLAMP



TOP VIEW

FRONT VIEW

SIDE VIEW



NOTES:

1. DRILL 3/4" HOLE IN CONCRETE APPROX. 2" DEEP FOR LEAD EXPANSION SHIELD.

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

CABLE RACKING EQUIPMENT DETAIL

Duke Energy®

FLA

DWG. 29.07-07

NOTES:

1. 500 MCM COPPER CONDUCTOR TO BE USED AS STREET MAINS. ORDER COPPER CONDUCTOR IN TRIPLEX REEL.

2. SERVICES TO BE SIZED AS 500 MCM COPPER OR 4/0 COPPER ACCORDING TO LOAD REQUIREMENTS.

3. SEE DWG. 23.03-113 AS GUIDANCE FOR 600 VOLT CU CONDUCTOR AMPACITY IN DUCT.

4. MANHOLE TO MANHOLE TO CONTAIN ONE RUN OF 500 MCM COPPER (SINGLE CONDUCTOR) AS NEUTRAL TIED TO BARE COPPER RING BUS IN EACH MANHOLE AND VAULT. RUN AN ADDITIONAL RUN OF NEUTRAL CABLE IF MORE THAN 4 PARALLEL RUNS PER PHASE. IN EACH VAULT ATTACH THE 500 MCM COPPER NEUTRAL (1 RUN OR 2) TO NEUTRAL SPADE ON SUBMERSIBLE TRANSFORMER.

5. ADD 20' OF MAKEUP FOR EACH RUN (10' FOR EACH HOLE).

6. MOLES CONTAIN AN INSULATED 500 MCM COPPER CONDUCTOR THAT TIE THEM ALL TOGETHER FOR VOLTAGE BALANCE. THIS IS TO BE UTILIZED WITH CRABS AS WELL.

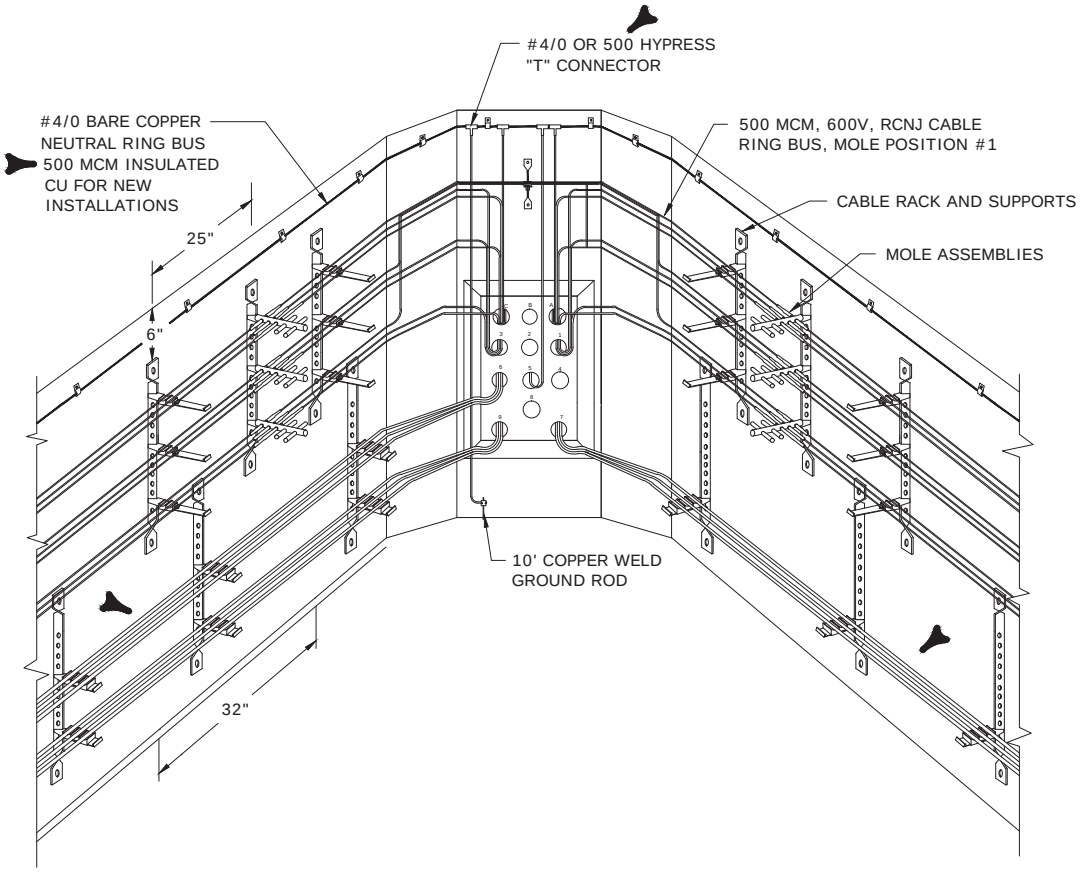
DUKE ENERGY.

3				
2				
1				
0	7/31/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CABLE SELECTION GUIDELINES

DEC	DEM	DEP	DEF
			X

29.07-08



DUCT NO.	CONDUIT ROUTING	TYPICAL CABLE INSTALLATION	STANDARD MOLE * POSITION	MOLIMETER REQUIRED	FIREPROOFING REQUIRED
A	SERVICE CONDUITS	3- #2, 2/0, 4/0 OR 500 MCM-1/C 600V RCNJ CABLES AND CODE RUBBER NEUTRAL	#3 OR #5	REDUCED SECTION FOR 500 MCM ONLY	NO
B		SPARE			
**C		3- #2, 2/0, 4/0 OR 500 MCM-1/C 600V RCNJ CABLES AND CODE RUBBER NEUTRAL	#3 OR #5	REDUCED SECTION FOR 500 MCM ONLY	NO
1	PRIMARY AND SECONDARY CONDUIT TIES MANHOLE TO MANHOLE	3- #4/0 OR 500 MCM-1/C, 600V, RCNJ CABLES	#2	#4/0 OR 500 MCM	NO
2		SPARE (SECONDARY)			
3		3- #4/0 OR 500 MCM-1/C, 600V, RCNJ CABLES	#2	#4/0 OR 500 MCM	NO
4		SPARE (PRIMARY OR SECONDARY)			
5		#4/0 BARE TINNED *** COPPER NEUTRAL			
6		#4/0-3/C, 15KV			YES
7		#4/0-3/C, 15KV			YES
8		SPARE (PRIMARY)			
9		#4/0-3/C, 15KV			YES

* MOLE POSITIONS ARE NUMBERED FROM WALL TO CENTER OF MANHOLE.
** SERVICE DUCTS ARE LETTERED CONSECUTIVELY AS INSTALLED.
*** WHEN REPLACING 4/0 CU NEUTRAL, INSTALL 500 MCM CU NEUTRAL. SEE DWG. 29.07-08 FOR GUIDANCE.

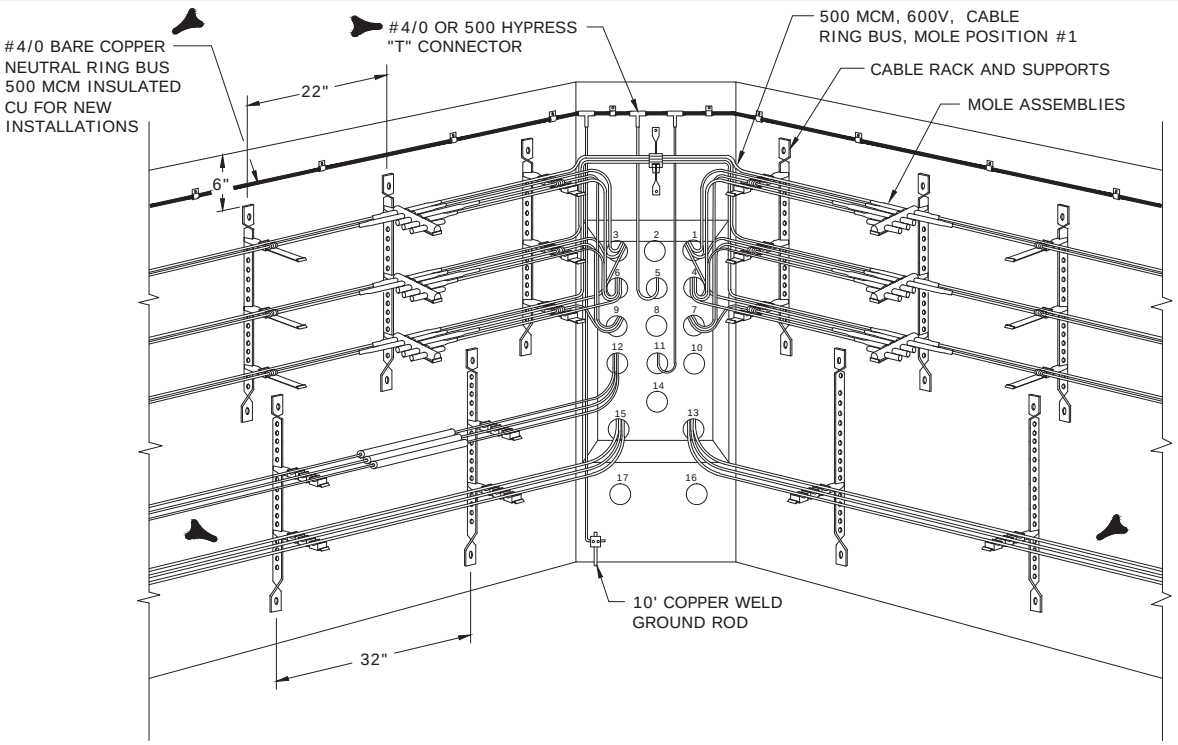
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1	7/31/17	DANNA	EANES	ADCOCK
0	10/5/10	DANNA	GUINN	ELKINS

CABLE RACKING CONFIGURATION
STANDARD 2-WAY MANHOLE

DEC	DEM	DEP	DEF
			X

29.07-09



DUCT NO.	CONDUIT ROUTING	TYPICAL CABLE INSTALLATION	STANDARD MOLE * POSITION	MOLIMETER REQUIRED	FIREPROOFING REQUIRED
1	SECONDARY CONDUIT TIES, TRANS. VAULT TO MANHOLE	3-500 MCM-1/C, 600V, RCNJ CABLES	#2	NO	NO
2		SPARE			
3		3-500 MCM-1/C, 600V, RCNJ CABLES	#2	NO	NO
4		3-500 MCM-1/C, 600V, RCNJ CABLES	#4	NO	NO
5		#4/0 BARE TINNED COPPER NEUTRAL			
6		3-500 MCM-1/C, 600V, RCNJ CABLES	#4	NO	NO
7	PRIMARY AND SECONDARY CONDUIT TIES MANHOLE TO MANHOLE	3-500MCM OR #4/0, 1/C, 600V, RCNJ CABLES	#3	#4/0 OR 500 MCM	NO
8		SPARE (SECONDARY)			
9		3-500MCM OR #4/0, 1/C, 600V, RCNJ CABLES	#3	#4/0 OR 500 MCM	NO
10		SPARE PRIMARY OR SECONDARY			
11		#4/0 BARE TINNED ** COPPER NEUTRAL			
12		#4/0-3/C, 15KV			YES
13		#4/0-3/C, 15KV			YES
14		SPARE (PRIMARY)			
15		#4/0-3/C, 15KV			YES
16	PRIMARY CONDUIT TIES, TRANS. VAULT TO MANHOLE	SPARE			
17		SPARE			

* MOLE POSITIONS ARE NUMBERED FROM WALL TO CENTER OF MANHOLE

** WHEN REPLACING 4/0 CU NEUTRAL, INSTALL 500 CU NEUTRAL. SEE DWG. 29.07-08 FOR GUIDANCE.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	7/31/17	DANNA	EANES	ADCOCK
0	10/5/10	DANNA	GUINN	ELKINS

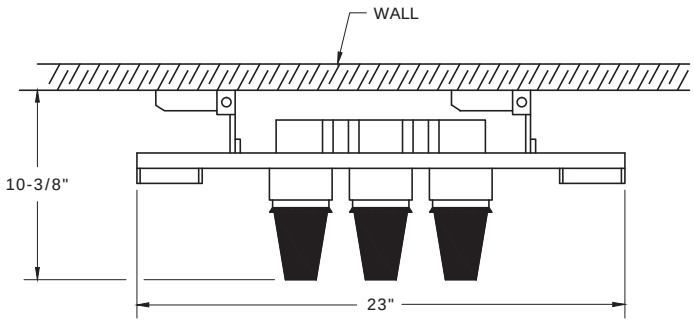
CABLE RACKING CONFIGURATION
STANDARD 4-WAY MANHOLE

DEC	DEM	DEP	DEF
			X

29.07-11

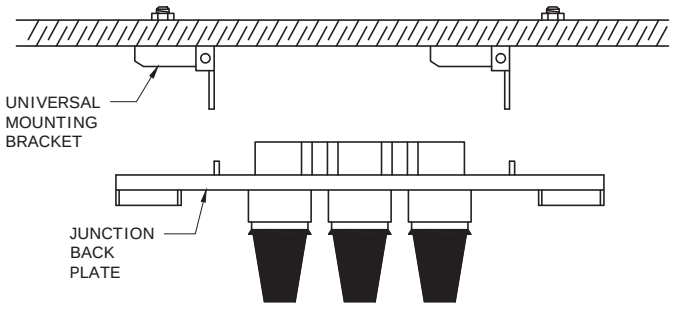
STEP 1

LOOSELY ATTACH UNIVERSAL MOUNTING BRACKETS TO JUNCTION BACK PLATE AND PLACE ASSEMBLY AGAINST WALL. ADJUST BRACKETS FOR PROPER ALIGNMENT AND MARK THEIR LOCATION ON WALL.



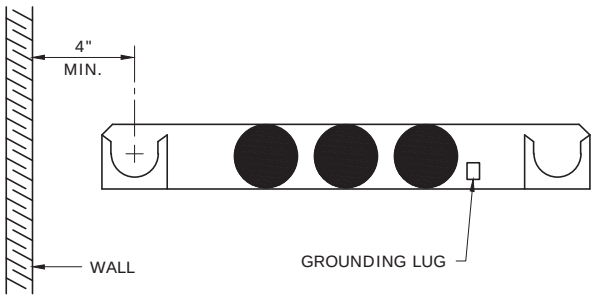
STEP 2

DETACH UNIVERSAL MOUNTING BRACKETS FROM JUNCTION BACK PLATE. MOUNT BRACKETS ON WALL ACCORDING TO MARKS MADE IN STEP 1.



STEP 3

WITH UNIVERSAL MOUNTING BRACKETS SECURE, FASTEN BACK PLATE (WITH JUNCTION ATTACHED) TO MOUNTING BRACKETS, MAKING SURE PARKING STANDS ARE IN UPRIGHT POSITION.

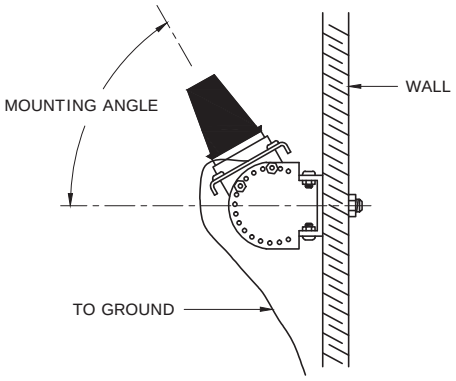


STEP 4

ADJUST MOUNTING ANGLE TO DESIRED POSITION.

FOR PAD-MOUNTED APPLICATIONS
SEE DWGS. 25.01-03A, 25.01-03B
25.01-10A, 25.01-10B AND 25.01-11.

CU FDTHR153WWMTF
CN 326223



STEP 5

TIGHTEN ALL BOLTS SECURELY TO ASSURE NO MOVEMENT DURING OPERATION. GROUND JUNCTION BRACKET TO SYSTEM GROUND USING #4 BC.

REMOVE PROTECTIVE CAPS, CLEAN AND LUBRICATE JUNCTION BUSHING INTERFACE WITH SILICONE GREASE PROVIDED. MATE THREE LOADBREAK ELBOWS TO JUNCTION BUSHINGS FOLLOWING APPLICABLE LOADMAKE OPERATING PROCEDURE.

NOTES:

1. IF ELBOW IS CLOSED INTO A FAULT, REPLACE ELBOW AND JUNCTION.

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

LOADBREAK THREE-WAY JUNCTION - WALL MOUNTED

Duke Energy®

FLA

DWG. 29.08-01

FEED THRU BUSHINGS		
COMPATIBLE UNIT	CATALOG NUMBER	DESCRIPTION
FDTHR153WWMTF	326223	FEED THRU TAP, 3-WAY, FOR 200 AMP ELBOW TERMINATORS WITH MOUNTING BRACKET
FDTHR154WWMTF	326224	FEED THRU TAP, 4-WAY, FOR 200 AMP ELBOW TERMINATORS WITH MOUNTING BRACKET

NOTES:

1. USE 600 AMP SWITCH ANGLE BRACKET (CN 070282) FOR MOUNTING OF FEED THRU BUSHING BRACKET.
2. GROUND BRACKET TO #2 CU GROUND GRID.

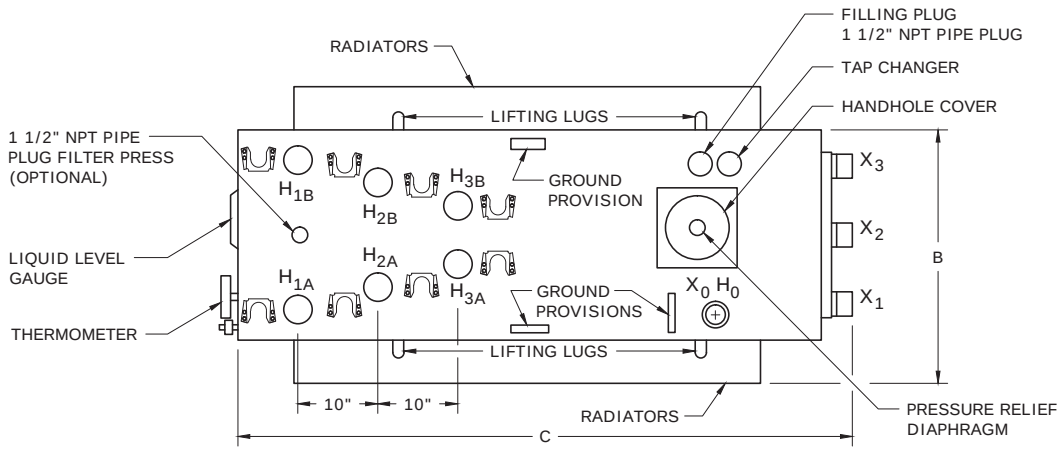
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

LOADBREAK JUNCTION -
BRACKET MOUNTED

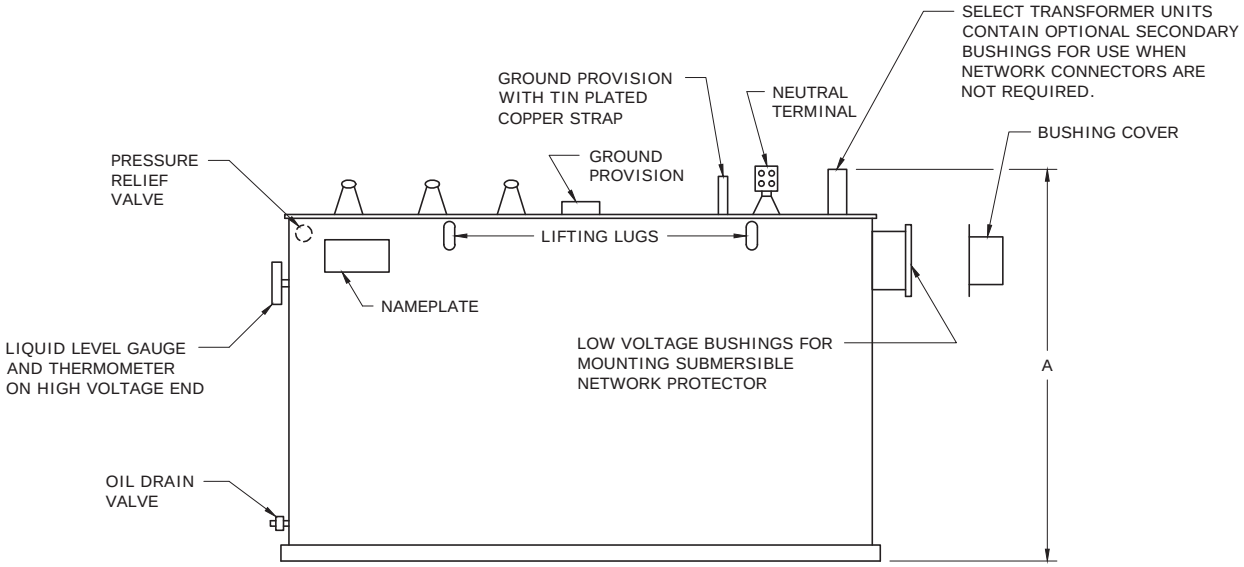
Duke Energy®

FLA

DWG.
29.08-03



PLAN VIEW



SIDE VIEW

SIZE (KVA)	MAXIMUM DIMENSION (INCHES)		
	A	B	C
500	68	38	82
750 - 1000	93	44	92
1500	108	52	155

NOTES:

1. H_{1B} , H_{2B} , H_{3B} INDICATE LOCATION OF BUSHING WELLS FOR LOOP FEED REQUIREMENTS WITH ADDITIONAL ACCESSORY PARKING LOADBREAK TYPE BRACE.

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

THREE-PHASE VAULT TRANSFORMERS

Duke Energy

FLA

DWG. 29.09-07

TRANSFORMERS - URBAN COMMERCIAL DISTRIBUTION (UCD)

THREE-PHASE VAULT STYLE, FOR USE WHERE PHYSICAL SURROUNDINGS DO NOT PERMIT THE USE OF PAD-MOUNTS. HAS STANDARD PAD-MOUNT STYLE HIGH SIDE BUSHING WELLS AND THROATED SECONDARY CONFIGURATION TO ALLOW ATTACHMENT OF A NETWORK PROTECTOR.

TRANSFORMER UNITS FOR CLEARWATER AND ST. PETERSBURG NETWORK ARE AVAILABLE IN THEIR RESPECTIVE OPERATION CENTERS.

BEFORE OPENING NEW UNITS, REVIEW NETWORK TRANSFORMER AVAILABILITY WITH NETWORK FOREMAN.

CATALOG NUMBER	COMPATIBLE UNIT	DESCRIPTION
3301700500	TUT500NOCU12YBF	500 KVA 120/208 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY WITH THROAT
3301700750	TUT750NOCU12YBF	750 KVA 120/208 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY WITH THROAT
9220189023	TU500NOCU12YBF	500 KVA 120/208 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY NO THROAT
9220189024	TU750NOCU12YBF	750 KVA 120/208 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY NO THROAT
9220204447	TUT500NOCU12YFF	500 KVA 277/480 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY WITH THROAT
9220068446	TUT750NOCU12YFF	750 KVA 277/480 MINERAL OIL WITH TAP CHANGER, 7.2 KV PRIMARY WITH THROAT

NOTES:

1. CATALOG NUMBERS ARE NOT AVAILABLE FOR OTHER TRANSFORMER SIZES. CONTACT DISTRIBUTION STANDARDS FOR SPECIAL ORDERS.

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

THREE-PHASE VAULT TRANSFORMERS

Progress Energy

FLA

DWG. 29.09-13

SUGGESTED INSTALLATION EQUIPMENT (NOT SUPPLIED WITH KIT)

- CABLE PREPARATION TOOLS
- TYCO ELECTRONICS P63 CABLE PREPARATION KIT OR CABLE MANUFACTURER APPROVED SOLVENT
- CLEAN, LINT-FREE CLOTHS
- NON-CONDUCTING ABRASIVE CLOTH, 120 GRIT OR FINER
- ELECTRICIAN'S TAPE
- CONNECTOR(S) AND INSTALLATION TOOLS
- TYCO ELECTRONICS RECOMMENDED TORCH

SAFETY INSTRUCTIONS

DANGER: WHEN INSTALLING ELECTRICAL POWER SYSTEM ACCESSORIES, FAILURE TO FOLLOW APPLICABLE PERSONAL SAFETY REQUIREMENTS AND WRITTEN INSTALLATION INSTRUCTIONS COULD RESULT IN FIRE OR EXPLOSION AND SERIOUS OR FATAL INJURIES.

TO AVOID RISK OF ACCIDENTAL FIRE OR EXPLOSION WHEN USING GAS TORCHES, ALWAYS CHECK ALL CONNECTIONS FOR LEAKS BEFORE IGNITING THE TORCH AND FOLLOW THE TORCH MANUFACTURER'S SAFETY INSTRUCTIONS.

TO MINIMIZE ANY EFFECTS OF FUMES PRODUCED DURING INSTALLATION, ALWAYS PROVIDE GOOD VENTILATION OF CONFINED WORK SPACES.

TYCO ELECTRONICS HAS NO CONTROL OVER FIELD CONDITIONS WHICH INFLUENCE PRODUCT INSTALLATION, IT IS UNDERSTOOD THAT THE USER MUST TAKE THIS INTO ACCOUNT AND APPLY THEIR OWN EXPERIENCE AND EXPERTISE WHEN INSTALLING PRODUCT.

CLEANING THE CABLE

USE AN APPROVED SOLVENT, SUCH AS THE ONE SUPPLIED IN THE P63 CABLE PREP KIT, TO CLEAN THE CABLE. BE SURE TO FOLLOW THE MANUFACTURER'S INSTRUCTIONS. FAILURE TO FOLLOW THESE INSTRUCTIONS COULD LEAD TO PRODUCT FAILURE.

SOME NEWER SOLVENTS DO NOT EVAPORATE QUICKLY AND NEED TO BE REMOVED WITH A CLEAN, LINT-FREE CLOTH. FAILURE TO DO SO COULD CHANGE THE VOLUME RESISTIVITY OF THE SUBSTRATE OR LEAVE A RESIDUE ON THE SURFACE.

PLEASE FOLLOW THE MANUFACTURER'S INSTRUCTIONS CAREFULLY.

RECOMMENDED TYCO ELECTRONICS TORCHES

INSTALL HEAT-SHRINKABLE CABLE ACCESSORIES WITH A "CLEAN BURNING" TORCH, I.E. A PROPANE TORCH THAT DOES NOT DEPOSIT CONDUCTIVE CONTAMINANTS ON THE PRODUCT.

CLEAN BURNING TORCHES INCLUDE THE TYCO ELECTRONICS FH-2629, FH-2649 (USES REFILLABLE PROPANE CYLINDERS) AND FH-2618A (USES DISPOSABLE CYLINDER).

ADJUSTING THE TORCH

ADJUST REGULATOR AND TORCH AS REQUIRED TO PROVIDE AN OVERALL 12" BUSHY FLAME. THE FH-2629 WILL BE ALL BLUE, THE OTHER TORCHES WILL HAVE A 3" TO 4" YELLOW TIP. USE THE YELLOW TIP FOR SHRINKING.

REGULATOR PRESSURE

FH-2618A	FULL PRESSURE
FH-2649	25 PSIG
FH-2629	15 PSIG

GENERAL SHRINKING INSTRUCTIONS

- APPLY OUTER 3" TO 4" TIP OF THE FLAME TO HEAT-SHRINKABLE MATERIAL WITH A RAPID BRUSHING MOTION
- KEEP FLAME MOVING TO AVOID SCORCHING
- UNLESS OTHERWISE INSTRUCTED, START SHRINKING TUBE AT CENTER, WORKING FLAME AROUND ALL SIDES OF THE TUBE TO APPLY UNIFORM HEAT

TO DETERMINE IF A TUBE HAS COMPLETELY RECOVERED, LOOK FOR THE FOLLOWING, ESPECIALLY ON THE BACK AND UNDERSIDE OF THE TUBE.

1. UNIFORM WALL THICKNESS.
2. CONFORMANCE TO SUBSTRATE.
3. NO FLAT SPOTS OR CHILL MARKS.
4. VISIBLE SEALANT FLOW IF THE TUBE IS COATED.

NOTE: WHEN INSTALLING MULTIPLE TUBES, MAKE SURE THAT THE SURFACE OF THE LAST TUBE IS STILL WARM BEFORE POSITIONING AND SHRINKING THE NEXT TUBE. IF INSTALLED TUBE HAS COOLED, RE-HEAT THE ENTIRE SURFACE.

3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR
1000 KCM AL SHIELD THREE 1/C
TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

DWG. 29.11-01

1. PRODUCT SELECTION

THE KITS SPECIFIED BELOW ARE PER PROGRESS ENERGY SPECIFICATION FPC #203-277 FOR 3/C SUBMARINE CABLE SPECIFICATION GS-2 FOR 1/C FEEDER CABLE WITH 0.175" INSULATION.

TABLE 1

CABLE DIMENSIONS

TYCO ELECTRONICS KIT NUMBER	CONNECTOR CATALOG NUMBER	NOMINAL CONDUCTOR SIZE (AWG/KCMIL)	MAX. CONDUCTOR LENGTH	MAX. CONDUCTOR O.D.
HVS-T-1551-PE	CSBS-20C-500C-SOS	4/0 CU - 4/0 CU	4.0"	1.2"
HVS-T-1552-PE	ASBS-350C-750	500 CU - 500 AL	6.0"	1.52"
HVS-T-1553-PE	ASBS-600C-1000	750 CU - 1000 AL	8.0"	1.75"

2. CHECK THE GROUND BRAID

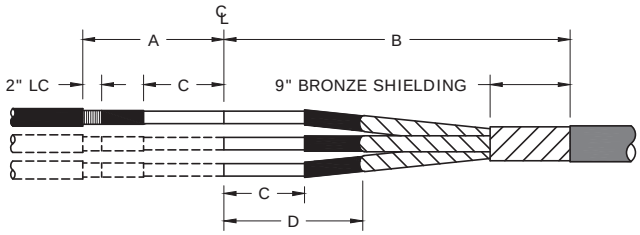
THE KITS SPECIFIED BELOW HAVE BEEN DESIGNED PER PROGRESS ENERGY REQUIREMENT OF BONDING THE LC SHIELD OR CONCENTRIC SHIELDING WIRES OF THE 1/C FEEDER CABLE TO THE COPPER TAPE SHIELD AND BRONZE CORRUGATED SHIELD OF THE 3/C SUBMARINE CABLE. SHIELD CONTINUITY IS BEING CARRIED ACROSS THE SPLICE BUT NOT NEUTRAL EMPATHIC CONTINUITY. NO EXTERNAL GROUNDING PROVISIONS ARE BEING PROVIDED.

3. PREPARE CABLES

CHOOSE THE SPLICE TYPE (CHOICE 1 OR 2) AND FOLLOW THE DIRECTIONS GIVEN.

CHOICE 1: LC SHIELD

USE THE DIMENSIONS SHOWN IN TABLE 2 AND PREPARE THE CABLES AS SHOWN. REMOVE ANY FILLERS TO THE OVERALL SHIELD CUTBACK. TERMINATE INDIVIDUAL SHIELDING TAPE AND LC SHIELD. SECURE WITH COPPER FOIL TAPE PROVIDED.



CHOICE 2: JACKETED CONCENTRIC NEUTRAL CABLE

USE THE DIMENSIONS SHOWN IN TABLE 2 AND PREPARE THE CABLES AS SHOWN. REMOVE ANY FILLERS TO THE OVERALL SHIELD CUTBACK. TERMINATE INDIVIDUAL SHIELDING TAPE AND LC SHIELD. SECURE WITH COPPER FOIL TAPE PROVIDED.

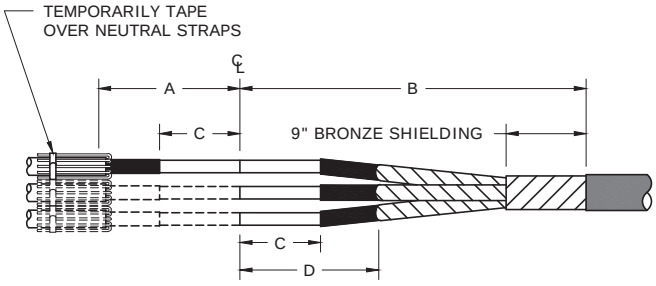


TABLE 2

TYCO ELECTRONICS KIT NUMBER	1/C JACKET CUTBACK "A"	3/C JACKET CUTBACK "B"	SEMI-CON CUTBACK "C"	COPPER TAPE CUTBACK "D"
HVS-T-1551-PE	12"	22"	5"	8"
HVS-T-1552-PE	13"	24"	6"	10"
HVS-T-1553-PE	13"	24"	7"	10"

3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR
1000 KCM AL SHIELD THREE 1/C TO
1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

DWG. 29.11-03

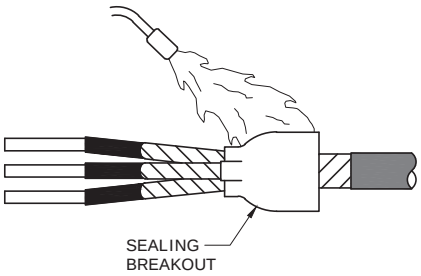
4. PREPARE THE CABLE ENDS FOR THE SHEARBOLT CONNECTORS. THE CABLE PREPARATION LENGTH IS EQUAL TO 1/2 LENGTH MINUS 1/8".

KIT	CONNECTOR CATALOG NUMBER	LENGTH	REMOVE INSULATION
HVS-T-1551-PE	CSBS-20C-500	4"	1-7/8"
HVS-T-1552-PE	ASBS-350C-750	6"	2-7/8"
HVS-T-1553-PE	ASBS-600C-1000	8"	3-7/8"

5. POSITION SEALING BREAKOUT; SHRINK IN PLACE

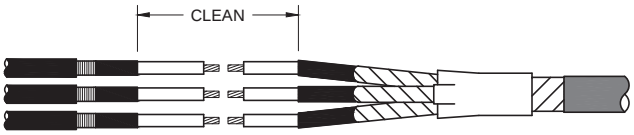
POSITION THE SEALING BREAKOUT OVER THE CABLE JACKET SO THAT THE INSIDE BUTTS UP HARD AGAINST THE BRONZE SHIELD CUTBACK.

SHRINK IN PLACE STARTING AT THE FINGERS AND WORKING TOWARD THE OTHER END.



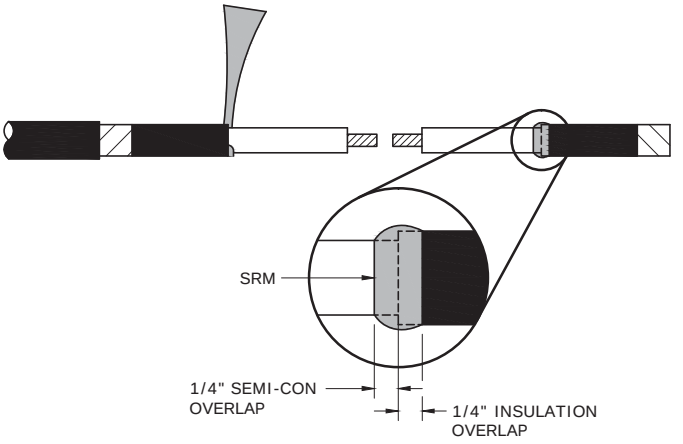
6. ABRADE INSULATION

ABRADE THE INSULATION, IF NECESSARY, TO REMOVE IMBEDDED SEMI-CON AND CLEAN AS SHOWN.



7. APPLY STRESS RELIEF MATERIAL (SRM) AT SEMI-CON CUTBACKS

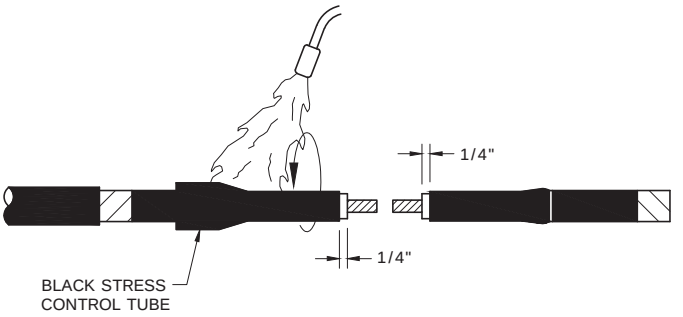
REMOVE BACKINGS FROM THE SHORT ANGLE-CUT PIECE OF SRM. PLACE TIP OF SRM AT SEMI-CON CUTBACK, STRETCH AND TIGHTLY WRAP TO FILL SEMI-CON STEP. OVERLAP SEMI-CON AND INSULATION AS SHOWN. TAPER SRM DOWN TO MEET INSULATION. REPEAT ON OTHER TWO CABLES.



8. POSITION BLACK STRESS CONTROL TUBE; SHRINK IN PLACE

PLACE A BLACK STRESS CONTROL TUBE OVER EACH CABLE 1/4" FROM THE INSULATION CUTBACK AS SHOWN.

BEGIN SHRINKING FROM THE EXPOSED CONDUCTOR. WORK THE TORCH AROUND ALL SIDES TOWARD THE OTHER END OF THE TUBE.



3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR 1000 KCM AL SHIELD THREE 1/C TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

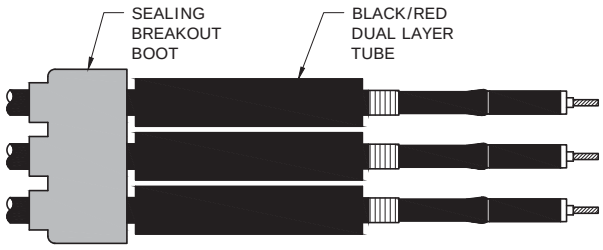
FLA

DWG. 29.11-05

9. POSITION SPLICE COMPONENTS

PLACE SEALING BREAKOUT BOOT OVER THE 1/C CABLES WITH THE FINGERS POINTING AWAY FROM THE SPLICE CENTER.

PLACE ONE BLACK/RED DUAL LAYER TUBE OVER EACH CLEAN 1/C CABLE.

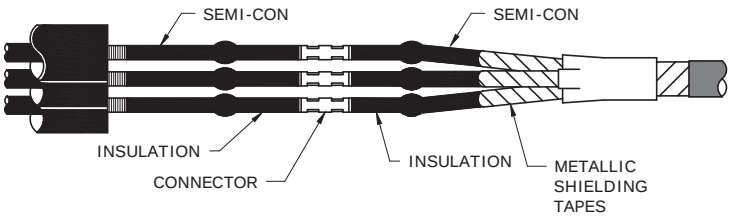


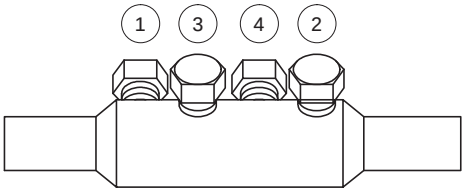
10. INSTALL CONNECTOR

COMPLETE STEPS 10-12 WORKING ON ONE PHASE AT A TIME

INSTALL ALUMINUM OR COPPER SHEARBOLT CONNECTOR. INSULATION SHOULD BE BUTTED UP TIGHT AGAINST THE CONNECTOR ON BOTH SIDES.

HAND TIGHTEN THE SHEAR BOLTS SO THAT THE CONNECTOR STAYS IN PLACE. ALTERNATELY TIGHTEN THE BOLT SET BY HALF TURNS WITH A SOCKET WRENCH UNTIL THE BOLTS SHEAR OFF. FOLLOW THE TIGHTENING SEQUENCE AS SHOWN. FILE SMOOTH ANY REMAINING PART OF THE SHEAR BOLT THAT REMAINS HIGHER THAN THE CONNECTOR.





11. APPLY YELLOW MASTIC OVER CONNECTOR

COMPLETE STEPS 10-12 WORKING ON ONE PHASE AT A TIME

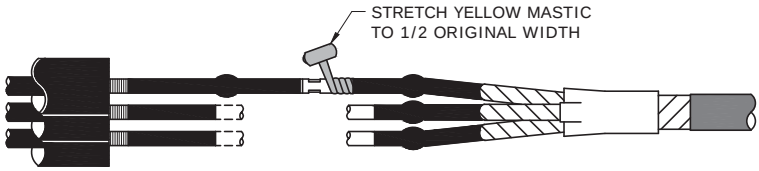
CLEAN CONNECTOR AREA AND INSULATION USING AN APPROVED SOLVENT.

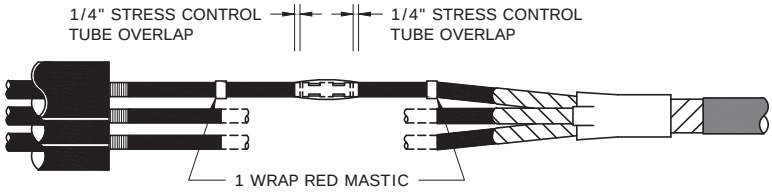
REMOVE BACKING FROM ONE SIDE OF THE LONG STRIP OF YELLOW MASTIC. ROLL THE YELLOW MASTIC AND REMAINING BACKING STRIP INTO A CONVENIENT SIZE. REMOVE THE REMAINING BACKING STRIP AND TIGHTLY WRAP THE YELLOW MASTIC AROUND THE CONNECTOR.

CONTINUE TO WRAP THE SRM ONTO THE STRESS CONTROL TUBE 1/4" AS SHOWN.

CONTINUE TO WRAP YELLOW MASTIC ACROSS THE AREA UNTIL THE LEVEL IS ONE LAYER LARGER IN DIAMETER THAN THE DIAMETER OF THE STRESS CONTROL TUBE.

WRAP ONE LAYER OF RED SEALANT AT THE END OF THE STRESS CONTROL TUBE.

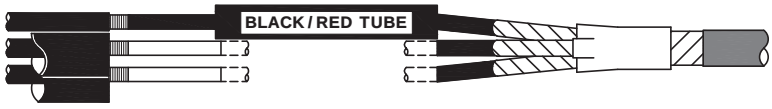




12. POSITION TUBE OVER CONNECTION

COMPLETE STEPS 10-12 WORKING ON ONE PHASE AT A TIME

CENTER BLACK/RED TUBE OVER COMPLETED CONNECTOR AREA.



REVISED		BY	CK'D	APPR.
3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS

INSTALLATION INSTRUCTIONS FOR 1000 KCM AL SHIELD THREE 1/C TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

DWG. 29.11-07

13. POSITION BLACK/RED TRIPLE LAYER TUBES; SHRINK IN PLACE

VERIFY THE BLACK/RED TRIPLE LAYER TUBES ARE CENTERED OVER THE JOINT AND EXTEND OVER THE RED SEALANT ON BOTH ENDS.

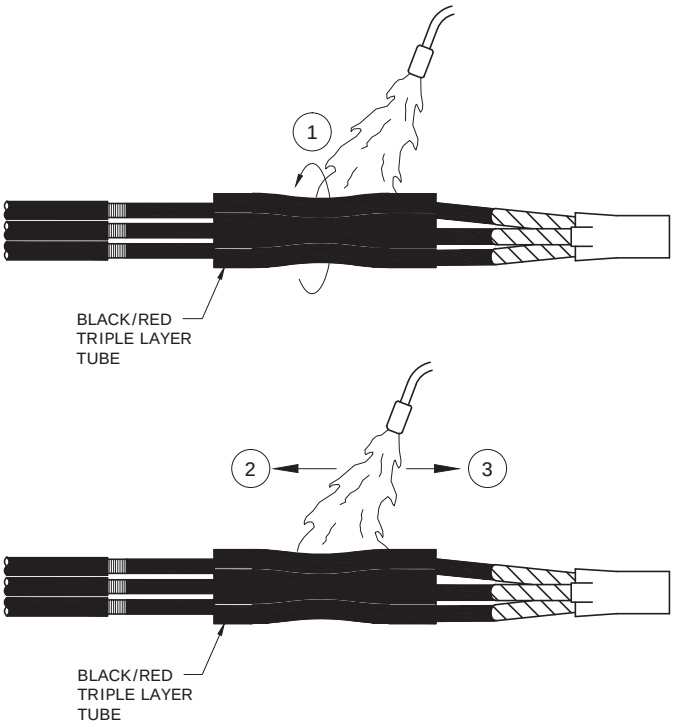
1. SHRINK ALL THREE TUBES AT ONCE. BEGIN SHRINKING IN CENTER OF TUBES, WORKING TORCH AROUND ALL SIDES OF THE TUBES. PAY PARTICULAR ATTENTION TO THE BACK AND UNDERSIDE OF THE TUBES.

2. SHRINK FROM THE CENTER TOWARD ONE END, UNTIL FULLY RECOVERED.

3. RETURN TO THE CENTER AND SHRINK TOWARD THE OTHER END UNTIL FULLY RECOVERED.

NOTE: AFTER COMPLETING THE ABOVE STEPS, THE RAISED EDGES ON THE SURFACE SHOULD DISAPPEAR. ABSENCE OF RIDGES CAN BE OBSERVED BY VISUAL INSPECTION BY FEELING SURFACE WITH A GLOVED HAND. POST HEAT ANY RIDGES UNTIL THE SURFACE IS SMOOTH.

NOTE: DO NOT POINT THE FLAME AT THE CABLE SEMI-CON.



14. CONNECT SHIELDS

CHOOSE THE SPLICE TYPE BELOW AND FOLLOW THE DIRECTIONS.

CHOICE 1: LC SHIELD CABLE

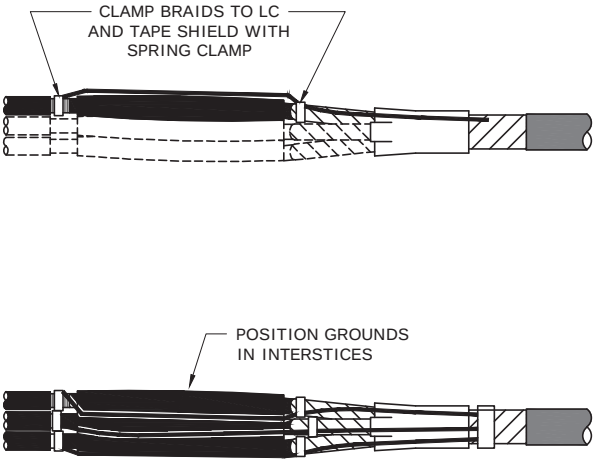
LAY GROUND WIRE OR BRAIDS ACROSS AND ATTACH TO LC SHIELD ON 1/C PHASES USING SPRING CLAMPS AND COPPER TAPE ON 3/C SIDE, AS SHOWN.

LAY THE THREE BRAIDS ACROSS THE JOINT EVENLY SPACED AROUND THE JOINT CIRCUMFERENCE SO THAT THE BRAIDS OVERLAP THE MESH AND TEMPORARILY TAPE THE BRAIDS IN POSITION.

MAKE TWO WRAPS OF THE LARGE SPRING CLAMP OVER THE BRAIDS AND BRONZE SHEATH.

REMOVE THE TEMPORARY TAPE.

FOLD BACK THE OVERLAPPING BRAIDS OVER THE SPRING CLAMP AND WRAP THE REMAINING SPRING CLAMP. TIGHTEN AND SECURE THE SPRING CLAMP. CUT OFF EXCESS BRAIDS.



3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR
1000 KCM AL SHIELD THREE 1/C
TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

DWG. 29.11-09

CHOICE 2: JACKETED CONCENTRIC NEUTRAL CABLE

BUNDLE GROUND WIRES OF EACH 1/C PHASE TOGETHER. LAY BRAIDS ACROSS THE SPLICE AND CONNECT BUNDLED 1/C SHIELD WIRES TO BRAIDS USING CUSTOMER SUPPLIED CRIMP CONNECTORS. ATTACH BRAIDS TO COPPER TAPE SHIELD.

LAY THE THREE BRAIDS ACROSS THE JOINT EVENLY SPACED AROUND THE JOINT CIRCUMFERENCE SO THAT THE BRAIDS OVERLAP THE MESH AND TEMPORARILY TAPE THE BRAIDS IN POSITION.

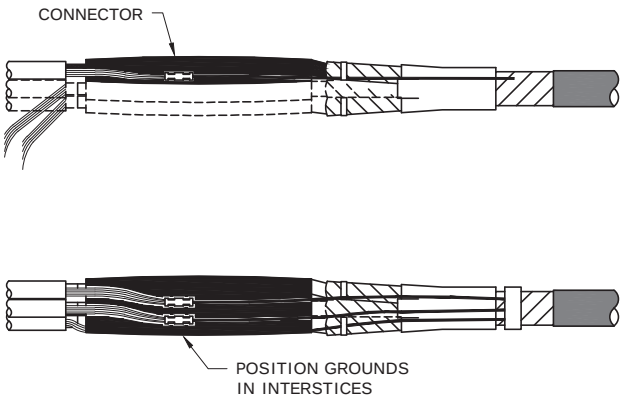
MAKE TWO WRAP OF THE LARGE SPRING CLAMP OVER THE BRAIDS AND BRONZE SHEATH.

REMOVE THE TEMPORARY TAPE.

FOLD BACK THE OVERLAPPING BRAIDS OVER THE SPRING CLAMP AND WRAP THE REMAINING SPRING CLAMP. TIGHTEN AND SECURE THE SPRING CLAMP. CUT OFF EXCESS BRAIDS.

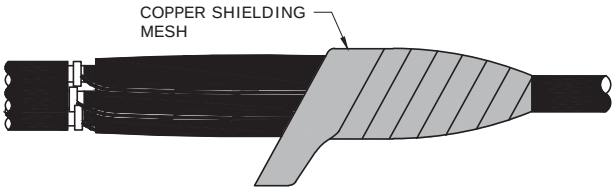
CLAMP EACH PHASE BRAID TO THE COPPER TAPE SHIELD OF THE PHASE.

GO TO STEP 15.



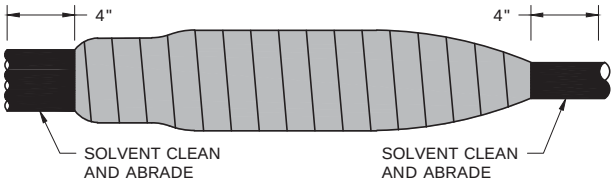
15. INSTALL THE SHIELDING MESH

STARTING AT THE 3/C CUTBACK, WRAP ONE HALF-LAPPED LAYER OF 2" WIDE COPPER MESH OVER THE EXPOSED BRONZE SHEATH AND BRAID ATTACHMENT, ACROSS THE SPLICES AND TIE OFF AT THE 3-1/C JACKETS AS SHOWN.



16. CLEAN CABLES

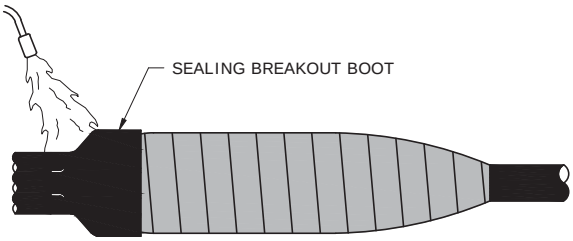
SOLVENT CLEAN AND ABRADE CABLE JACKETS (OR LEAD SHEATH) AS SHOWN USING AN OIL-FREE SOLVENT



17. POSITION SEALING BREAKOUT BOOT; SHRINK IN PLACE

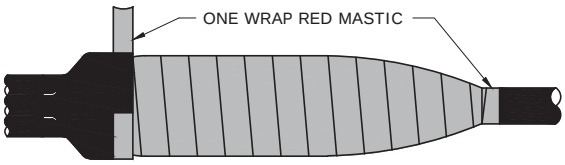
MAKE SURE THAT THE FULL LENGTH OF THE FINGERS OF THE BREAKOUT BOOT ARE OVER THE EXTRUDED DIELECTRIC CABLE JACKETS WITH THE BODY EXTENDING OVER THE SPLICES.

SHRINK IN PLACE STARTING AT THE FINGERS AND WORKING TOWARD THE SPLICE CENTER.



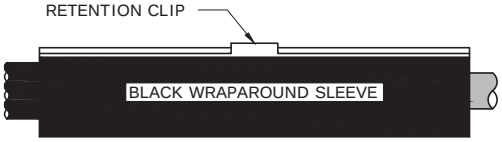
18. APPLY RED MASTIC

APPLY ONE WRAP OF RED MASTIC OVER THE BODY OF THE BREAKOUT BOOT AND ONE LAYER OVER THE 3/C JACKET AS SHOWN.



19. POSITION WRAPAROUND SLEEVE

REMOVE OR TAPE OVER ALL SHARP POINTS TO PREVENT PUNCTURE OF WRAPAROUND SLEEVE. REMOVE BACKING FROM WRAPAROUND SEALING SLEEVE AND CENTER SLEEVE OVER SPLICE. SLIDE METAL RETENTION CLIP ONTO THE BUTTED RAILS.



3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR
1000 KCM AL SHIELD THREE 1/C
TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

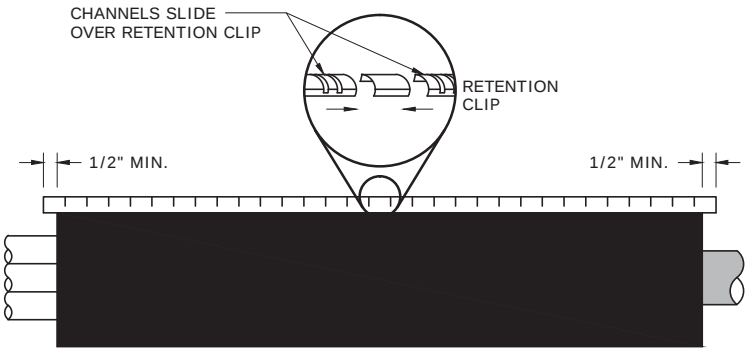
DWG. 29.11-11

20. INSTALL CHANNELS

SLIDE CHANNELS TOWARD THE CENTER FROM EACH END OF THE SLEEVE AND OVER THE RETENTION CLIP. A MINIMUM OF 1/2" OF CHANNEL SHOULD BE EXTENDED BEYOND THE EDGES OF THE SLEEVE.

IF CHANNELS SLIDE ON EASILY, GO TO STEP 21. IF CHANNEL FIT SEEMS TIGHT, CONTINUE WITH NEXT PARAGRAPH.

AS SHOWN IN ILLUSTRATION 'A', MAKE SURE FLAP IS NOT PINCHED BETWEEN THE RAILS. PUSH THE SLEEVE UP FROM THE BOTTOM AND DOWN FROM THE TOP WHILE SLIDING ON CHANNEL AS SHOWN IN ILLUSTRATION 'B'. THE IDEA IS TO FLATTEN THE RAILS TOGETHER TO PREVENT THE CHANNELS FROM BINDING.



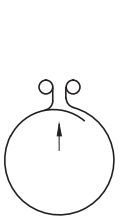


ILLUSTRATION 'A'

ILLUSTRATION 'B'

21. SHRINK THE WRAPAROUND SLEEVE

PREHEAT EVENLY ALONG BOTH SIDES OF THE RAIL/CHANNEL AREA UNTIL THIS AREA BEGINS TO SHRINK. TO ACHIEVE UNIFORM HEATING, MOVE THE FLAME BACK AND FORTH FROM ONE SIDE OF THE CHANNEL TO THE OTHER AS SHOWN IN ILLUSTRATION 'C' WHILE MOVING FLAME ALONG THE ENTIRE LENGTH OF THE CHANNEL AS SHOWN IN ILLUSTRATION 'D' UNTIL THE SLEEVE STARTS TO SHRINK. THIS TECHNIQUE WILL ASSURE A PROPERLY PREHEATED RAIL AND CHANNEL AREA.

BEGIN SHRINKING AT THE CENTER OF THE SLEEVE AND WORK TOWARD EACH END.

APPLY HEAT UNTIL THE SLEEVE IS FULLY SHRUNK AND THE HEAT-SENSITIVE GREEN PAINT IS COMPLETELY CONVERTED TO BLACK. CONTINUE HEATING THE RAIL/ CHANNEL AREA FOR ANOTHER FIVE SECONDS PER FOOT. A WHITE LINE SHOULD BE VISIBLE IN THE CHANNEL GAPS INDICATING SUFFICIENT HEATING.

NOTE: GREEN HEAT-SENSITIVE PAINT WILL TURN BLACK AS THE SLEEVE SHRINKS IN PLACE.

THIS COMPLETES THE SPLICE.

NOTE: ALLOW TO COOL BEFORE MOVING OR PLACING IN SERVICE.

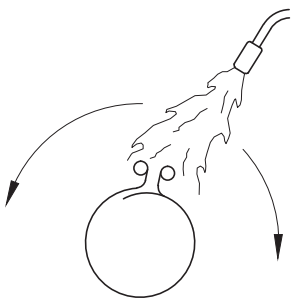


ILLUSTRATION 'C'

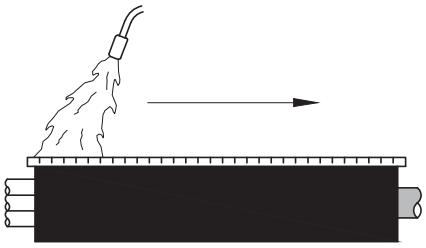
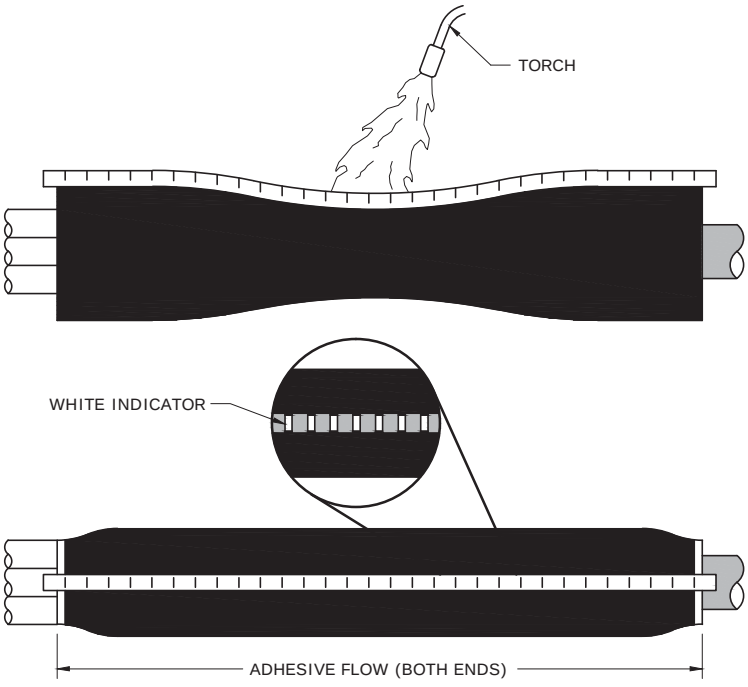


ILLUSTRATION 'D'



3				
2				
1				
0	11/30/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

INSTALLATION INSTRUCTIONS FOR 1000 KCM AL SHIELD THREE 1/C TO 1000 KCM AL COMPRESSED SUBMARINE 3/C

Duke Energy®

FLA

DWG. 29.11-13

NOTES:

LIMITERS ARE INSTALLED AT EACH SECONDARY JUNCTION ON BOTH SIDES OF MOLE CONNECTION. IN ADDITION LIMITERS ARE INSTALLED AT ALL SERVICE CONNECTIONS. FULL SECTION LIMITERS ARE USED ON THE STREET MAIN SECONDARY GRID AND ARE SIZED TO MATCH THE SECONDARY CONDUCTOR. HALF-SECTION LIMITERS ARE TO BE USED ON SERVICE CONNECTION JUNCTION POINTS AND ARE SIZED TO MATCH THE CONDUCTOR SIZE. THIS IS TO ENSURE THE HALF SECTION LIMITER WILL ISOLATE A SERVICE CONDUCTOR FAULT BEFORE DAMAGING THE SECONDARY MAIN AND ASSOCIATED LIMITERS. TO ISOLATE A FAULT BEFORE IT CAN CAUSE EXTENSIVE DAMAGE, AND WITHOUT INTERRUPTING SERVICE IN OTHER SECTIONS OF THE NETWORK, LIMITERS AND FUSES MUST CLEAR AT THE PROPER TIME AND IN PROPER SEQUENCE. WHEN A PRIMARY FAULT OCCURS, THE FUSE SHOULD CLEAR BEFORE ANY LIMITERS BLOW. FOR A SECONDARY FAULT, LIMITERS SHOULD CLEAR THE FAULT BEFORE THE NETWORK PROTECTOR FUSE OPENS.

MATERIALS:

1. CRABS AND SMART LIMITERS CAN BE USED (AND ARE PREFERRED) AS A SUBSTITUTE FOR MOLES AND FULL LINK MOLIMETERS.

2. STUD MOLES ARE RATED FOR 2000A (MAX 4 RUNS OF 500 CU PER MOLE). THIS IS EQUIVALENT TO 750KVA (208V) MAXIMUM SIZE TRANSFORMER. IF LARGER TRANSFORMER, STANDARDS SHOULD BE CONTACTED FOR SPECIAL ORDER.

3. IN-LINE MOLES ARE RATED FOR 1500A (MAX 3 RUNS OF 500 CU PER MOLE).

4. MOLES REQUIRE THE FOLLOWING MATERIAL TO ASSEMBLE CABLE AND HAND TAPING TO WATERPROOF:
   A. MOLE
   B. NUT & SOCKET
   C. CONE
   D. SLEEVE OR MOLIMETER KIT AS REQUIRED
   E. MOLE PLUGS

5. CRABS AND SMART-LIMITERS REQUIRE THE FOLLOWING MATERIAL (NO TAPING REQUIRED):
   A. CRAB
   B. GEL WRAPS
   C. END CAPS
   D. SMART LIMITERS AS REQUIRED
   E. ADHESIVE STRIP AS REQUIRED

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	7/31/17	DANNA	EANES	ADCOCK

MOLE/CRAB - LIMITER APPLICATION

DEC	DEM	DEP	DEF
			X

29.13-00A

ITEM DESCRIPTION	ITEM NUMBER	COMMENTS
RACK	320774	TYPICALLY 3 RACKS PER WALL
STEP	320526 (12")	3 STEPS PER RACK (ONE PER PHASE), 12"
	320528 (15")	3 STEPS PER RACK (ONE PER PHASE), 15"
PORCELAIN	80103	ONE PORCELAIN REQUIRED PER RUN OF CABLE IN EACH STEP IN THE NON-MOLE/NON CRAB RACKS
MOLE ASSEMBLY	312205 (10 POSITION)	10 POSITION MOLE IS MOST TYPICAL BUT MUST LOOK AT DRAWING SEE IF BIGGER IS NEEDED
NUT & SOCKET	313355 (500)	CABLE SIZE DEPENDENT. ONE REQUIRED FOR EACH CABLE CONNECTION IN A MOLE
	313353 (4/0)	
CONE	313388 (500)	CABLE SIZE DEPENDENT. ONE REQUIRED FOR EACH CABLE CONNECTION IN A MOLE
	313386 (4/0)	
MOLE PLUG	313153	1 REQUIRED FOR EACH UNUSED CONNECTION IN A MOLE
MOLE END PLUG	9220191120	2 REQUIRED FOR EACH MOLE
MOLIMETER KIT	312552 (500)	1 REQUIRED FOR EACH SERVICE AND ONE FOR EACH END OF A STREET MAIN CABLE
	312503 (4/0)	
MOLE SLEEVE	313205	1 REQUIRED FOR EACH NON-MOLIMETER CABLE CONNECTION IN A MOLE
HALF LINK	9220191129 (500)	1 REQUIRED FOR EACH SERVICE TO REPLACE FULL LINK THAT COMES IN MOLIMETER KIT. CABLE SIZE DEPENDENT
	9220191126 (4/0)	
MOLIMETER KIT 4/0 HALF	9220285437	THIS 4/0 HALF LIMITER KIT CAN BE CRIMPED IN LINE ON CABLE ALLOWING IT TO BE USED WITH TE CRAB USED WITH TE CRAB
DUCT SHOE	320725	1 REQUIRED FOR EACH CABLE CONTAINING DUCT IN MANHOLE
3-500 1/C CABLE	9220285278	TRIPLEX COPPER CABLE. ORDER AS NEEDED BASED ON DRAWING. SOUTHWIRE PART NUMBER 56-15-56-01
CRABS	(3 WAY) 9220285338	5 WAY WILL BE THE MOST PRACTICAL BUT CERTAIN LOCATIONS MAY REQUIRE A 7 WAY OR ONLY A 3 WAY. FOR A 7 WAY, THE MANUFACTURER'S PART NUMBER IS CJ-500-7W7W-CU-FT-B1.
	(5 WAY) 9220285336	
SMART LIMITER	(500 FULL) 9220285346	1 REQUIRED FOR EACH SERVICE AND ONE FOR EACH END OF A STREET MAIN CABLE SECTION (BETWEEN CRABS)
	(4/0 FULL) 9220285339	
	(500 HALF) 9220285340	
END CAPS	074121716	USE 1 PER UNUSED CRAB CONNECTION
GEL WRAPS	9220285335	USE 1 PER STRAIGHT SPLICE AS NEEDED (FOR 500 TO 500 CONNECTIONS)
ADHESIVE STRIP	9220285388	FOR 500 TO 4/0 CONNECTIONS MUST BUILD UP 4/0 CONDUCTOR WITH ADHESIVE STRIP AND THEN USE GEL WRAP

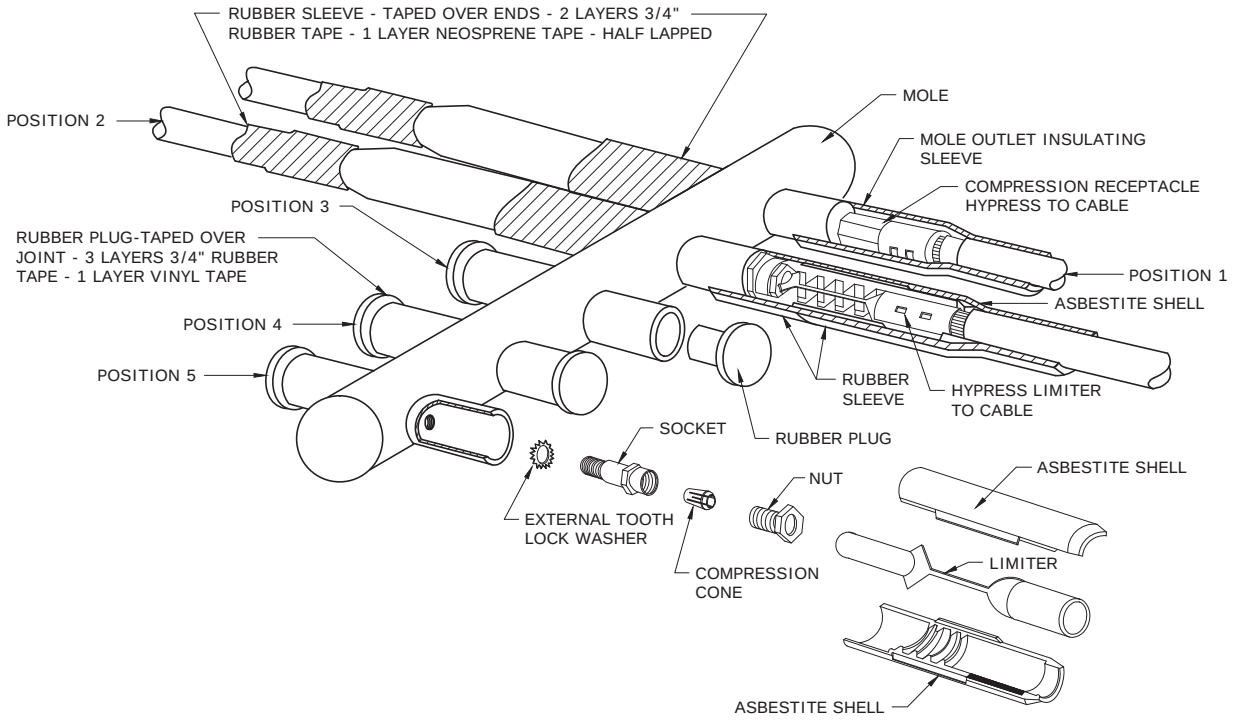
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/31/17	DANNA	EANES	ADCOCK

MOLE/CRAB - APPLICATION AND ITEM NUMBERS

DEC	DEM	DEP	DEF
			X

29.13-00B



CABLE POSITION	PLACEMENT	CABLE TYPE
1	CLOSEST TO WALL	JUMPER
2	-	STREET MAIN OR TRANSFORMER LEAD
3	-	STREET MAIN OR TRANSFORMER LEAD
4	-	SERVICE
5	FURTHEST FROM WALL	SERVICE

NOTES:

1. SAND, CLEAN AND PREPARE TAPING SURFACES OF MOLE, CABLE, SLEEVES AND PLUGS. APPLY LIQUID ADHESIVE (CN 9220264758).

REVISED		BY	CK'D	APPR.
3				
2				
1	2/19/14	DANNA	DANNA	ADCOCK
0	10/5/10	DANNA	GUINN	ELKINS

SECONDARY CABLE

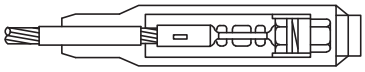
MOLE CONNECTION DETAILS

DUKE ENERGY.

FLA

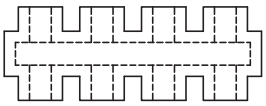
DWG. 29.13-01

LIMITERS



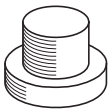
ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
LINK ONLY	4/0	9220191136	MOLLINK40F
LINK ONLY	500	9220191123	MOLLINK500F
HALF LINK ONLY	4/0	9220191126	MOLHLINK40F
HALF LINK ONLY	500	9220191129	MOLHLINK500F
RECEPTACLE TYPE ASSEMBLY CABLE TO MULTI-OUTLET TO CLEAR FAULTED SECONDARY CABLE IN SECONDARY NETWORKS INCLUDES LINK, SHELL AND RUBBER SLEEVE	4/0 STRAND LINE	312503	MOLLIMASBLY40F
	500 KCM LINE	312552	MOLLIMASBLY500F

MOLE - 600V MECHANICAL ASSEMBLY, TYPE 2-WAY, PRE-INSULATED



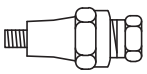
ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
CONNECTOR, STUD MOLE 600V MECHANICAL TYPE, STUD BASE, PRE-INSULATED "STUD MOLE"	8 HOLE, 1500 AMP	312204	MOLBC8P15F
	10 HOLE, 1500 AMP	312205	MOLBC10P15F
	16 HOLE, 1500 AMP	9220191936	MOLBC16P15F

PLUGS



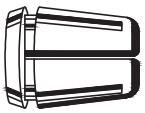
ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
POSITION PLUGS, MULTI-OUTLET RECEPTACLE MOLE PLUG	1500 AMP	313153	MOLPP15F
END PLUG	1500 AMP	9220191120	MOLEP15F
END PLUG	2000 AMP	9220191431	MOLEP20F

SOCKETS



ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
SOCKET AND NUT ASSEMBLY CABLE TO MULTI-OUTLET RECEPTACLE	4/0 STRANDED MAXIMUM	313353	MOLSN40F
	500 MCM MAXIMUM	313355	MOLSN500F

CONES



CORRESPONDING SOCKET	* TYPE	CATALOG NUMBER	COMPATIBLE UNIT
313353	#6 CABLE	9220191119	MOLCONE6F
	#2 CABLE	9220191138	MOLCONE2F
	1/0 CABLE	313382	MOLCONE10F
	4/0 CABLE	313386	MOLCONE40F
313355	500 CABLE	313388	MOLCONE500F

*CONTACT DISTRIBUTION STANDARDS TO REQUEST OTHER CONE SIZES

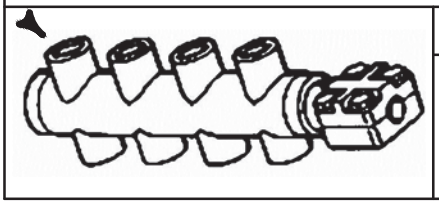
3				
2				
1				
0	10/5/10	DANNA	GUINN	ELKINS
REVISED		BY	CK'D	APPR.

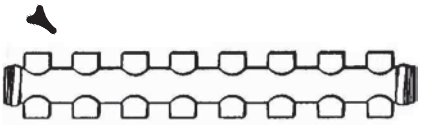
SECONDARY CABLE
MOLE CONNECTION CATALOG NUMBERS

Duke Energy®

FLA

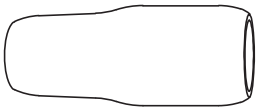
DWG. 29.13-05

STUD MOLE				
	ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
	STUD MOLE, 2000 AMP	8 POS	9220191124	MOSTUD8P20F

MOLE INSULATION ONLY				
	ITEM	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
	MOLE INSULATION, 1500 AMP	8 POS	9220191121	MOLCOV8PI5F
	MOLE INSULATION, 1500 AMP	10 POS	9220191122	MOLCOV10P15F
	MOLE INSULATION, 1500 AMP	16 POS	9220191938	MOLCOV16P15F

CONNECTOR		
ITEM	CATALOG NUMBER	COMPATIBLE UNIT
CONNECTOR 4/0, TEE	9220191133	MOLTEE40F

HYDENT SOCKET		
ITEM	CATALOG NUMBER	COMPATIBLE UNIT
4/0 SOCKET	9220191130	MOLHYSOC40F
500 SOCKET	9220191131	MOLHYSOC500F

MOLE INSULATION ONLY			
	ITEM	CATALOG NUMBER	COMPATIBLE UNIT
	COVER FOR SOCKET AND NUT ASSEMBLY	313205	MOLCONECOVEF

REVISED	BY	CK'D	APPR.
3			
2			
1 7/15/11	DANNA	BURLISON	ELKINS
0 10/5/10	DANNA	GUINN	ELKINS

SECONDARY CABLE

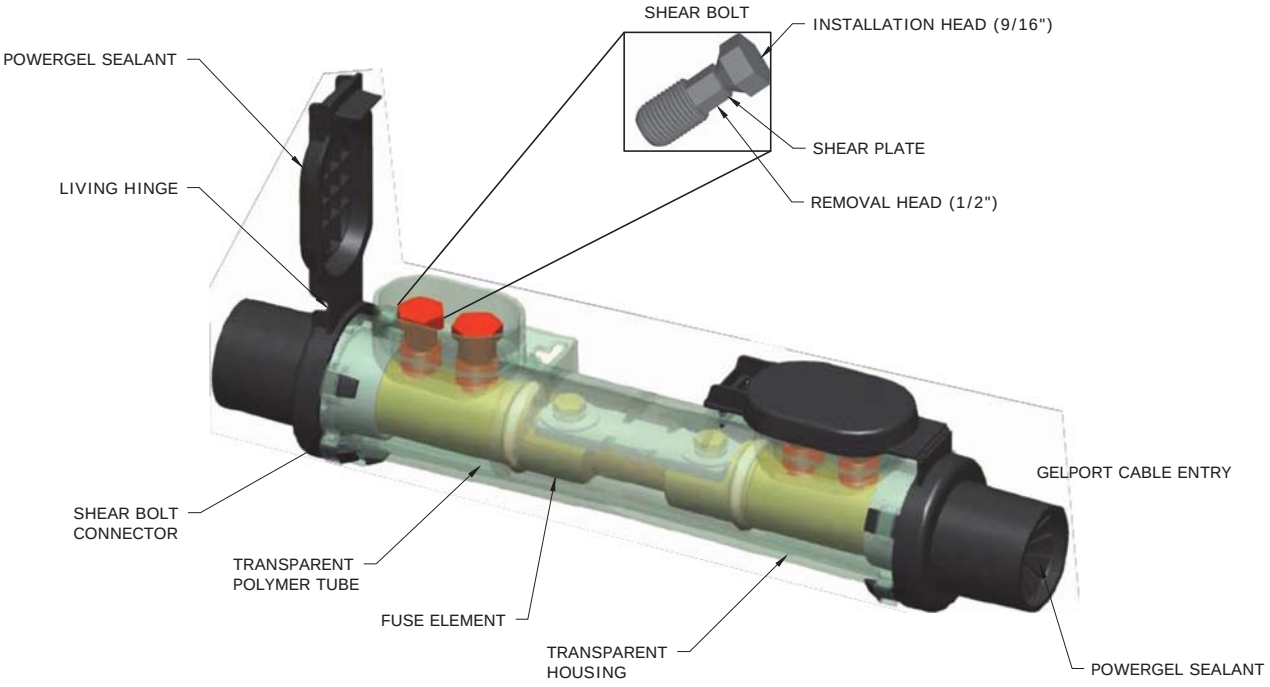
MOLE CONNECTION CATALOG NUMBERS

Progress Energy

FLA

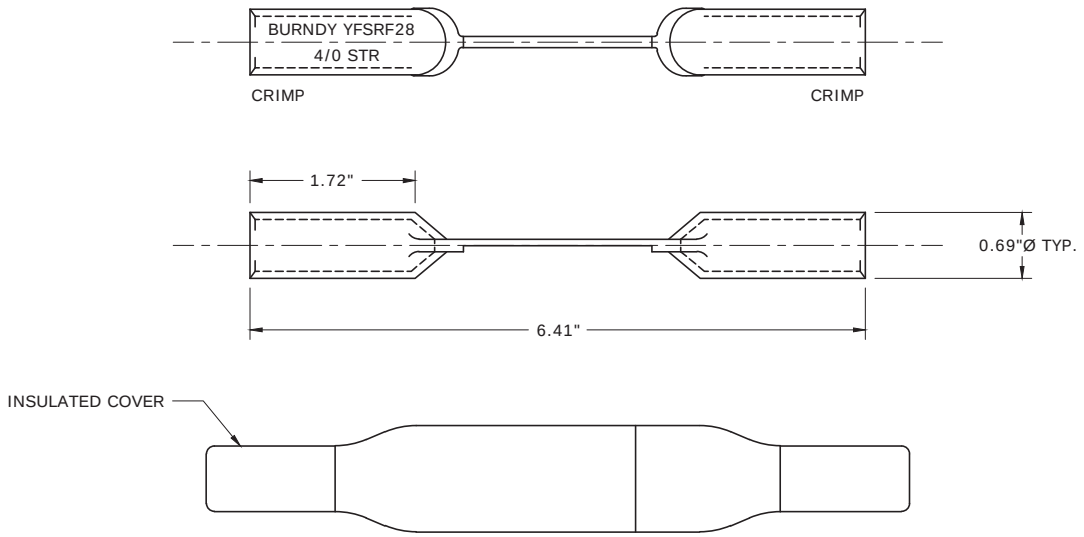
DWG. 29.13-07

SMART LIMITER



- FOR USE ON STREET MAINS 500 CU OR 4/0 CU , CONTAINS FULL LIMITER
- FOR USE ON SERVICE 500 CU, CONTAINS HALF LIMITER

BURNDY - 4/0 HALF LIMITER



- FOR USE ON SERVICE 4/0 CU, CONTAINS HALF LIMITER
- CRIMP TO CRIMP STYLE ALLOWS FOR USE WITH CABLE ASSOCIATED WITH A CRAB JOINT
- LIMITER SHELL NOT SHOWN

DUKE ENERGY.

3				
2				
1				
0	7/31/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

LIMITERS FOR USE WITH CRAB CONNECTORS

DEC	DEM	DEP	DEF
			X

29.13-09

CRAB JOINT

NOTES:

1. USE WHEN REPLACING IN LINE MOLES.

CRAB JOINT SHOWN
WITH SMART LIMITERS

NOTES:

1. LIMITERS MUST BE INSTALLED ON BOTH ENDS OF CRAB JOINT.

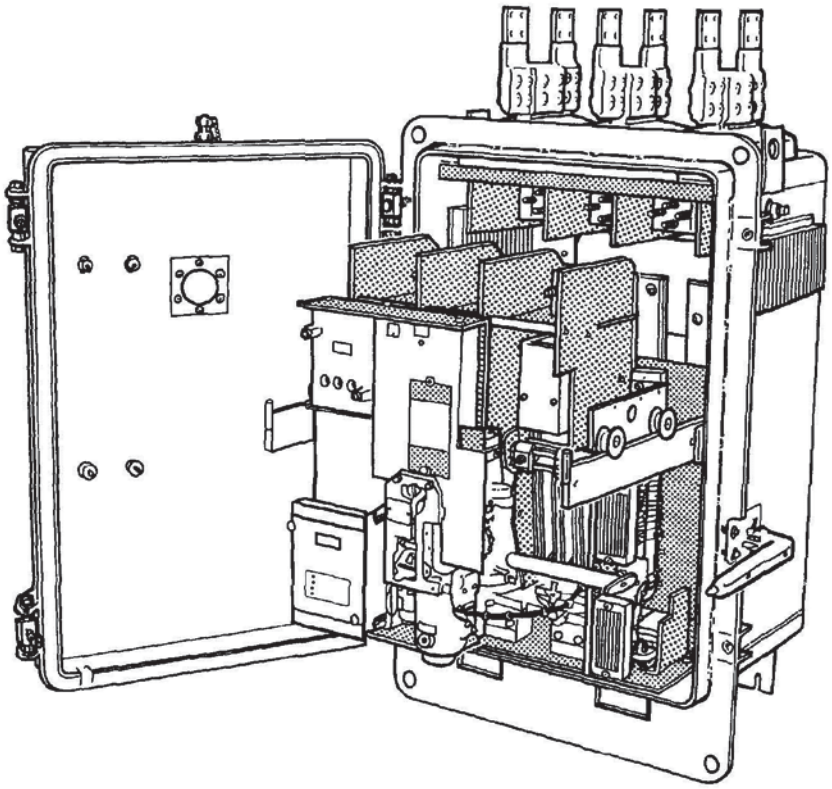
3				
2				
1				
0	7/31/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CRAB JOINT / SMART LIMITER APPLICATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

29.13-11



RATING	VOLTAGE	TYPE	CATALOG NUMBER	COMPATIBLE UNIT
1600 AMP	125/216V	CM22	9220191118	NPR1600CM22216F
1875 AMP	125/216V	CM22	9220191137	NPR1875CM22216F
1875 AMP	277/480V	CM22	9220197374	NPR1875CM22480F
2500 AMP	125/216V	CM22	9220236978	NPR2500CM22216F
5100 AMP	277/480V	CMR8	-	NPR5100CMR8480F

NOTES:

1. SEE NETWORK FOREMAN FOR PART AVAILABILITY ON PROTECTORS IN SERVICE OR FOR LIKE FOR LIKE UNIT CHANGEOUT. SEE DISTRIBUTION STANDARDS FOR NETWORK PROTECTOR UPGRADES.

REVISED		BY	CK'D	APPR.
3				
2	11/30/12	DANNA	DANNA	ADCOCK
1	2/13/12	DANNA	BURLISON	ELKINS
0	10/5/10	DANNA	GUINN	ELKINS

NETWORK PROTECTORS

GENERAL INFORMATION

Duke Energy

FLA

DWG. 29.14-01

NETWORK PROTECTOR			NETWORK TRANSFORMER		
CONTINUOUS RMS CURRENT RATING (A)	INTERRUPTING RATING, RMS SYMMETRICAL (A)	CLOSE AND LATCH RATING, RMS SYMMETRICAL (A)	NAMEPLATE RATING (KVA)	NAMEPLATE RMS CURRENT (A)	PROTECTOR RATING AS % OF TRANSFORMER NAMEPLATE CURRENT
800	30,000	25,000	225	600	133
1200	30,000	25,000	300	800	150
1600	30,000	25,000	500	1333	120
1875	30,000	25,000	500	1333	141
2000	35,000	35,000	500	1333	150
2250	35,000	35,000	500	1333	169
2500	60,000	40,000	750	2000	125
2825	60,000	40,000	750	2000	141
3000	60,000	40,000	1000	2667	112
3500	60,000	40,000	1000	2667	131
4500	60,000	40,000	1000	2667	169

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

NETWORK PROTECTOR

TRANSFORMER TO PROTECTOR RATINGS

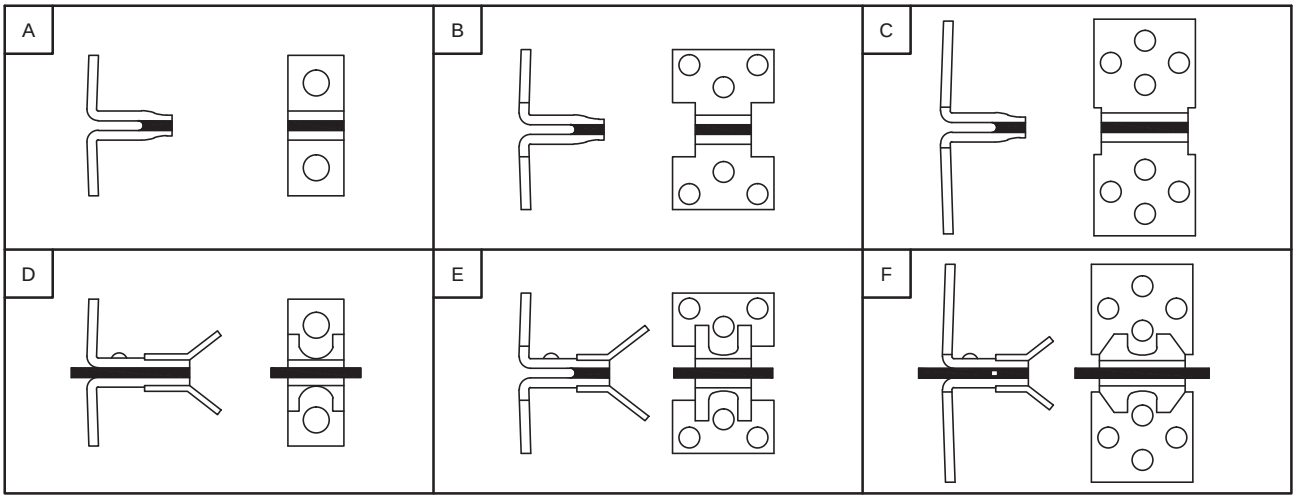
Duke Energy®

FLA

DWG. 29.14-03

WESTINGHOUSE LOW LOSS LEAD ALLOY STANDARD SPEED FUSES USED ON NETWORK PROTECTORS						
	NETWORK PROTECTOR ENCLOSURE					
	OPEN OR VENTILATED		SUBMERSIBLE OR NEMA 1A SEMI-DUST-TIGHT		FUSE STYLE NUMBER	FUSE CONFIGURATION
	PROTECTOR AMPERE RATING	CURVE 250300	PROTECTOR AMPERE RATING	CURVE 250300		
125/216 VOLTS	800	1			1173006	A
	1200	2	800	1	1173007	
	1600	3	1200	2	1173008	
			1600	3	1173010	
	1875	4			1173009	
			1875	4	1173011	
	2000	4			1346880	B
	2250	5	2000	4	1346881	
			2250	5	2A9867G06	
	2500	5			1346917	C
	2825	6	2500	5	1247325	
			2825	6	1291274	
	3000	6			1247325	
			3000	6	12A3822G07	
	3500	7			1291274	
			3500 *	7	12A3822G07	
277/480 VOLTS	800	1			1254871	D
	1200	2	800	1	1254872	
	1600	3	1200	2	1300550	
			1600	3	1300551	
	1875	4			1346424	
			1875	4	14A579G06	
	2000	4			1300552	E
	2250	5	2000	4	1300553	
			2250	5	1300564	
	2500	5			1491538	F
	2825	6	2500	5	1332318	
			2825	6	1615572	
	3000	6			1332318	
			3000	6	15A4106G04	
	3500	7			1615572	
			3500 *	7	15A4106G04	

* SUBMERSIBLE UNITS ONLY



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

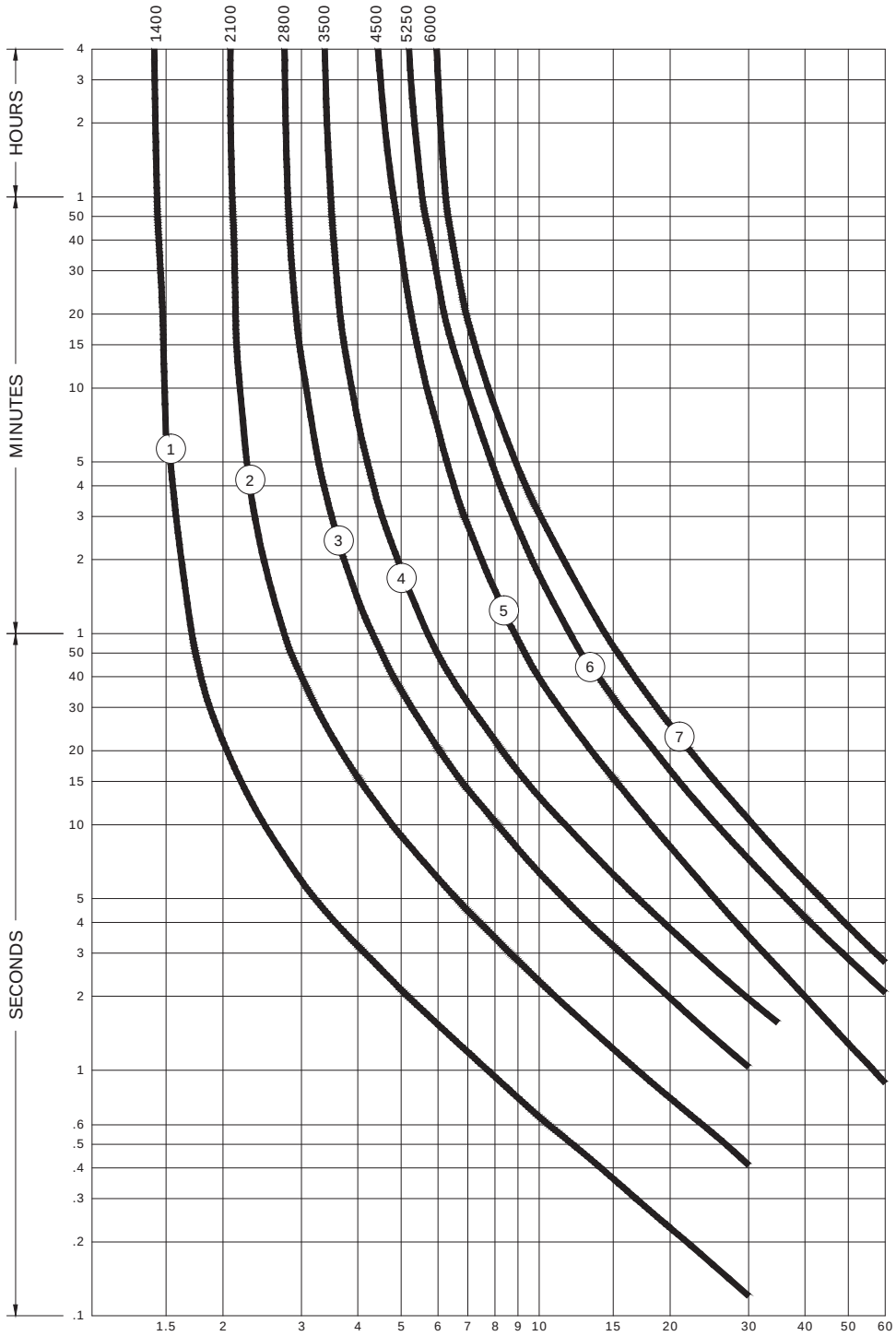
NETWORK PROTECTOR
CM-22 PROTECTOR
FUSE TYPES

Duke Energy®

FLA

DWG. 29.14-05

ALLOY FUSE FOR TYPE CM-22 PROTECTORS - CHARACTERISTIC CURVES 250300



CURRENT - 1000 AMPERES

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

NETWORK PROTECTOR
CM-22 PROTECTOR
FUSE CURVES

Duke Energy

FLA

DWG.
29.14-07

THE TYPE CM-22 NETWORK PROTECTOR CONSISTS OF AN AUTOMATIC, ELECTRICALLY-OPERATED AIR CIRCUIT BREAKER, WHICH INCLUDES A TRIPPING MECHANISM, SUITABLE CONTROL EQUIPMENT, AND NETWORK RELAYS. THE ENTIRE OPERATION OF THE PROTECTOR IS USUALLY CONTROLLED BY TWO RELAYS:

- THE MASTER RELAY (TYPE CN-33)
- THE PHASING RELAY (TYPE CNJ)

OPERATION

THE TYPES CN-33 AND CNJ RELAYS WERE DESIGNED TO CONTROL THE OPERATION OF THE CM-22 NETWORK PROTECTOR WHICH ARE USED FOR THE CONTROL AND PROTECTION OF THE COMPANY'S NETWORK SYSTEMS. THIS SYSTEM IS A LOW VOLTAGE A/C NETWORK SYSTEM WHICH IS AN INTERCONNECTED GRID OR MESH OF LOW VOLTAGE MAINS, FROM WHICH THE CUSTOMERS' SERVICES ARE TAKEN, SUPPLIED THROUGH A NUMBER OF NETWORK TRANSFORMER BANKS OVER TWO OR MORE HIGH VOLTAGE FEEDERS. NETWORK PROTECTORS ARE CONNECTED IN THE SECONDARY LEADS OF NETWORK TRANSFORMER BANKS TO PROVIDE MEANS FOR DISCONNECTING ANY HIGH VOLTAGE OR PRIMARY FEEDER AND ITS ASSOCIATED NETWORK TRANSFORMERS FROM THE SECONDARY GRID OR NETWORK.

THE CHARACTERISTICS FOR THE TYPE CN-33 NETWORK MASTER RELAY ARE SUCH THAT IT WILL OPERATE TO CLOSE THE NETWORK PROTECTOR WHEN THE VOLTAGE ON THE TRANSFORMER SIDE OF THE PROTECTOR IS APPROXIMATELY EQUAL TO OR GREATER THAN AND SUBSTANTIALLY IN PHASE WITH THE VOLTAGE ON THE NETWORK SIDE OF THE PROTECTOR.

ALSO, THE CN-33 NETWORK MASTER RELAY WILL TRIP THE PROTECTOR WHEN THE FLOW OF POWER THROUGH THE PROTECTOR IS REVERSED, THAT IS, THE FLOW IS FROM THE NETWORK TO THE TRANSFORMER BANK.

AN ADDITIONAL RELAY IS USED TO OPERATE THE NETWORK PROTECTOR. THE CNJ PHASING RELAY IS USED ALONG WITH THE CN-33 TO PREVENT THE NETWORK PROTECTOR FROM CLOSING UNDER VOLTAGE CONDITIONS WHICH WOULD PRODUCE A REVERSAL OF POWER WHEN THE PROTECTOR CLOSED THUS CAUSING IT TO IMMEDIATELY REOPEN. SUCH REPEATED CLOSING AND OPENING OF THE NETWORK PROTECTOR WITHOUT ANY CHANGES IN LOAD AND VOLTAGE CONDITIONS ON THE SYSTEM OTHER THAN THOSE PRODUCED BY THE OPERATION OF THE PROTECTOR IS REFERRED TO AS PUMPING. THE CONTACTS OF THE CNJ AND THE CN-33 RELAY THAT ARE USED IN THE CLOSING CIRCUIT ARE IN SERIES WITH EACH OTHER. IN OTHER WORDS, BOTH OF THESE RELAYS HAVE TO BE PICKED UP (ENERGIZED) AND THEIR CONTACTS CLOSED BEFORE THE PROTECTOR WILL CLOSE.

SITUATION	RESPONSE
1. PROTECTOR CLOSED, POWER FLOWING TO THE NETWORK	1. PROTECTOR WILL REMAIN CLOSED. CN-33
2. PROTECTOR CLOSED, POWER FLOWING TO TRANSFORMER	2. PROTECTOR WILL OPEN RELAY CN-33
3. PROTECTOR OPEN, NETWORK AND TRANSFORMER VOLTAGE EQUAL	3. PROTECTOR WILL REMAIN OPEN
4. FEEDER DEAD, PROTECTOR OPEN, NETWORK ENERGIZED	4. PROTECTOR WILL REMAIN OPEN CN-33 & CNJ
5. TRANSFORMER VOLTAGE HIGHER AND LEADING THE NETWORK AND APPROXIMATELY IN PHASE	5. PROTECTOR WILL CLOSE CN-33 & CNJ RELAY
6. PROTECTOR OPEN, NETWORK DE-ENERGIZED.	6. PROTECTOR WILL REMAIN OPEN. CN-33
7. TRANSFORMER AND NETWORK IN A CROSSED PHASE SITUATION	7. PROTECTOR WILL REMAIN OPEN, CN-33 RELAY

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

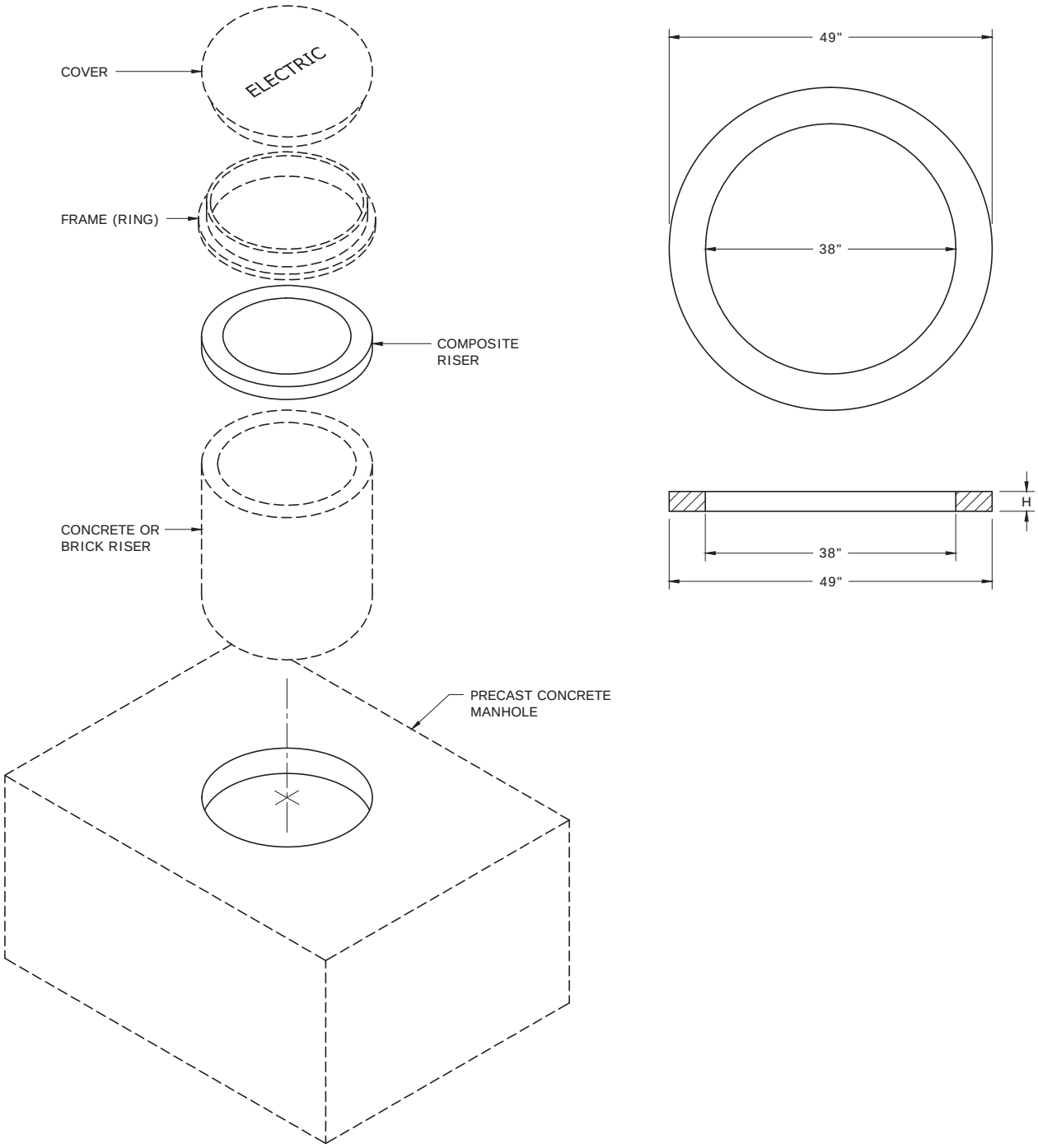
NETWORK PROTECTOR - GENERAL OPERATION

W/E/M RELAY

Duke Energy®

FLA

DWG. 29.14-09



BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
NCKMH05X38CPF	1	9220285736	1	0.5" COMPOSITE RISER
NCKMH1X38CPF	1	9220285731	1	1" COMPOSITE RISER
NCKMH2X38CPF	1	9220285732	1	2" COMPOSITE RISER
NCKMH3X38CPF	1	9220285733	1	3" COMPOSITE RISER

NOTES:

1. DO NOT STACK MORE THAN 2 COMPOSITE RISERS. TOTAL HEIGHT OF RISERS SHOULD NOT EXCEED 3".
2. APPLY A POLYURETHANE SEALANT/ADHESIVE BETWEEN THE COMPOSITE RISER AND CONCRETE RISER OR MANHOLE, BETWEEN COMPOSITE RISERS AND BETWEEN COMPOSITE RISER AND FRAME.

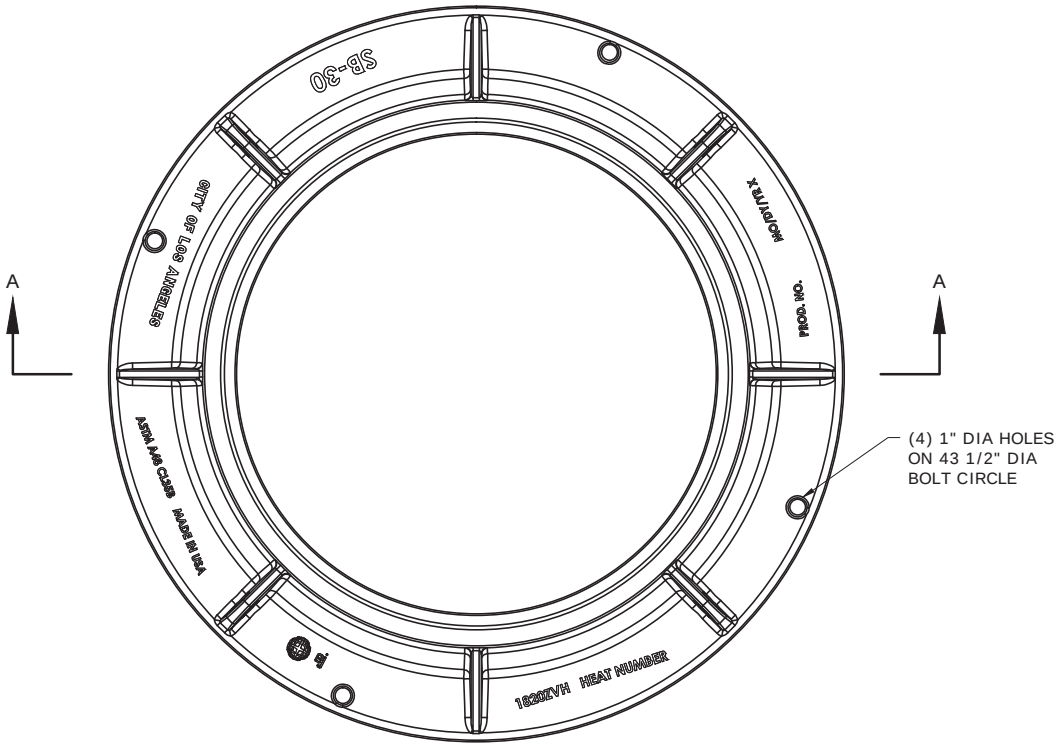
3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

COMPOSITE RISER

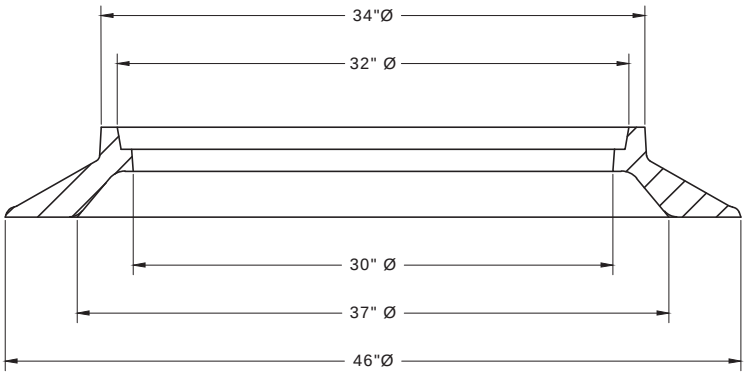
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

29.14-105



SECTION A-A



SECTION A-A

BILL OF MATERIALS				
COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
NCKMH6X32GIF	1	9220285421	1	FRAME, BOTTOM FLG MANHOLE RING, 32" DIA X 5-5/8" HT, GRAY IRON ASTM A48

NOTES:

1. FRAME ALLOWS FOR A 30" CLEAR OPENING.

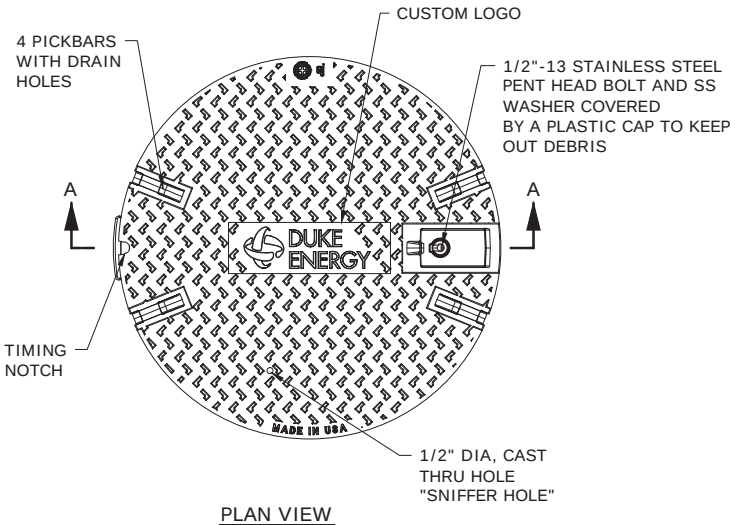
DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

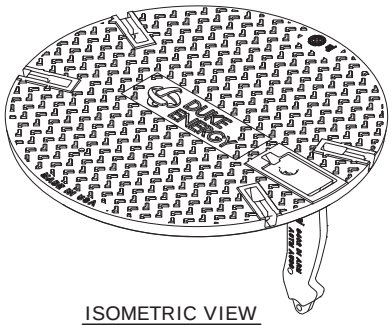
FRAME - MANHOLE - 32"

DEC	DEM	DEP	DEF
			X

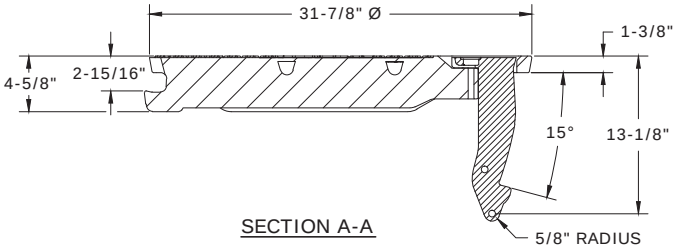
29.14-106



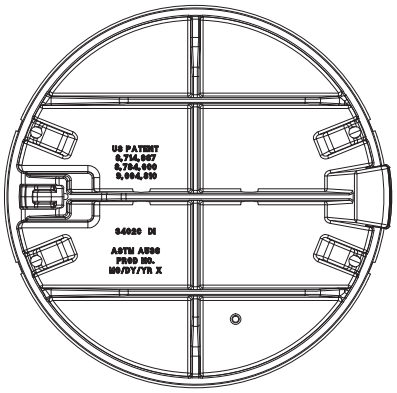
PLAN VIEW



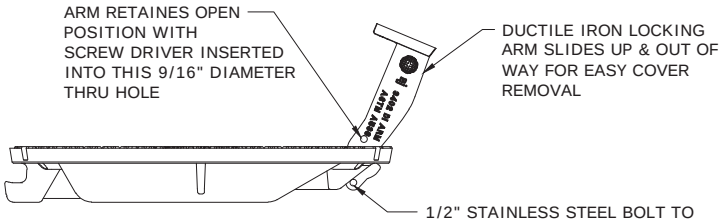
ISOMETRIC VIEW



SECTION A-A



BOTTOM VIEW



SIDE VIEW
(COVER REMOVED)

BILL OF MATERIALS						
MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	CVRMHRA32DIF	1	9220285422	1	COVER, MANHOLE, 31-7/8" DIA, DI, W/ RETAINING ARM & TIMING NOTCH

NOTES:

1. EXPLOSION MITIGATING DESIGNS SHALL BE USED FOR ANY NEW INSTALLATION AS WELL AS RETROFIT PROJECTS.
2. RETAINING ARM AND MISCELLANEOUS HARDWARE ARE INCLUDED WITH THE LID FROM THE MANUFACTURER.
3. SEE DWGS. 29.14-116A THROUGH 29.14-116E FOR INSTALLATION INSTRUCTIONS.
4. SEE DWGS. 29.14-118A THROUGH 29.14-118C AND DWGS. 29.14-120A THROUGH 29.14-120C FOR REQUIRED CIVIL WORK NEEDED TO ANCHOR FRAME AND LID.

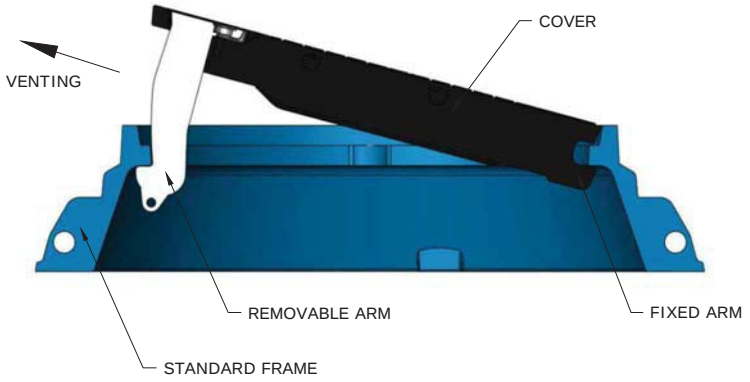
3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

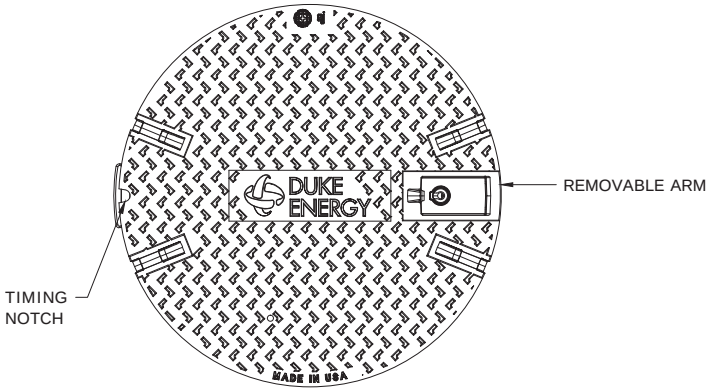
MANHOLE COVER - EXPLOSION MITIGATING - 32"

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

29.14-108





PLAN VIEW

NOTES:

1. THE DESIGN OF THE EJ EXPLOSION MITIGATING MANHOLE COVER VENTS GASES IN THE DIRECTION OF THE REMOVABLE ARM. FOR THIS REASON IT IS IMPERATIVE TO ALIGN THE MANHOLE LID IN SUCH A MANNER THAT PROTECTS THE GENERAL PUBLIC, STRUCTURES, AND PROPERTY TO THE GREATEST EXTENT POSSIBLE. AREAS TO THE SIDE AND BEHIND THE REMOVABLE ARM AND OPENING WILL BE LEAST IMPACTED.

2. PER DWG. 29.14-108, THE LOCATOR NOTCH THAT IS DRILLED INTO THE MANHOLE FRAME SHALL BE LOCATED OPPOSITE THE PREFERRED DIRECTION AS INDICATED IN THE FOLLOWING NOTES. THE REMOVABLE ARM AND OPENING SHALL FACE OR POINT TOWARDS THE PREFERRED DIRECTION.

3. WHEN LOCATED ANYWHERE WITHIN A ROAD RIGHT-OF-WAY THAT HAS A SIDEWALK, THE VENTING SHALL FACE AWAY FROM THE SIDEWALK AND WITH THE FLOW OF TRAFFIC. WITHIN A ROAD RIGHT-OF-WAY THAT HAS NO SIDEWALKS, THE VENTING SHALL FACE WITH THE FLOW OF TRAFFIC.

4. WHEN LOCATED AT AN INTERSECTION, THE VENTING SHALL FACE TOWARDS THE MIDDLE OF THE INTERSECTION.

5. WHEN LOCATED IN A PARKING LOT OR ROAD SURROUNDED BY BUILDINGS AND STRUCTURES, THE VENTING SHALL FACE IN A DIRECTION THAT CAUSES THE LEAST IMPACT TO FIRST OF ALL PEDESTRIANS, AND THEN TO BUILDINGS AND STRUCTURES.

6. WHEN LOCATED IN A SIDEWALK, THE VENTING SHALL FACE INTO THE STREET, AWAY FROM THE PEDESTRIAN WALKWAY.

7. WHEN LOCATED WITHIN AN ALLEY, THE VENTING SHALL FACE IN THE DIRECTION OF THE ALLEY EITHER WAY. IN THE CASE OF A ONE-WAY ALLEY, IT SHALL FACE IN THE DIRECTION OF THE FLOW OF TRAFFIC. IT SHOULD NEVER FACE TOWARDS THE BUILDINGS.

8. NEVER FACE THE VENTING TOWARDS A HEAVILY POPULATED AREA, SUCH AS A BUS STOP OR PARK.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - ALIGNMENT INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

29.14-114

INSTALLATION PROCEDURE

STEP 1: COVER PREPARATION

DETACH REMOVABLE ARM FROM COVER.

REMOVE 1/2" X 3" BOLT AND PLASTIC CAP FROM REMOVABLE ARM.

REMOVE 1/2" X 1-1/4" BOLT AND WASHER FROM TOP OF COVER.

INSTALL REMOVABLE ARM COVER AND REINSTALL 1/2" X 3" BOLT AND LOCK NUT INTO REMOVABLE ARM.

STEP 2: INSERT COVER

SLIDE COVER INTO MANHOLE FRAME. THE SIDE WITH THE FIXED ARM SHOULD GO FIRST.

STEP 3: ROTATE COVER

ONCE COVER IS INSTALLED IN FRAME, REMOVABLE ARM SHOULD NOW DROP DOWN AND BECOME FLUSH WITH COVER SURFACE. ROTATE COVER TO DESIRED OPENING DIRECTION.

NOTES:

1. NECESSARY HARDWARE SUCH AS BOLTS, WASHERS, AND PLASTIC CAPS ARE INCLUDED WITH THE COVER.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - INSTALLATION AND OPERATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

29.14-116A

INSTALLATION PROCEDURE

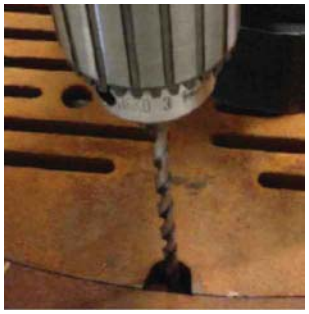
STEP 4: INSTALL BOLT

INSTALL 1/2" X 1-1/4" BOLT AND STAINLESS WASHER. TORQUE TO 40 LB-FT.

STEP 5: INSERT PLASTIC CAP

INSERT PLASTIC CAP OVER BOLT HEAD TO KEEP DEBRIS OUT.

STEP 6: DRILL AND TAP FRAME



CONFIRM COVER IS ROTATED TO DESIRED OPENING DIRECTION. DRILL AND TAP 3/8 - 16 HOLE IN FRAME USING FEATURE IN COVER AS GUIDE. TAP HOLE A MINIMUM 1" DEPTH.

STEP 7: INSTALL COVER LOCATING SPACER

INSTALL COVER LOCATING SPACER AND 3/8" X 1" STAINLESS SOCKET HEAD CAP SCREW IN TAPPED HOLE CREATED IN STEP 6. TORQUE TO 20 LB-FT.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - INSTALLATION AND OPERATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

29.14-116B

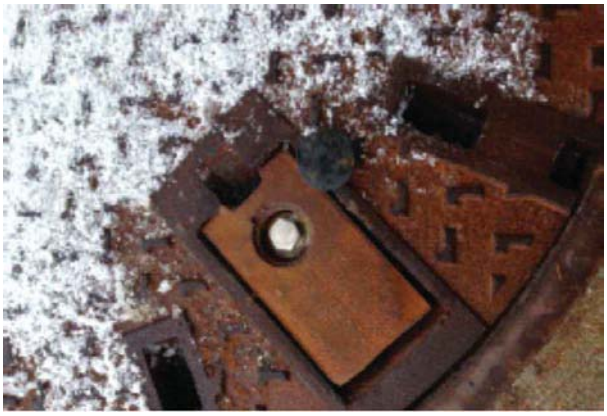
INSTALLATION PROCEDURE

STEP 8: CHECK COVER

COVER CAN BE CHECKED FOR FIT AND FUNCTION BY LIFTING COVER USING PICKBAR OPENING NEAR LOCKING FRONT ARM. COVER SHOULD OPEN ROUGHLY 15 DEGREES AND RETURN TO CLOSED POSITION UNDER ITS OWN WEIGHT.

COVER REMOVAL PROCEDURE

STEP 1: REMOVE CAP BOLT AND WASHER



REMOVE PLASTIC CAP AND 1/2" BOLT AND WASHER.

STEP 2: LIFT AND UNLATCH ARM

INSERT HOOK OR OTHER PULLING TOOL INTO SLOT ON REAR OF ARM AND LIFT ARM INTO ITS UNLATCHED POSITION. PLACE A SCREWDRIVER INTO THE 9/16" DIAMETER HOLE AT THE BASE OF THE ARM TO RETAIN THE OPEN POSITION WHILE THE APPROPRIATE PULLING DEVICE IS USED TO REMOVE THE LID.

STEP 3: LIFT AND REMOVE COVER

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - INSTALLATION AND OPERATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

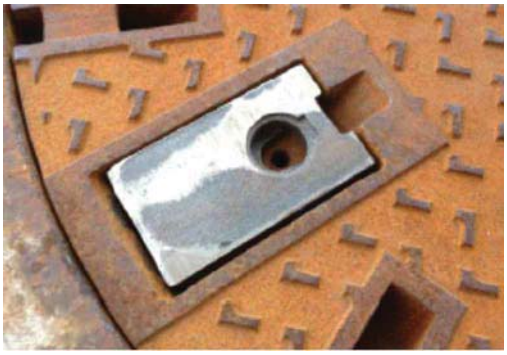
29.14-116C

RESEAT THE COVER

STEP 1: INSERT COVER INTO FRAME

WITH THE PROPER TOOL, SLIDE THE COVER INTO THE MANHOLE FRAME. THE SIDE WITH THE FIXED ARM SHOULD GO FIRST.

STEP 2: ROTATE COVER



ONCE COVER IS INSTALLED IN FRAME, REMOVABLE ARM SHOULD NOW DROP DOWN AND BECOME FLUSH WITH COVER SURFACE. ROTATE COVER TO DESIRED OPENING DIRECTION. THE TIMING NOTCH IN THE COVER SHOULD LINE UP WITH THE COVER LOCATING SPACER.

STEP 3: INSTALL BOLT, WASHER, AND CAP

INSTALL 1/2" BOLT AND STAINLESS WASHER. TORQUE TO 40 LB-FT. INSERT PLASTIC CAP OVER BOLT HEAD TO KEEP DEBRIS OUT.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - INSTALLATION AND OPERATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

29.14-116D

POST EVENT INSPECTION/REPLACEMENT

STEP 1: REMOVE AND INSPECT PARTS

REMOVE COVER AND VISUALLY INSPECT FOR ANY DAMAGE TO COVER, ARM, OR FRAME. REPLACE ASSEMBLY IF ANY DAMAGE IS PRESENT.

STEP 2: REPLACE BOLT, WASHER, AND CAP

REPLACE 1/2" X 1-1/4" BOLT AND WASHER USED TO HOLD ARM TO COVER. TORQUE TO 40 LB-FT. AND REPLACE PLASTIC CAP.

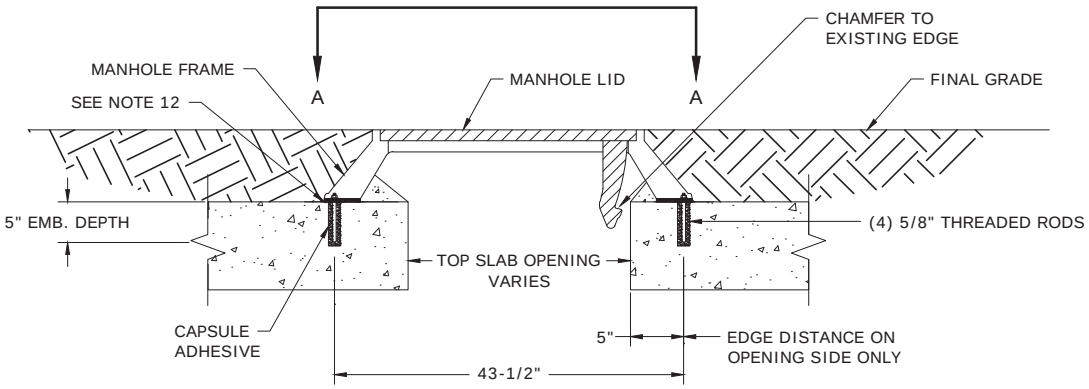
DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

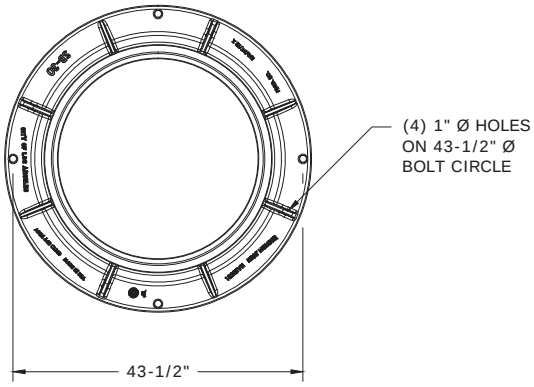
MANHOLE COVER - EXPLOSION MITIGATING - INSTALLATION AND OPERATION INSTRUCTIONS

DEC	DEM	DEP	DEF
X		X	X

29.14-116E



NOTE: FRAME OFF CENTER ON TOP SLAB OPENING
TO PROVIDE CLEARANCE FOR RETAINING ARM



SECTION A-A

NOTES:

1. OBTAIN ALL NECESSARY PERMITTING FOR EXCAVATION, TRAFFIC CONTROL, REMEDIATION, ETC FROM LOCAL GOVERNING BODY PRIOR TO BEGINNING CONSTRUCTION.

2. OBTAIN LOCATES FOR UNDERGROUND UTILITIES IN THE VICINITY OF THE EXCAVATION.

3. THIS ANCHORING METHOD SHOULD BE UTILIZED IN THOSE INSTANCES WHERE THE MANHOLE FRAME SITS DIRECTLY ON THE ROOF OF THE VAULT OR MANHOLE, OR WHEN TOTAL ADJUSTMENTS TO FINAL GRADE TOTAL 3" OR LESS.

4. SEE DWG 29.14-118B FOR SPECIFIC INSTRUCTIONS.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

MANHOLE COVER - EXPLOSION MITIGATING -
ANCHORING INSTRUCTIONS - WITHOUT CHIMNEY

DEC	DEM	DEP	DEF
			X

29.14-118A

GENERAL INSTRUCTIONS:

1. ACTUAL FIELD CONDITIONS CAN VARY WIDELY FROM LOCATION TO LOCATION. THESE INCLUDE BUT ARE NOT LIMITED TO DEPTH OF THE MANHOLE, TYPE OF MANHOLE (PRECAST, POURED IN PLACE, ETC), AND SURROUNDING MATERIAL (ASPHALT, CONCRETE, OR SOIL). THE METHOD DESCRIBED ON DWG. 29.14-118A AND BELOW IS A GENERAL MEANS OF SECURING THE MANHOLE FRAME AND COVER IN PLACE IN THE EVENT OF AN EXPLOSION, AND MAY NEED TO BE MODIFIED TO SUIT SPECIFIC SITE CONDITIONS.
2. ITEMS LISTED AS 'PURCHASE LOCALLY AS NEEDED' SHOULD BE ACCOUNTED FOR IN THE ESTIMATE WITH THE 'ADD $1 DOLLAR OF COST' CU. FOR EXAMPLE, IF THE COST OF THREADED ROD FOR THE PROJECT IS $20, IT SHOULD BE CAPTURED IN THE ESTIMATE WITH A QUANTITY OF 20 CU'S THAT EACH ADD $1 DOLLAR OF COST.
3. WHILE ACTUAL LABOR TIME MAY VARY DEPENDING UPON THINGS SUCH AS TRAFFIC CONTROL, MULTIPLE SITE TRIPS TO ALLOW FOR CONCRETE CURING TIMES, ETC, IT HAS BEEN DETERMINED THAT AN APPROPRIATE INSTALL TIME ASSUMES TWO CREWS FOR A PERIOD OF TWO DAYS. ALONG WITH THE LABOR INCLUDED IN THE ASPHALT AND CONCRETE REMOVAL CU'S, ADJUST THE ESTIMATE ACCORDINGLY WITH THE 'ADD 1 MAN HOUR OF LABOR' CU.
4. IF AN EVENT IS KNOWN TO HAVE OCCURRED, IT IS NECESSARY TO INSPECT THE FRAME AND COVER FOR PHYSICAL DAMAGE TO THE COVER AND TO SEE IF THE SURROUNDING MATERIAL HAS BEEN DAMAGED (SUCH AS BROKEN CONCRETE OR BUCKLED ASPHALT).

SPECIFIC INSTRUCTIONS:

1. THE EMBEDMENT DEPTH OF THE CAPSULE ADHESIVE IS 5". THE RECOMMENDED THICKNESS OF THE MANHOLE OR VAULT CEILING SHOULD BE AT LEAST 1.5 TIMES THE EMBEDMENT DEPTH, OR 7.5" (THIS SHOULD BE IDENTIFIED IN THE LITERATURE OF THE ADHESIVE). THIS MEASUREMENT NEEDS TO BE VERIFIED PRIOR TO INSTALLATION, AND IF LESS THAN THE RECOMMENDED THICKNESS CONTACT DISTRIBUTION STANDARDS FOR ALTERNATIVES.
2. EXCAVATE THE MATERIAL AROUND THE MANHOLE FRAME/CHIMNEY TO EXPOSE THE TOP OF THE SLAB.
3. MARK THE ANCHOR BOLTS ON THE SLAB FOR INSTALLING THE ADHESIVE ANCHORS. ASSEMBLE THE TEMPLATE FOR LOCATING THE BOLT HOLES PRIOR TO FIELD DRILLING IN THE SLAB.
4. FOLLOW THE INSTRUCTIONS PROVIDED WITH THE ADHESIVE ANCHORS TO DRILL THE HOLE TO EMBEDMENT DEPTH AS SHOWN IN DWG. 29.14-118A.
5. INSERT THE THREADED ROD INTO THE CAPSULE AND ALLOW TO SET PER THE MANUFACTURER'S INSTRUCTIONS. DEPENDING UPON THE AMBIENT TEMPERATURE THIS WILL LIKELY BE THE FOLLOWING DAY.
6. INSERT THE MANHOLE FRAME ON THE SLAB WITH THE THREADED RODS PASSING THROUGH THE 1" DIAMETER HOLES LOCATED ON THE FLANGE OF THE MANHOLE FRAME.
7. USE THE COMPOSITE RISERS IN DWG. 29.14-105 FOR SMALL ADJUSTMENTS TO THE FRAME ELEVATION (3" OR LESS).
8. INSTALL THE ANCHOR BOLT NUTS AND WASHERS TO SECURE THE MANHOLE FRAME IN PLACE.
9. CUT THE EXTRA PROJECTIONS OF THE ANCHOR BOLTS TO MAKE IT FLUSH OR LEAVE 1" PROJECTION ON THE TOP OF THE ANCHOR BOLT NUT.
10. BACKFILL AROUND THE FRAME AND COVER WITH SIMILAR MATERIAL THAT WAS EXCAVATED AND RESTORE THE TOP SURFACE TO MATCH THE SURROUNDING GROUND OR PAVEMENT SURFACE, PER THE CRITERIA OF THE EXCAVATION PERMIT.
11. ORIENT THE MANHOLE LID PER THE INSTRUCTIONS IN DWG. 29.14-114.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING -

ANCHORING INSTRUCTIONS - WITHOUT CHIMNEY

DEC	DEM	DEP	DEF
			X

29.14-118B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	WMIS VOUCHER	-	-	-	5/8" SS THREADED ROD, 304/316 SS (PURCHASE LOCALLY AS NEEDED)
2	WMIS VOUCHER	-	-	4	5/8" STAINLESS STEEL HEX NUT, 11 TPI (PURCHASE LOCALLY AS NEEDED)
3	WMIS VOUCHER	-	-	4	STAINLESS STEEL FLAT WASHER (PURCHASE LOCALLY AS NEEDED)
4	WMIS VOUCHER	-	-	4	STAINLESS STEEL SPLIT LOCK WASHER (PURCHASE LOCALLY AS NEEDED)
5	WMIS VOUCHER	-	-	4	CAPSULE ADHESIVE (PURCHASE LOCALLY AS NEEDED)
6	NTLABVLTRBF	64	-	1	LABOR ADDER 1 MAN HOUR

DUKE ENERGY.

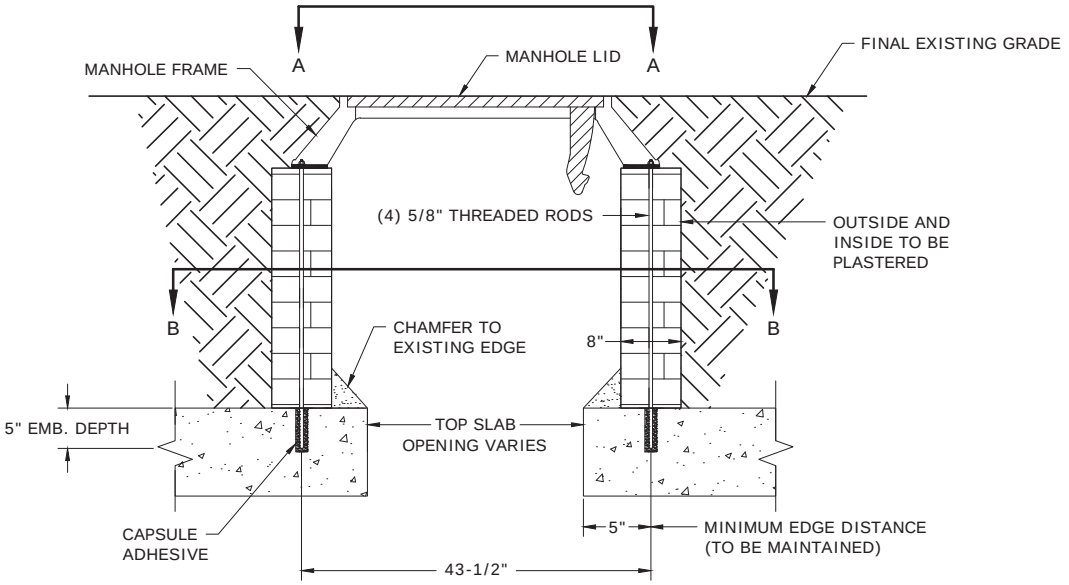
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK

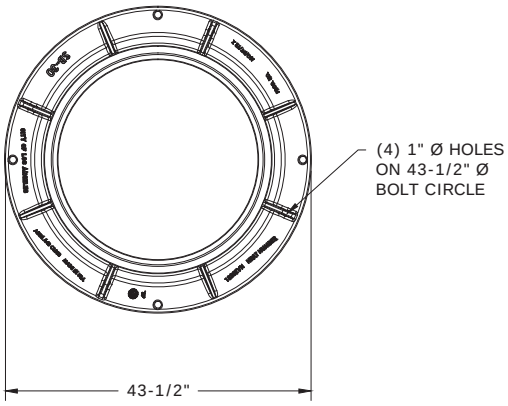
MANHOLE COVER - EXPLOSION MITIGATING -

ANCHORING INSTRUCTIONS - WITHOUT CHIMNEY

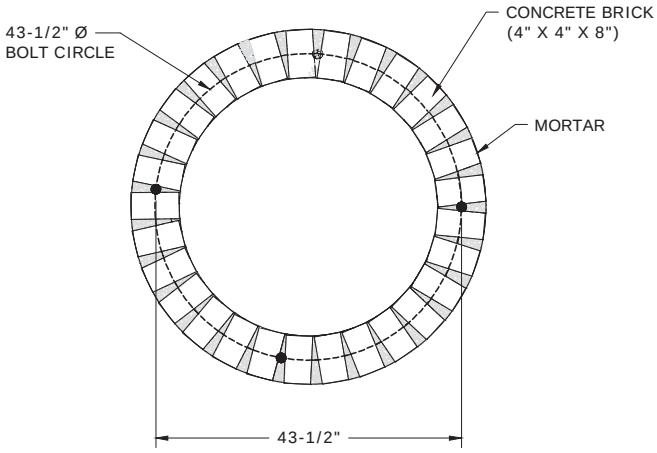
DEC	DEM	DEP	DEF
			X

29.14-118C





SECTION A-A



SECTION B-B

NOTES:

1. OBTAIN ALL NECESSARY PERMITTING FOR EXCAVATION, TRAFFIC CONTROL, REMEDIATION, ETC FROM LOCAL GOVERNING BODY PRIOR TO BEGINNING CONSTRUCTION.
2. OBTAIN LOCATES FOR UNDERGROUND UTILITIES IN THE VICINITY OF THE EXCAVATION.
3. THIS ANCHORING METHOD CAN BE UTILIZED IN THOSE INSTANCES WHERE A MASONRY CHIMNEY MUST BE CONSTRUCTED TO REACH FINAL GRADE.
4. SEE DWG 29.14-120B FOR SPECIFIC INSTRUCTIONS.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - ANCHORING INSTRUCTIONS - WITH CHIMNEY

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

29.14-120A

GENERAL INSTRUCTIONS:

1. ACTUAL FIELD CONDITIONS CAN VARY WIDELY FROM LOCATION TO LOCATION. THESE INCLUDE BUT ARE NOT LIMITED TO DEPTH OF THE MANHOLE, TYPE OF MANHOLE (PRECAST, POURED IN PLACE, ETC), AND SURROUNDING MATERIAL (ASPHALT, CONCRETE, OR SOIL). THE METHOD DESCRIBED ON DWG. 29.14-120A AND BELOW IS A GENERAL MEANS OF SECURING THE MANHOLE FRAME AND COVER IN PLACE IN THE EVENT OF AN EXPLOSION, AND MAY NEED TO BE MODIFIED TO SUIT SPECIFIC SITE CONDITIONS.
2. ITEMS LISTED AS 'PURCHASE LOCALLY AS NEEDED' SHOULD BE ACCOUNTED FOR IN THE ESTIMATE WITH THE 'ADD $1 DOLLAR OF COST' CU. FOR EXAMPLE, IF THE COST OF THREADED ROD FOR THE PROJECT IS $20, IT SHOULD BE CAPTURED IN THE ESTIMATE WITH A QUANTITY OF 20 CU'S THAT EACH ADD $1 DOLLAR OF COST.
3. WHILE ACTUAL LABOR TIME MAY VARY DEPENDING UPON THINGS SUCH AS TRAFFIC CONTROL, MULTIPLE SITE TRIPS TO ALLOW FOR CONCRETE CURING TIMES, ETC, IT HAS BEEN DETERMINED THAT AN APPROPRIATE INSTALL TIME ASSUMES TWO CREWS FOR A PERIOD OF TWO DAYS. ALONG WITH THE LABOR INCLUDED IN THE ASPHALT AND CONCRETE REMOVAL CU'S, ADJUST THE ESTIMATE ACCORDINGLY WITH THE 'ADD 1 MAN HOUR OF LABOR' CU.
4. IF AN EVENT IS KNOWN TO HAVE OCCURRED, IT IS NECESSARY TO INSPECT THE FRAME AND COVER FOR PHYSICAL DAMAGE TO THE COVER AND TO SEE IF THE SURROUNDING MATERIAL HAS BEEN DAMAGED (SUCH AS BROKEN CONCRETE OR BUCKLED ASPHALT).

SPECIFIC INSTRUCTIONS:

1. THE EMBEDMENT DEPTH OF THE CAPSULE ADHESIVE IS 5". THE RECOMMENDED THICKNESS OF THE MANHOLE OR VAULT CEILING SHOULD BE AT LEAST 1.5 TIMES THE EMBEDMENT DEPTH, OR 7.5" (THIS SHOULD BE IDENTIFIED IN THE LITERATURE OF THE ADHESIVE). THIS MEASUREMENT NEEDS TO BE VERIFIED PRIOR TO INSTALLATION, AND IF LESS THAN THE RECOMMENDED THICKNESS, CONTACT DISTRIBUTION STANDARDS FOR ALTERNATIVES.
2. EXCAVATE THE MATERIAL AROUND THE MANHOLE FRAME/CHIMNEY TO EXPOSE THE TOP OF THE SLAB.
3. SAW CUT THE EXISTING MASONRY CHIMNEY AROUND ITS CIRCUMFERENCE AND REMOVE IT FROM PLACE.
4. MARK THE ANCHOR BOLTS ON THE SLAB FOR INSTALLING THE ADHESIVE ANCHORS. ASSEMBLE THE TEMPLATE FOR LOCATING THE BOLT HOLES PRIOR TO FIELD DRILLING IN THE SLAB.
5. FOLLOW THE INSTRUCTIONS PROVIDED WITH THE ADHESIVE ANCHORS TO DRILL THE HOLE TO EMBEDMENT DEPTH AS SHOWN IN DWG . 29.14-120A.
6. INSERT THE THREADED ROD INTO THE CAPSULE AND ALLOW TO SET PER THE MANUFACTURER'S INSTRUCTIONS. DEPENDING UPON THE AMBIENT TEMPERATURE THIS WILL LIKELY BE THE FOLLOWING DAY.
7. FOR EACH COURSE OF 4"X4"X8" CONCRETE BRICK NEEDED TO RAISE THE FRAME AND COVER TO THE PROPER ELEVATION, ASSUME 35 TO 40 BRICK IN THE ESTIMATE. OBTAIN LOCAL PRICING AND UTILIZE THE 'ADD $1 DOLLAR OF COST' CU TO PROPERLY CAPTURE THIS EXPENSE.
8. ALL CONCRETE BRICK MASONRY SHALL MEET THE MINIMUM REQUIREMENTS OF ASTM C55 WITH A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI. TYPE M MORTAR SHALL BE USED WITH A MINIMUM COMPRESSIVE STRENGTH OF 2500 PSI.
9. LAY THE CONCRETE BRICKS IN ALTERNATE COURSES WITH INITIAL RADIAL HEADER COURSE ON TOP OF THE SLAB, THEN RADIAL STRETCHER COURSE WITH TWO WYTHES AND SO ON WORKING TO THE GROUND LEVEL. ENSURE THERE IS ENOUGH SPACE AVAILABLE BELOW GROUND TO INSTALL THE MANHOLE FRAME. ALTERNATE COURSE SHALL BE LAID IN RUNNING BONDS WITH A MINIMUM UNIT OVERLAP OF 2".
10. THE INITIAL CURE TIME OF TYPE M MORTAR IS 1.5 HOURS AND THE FINAL CURE TIME IS 24 HOURS. LET THE MORTAR CURE AND INSTALL THE MANHOLE FRAME ON TOP OF THE MASONRY WITH THREADED RODS PASSING THROUGH 1" DIAMETER HOLES LOCATED ON THE FLANGE OF THE MANHOLE FRAME.
11. USE THE COMPOSITE RISERS ON DWG. 29.14-105 FOR SMALL ADJUSTMENTS TO THE FRAME ELEVATION (3" OR LESS).
12. INSTALL THE ANCHOR BOLT NUTS AND WASHERS TO SECURE THE MANHOLE FRAME IN PLACE.
13. CUT THE EXTRA PROJECTIONS OF THE ANCHOR BOLTS TO MAKE IT FLUSH OR LEAVE 1" PROJECTION ON THE TOP OF THE ANCHOR BOLT NUT.
14. BACKFILL AROUND THE FRAME AND COVER WITH SIMILAR MATERIAL THAT WAS EXCAVATED AND RESTORE THE TOP SURFACE TO MATCH THE SURROUNDING GROUND OR PAVEMENT SURFACE, PER THE CRITERIA OF THE EXCAVATION PERMIT.
15. ORIENT THE MANHOLE LID PER THE INSTRUCTIONS SHOWN ON DWG. 29.14-114.

DUKE ENERGY.

3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

MANHOLE COVER - EXPLOSION MITIGATING - ANCHORING INSTRUCTIONS - WITH CHIMNEY

DEC	DEM	DEP	DEF
			X

29.14-120B

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	WMIS VOUCHER	-	-	-	CONCRETE BRICK, 4"X4"X8" (PURCHASE LOCALLY AS NEEDED)
2	WMIS VOUCHER	-	-	-	MORTAR, TYPE M (PURCHASE LOCALLY AS NEEDED)
3	WMIS VOUCHER	-	-	-	5/8" SS THREADED ROD (PURCHASE LOCALLY AS NEEDED)
4	WMIS VOUCHER	-	-	4	5/8" STAINLESS STEEL HEX NUT (PURCHASE LOCALLY AS NEEDED)
5	WMIS VOUCHER	-	-	4	STAINLESS STEEL FLAT WASHER (PURCHASE LOCALLY AS NEEDED)
6	WMIS VOUCHER	-	-	4	SS SPLIT LOCK WASHER (PURCHASE LOCALLY AS NEEDED)
7	WMIS VOUCHER	-	-	4	CAPSULE ADHESIVE (PURCHASE LOCALLY AS NEEDED)
8	NTLABVLTRBF	64	-	1	LABOR ADDER 1 MAN HOUR

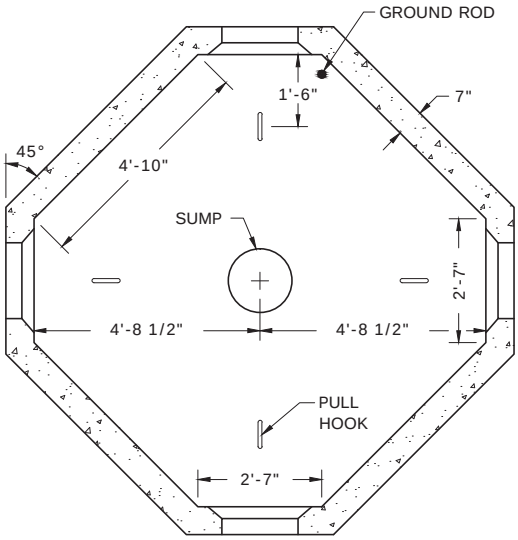
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	3/31/17	EANES	FLETCHER	ADCOCK

MANHOLE COVER - EXPLOSION MITIGATING - ANCHORING INSTRUCTIONS - WITH CHIMNEY

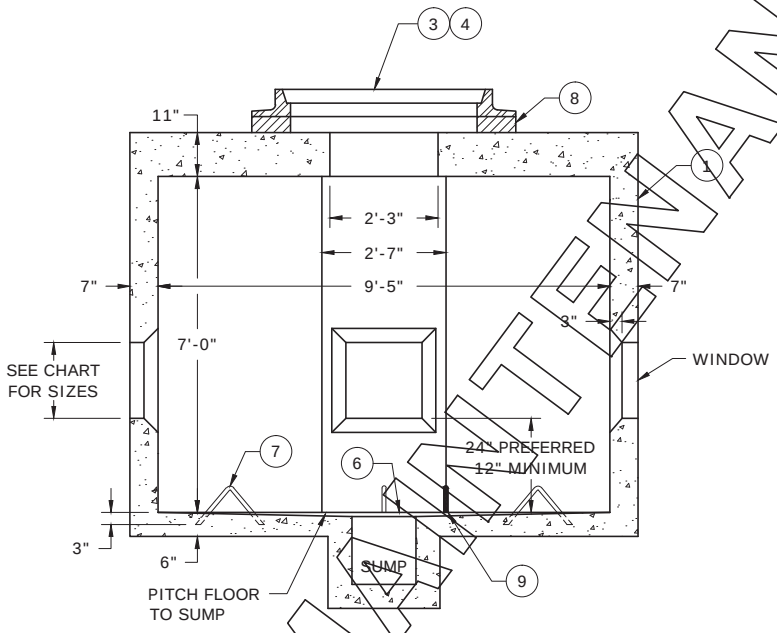
DEC	DEM	DEP	DEF
			X

29.14-120C



PLAN VIEW

WINDOW SIZES	
NO. OF DUCTS	SIZE OF WINDOW
1 OR 2	20" X 7"
3	20" X 12"
6 OR 8	20" X 20"
9	20" X 25"
12	20" X 32"
15	20" X 38"
17	20" X 45"



SIDE SECTION

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	-	1	-	10	CONCRETE, YARDS
	2	-	1	-	1003	REINFORCING STEEL 5/8", FT. (NOT SHOWN)
	3	-	1	-	1	MANHOLE RING
	4	-	1	-	1	MANHOLE COVER
	5	-	1	-	1	SUMP PIPE (NOT SHOWN)
	6	-	1	-	1	SUMP COVER
	7	-	1	-	4	PULL HOOKS
	8	-	1	-	AS REQ'D.	CEMENT BRICK
	9	-	1	-	2	GROUND ROD 1/2" X 10"

3					
2					
1					
O	9/27/11	GUINN	BURLISON	ELKINS	
REVISED		BY	CK'D	APPR.	

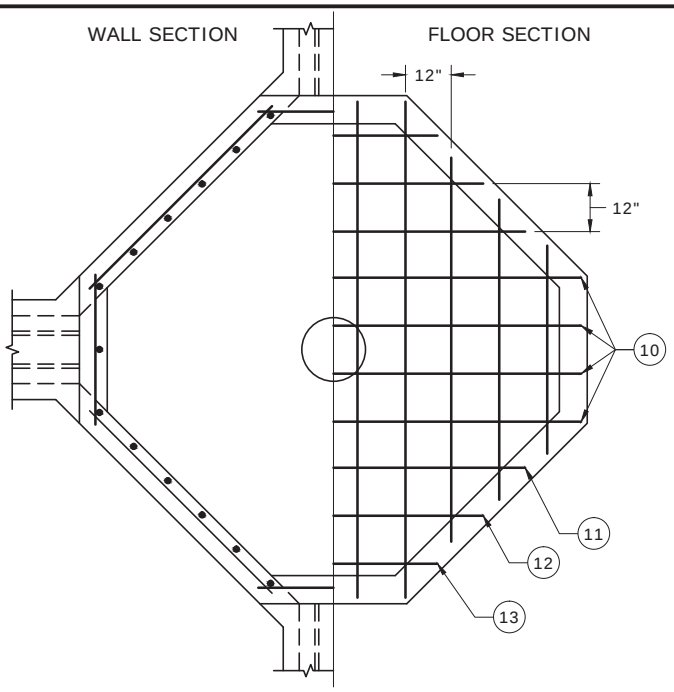
FOUR WAY MANHOLE CONSTRUCTION DETAILS

(FMO)

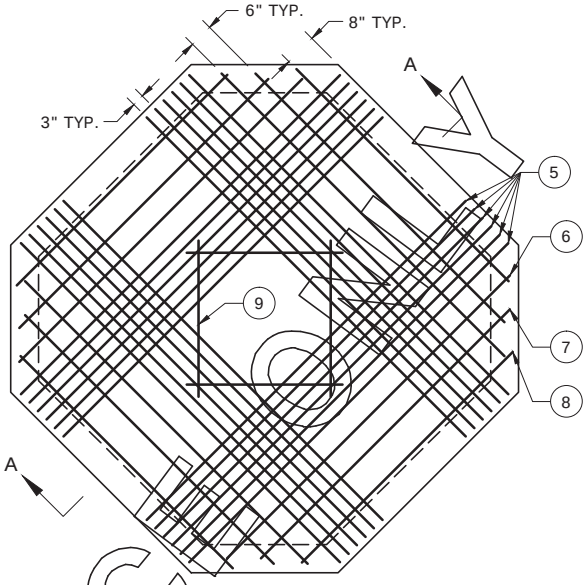
Progress Energy

FLA

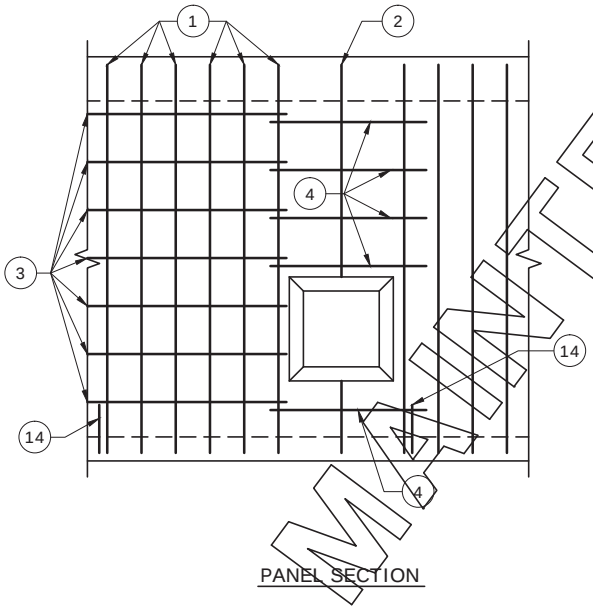
DWG. 29.03-17



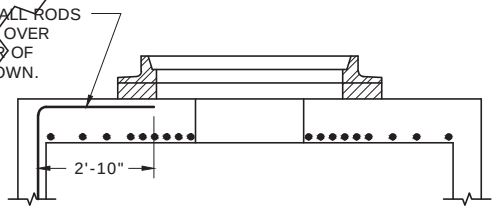
REINFORCING DETAIL



ROOF REINFORCING DETAIL



PANEL SECTION



SECTION A-A

REINFORCING RODS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	24	10'-10"	WALLS (VERTICAL)
2	4	8'-2"	WALLS (VERTICAL)
3	26	5'-6"	WALLS (HORIZONTAL)
4	20	3'-3"	WALLS (HORIZONTAL)
5	24	9'-5"	ROOF
6	4	8'-4"	ROOF
7	4	7'-4"	ROOF
8	4	6'-3"	ROOF
9	4	3'-3"	ROOF
10	8	10'-4"	ROOF
11	4	8'-0"	ROOF
12	4	6'-3"	ROOF
13	4	4'-4"	ROOF
14	24	1'-0"	ROOF

NOTES:

1. ALL REINFORCING TO BE 5/8" ROUND STRUCTURAL GRADE BARS WITH ASTM A-305 DEFORMATION. BARS TO BE 1-1/2" MIN. FROM SURFACE OF CONCRETE.

2. CONCRETE TO HAVE A 28 DAY MIN. STRENGTH OF 3,000 PSI.

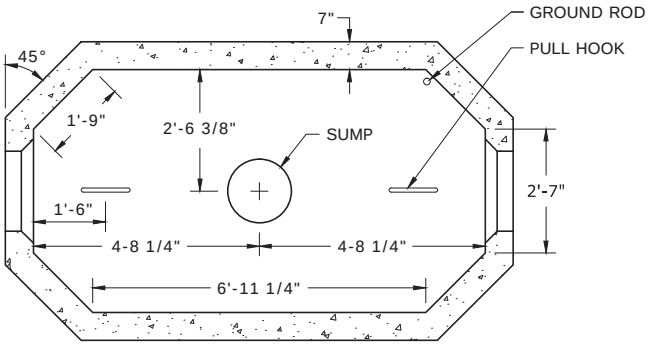
3				
2				
1				
O	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

FOUR WAY MANHOLE REINFORCING DETAILS (FMO)

Progress Energy

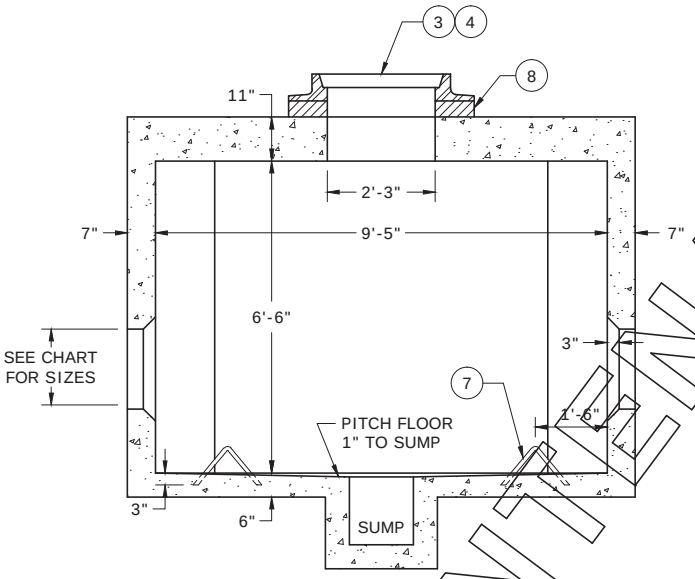
FLA

DWG. 29.03-19

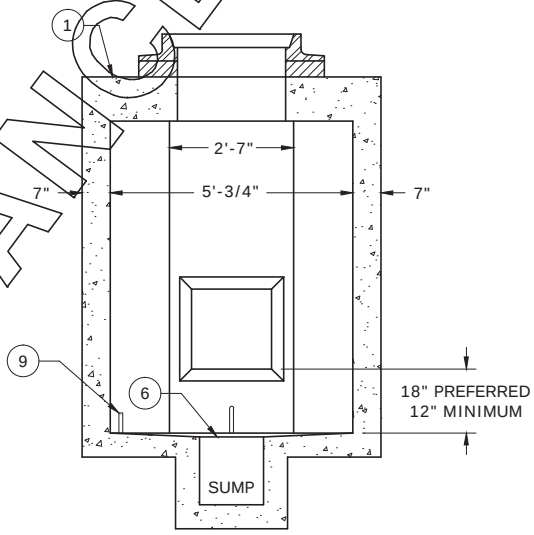


PLAN VIEW

WINDOW SIZES	
NO. OF DUCTS	SIZE OF WINDOW
1 OR 2	20" X 7"
3	20" X 12"
6 OR 8	20" X 20"
9	20" X 25"
12	20" X 32"
15	20" X 38"
17	20" X 45"



SIDE SECTION



END SECTION

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	-	1	-	7	CONCRETE, YARDS
	2	-	1	-	894	REINFORCING STEEL, 5/8", FT. (NOT SHOWN)
	3	-	1	-	1	MANHOLE RING
	4	-	1	-	1	MANHOLE COVER
	5	-	1	-	1	SUMP PIPE (NOT SHOWN)
	6	-	1	-	1	SUMP COVER
	7	-	1	-	2	PULL HOOKS
	8	-	1	-	AS REQ'D.	CEMENT BRICK
	9	-	1	-	2	GROUND ROD, 1/2" X 10"

3				
2				
1				
O	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

TWO WAY MANHOLE CONSTRUCTION DETAILS (FMO)

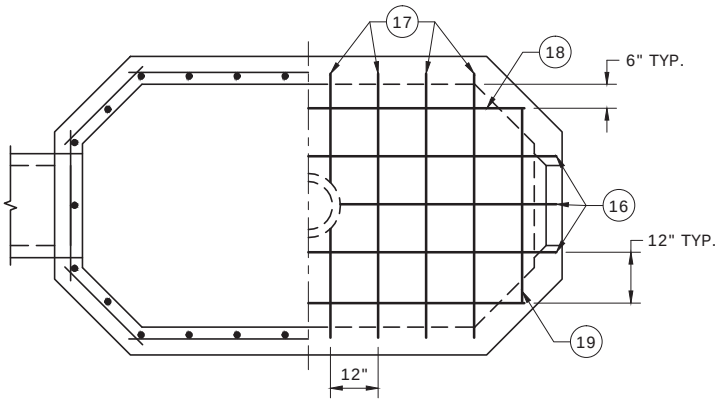
Progress Energy

FLA

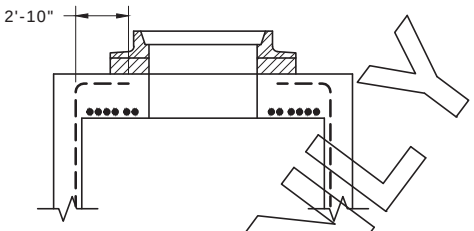
DWG. 29.03-21

WALL SECTION

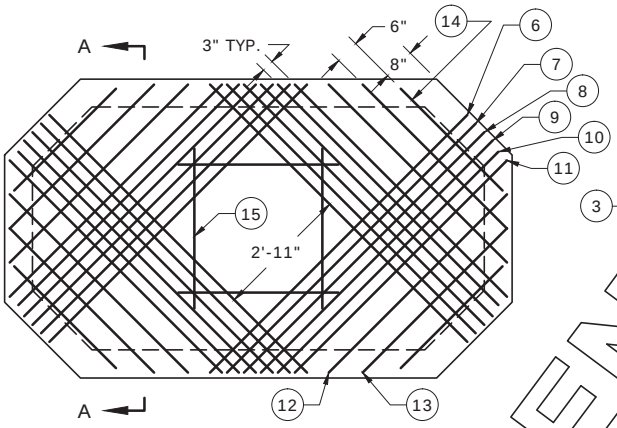
FLOOR SECTION



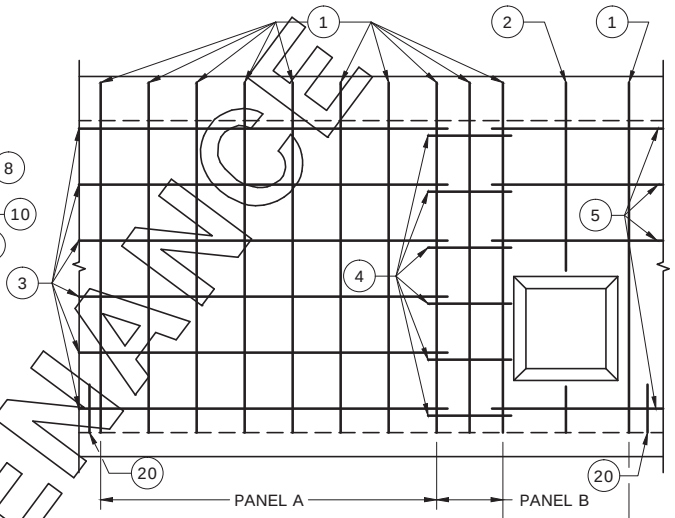
REINFORCING DETAIL



SECTION A-A



ROOF REINFORCING DETAIL



PANEL SECTION

REINFORCING RODS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	24	10'-4"	WALLS (VERTICAL)
2	2	4'-8"	WALLS (VERTICAL)
3	12	7'-6"	WALLS (HORIZONTAL)
4	24	2'-4"	WALLS (HORIZONTAL)
5	8	3'-4"	WALLS (HORIZONTAL)
6	4	7'-7"	ROOF
7	4	7'-4"	ROOF
8	4	7'-1"	ROOF
9	4	6'-10"	ROOF
10	4	6'-6"	ROOF
11	4	6'-3"	ROOF
12	4	5'-3"	ROOF
13	4	4'-3"	ROOF
14	4	3'-0"	ROOF
15	4	3'-4"	ROOF
16	3	10'-4"	FLOOR
17	8	5'-6"	FLOOR
18	2	9'-0"	FLOOR
19	2	4'-0"	FLOOR
20	24	1'-0"	FLOOR

NOTES:

1. ALL REINFORCING TO BE 5/8" ROUND STRUCTURAL GRADE BARS WITH ASTM A-305 DEFORMATION. BARS TO BE 1-1/2" MIN. FROM SURFACE OF CONCRETE.

2. CONCRETE TO HAVE A 28 DAY MIN. STRENGTH OF 3,000 PSI.

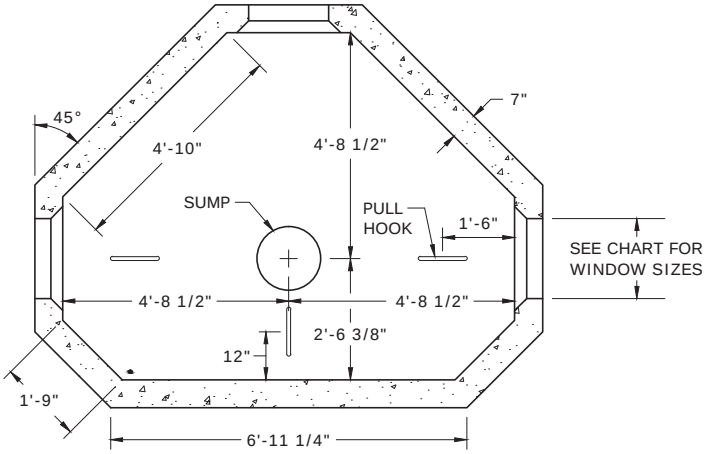
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS

TWO WAY MANHOLE CONSTRUCTION DETAILS (FMO)

Progress Energy

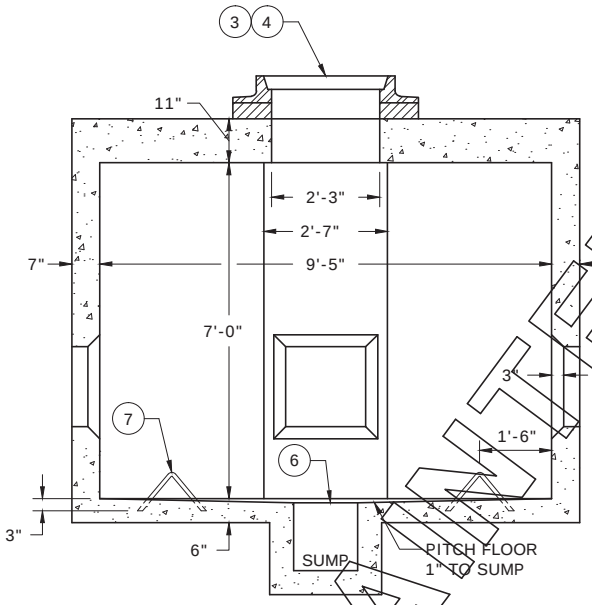
FLA

DWG. 29.03-23

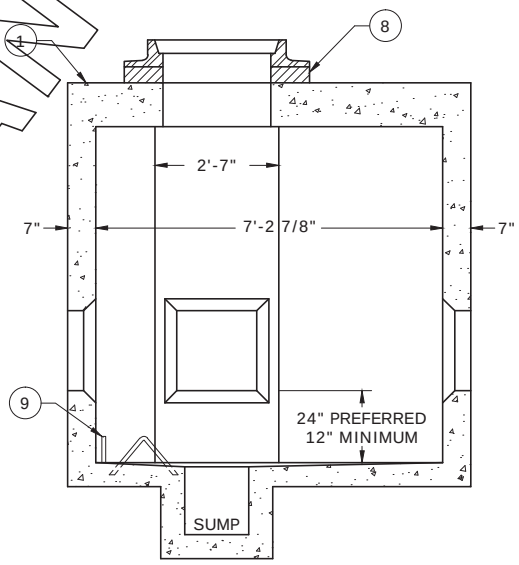


PLAN VIEW

WINDOW SIZES	
NO. OF DUCTS	SIZE OF WINDOW
1 OR 2	20" X 7"
3	20" X 12"
6 OR 8	20" X 20"
9	20" X 25"
12	20" X 32"
15	20" X 38"
17	20" X 45"



SIDE SECTION



END SECTION

BILL OF MATERIALS

MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
	1	-	1	-	9	CONCRETE, CUBIC YARDS
	2	-	1	-	936	REINFORCING STEEL, 5/8", FT. (NOT SHOWN)
	3	-	1	-	1	MANHOLE RING
	4	-	1	-	1	MANHOLE COVER
	5	-	1	-	1	SUMP PIPE (NOT SHOWN)
	6	-	1	-	1	SUMP COVER
	7	-	1	-	3	PULL HOOKS
	8	-	1	-	AS REQ'D.	CEMENT BRICK
	9	-	1	-	2	GROUND ROD, 1/2" X 10"

3					
2					
1					
0	9/27/11	GUINN	BURLISON	ELKINS	
REVISED		BY	CK'D	APPR.	

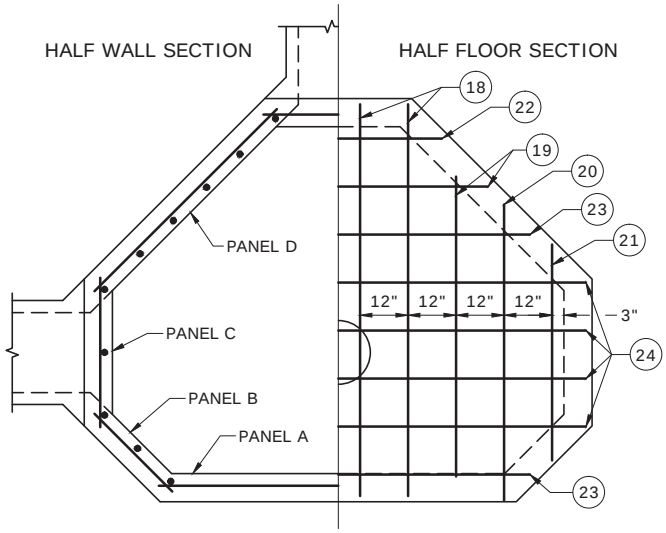
THREE WAY MANHOLE CONSTRUCTION DETAILS

(FMO)

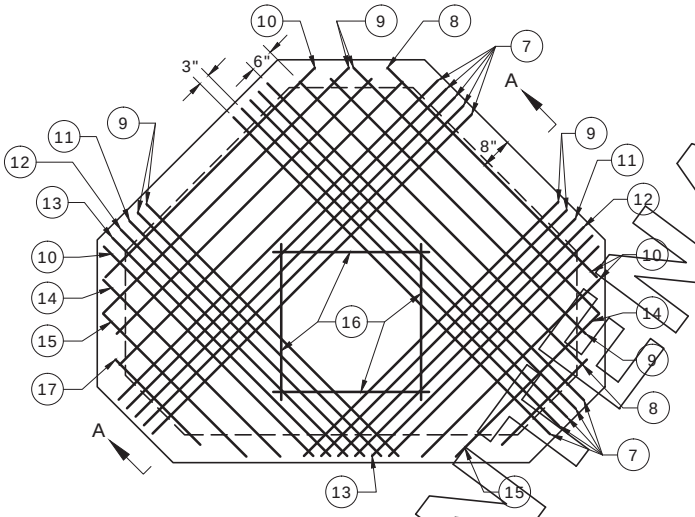
Progress Energy

FLA

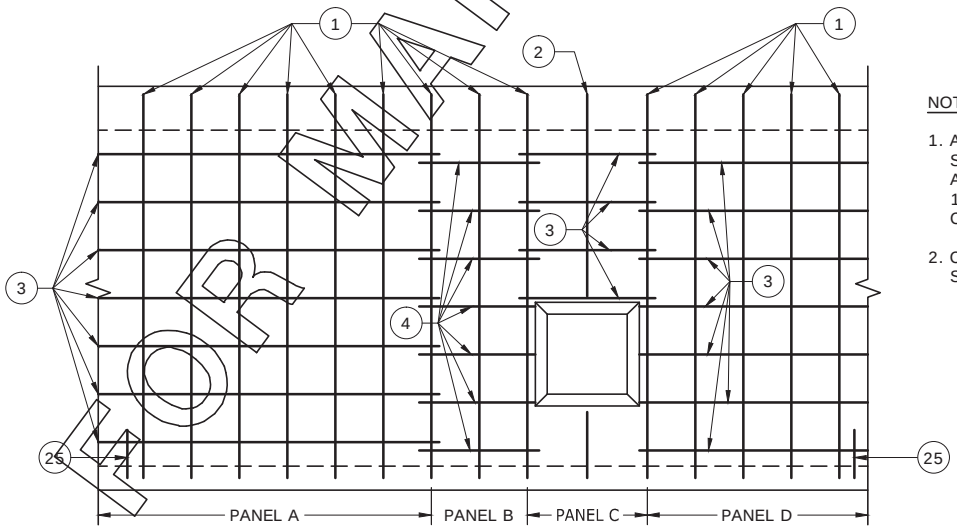
DWG. 29.03-25



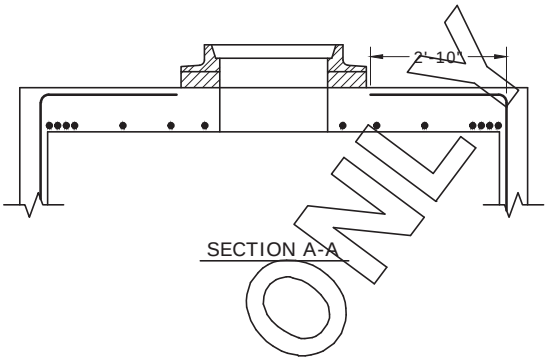
REINFORCING DETAIL



ROOF REINFORCING DETAIL



PANEL SECTION



SECTION A-A

REINFORCING RODS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	24	10'-10"	WALLS (VERTICAL)
2	3	5'-2"	WALLS (VERTICAL)
3	7	7'-10"	WALLS (HORIZONTAL)
4	14	2'-6"	WALLS (HORIZONTAL)
5	14	5'-6"	WALLS (HORIZONTAL)
6	15	3'-3"	WALLS (HORIZONTAL)
7	12	9'-5"	ROOF
8	2	8'-4"	ROOF
9	6	7'-6"	ROOF
10	4	6'-2"	ROOF
11	2	7'-1"	ROOF
12	2	6'-10"	ROOF
13	2	6'-7"	ROOF
14	2	5'-4"	ROOF
15	2	4'-4"	ROOF
16	4	3'-3"	ROOF
17	2	2'-6"	ROOF
18	4	8'-2"	FLOOR
19	3	6'-3"	FLOOR
20	2	6'-2"	FLOOR
21	2	4'-6"	FLOOR
22	1	4'-4"	FLOOR
23	1	8'-0"	FLOOR
24	4	10'-4"	FLOOR
25	24	1'-0"	FLOOR

NOTES:

1. ALL REINFORCING TO BE 5/8" ROUND STRUCTURAL GRADE BARS WITH ASTM A-305 DEFORMATION. BARS TO BE 1 1/2" MIN. FROM SURFACE OF CONCRETE.

2. CONCRETE TO HAVE A 28 DAY MIN. STRENGTH OF 3,000 PSI.

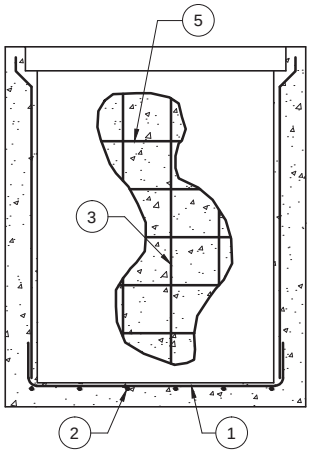
REVISED	BY	CK'D	APPR.
3			
2			
1			
0 9/27/11	GUINN	BURLISON	ELKINS

THREE WAY MANHOLE REINFORCING DETAILS (FMO)

Progress Energy

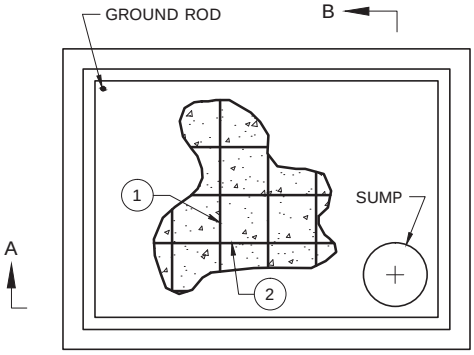
FLA

DWG. 29.03-27

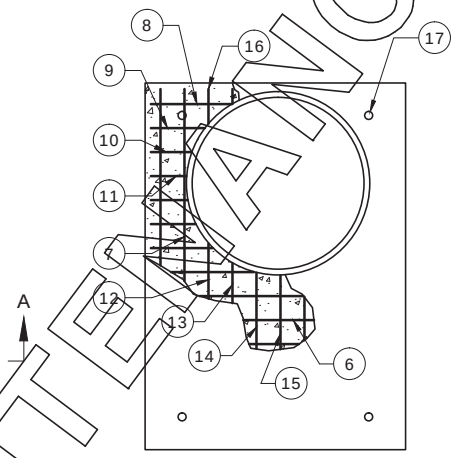


SECTION B-B

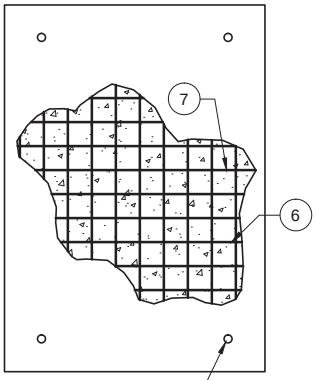
REINFORCING RODS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	6	7'-6"	5/8" REINFORCING ROD - FLOOR
2	6	9'-6"	5/8" REINFORCING ROD - FLOOR
3	28	6'-9" / 7'-9"	5/8" REINFORCING ROD - WALLS (VERTICAL)
4	12	8'-0"	5/8" REINFORCING ROD - WALLS (HORIZONTAL)
5	12	6'-0"	5/8" REINFORCING ROD - WALLS (HORIZONTAL)
6	22	3'-5"	1/2" REINFORCING ROD - SLAB
7	15	5'-1 1/2"	1/2" REINFORCING ROD - SLAB
8	4	1'-1"	1/2" REINFORCING ROD - SLAB
9	4	0'-8"	1/2" REINFORCING ROD - SLAB
10	4	0'-6"	1/2" REINFORCING ROD - SLAB
11	4	0'-5"	1/2" REINFORCING ROD - SLAB
12	2	2'-9"	1/2" REINFORCING ROD - SLAB
13	2	2'-6"	1/2" REINFORCING ROD - SLAB
14	2	2'-5"	1/2" REINFORCING ROD - SLAB
15	1	2'-4"	1/2" REINFORCING ROD - SLAB
16	2	0'-7"	1/2" REINFORCING ROD - SLAB
17	8	0'-5"	3/4" GALVANIZED PIPE NIPPLE



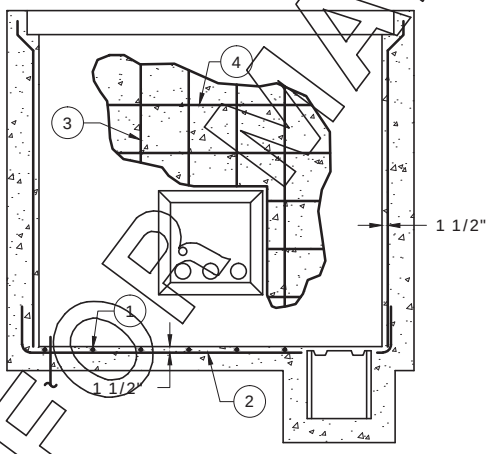
PLAN VIEW



ROOF SLAB WITH MANHOLE RING



ROOF SLAB



SECTION A-A

NOTES:

1. BEND ALL FLOOR REINFORCING RODS UP 12" AND TIE TO VERTICAL REINFORCING RODS IN WALLS.
2. SLAB REINFORCING RODS TO BE ON 4" CENTERS AND PLACES IN CENTER OF SLAB.
3. WALL AND FLOOR REINFORCING RODS TO BE ON 12" CENTERS.
4. ALL REINFORCING TO BE 5/8" ROUND STRUCTURAL GRADE BARS WITH ASTM STD. A-305 DEFORMATION. 1-1/2" MIN. FROM SURFACE.
5. CONCRETE TO HAVE A 28 DAY MINIMUM STRENGTH OF 3,000 PSI.

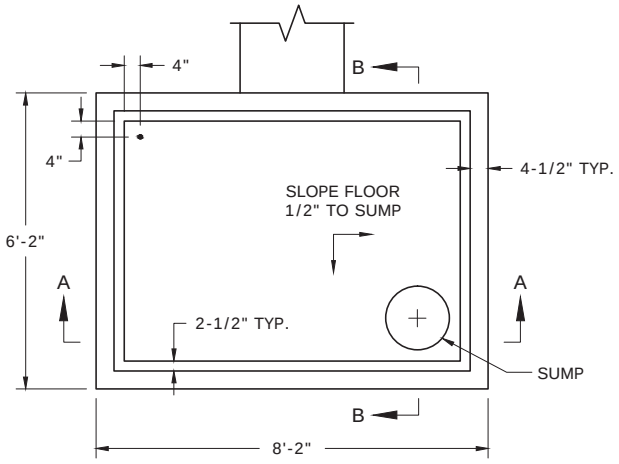
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS

SWITCH MANHOLE REINFORCING DETAILS (FMO)

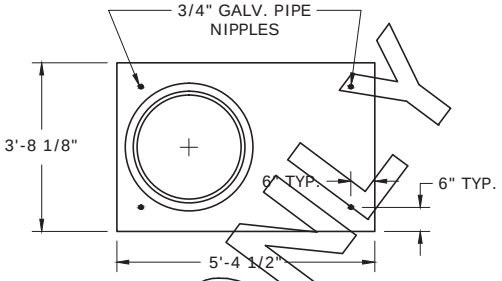
Progress Energy

FLA

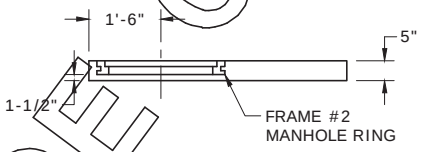
DWG. 29.03-29



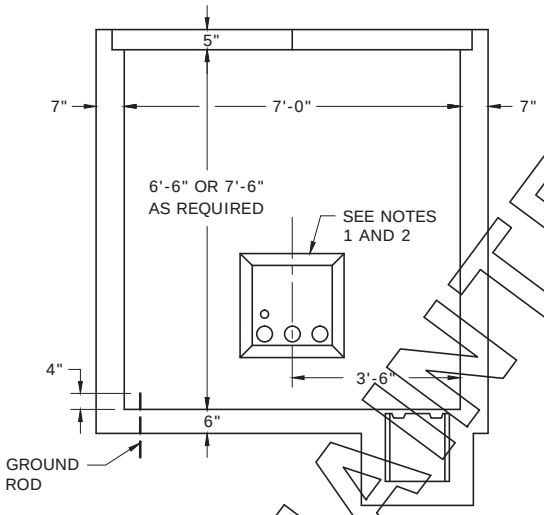
PLAN VIEW



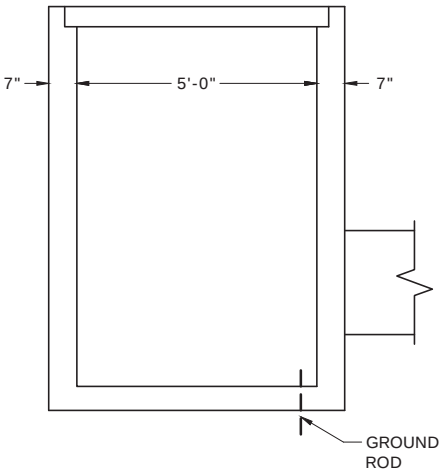
SLAB DETAIL



SLAB DETAIL



SECTION A-A



SECTION B-B

NOTES:

1. DUCTS TO ENTER MANHOLE HORIZONTALLY ON GIVEN CENTERLINE DIMENSION OF MANHOLE WINDOW OPENING.
2. THREE 4" DUCTS FOR PRIMARY CABLE TO SWITCH. ONE 2" DUCT FOR SECONDARY CABLE TO MANHOLE LIGHTS AND AUTOMATIC SUMP PUMP.
3. SLAB NO. 2 TO BE OF SAME DIMENSIONS AS SLAB NO. 1 BUT WITHOUT MANHOLE RING.

3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

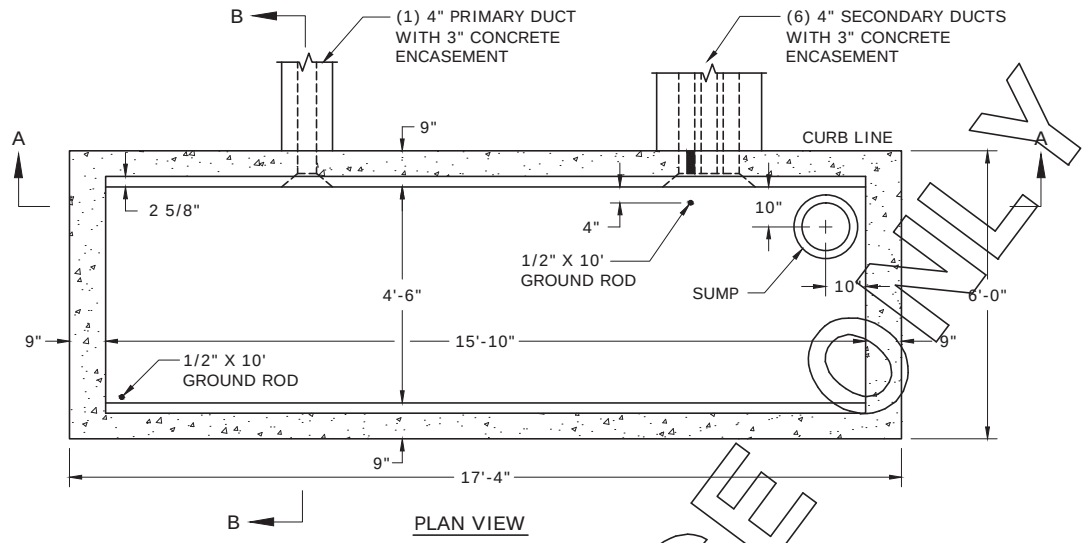
SWITCH MANHOLE CONSTRUCTION DETAILS

(FMO)

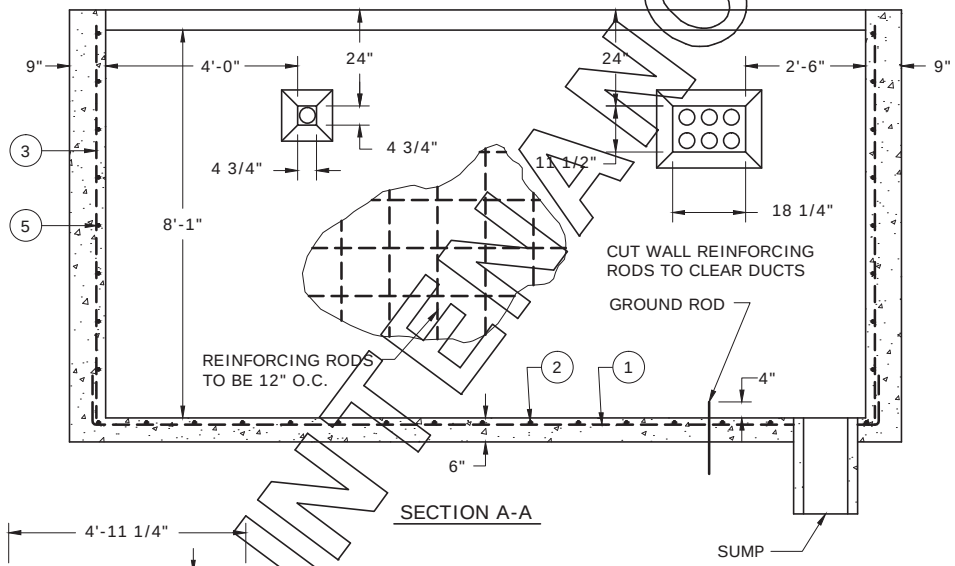
Progress Energy

FLA

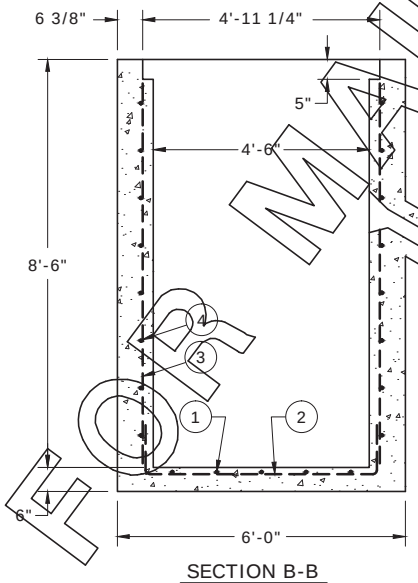
DWG. 29.03-31



PLAN VIEW



SECTION A-A



SECTION B-B

BILL OF MATERIALS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	5	19'-0"	5/8" REINFORCING RODS - FLOOR
2	16	6'-6"	5/8" REINFORCING RODS - FLOOR
3	42	8'-0"	5/8" REINFORCING RODS - WALLS (VERTICAL)
4	16	16'-6"	5/8" REINFORCING RODS - WALLS (HORIZONTAL)
5	16	5'-0"	5/8" REINFORCING RODS - WALLS (HORIZONTAL)

NOTE: ALL REINFORCING RODS TO BE 1 1/2" MINIMUM FROM CONCRETE SURFACE. FLOOR AND WALL RODS TO BE ON 12" CENTERS

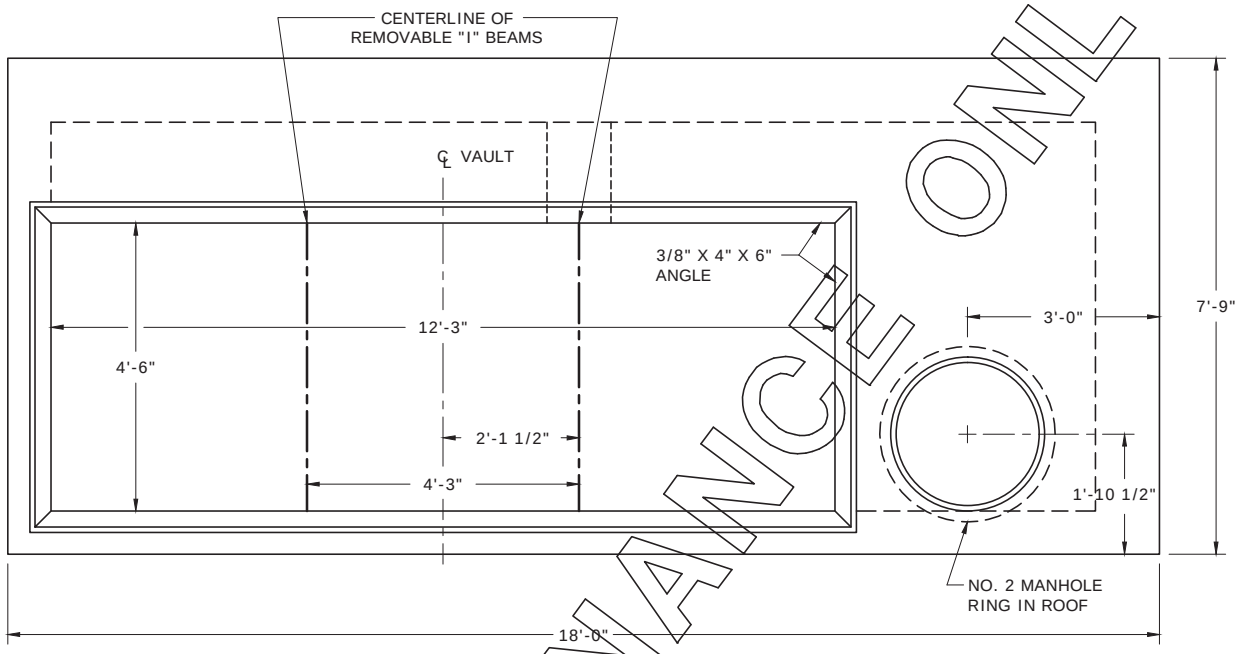
3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

SIDEWALK AREA VAULT CONSTRUCTION DETAILS (FMO)

Progress Energy

FLA

DWG. 29.03-33



PLAN VIEW

3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

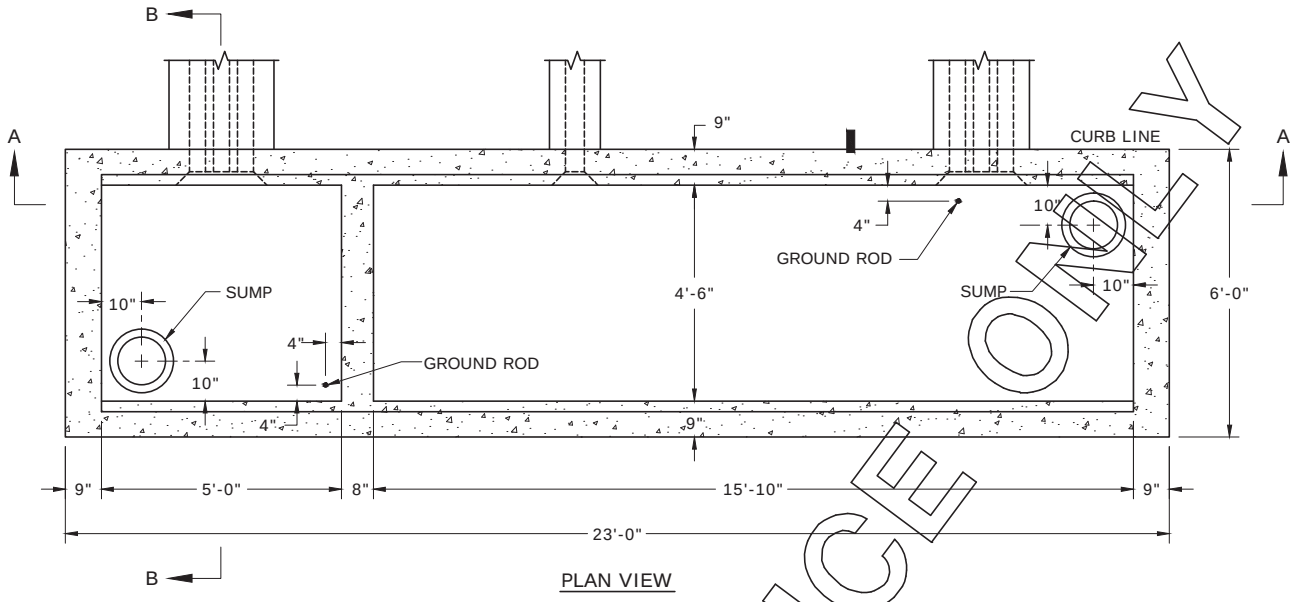
STREET AREA VAULT CONSTRUCTION DETAILS

(FMO)

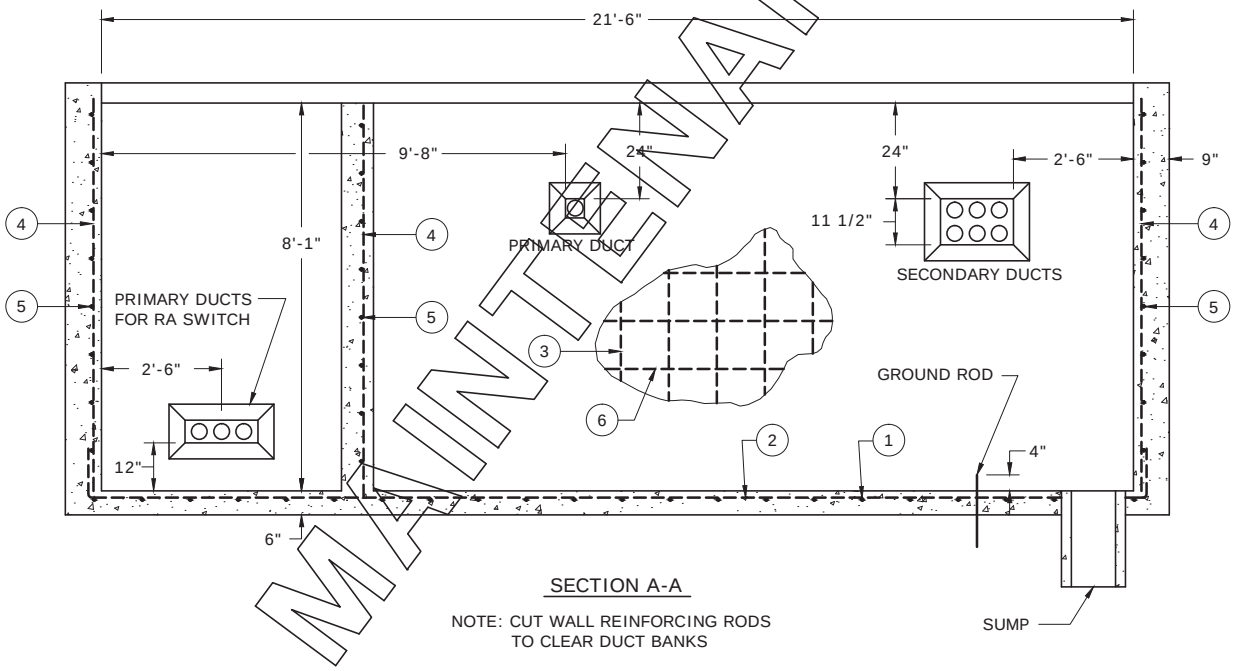
Progress Energy

FLA

DWG. 29.03-35



PLAN VIEW



SECTION A-A

NOTE: CUT WALL REINFORCING RODS TO CLEAR DUCT BANKS

BILL OF MATERIALS			
ITEM NO.	QTY REQ'D	LENGTH	DESCRIPTION
1	23	6'-10"	5/8" REINFORCING ROD
2	5	23'-10"	5/8" REINFORCING ROD
3	47	8'-1"	5/8" REINFORCING ROD
4	10	8'-6"	5/8" REINFORCING ROD
5	26	4'-10"	5/8" REINFORCING ROD
6	16	21'-10"	5/8" REINFORCING ROD

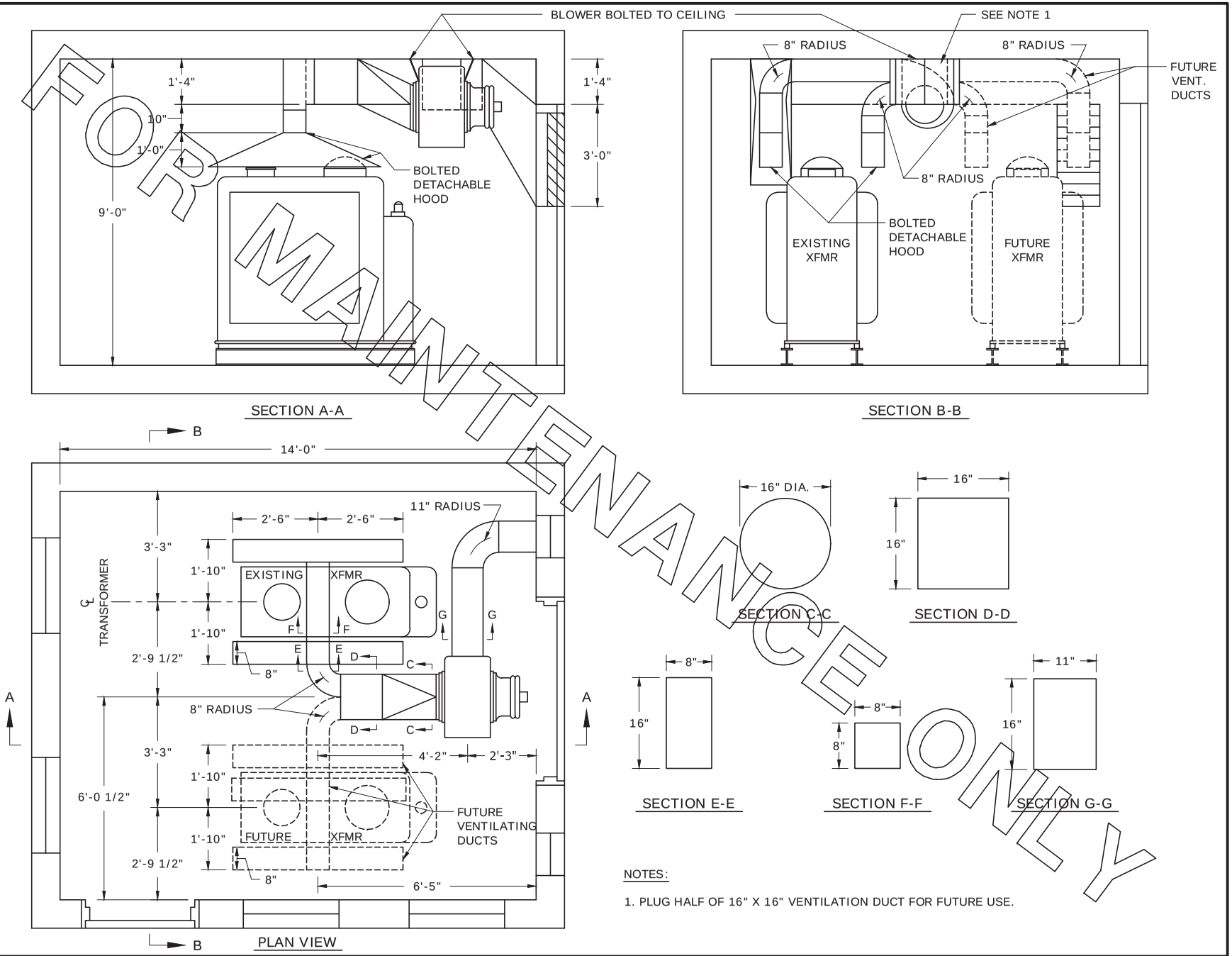
REVISED		BY	CK'D	APPR.
3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS

SIDEWALK AREA SWITCH VAULT CONSTRUCTION DETAILS (FMO)

Progress Energy

FLA

DWG. 29.03-37



NOTES:

1. PLUG HALF OF 16" X 16" VENTILATION DUCT FOR FUTURE USE.

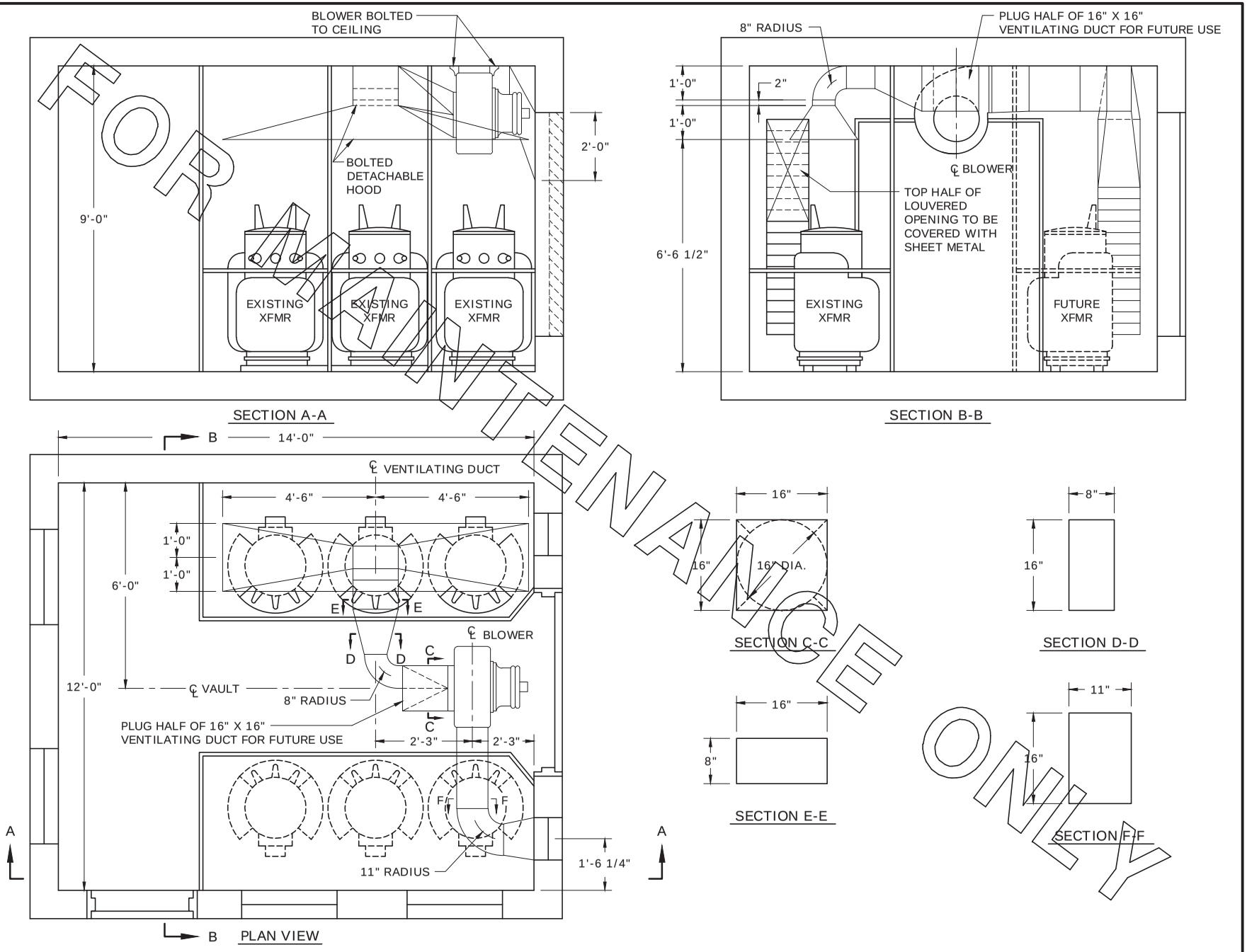
REVISED	BY	CK'D	APPR.
0 9/27/11	GUINN	BURLISON	EIKINS
1			
2			
3			

TYPICAL BUILDING VAULT
VENTILATION SYSTEM
NETWORK TYPE TRANSFORMER (FMO)

Progress Energy

FLA

DWG. 29.03-43



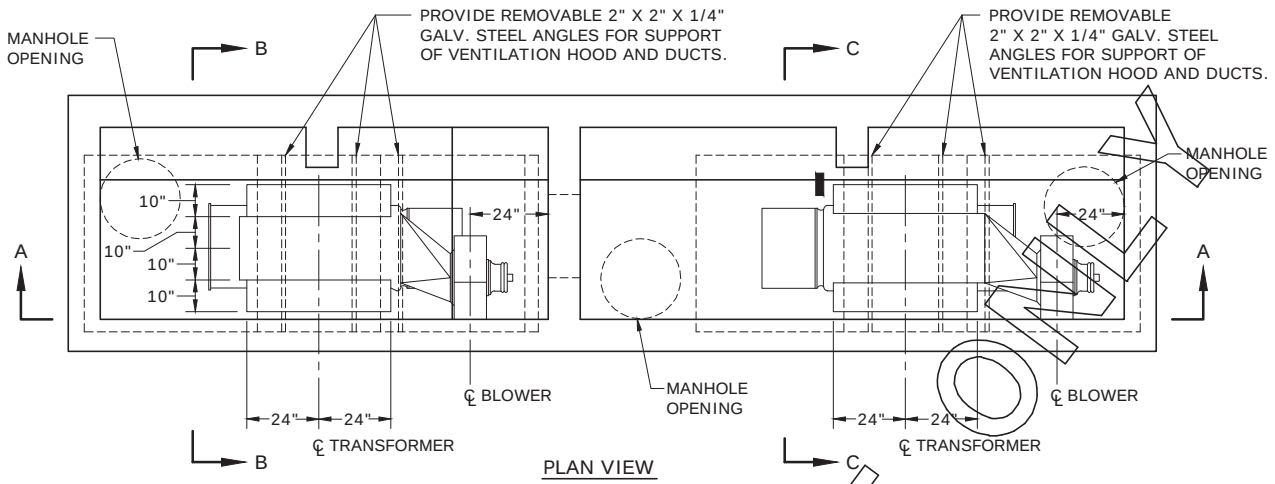
	REVISED	BY	CK'D	APPR.
3				
2				
1				
0	9/27/11	GUINN	BURLISON	EIKINS

TYPICAL BUILDING VAULT
VENTILATION SYSTEM
SINGLE-PHASE TRANSFORMER (FMO)

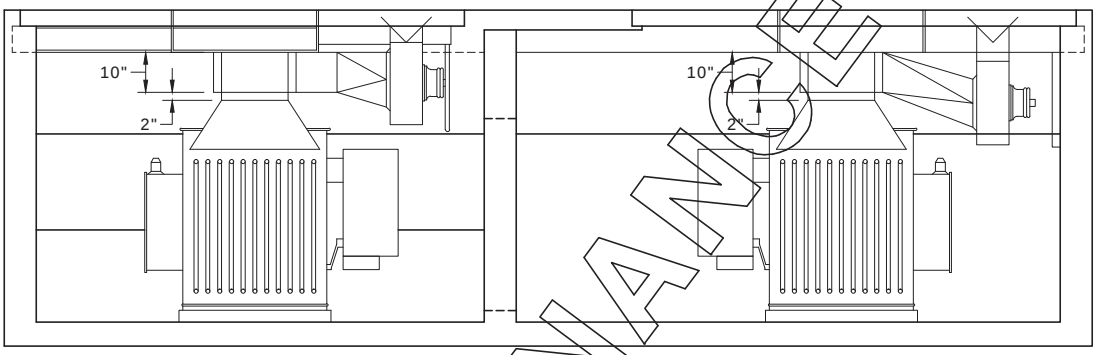
Progress Energy

FLA

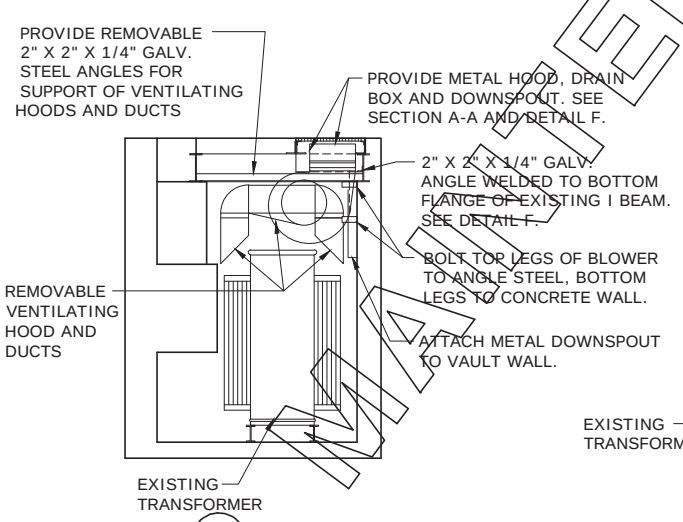
DWG: 29.03-45



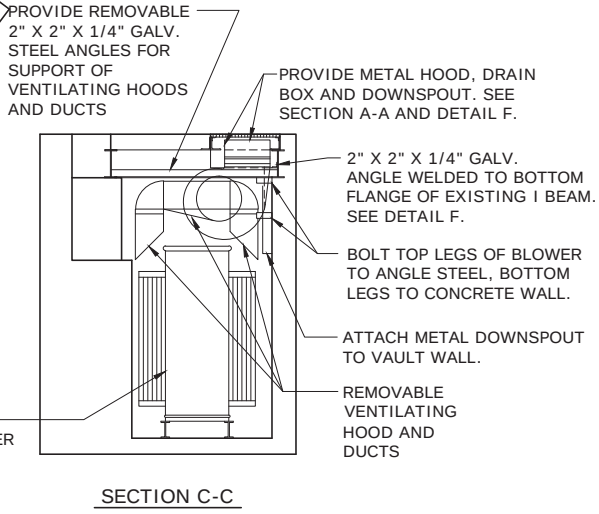
PLAN VIEW



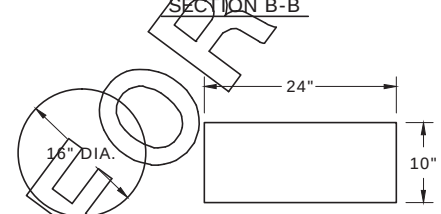
SECTION A-A



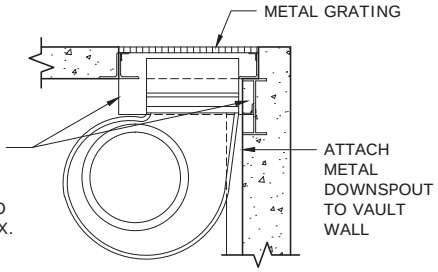
SECTION B-B



SECTION C-C



SECTION D-D SECTION E-E



DETAIL F

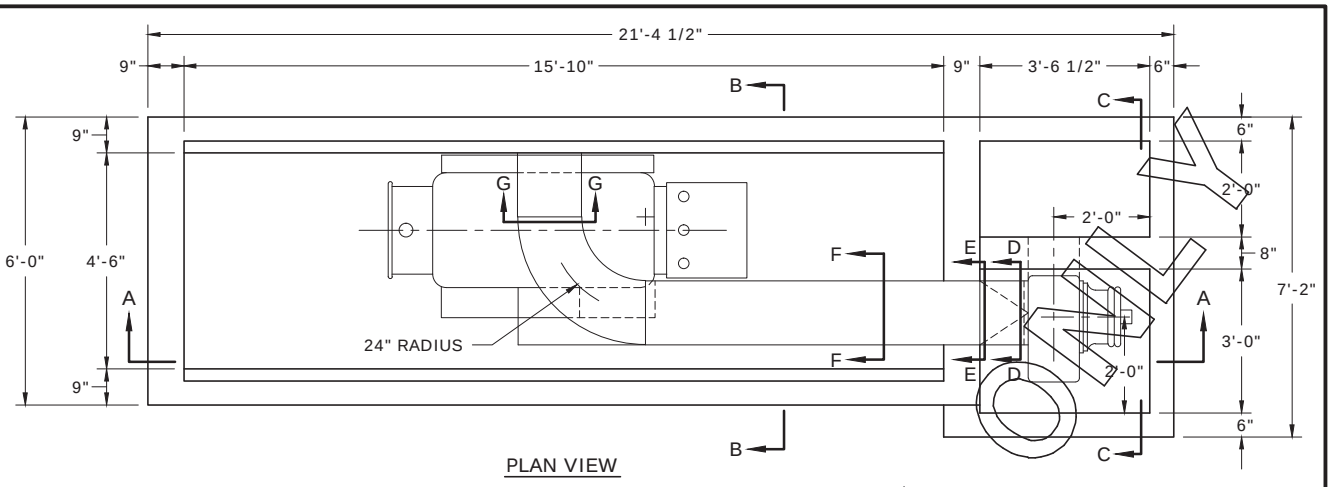
3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

TYPICAL STREET AREA VAULT VENTILATION SYSTEM (FMO)

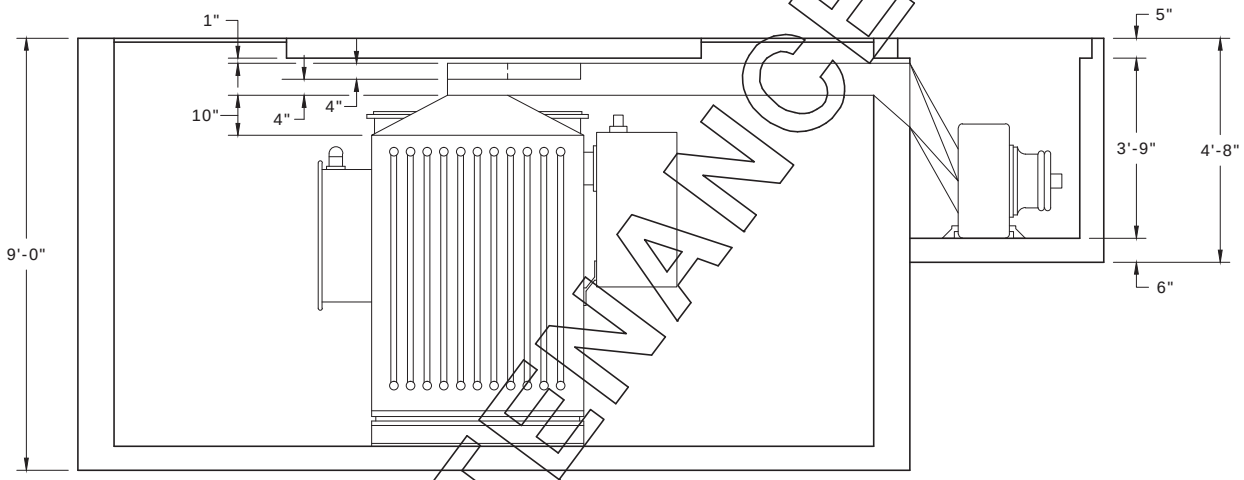
Progress Energy

FLA

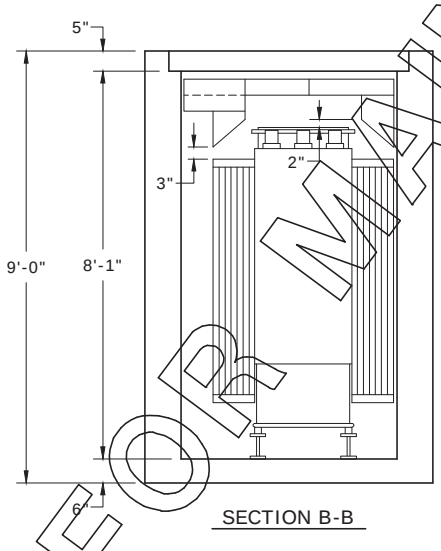
DWG. 29.03-47



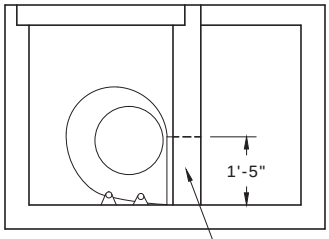
PLAN VIEW



SECTION A-A

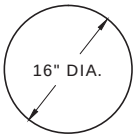


SECTION B-B

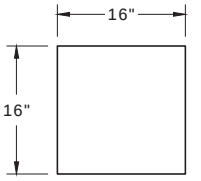


LINE OPENING IN 8" BLOCK WALL WITH SHEET METAL DUCT

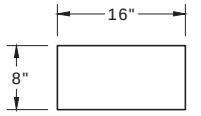
SECTION C-C



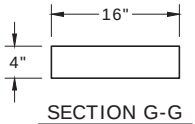
SECTION D-D



SECTION E-E



SECTION F-F



SECTION G-G

3				
2				
1				
0	9/27/11	GUINN	BURLISON	ELKINS
REVISED		BY	CK'D	APPR.

TYPICAL SIDEWALK VAULT VENTILATION SYSTEM (FMO)

Progress Energy

FLA

DWG. 29.03-49

REVISED	BY	CK'D	APPR.
3 5/6/16	DEFREITAS	BLOCKER	COWLING
2 11/24/15	DEFREITAS	GUY	COWLING
1 11/8/12	DEFREITAS	DANNA	ADCOCK
0 7/22/10	CECCONI	GUINN	ELKINS

SECTION 30 - STREET AND AREA LIGHTING

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

30.08 LUMINARIES AND RELAYS (CONT.)

30.09 POLES

30.10 HOLIDAY RECEPTACLES

30.11 LIGHTING ACCESSORIES

DUKE ENERGY.

REVISED	BY	CHK'D	APPR.
4 11/8/18	SIMPKINS	BLOCKER	COWLING
3 4/6/16	DEFREITAS	BLOCKER	COWLING
2 1/27/15	DEFREITAS	COWLING	HENSON
0 7/27/10	CECCONI	GUINN	ELKINS

SECTION 30 - STREET AND AREA LIGHTING

TABLE OF CONTENTS

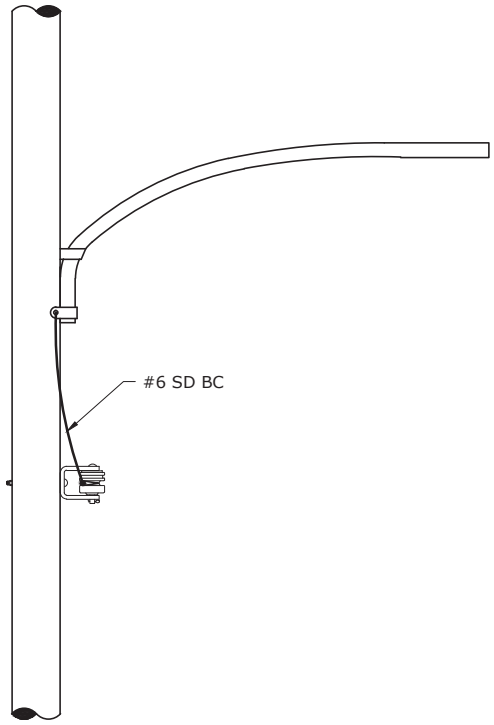
DEC	DEM	DEP	DEF
			X

30.12 WIRING DIAGRAMS

30.13 SHIELDS

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE



NOTES:

1. ALWAYS GROUND STREET AND AREA LIGHT BRACKETS BY BONDING TO NEUTRAL.

3				
2				
1				
0	11/8/12	HOFFMAN	DANNA	ADCOCK
REVISED		BY	CK'D	APPR.

STREET AND AREA LIGHT BRACKET GROUND

Duke Energy®

FLA

DWG. 30.00-01

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

HANDLING OF FAILED LIGHTING EQUIPMENT

POLES, BRACKETS, FOUNDATIONS AND MISCELLANEOUS HARDWARE: RETURN ANY FAILED MATERIAL IN THESE CATEGORIES TO THE PROGRESS ENERGY FLORIDA RECOVERY CENTER FOR ANALYSIS. IDENTIFY DEFECTIVE MATERIAL WITH A PINK DEFECTIVE MATERIAL TAG (CN 9220099314). DEFECTIVE MATERIAL SHOULD BE MARKED "FAILED".

LUMINAIRES: LUMINAIRES THAT DO NOT WORK UPON INITIAL INSTALLATION OR FAIL WITHIN FIVE YEARS FROM THE DATE OF MANUFACTURE ARE TO BE RETURNED TO THE PROGRESS ENERGY FLORIDA MATERIAL RECOVERY CENTER FOR WARRANTY CLAIMS. LUMINARIES THAT HAVE BEEN REMOVED FROM SERVICE AND ARE STILL OPERABLE SHOULD BE RE-STOCKED FOR INVENTORY AT THE LOCAL STORE ROOM WITH GREEN TAG ATTACHED.

PHOTOCONTROLS: PHOTOCONTROLS THAT DO NOT OPERATE PROPERLY UPON INITIAL INSTALLATION OR FAIL WITHIN EIGHT YEARS FROM THE DATE OF MANUFACTURE ARE TO BE BATCHED AND RETURNED TO THE RECOVERY CENTER. PHOTOCONTROLS OLDER THAN EIGHT YEARS SHOULD BE SCRAPPED IN THE FIELD.

LAMPS: ANY LAMP THAT DOES NOT WORK UPON INITIAL INSTALLATION OR FAILS WITHIN THREE YEARS FROM DATE OF INSTALLATION IS TO BE BATCHED AND RETURNED TO THE APPROPRIATE MATERIAL RECOVERY CENTER. IF THE INSTALLATION DATE CANNOT BE DETERMINED OR IF THE LAMP HAS BEEN IN SERVICE FOR OVER THREE YEARS, THE LAMP IS TO BE SCRAPPED IN THE FIELD.

BALLAST TRAYS: BALLAST TRAYS THAT HAVE FAILED IN THE FIELD MUST BE RETURNED TO THE RECOVERY CENTER. BALLAST TRAYS THAT FAIL DURING THE FIXTURE'S FIVE YEAR WARRANTY PERIOD SHOULD BE TAGGED BEFORE SENDING THEM BACK TO THE RECOVERY CENTER.

STARTER-AID: ANY STARTER THAT FAILED AND MUST BE REPLACED DURING THE FIXTURE'S FIVE YEAR WARRANTY PERIOD SHOULD BE TAGGED BEFORE SENDING IT BACK TO THE RECOVERY CENTER. FAILED STARTERS OLDER THAN FIVE YEARS CAN BE SCRAPPED IN THE FIELD.

NOTES:

1. ALL WARRANTY RETURNS ARE PROCESSED BY LIGHTING SOLUTIONS' UNIT FOR FULL WARRANTY REPLACEMENT FROM VENDORS AT WILDWOOD RECOVERY CENTER.

2. POLES, BRACKETS, LUMINAIRES, BALLAST TRAYS AND STARTERS ARE ONE-FOR-ONE REPLACEMENT.

3. PHOTOCONTROLS ARE FOUR-FOR-ONE FOR THE THE FIRST YEAR, THREE-FOR-ONE FOR THE SECOND YEAR, TWO-FOR-ONE FOR THE THIRD YEAR AND ONE-FOR-ONE FOR THE FOURTH THROUGH TENTH YEAR ON FAILURES.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

DISPOSAL OF FAILED LIGHTING EQUIPMENT

Duke Energy®

FLA

DWG. 30.00-03

REMOVAL/RESTOCK LIGHT FIXTURES TRACKING SYSTEM

REMOVAL:

COMPLETE A REMOVAL/RESTOCKING LIGHT FIXTURE TAG (SEE FIGURE BELOW) AND ATTACH IT TO ALL FIXTURES REMOVED DUE TO NORMAL MAINTENANCE, UPGRADE OR IDLE REMOVAL. THE TAGGED FIXTURE MUST BE CHECKED AT THE LOCAL OPERATIONS CENTER BEFORE IT IS RESTOCKED.

IF A FIXTURE IS DEFECTIVE AND NEEDS TO BE ANALYZED BY DISTRIBUTION STANDARDS, REPLACE THIS TAG WITH A PINK DEFECTIVE MATERIAL TAG (CN 9220099314). SEE DWG. 20.04-10. SEND TO MATERIAL RECOVERY AT WILDWOOD.

RESTOCKING:

- ANY REMOVED OPERABLE FIXTURE SHOULD BE RESTOCKED LOCALLY IF POSSIBLE.
- THE SURPLUS OF VERIFIED OPERABLE LIGHTS CAN BE TRANSFERRED TO OTHER OPERATIONS CENTERS WITHIN THE REGION.
- LEAVE THIS (GREEN) RESTOCKING TAG ON THE FIXTURE IF IT IS RETURNED TO MATERIAL RECOVERY FOR NORMAL REPAIR OR RESTOCKING.

ACCURATE RESTOCKING TAGS ENABLE EACH OPERATIONS CENTER TO REDUCE ITS MAINTENANCE BUDGET BY ALLOWING THEM TO RESTOCK AND REUSE GOOD FIXTURES.

TAG IS GREEN WITH BLACK LETTERS →

REMOVAL & RESTOCKING

LIGHT FIXTURE TAG

FROM:

Florida REGION: [South Coastal] [North Coastal] [North Central] [South Central]

OPS LOCATION: _____

BY _____ DATE _____

☐ NORMAL TAKEDOWN - OPERATING
☐ IDLE REMOVAL - OPERATING
☐ UPGRADE LIGHT - OPERATING

THIS SECTION MUST BE FILLED OUT BY PERSON THAT REMOVES THE LIGHT FROM SERVICE

RESTOCKING:

FIXTURE WAS TESTED AND VERIFIED AS OK FOR RESTOCKING YES ☐ NO ☐

C/N _____

BY _____ DATE _____

☐ LIGHT RESTOCKED LOCALLY
☐ RETURN TO MATERIAL RECOVERY FOR REPAIR OR RESTOCKING

DO NOT REMOVE THIS TAG UNTIL FIXTURE HAS BEEN REINSTALLED FROM LOCAL STOCK

THIS SECTION MUST BE FILLED OUT BY PERSON THAT VERIFIES LIGHT IS OPERABLE FOR RESTOCKING

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

REMOVAL AND RESTOCKING
LIGHT FIXTURE PROCESS

Duke Energy®

FLA

DWG. 30.00-05

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

STANDARD MOUNTING HEIGHTS OF LUMINAIRES ON WOOD POLES

TYPE OF LUMINAIRES	RECOMMENDED HEIGHTS OF LIGHT CENTER TO GROUND *
5,800 LUMEN SODIUM (70 WATT) SEMI, ENC CUTOFF	25'
9,500 LUMEN SODIUM (100 WATT) SEMI, ENC CUTOFF	25'
16,000 LUMEN SODIUM (150 WATT) ENC CUTOFF	30'
20,000 LUMEN SODIUM (250 WATT METAL HALIDE) FLOOD, ENC CUTOFF	30'
22,000 LUMEN SODIUM (200 WATT) ENC CUTOFF CUTOFF	30'
28,500 LUMEN SODIUM (250 WATT) FLOOD, ENC CUTOFF	30'
50,000 LUMEN SODIUM (400 WATT) ENC, FLOOD	35' *
40,000 LUMEN METAL HALIDE (320 AND 400 WATT) FLOOD	30'
110,00 LUMEN METAL HALIDE (1000 WATT) FLOOD	35'

FOR ALL INSTALLATIONS, ENGINEER IS TO DETERMINE ACTUAL MOUNTING HEIGHTS FOR LUMINAIRES WITHIN A RANGE OF ±2-1/2' OF THE RECOMMENDED HEIGHTS GIVEN ABOVE. WORK ORDER IS TO SPECIFY LOCATION OF UPPER THRU BOLT HOLE FOR LIGHTING SUPPORT. SEE DWG. 30.02-25 FOR DIMENSIONS OF BRACKETS AND MAST ARMS.

FOR PLANNED SYSTEMS (LIGHTS CLOSER THAN 200'), ENGINEER IS TO DETERMINE HEIGHTS FOR PROJECT BASED ON RECOMMENDED HEIGHTS GIVEN ABOVE, TYPE OF SUPPORT, AND EXISTING OR REQUIRED OTHER DISTRIBUTION FACILITIES. WHERE JOB HAS MOSTLY NEW POLE, ACTUAL MOUNTING HEIGHTS SHOULD TEND TO BE IN THE UPPER PART OF THE RECOMMENDED RANGE (EXAMPLE, 30' TO 32.5'). WHERE EXISTING POLES DO NOT PERMIT RECOMMENDED MOUNTING HEIGHTS, THE LOWER END OF THE RANGE MAY BE USED. (EXAMPLE, 30' TO 27.5'. FOR PLANNED SYSTEMS, THE MOUNTING HEIGHTS OF ADJACENT LUMINAIRES SHOULD NOT VARY MORE THAN 6' FOR EACH 100' OF SPACING BETWEEN LIGHTING UNITS.

* HEIGHT FROM LIGHT CENTER TO SURFACE BEING ILLUMINATED. IN SPECIFYING HEIGHT, TAKE INTO CONSIDERATION ANY DIFFERENCE IN ELEVATION OR GROUND AT POLE AND AT SURFACE DIRECTLY UNDER LIGHT. 35' MOUNTING HEIGHT RECOMMENDED. DO NOT CHANGE OUT EXISTING FACILITIES TO ACHIEVE RECOMMENDED MOUNTING HEIGHT.

TYPE OF FLOODLIGHTS	HEIGHTS OF LIGHT CENTER TO BASE OF POLE **
28,500 LUMEN SODIUM (250 WATT)	28'
50,000 LUMEN SODIUM (400 WATT)	33'
40,000 LUMEN METAL HALIDE (320 AND 400 WATT)	30'
110,000 LUMEN METAL HALIDE (1000 WATT)	35'/39'

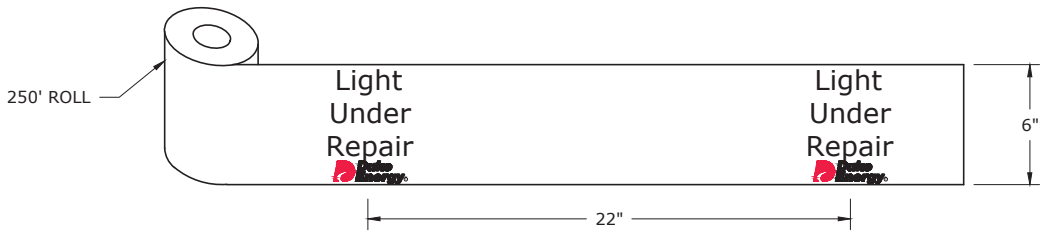
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

MOUNTING HEIGHT FOR LUMINAIRES

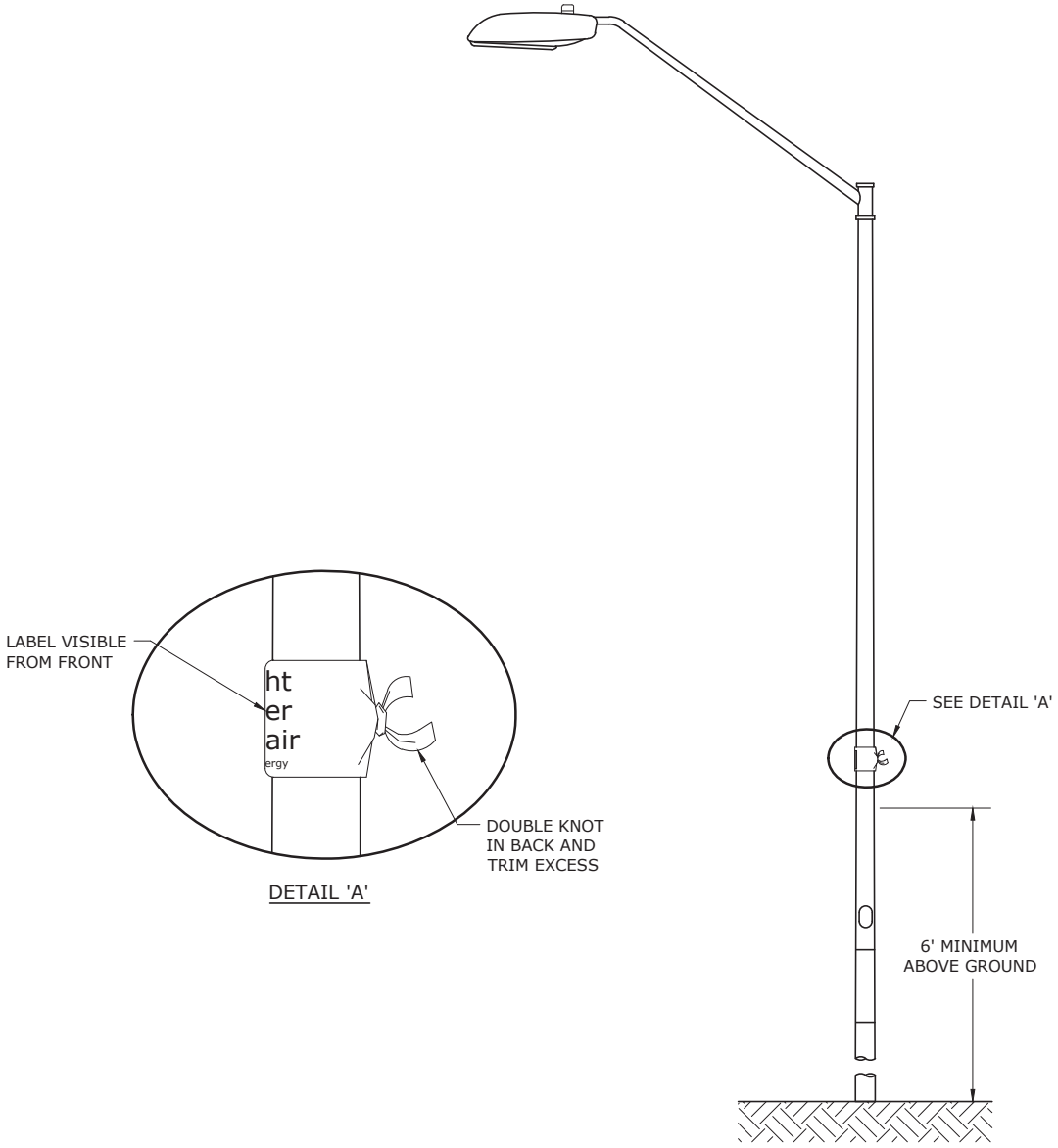
Duke Energy®

FLA

DWG. 30.00-15



CN 9220104637



DETAIL 'A'

NOTES:

1. THIS LABELING TAPE IS USED TO MARK LIGHT FIXTURES THAT REQUIRE A SECOND TRIP TO COMPLETE REPAIRS DUE TO BAD WIRING, UNAVAILABLE PARTS, ETC. ONCE THE POLE HAS BEEN LABELED, REPEAT TROUBLE CALLS SHOULD BE REDUCED WHILE WAITING FOR REPAIRS TO BE FINALIZED. THE LABEL SHOULD BE REMOVED FROM THE POLE ONCE THE LIGHT IS WORKING PROPERLY.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

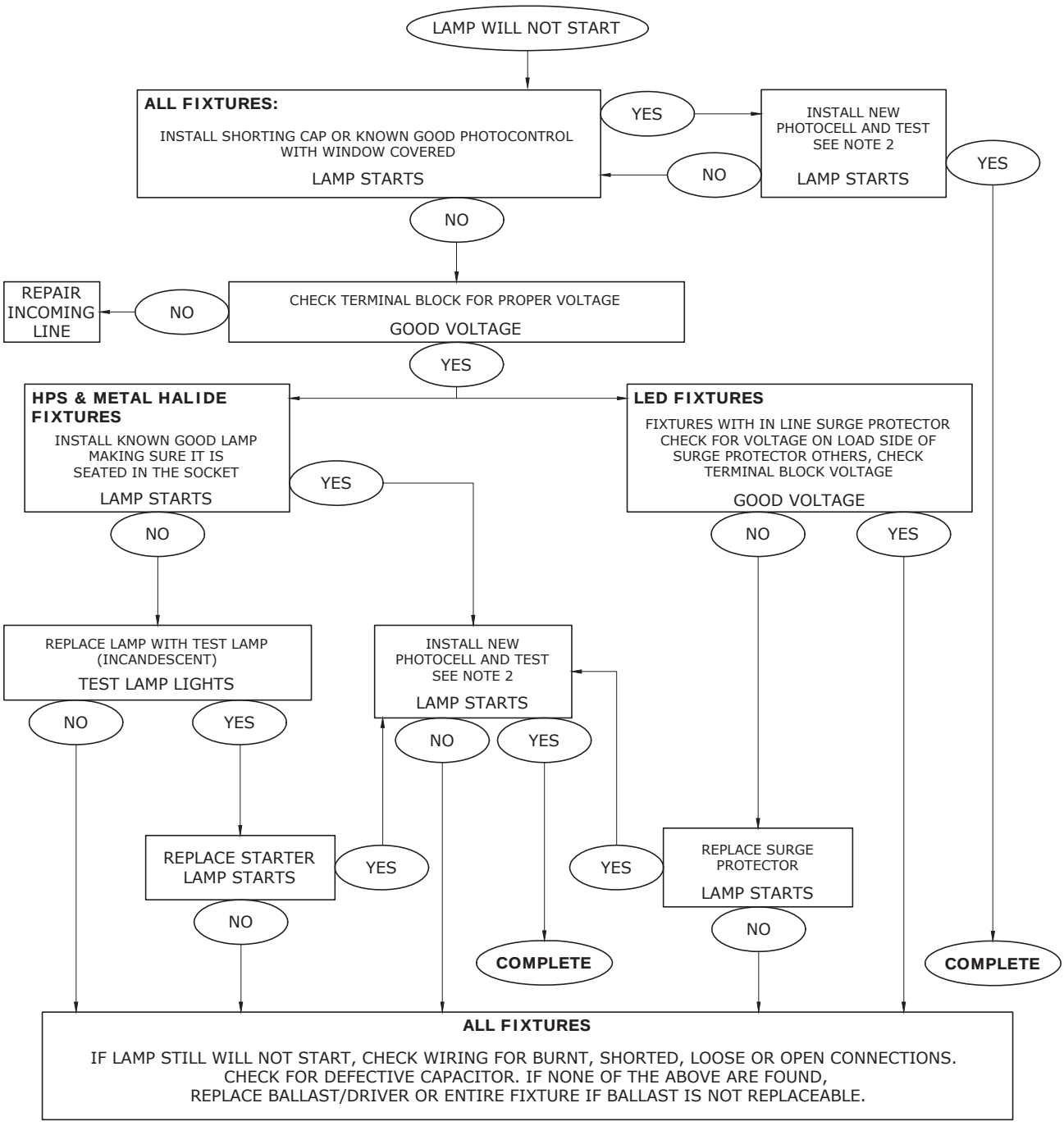
"LIGHT UNDER REPAIR" LABELING TAPE

Duke Energy®

FLA

DWG. 30.00-17

INSPECT OUTSIDE OF LIGHT FIXTURE FOR ANY SIGNS OF DAMAGE.
TAP ON LIGHT FIXTURE AND LISTEN FOR ANY INDICATION OF ANIMAL INTRUSION.
OPEN FIXTURE AND INSPECT FOR OBVIOUS PROBLEMS.



NOTES:

1. LED LIGHT FIXTURES USE PHOTOCELL WITH A "FAIL OFF" FEATURE (CN 9220208023).

2. HPS LAMPS HOT RESTRIKE TIME IS 1 TO 3 MINUTES, WARM UP TIME IS 3 TO 4 MINUTES. METAL HALIDE HOT RESTRIKE TIME IS 10 TO 20 MINUTES, WARM UP TIME IS 2 TO 5 MINUTES.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

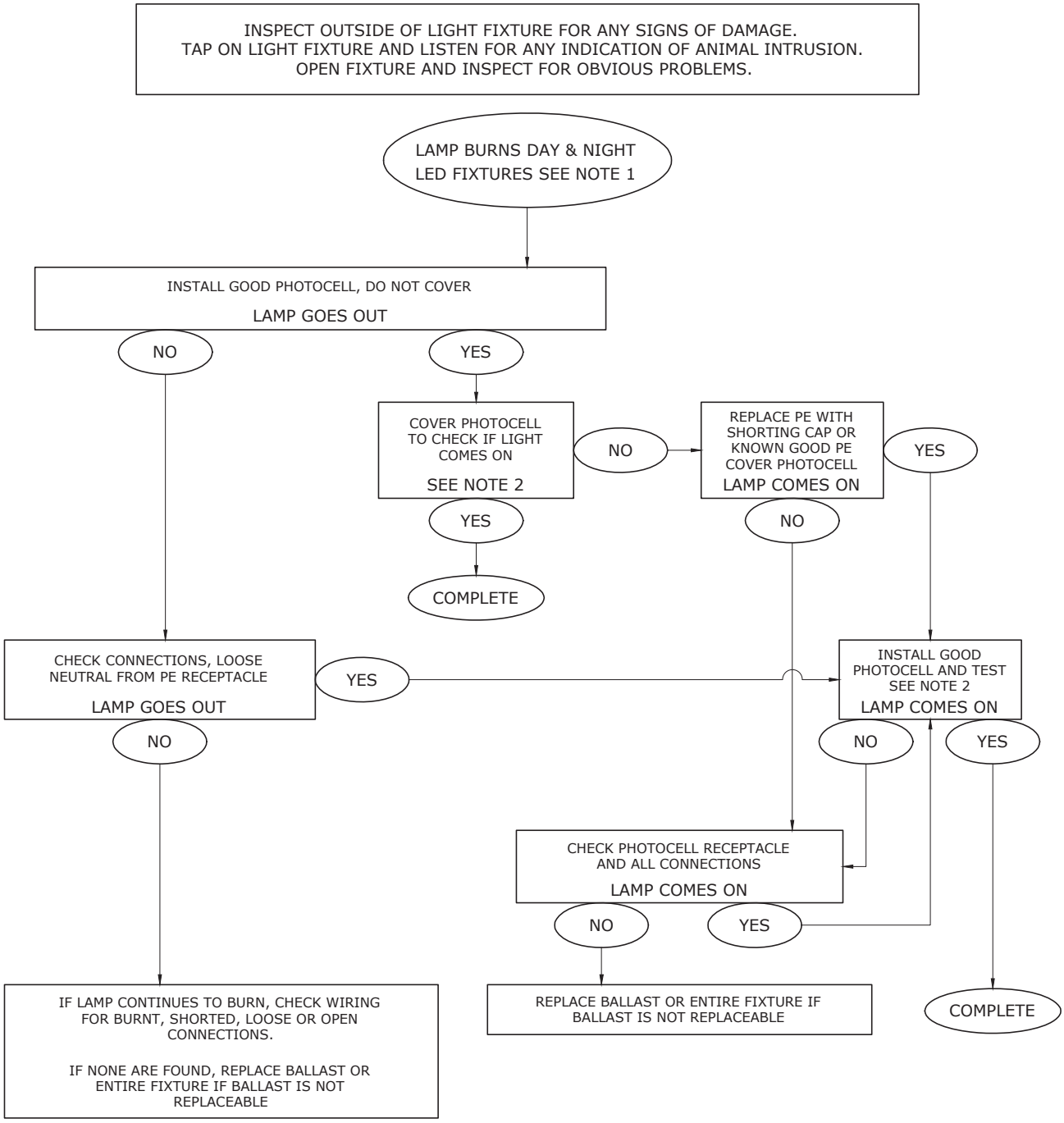
LIGHT FIXTURE TROUBLESHOOTING GUIDE -

LAMP WILL NOT START

Duke Energy®

FLA

DWG. 30.00-29A



NOTES:

1. LED LIGHT FIXTURES USE PHOTOCELL WITH A "FAIL OFF" FEATURE (CN 9220208023).

2. HPS LAMPS HOT RESTRIKE TIME IS 1 TO 3 MINUTES, WARM UP TIME IS 3 TO 4 MINUTES. METAL HALIDE HOT RESTRIKE TIME IS 10 TO 20 MINUTES, WARM UP TIME IS 2 TO 5 MINUTES.

3. METAL HALIDE DAY BURNERS CAN CAUSE LAMP TO SHATTER IF LEFT ON FOR AN EXTENDED PERIOD (30 DAYS).

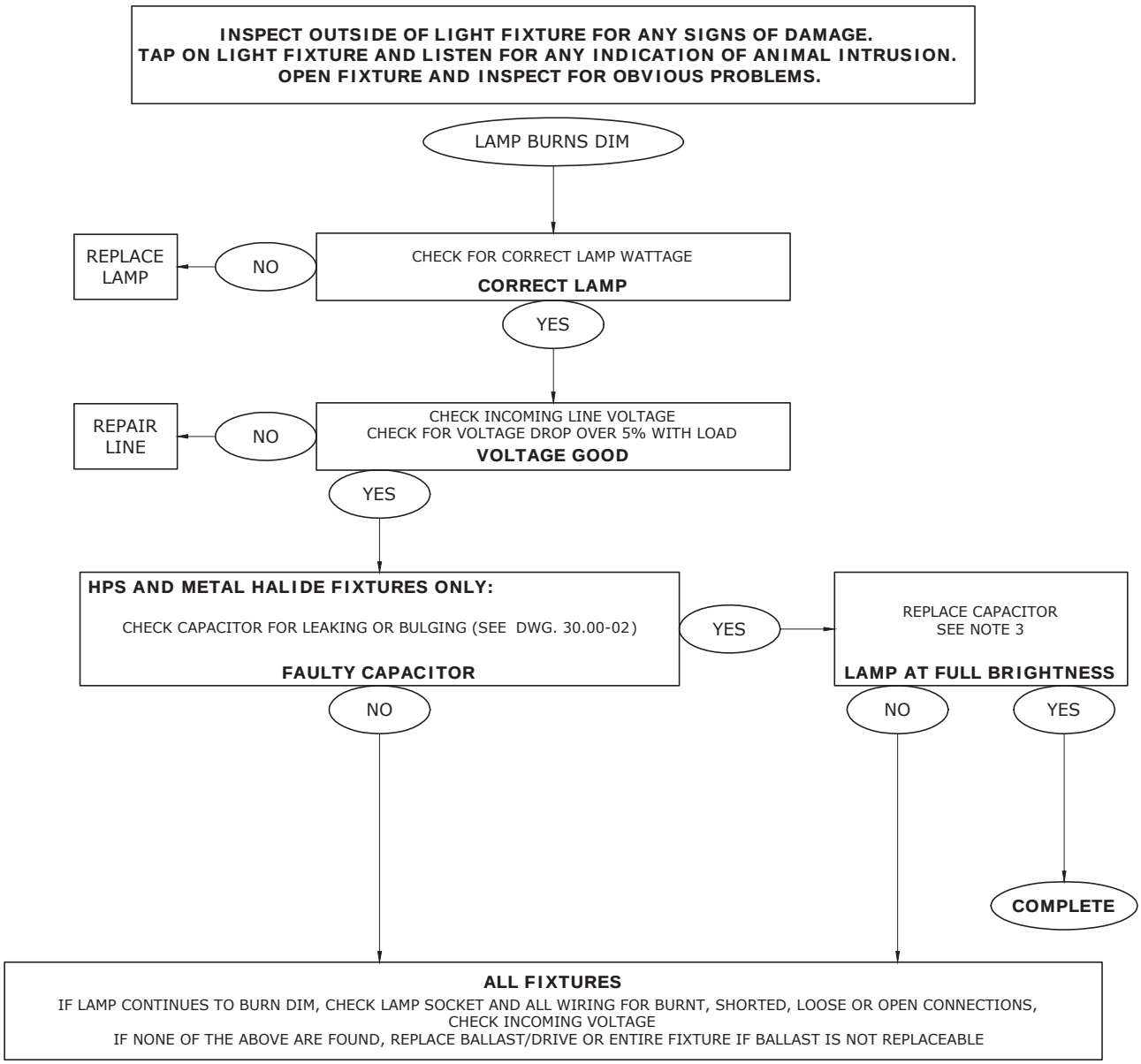
REVISED		BY	CK'D	APPR.
3				
2				
1	3/6/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN

LIGHT FIXTURE TROUBLESHOOTING GUIDE - LAMP BURNS DAY & NIGHT

Progress Energy

FLA

DWG. 30.00-29B



NOTES:

1. LED LIGHT FIXTURES USE PHOTOCELL WITH A "FAIL OFF" FEATURE (CN 9220208023).

2. CYCLING IS NORMAL END OF LIFE FOR HPS LAMPS.

3. HPS LAMPS HOT RESTRIKE TIME IS 1 TO 3 MINUTES, WARM UP TIME IS 3 TO 4 MINUTES. METAL HALIDE HOT RESTRIKE TIME IS 10 TO 20 MINUTES, WARM UP TIME IS 2 TO 5 MINUTES.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

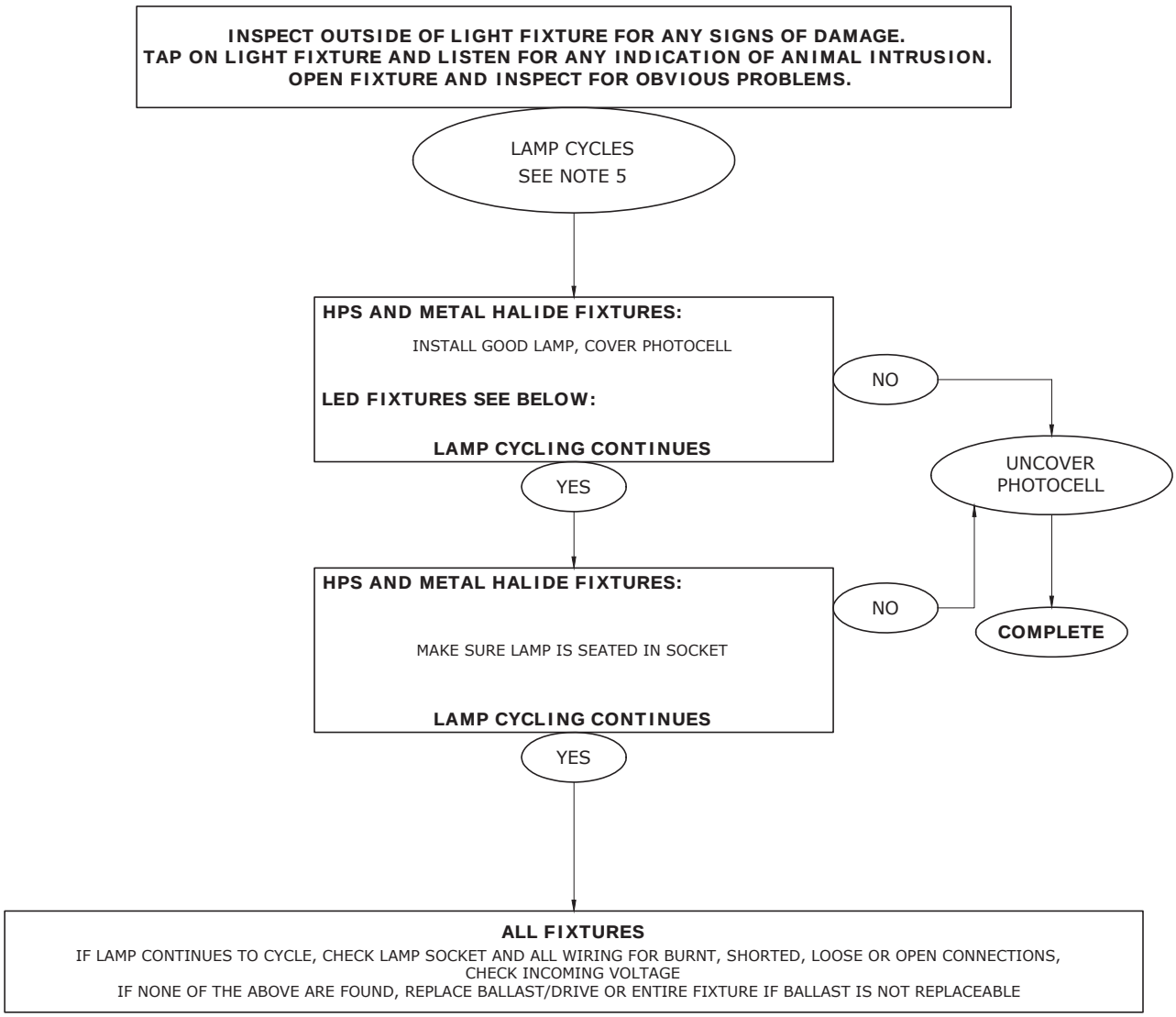
LIGHT FIXTURE TROUBLESHOOTING GUIDE -

LAMP BURNS DIM

Duke Energy®

FLA

DWG. 30.00-29C



NOTES:

1. LED LIGHT FIXTURES USE PHOTOCELL WITH A "FAIL OFF" FEATURE (CN 9220208023).
2. CYCLING IS NORMAL END OF LIFE FOR HPS LAMPS.
3. LOW WATTAGE HPS LAMPS (50 TO 150 WATT) WITH REACTOR TYPE BALLASTS MAY CYCLE DUE TO VOLTAGE DIP FROM EQUIPMENT STARTUP.
4. HPS LAMPS HOT RESTRIKE TIME IS 1 TO 3 MINUTES, WARM UP TIME IS 3 TO 4 MINUTES. METAL HALIDE HOT RESTRIKE TIME IS 10 TO 20 MINUTES, WARM UP TIME IS 2 TO 5 MINUTES.
5. THE AGE OF A HPS LAMP CAN BE DETERMINED BY MEASURING THE VOLTAGE AT THE LAMP SOCKET. SEE DWG. 30.00-30 FOR HPS REPLACEMENT GUIDE.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

LIGHT FIXTURE TROUBLESHOOTING GUIDE - LAMP CYCLES

Duke Energy®

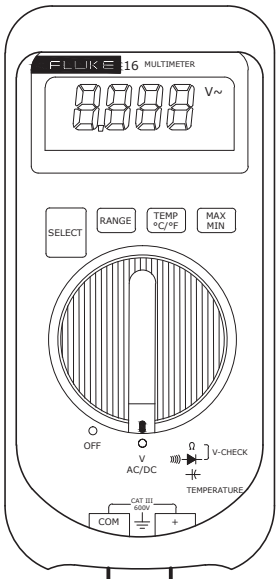
FLA

DWG. 30.00-29D

TABLE 1: HPS LAMP REPLACEMENT GUIDE					
LAMP WATTAGE	LAMP LUMEN	NEW HIGH PRESSURE SODIUM VOLTAGE VALUES			RECOMMENDED VOLTAGE TO CHANGE OUT OLD HIGH PRESSURE SODIUM LAMPS
		MIN.	NOMINAL	MAX.	
70W	5800	41V	52V	62V	MORE THAN 75 VOLTS
100W	9500	42V	55V	63V	MORE THAN 75 VOLTS
150W	16000	45V	55V	64V	MORE THAN 75 VOLTS
200W	22,000	72V	100V	120V	MORE THAN 140 VOLTS
250W	28,500	72V	100V	120V	MORE THAN 140 VOLTS
400W	50,000	75V	100V	120V	MORE THAN 130 VOLTS

TABLE 2: HPS STARTER REPLACEMENT GUIDE					
ANSI LAMP TYPE	LAMP WATTAGE	LAMP VOLTAGE	OPERATING VOLTAGE	DISCONNECT JUMPER	DO NOT DISCONNECT JUMPER
S62	70	55	120		X
S54	100	55	↓		X
S55	150	55	↓		X
S66	200	100	↓	X	
S51	400	100	240	X	
S66	200	100	↓	X	
S50	250	100	↓	X	
S51	400	100	↓	X	

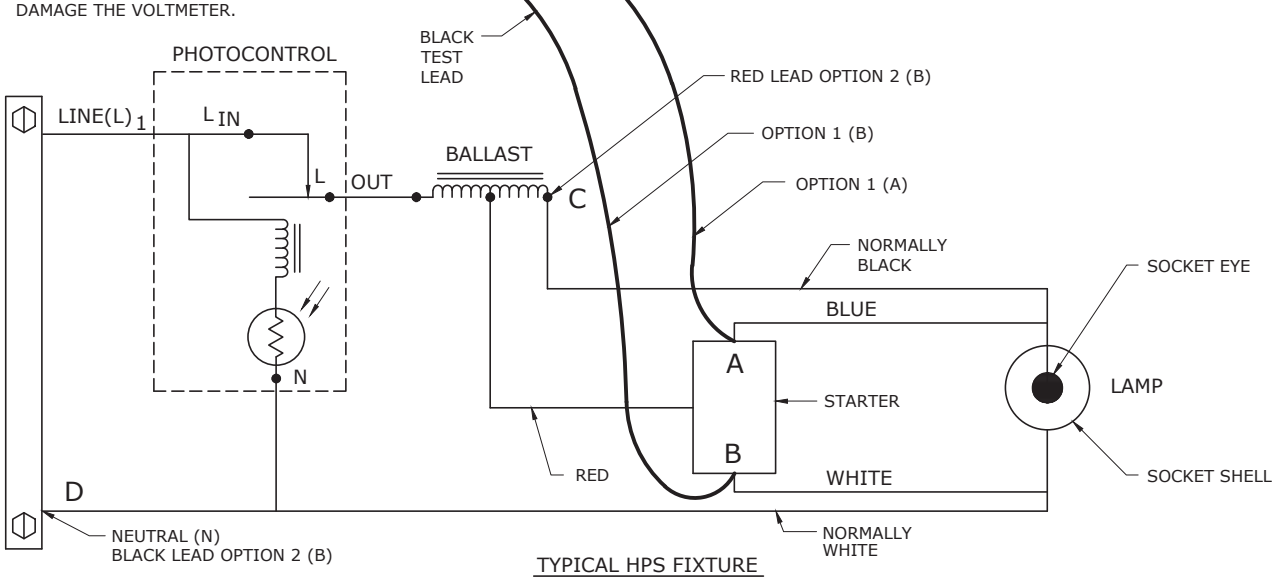
CAUTION: FAILURE TO DISCONNECT JUMPER WHEN REQUIRED CAN CAUSE EARLY STARTER FAILURE.



RED TEST LEAD

CAUTION

CONNECT METER TO LAMP CIRCUIT **AFTER** LAMP IS IGNITED. PULSES FROM THE STARTER MODULE WILL DAMAGE THE VOLTMETER.



TYPICAL HPS FIXTURE

NOTES:

1. USE TABLE 1 FOR CHANGING OR REPLACING HPS LAMPS.
2. USE TABLE 2 FOR REPLACING STARTER AND WHEN TO DISCONNECT RED JUMPER.

OPTION 1 FOR READING VOLTAGE

A) TOUCH RED LEAD TO STARTER BOARD AT POINT "A"
B) TOUCH BLACK LEAD TO STARTER BOARD AT POINT "B"

OPTION 2 FOR READING VOLTAGE

A) TRACE THE TWO LEADS FROM THE LAMP SOCKET BACK TO POINTS "C" AND "D"
B) TOUCH THE RED LEAD TO POINT "C" AND THE BLACK LEAD TO POINT "D"

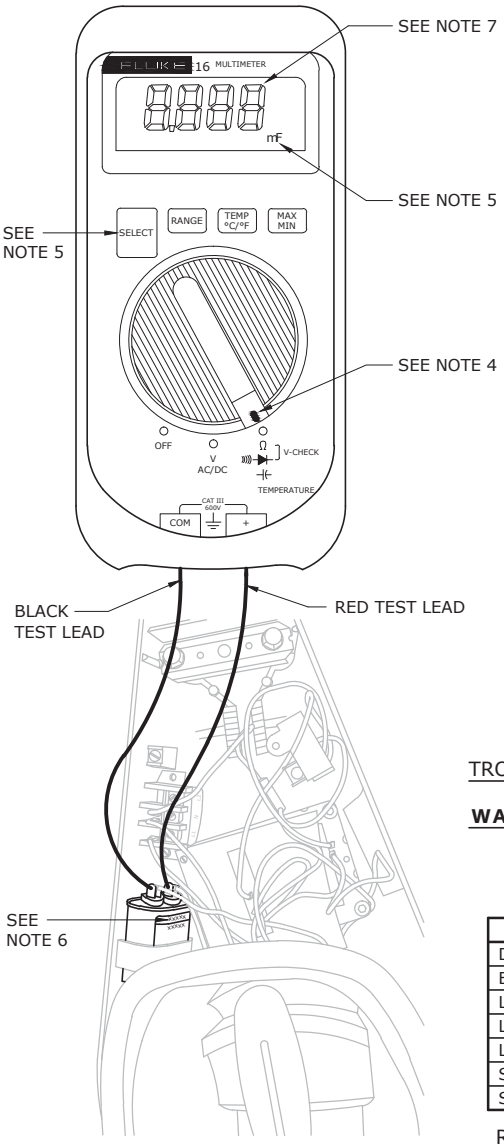
REVISED	BY	CK'D	APPR.
3			
2			
1			
0 7/21/10	DEFREITAS	JUDAH	LARSEN

MEASURING THE LAMP VOLTAGE OF HIGH PRESSURE SODIUM LUMINAIRES

Duke Energy®

FLA

DWG. 30.00-30



TYPICAL HID FIXTURE (FIGURE 1)

TABLE 1 FIXTURES: CAPACITOR REPLACEMENT GUIDE					
WATTAGE & SOURCE	FIXTURE MFG.	CAP. VALUE	VOLTAGE RATING	CAPACITOR CAT. NUMBER	FIXTURE TYPE
1000W, MH/MV	COOPER	24µF	480 VAC	9220129336	CUBE & FLOOD
1000W, MH/MV	GE	20µF	580 VAC	9220129484	FLOOD & SHOEBOX
1000W, HPS	AEL	26µF	525 VAC	9220142407	FLOOD, ENCL
1000W, MH/MV	AEL	24µF	480 VAC	9220142405	FLOOD, ENCL
400W, HPS	AEL	55µF	280 VAC	9220142411	FLOOD, ENCL
400W, HPS	GE	48µF	280 VAC	9220136063	FLOOD, ENCL, SHOEBOX
400W, HPS	COOPER	48µF	280 VAC	9220135809	FLOOD, ENCL, SHOEBOX
400W, MH	AEL	24µF	400 VAC	9220142409	FLOOD, ENCL
400W, MH	COOPER	24µF	360 VAC	9220135807	FLOOD, ENCL, SHOEBOX
400W, MH	GE	20µF	480 VAC	9220136060	FLOOD, ENCL, SHOEBOX
250W, HPS	COOPER	35µF	300 VAC	9220135805	FLOOD, ENCL, SHOEBOX
250W, HPS	AEL	35µF	240 VAC	9220142413	FLOOD, ENCL
250W, HPS	GE	28µF	330 VAC	9220136070	FLOOD, ENCL, SHOEBOX
250W, MH	COOPER	15µF	400 VAC	9220135803	FLOOD, ENCL, SHOEBOX
250W, MH	GE	14.5µF	580 VAC	9220136067	FLOOD, ENCL, SHOEBOX
250W, MH	AEL	15µF	500 VAC	9220142412	FLOOD, ENCL
200W, HPS	AEL	28µF	300 VAC	9220142414	ENCL
200W, HPS	GE	24.5µF	280 VAC	9220136073	ENCL, SHOEBOX
150W, HPS	GE	55µF	170 VAC	9220142417	ENCL
150W, HPS	AEL	12µF	280 VAC	9220142416	ENCL
100W, MH	AEL	12µF	280 VAC	9220142418	FLOOD
175W, MH	HOL	10µF	400 VAC	9220149986	DECORATIVE
250W, HPS	HOL	32µF	280 VAC	-	DECORATIVE

TROUBLESHOOTING FOR DEFECTIVE CAPACITOR

WARNING: DISCONNECT POWER TO THE UNIT AND DISCHARGE ALL CAPACITORS BEFORE TAKING ANY READINGS. TYPICAL CAPACITOR FAILURE INDICATION: LEAKING, BULGING, BURNED CONTACTS OR BURNED HOLES THROUGH UNIT.

LAMP CONDITION	POSSIBLE PROBLEM
DIM LAMP	CAPACITOR BELOW SPECIFICATION BY MORE THAN 5%
BRIGHT LAMP	CAPACITOR ABOVE SPECIFICATION BY MORE THAN 5%
LAMP WILL NOT LIGHT	CAPACITOR OPEN (IN CWA BALLAST)
LAMP HAS SHORT CYCLE	CAPACITOR ABOVE SPECIFICATION BY MORE THAN 5%
LAMP FLICKERING	CAPACITOR BELOW SPECIFICATION BY MORE THAN 5%
SHORT LIFE	CAPACITOR ABOVE SPECIFICATION BY MORE THAN 5%
SHORT LIFE	CAPACITOR SHORTED

REPLACING A DEFECTIVE CAPACITOR MAY NOT CORRECT THE PROBLEM IF THE ORIGINAL CAPACITOR CAUSED A BALLAST WINDING FAILURE. IN THIS CASE, A BALLAST REPLACEMENT IS REQUIRED.

HIGH REACTANCE BALLAST	
SHORT	MAY BURN UP PRIMARY WINDING
OPEN	HIGH INPUT CURRENT, PF OFF, POSSIBLE PRIMARY BALLAST WINDING BURN UP. LAMP WILL LIGHT.
LOW CAPACITANCE	INPUT CURRENT AFFECTED, PF OFF, POSSIBLE PRIMARY BALLAST WINDING BURN UP. LAMP WILL PERFORM WITHIN SPEC.
HIGH CAPACITANCE	INPUT CURRENT AFFECTED, PF OFF, POSSIBLE PRIMARY BALLAST WINDING BURN UP. LAMP WILL PERFORM WITHIN SPEC.
CWA BALLAST	
SHORT	INPUT CURRENT RUNS HIGH, POSSIBLE BALLAST BURNING UP, LAMP WILL RUN AT HIGHER VOLTAGE SHORTENING LIFE.
OPEN	LAMP WILL NOT LIGHT
LOW CAPACITANCE	NO EFFECT ON BALLAST, LAMP BURNS DIM, POSSIBLE SHORT CYCLE OF LAMP.
HIGH CAPACITANCE	INPUT CURRENT RUNS HIGH, POSSIBLE BALLAST BURNING UP. LAMP WILL RUN AT HIGHER VOLTAGE SHORTENING LIFE.

NOTES:

1. REMOVE PHOTOCONTROL FROM FIXTURE TO DE-ENERGIZE BALLAST. VOLTAGE MAY STILL BE PRESENT ON CERTAIN AREAS OF THE FIXTURE!
2. CONNECT METER LEADS TO CAPACITOR TERMINALS AS SHOWN IN FIGURE 1.
3. MEASURE VOLTAGE ON CAPACITOR TO VERIFY IT IS DISCHARGED.
4. ROTATE MULTIMETER DIAL TO "⊣⊢" POSITION.
5. PRESS "SELECT" BUTTON UNTIL "µF" IS DISPLAYED.
6. MEASURE CAPACITANCE VALUE AND COMPARE IT TO VALUE ON CAPACITOR LABEL.
7. REPLACE CAPACITOR IF THE MEASURED VALUE IS MORE THAN +/- 10% OF THE LABEL VALUE.
8. CONTACT LIGHTING SOLUTIONS FOR CAPACITOR REPLACEMENT AVAILABILITY. SEE TABLE 1.
9. THE 1000W MH CAPACITOR FOR ALL MANUFACTURERS WILL WORK IN BOTH MH AND MV 1000W FIXTURES.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN

MEASURING THE CAPACITOR VALUE IN HID LUMINAIRES

Duke Energy®

FLA

DWG. 30.00-32

STREET SIGN BANDING POLICY

COMPANY AGREES TO ALLOW GOVERNMENTAL CUSTOMER TO BAND STREET SIGNS ON STANDARD OR NON-STANDARD POLES OR POSTS UNDER THE FOLLOWING CONDITIONS:

A. THE STREET SIGN SURFACE AREA SHALL NOT EXCEED 4 SQUARE FEET AND SHALL BE CONSTRUCTED OF EITHER ALUMINUM OR FIBERGLASS. THE BANDING MATERIAL SHALL BE CONSTRUCTED OF STAINLESS STEEL, ALUMINUM OR PLASTIC AND THE ATTACHMENT SHALL NOT DAMAGE THE POLE OR POST.

B. IF COMPANY LATER DETERMINES THAT THE STRUCTURAL INTEGRITY OF ITS POLES OR POSTS ARE BEING ADVERSELY IMPACTED OR COULD BE ADVERSELY IMPACTED BY THE ATTACHMENT OF THE STREET SIGNS TO ITS POLES OR POSTS, CUSTOMER AGREES TO REMOVE THE SIGNS AT COMPANY'S REQUEST AND AT NO COST TO COMPANY.

C. CUSTOMER SHALL BAND THE STREET SIGNS AROUND THE POLES OR POSTS AFTER THE POLES OR POSTS HAVE BEEN INSTALLED BY THE COMPANY.

D. COMPANY SHALL NOT BE RESPONSIBLE FOR REMOVING AND/OR REBANDING CUSTOMER'S STREET SIGNS WHENEVER POLES OR POSTS HAVE TO BE REPLACED OR REPAIRED.

E. THE BOTTOM OF BANDED STREET SIGNS SHALL NOT BE LOWER THAN 11 FEET FROM THE GROUND AT THE BASE OF THE POLE OR POST.

F. 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.

NOTES:

A. THIS POLICY DOES NOT INCLUDE ATTACHMENT OF BANNER ARMS, BANNERS OR HOLIDAY DECORATIONS TO PROGRESS ENERGY DECORATIVE POLES.

B. THE COMPANY WILL NOT ALLOW CITIES OR TOWNS TO ATTACH TRAFFIC WALK SIGNALS OR TRAFFIC CAMERAS OR DETECTION DEVICES ON STREET LIGHT POLES. FOR ADDITIONAL ASSISTANCE, CONTACT LIGHTING SELECTION UNIT.

3				
2				
1				
0	7/26/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

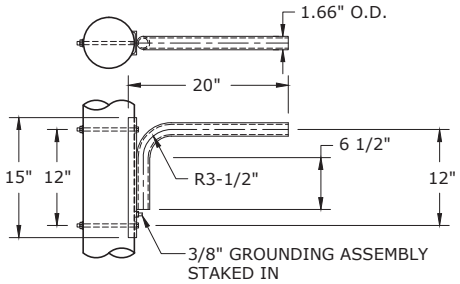
STREET SIGN BANDING POLICY

Duke Energy®

FLA

DWG. 30.01-01

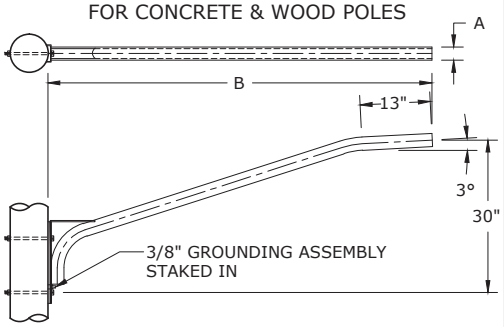
FOR CONCRETE & WOOD POLES



CN	DESCRIPTION
240302	20" BRACKET

FIG. 1

FOR CONCRETE & WOOD POLES

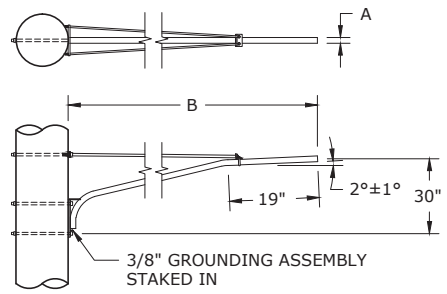


CN	A	B	DESCRIPTION
*240304	1.66" O.D.	48"	4' BRACKET
240306	2-3/8" O.D.	72"	6' BRACKET

*MAINTENANCE ONLY

FIG. 4

FOR CONCRETE & WOOD POLES

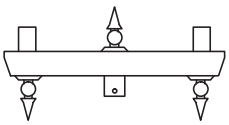


CN	A	B	DESCRIPTION
*240308	2-3/8" O.D.	96"	8' BRACKET
240310	2-3/8" O.D.	118"	10' BRACKET
*240312	2-3/8" O.D.	138"	12' BRACKET
*240314	2-3/8" O.D.	166"	14' BRACKET

*MAINTENANCE ONLY

FIG. 6

POST TOP BRACKET

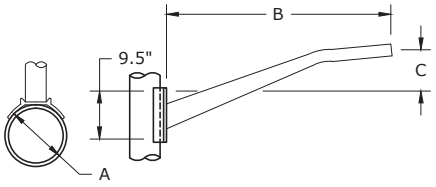


CN	DESCRIPTION
*240364	DUAL LIGHT APPLICATOR FOR POST TOP, GREEN
240365	DUAL LIGHT APPLICATOR FOR POST TOP, BLACK

*MAINTENANCE ONLY

FIG. 7

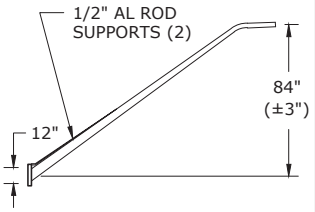
FOR FIBERGLASS POLES (MAINTAINENCE ONLY)



CN	A	B	C	DESCRIPTION
240352	6"Ø	6'	30"	6' BRACKET
240354	-	8'	-	8' BRACKET
240356	6"Ø	10'	30"	10' BRACKET
240358	4-5/8"Ø	12'	40"	12' BRACKET
240360	-	15'	-	15' BRACKET

FIG. 2

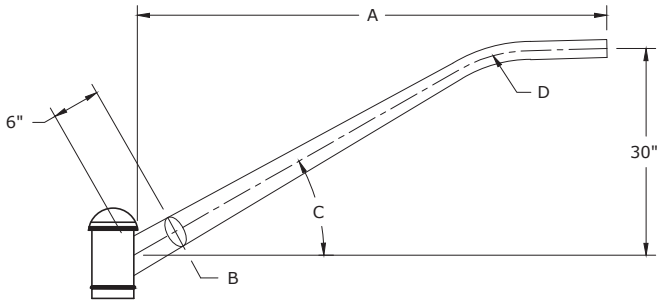
STREET LIGHT RISE BRACKET WOOD/CONCRETE



CN	DESCRIPTION
240313	12' BRACKET WITH 7' RISE

FIG. 3

FOR ALUMINUM POLES

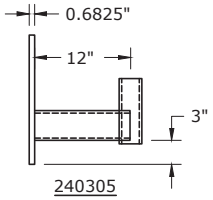


CN	A	B	C	D	DESCRIPTION
*034179	6'	2-1/2" X 5-1/8"	28°	R23"	6' BRACKET
036220	10'	3-1/2" X 7"	16°	R42"	10' BRACKET
036224	12'	3-1/2" X 7-3/4"	14°	R54"	12' BRACKET

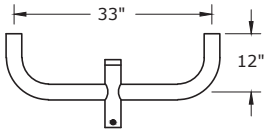
* COLOR: BLACK

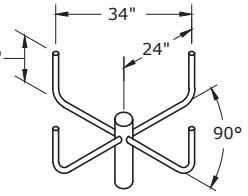
FIG. 5

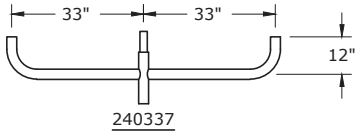
POLE MOUNT



TENON MOUNT BULL HORN BRACKETS







CN	MAX SIZE OF EACH FLOODLIGHT		BULLHORN SIZE			POLE TENON SIZE	DESCRIPTION
	EPA (SQ. FT.)	WEIGHT (LBS.)	EPA (SQ. FT.)	WEIGHT (LBS.)	FIXED TENON SIZE		
240305*	-	-	-	-	2 3/8"	-	SINGLE
240336	16.0	130	1.1	23	2 3/8"	3"	DOUBLE
240337	10.0	130	1.8	36	2 3/8"	3"	TRIPLE
240338	7.5	130	1.6	49	2 3/8"	3"	QUADRUPLE

*NOTE: FLOODLIGHT BRACKET (CN 240305) IS FOR SINGLE FLOODLIGHT INSTALLATION ONLY.

FIG. 8

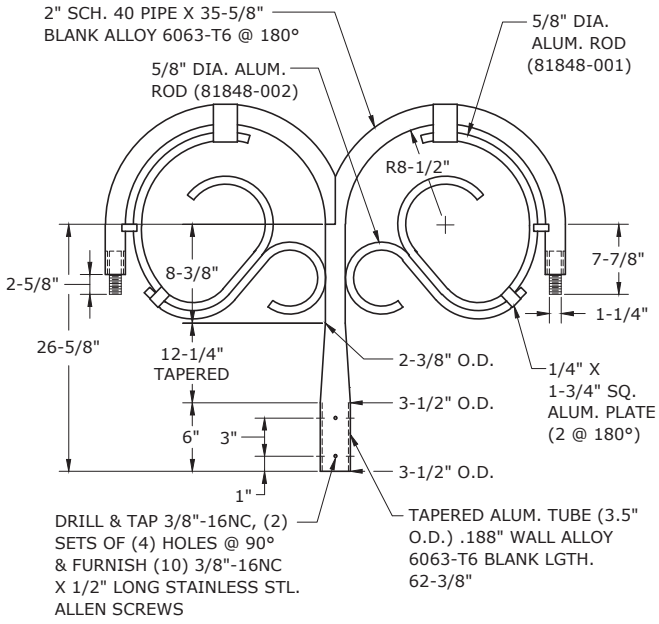
3				
2				
1	3/6/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

STREET LIGHT BRACKETS

Duke Energy®

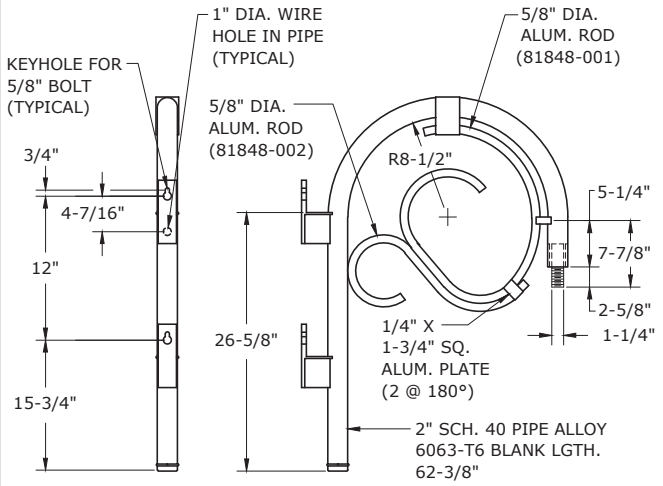
FLA

DWG. 30.02-25



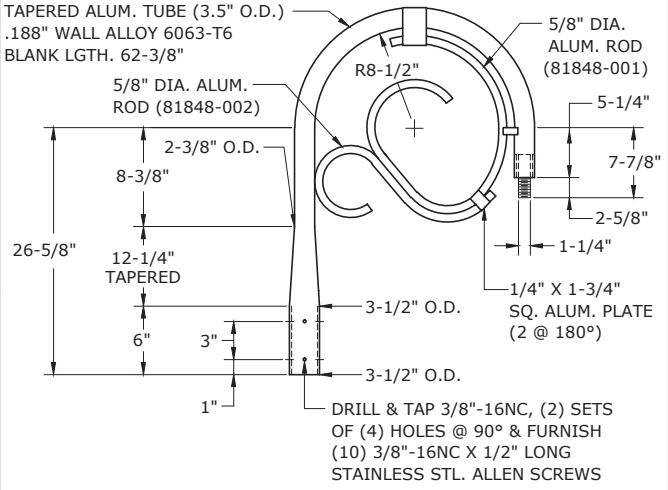
SCROLL ARM - DOUBLE
CN 9220067355
LBKTBLDCLERMNTF

FIG.1



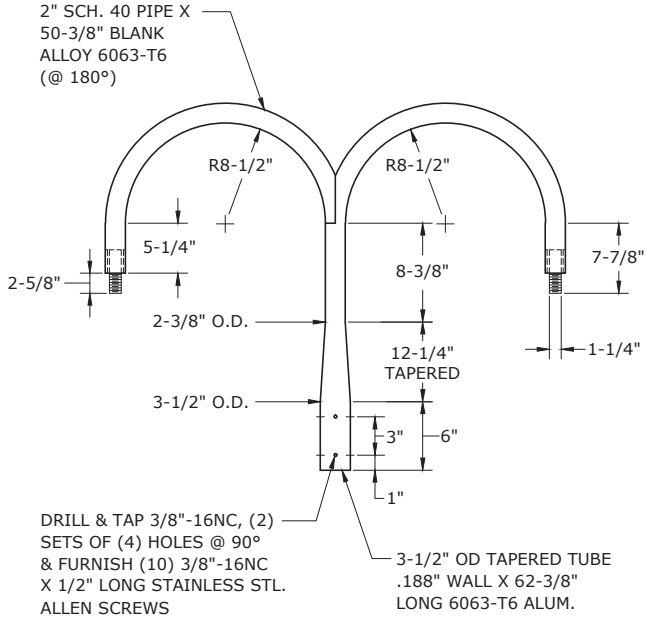
SCROLL ARM - SIDE MOUNT
CN 9220067357
LBKTBLCLERSIDEF

FIG.2



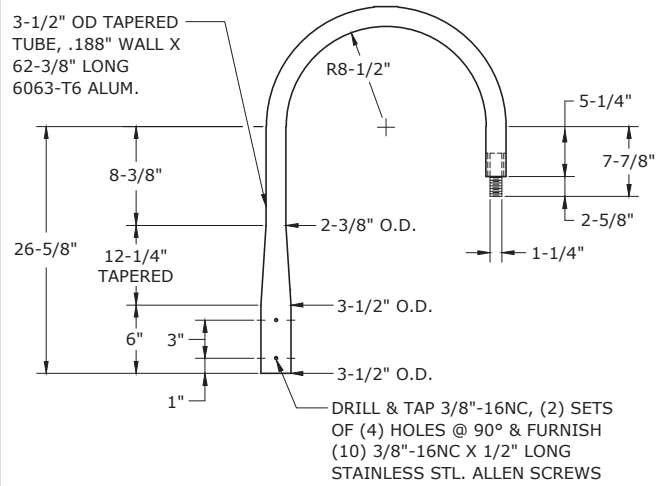
SCROLL ARM - SINGLE
CN 9220067354
LBKTBLCLERMONTF

FIG.3



SHEPARD ARM - DOUBLE
CN 240321
LBKTSHEPSAN2DF

FIG.4



SHEPARD ARM - SINGLE
CN 240320
LBKTSHEPSAN2SF

FIG.5

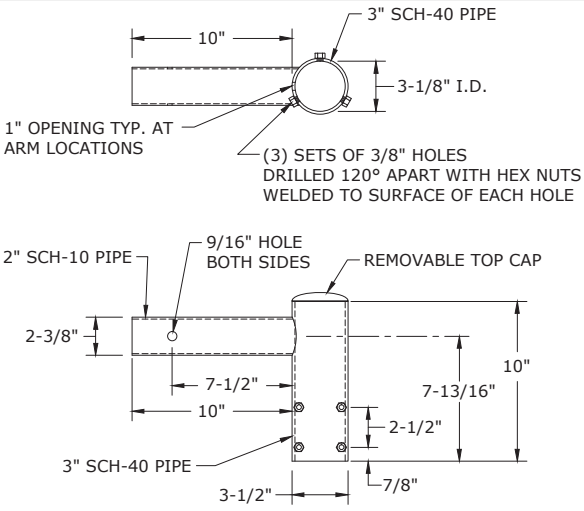
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

PIPE BRACKET ASSEMBLIES

Duke Energy®

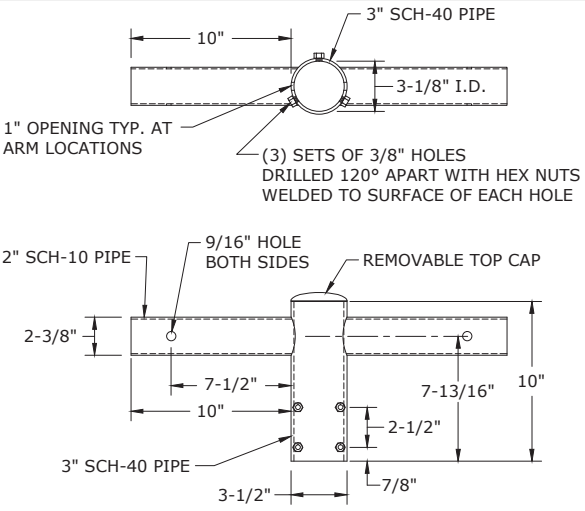
FLA

DWG. 30.02-26



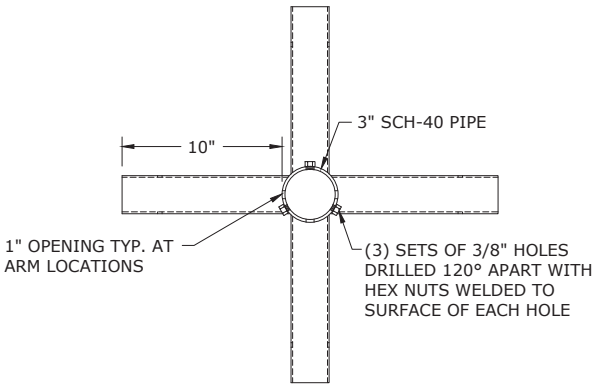
SINGLE MOUNT BRACKET	
COLOR	ITEM #
BLACK	9220278687
BRONZE	9220278676

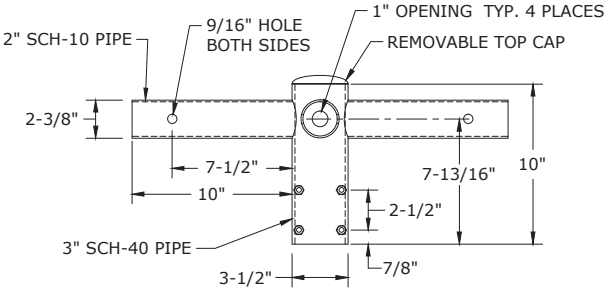
FIG. 1



DOUBLE MOUNT BRACKET	
COLOR	ITEM #
BLACK	9220278688
BRONZE	9220278686

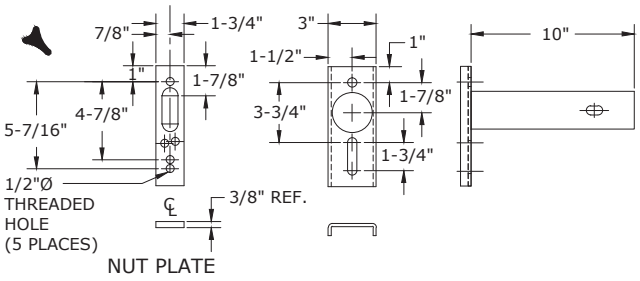
FIG. 2





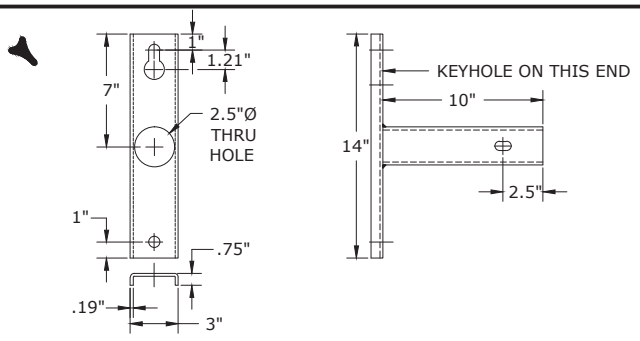
QUAD MOUNT BRACKET	
COLOR	ITEM #
BLACK	9220278685
BRONZE	9220278677

FIG. 3



UNIVERSAL BRACKET		
COLOR	ITEM #	COMP. UNIT
BLACK	9220274924	LBKTSBUBLF
BRONZE	9220271340	LBKTSBUBRF

FIG. 4



WOOD POLE BRACKET		
COLOR	ITEM #	COMP. UNIT
BLACK	9220282860	LBKTSBPMBLF
BRONZE	9220282859	LBKTSBPMBRF

FIG. 5

NOTES:

1. BRACKETS IN FIG. 1-3 ARE DESIGNED FOR 3" X 4" TALL MINIMUM TENON.
2. SAFETY BOLT INCLUDED WITH LUMINAIRES.
3. DO NOT INSTALL LIGHT FIXTURES UNTIL POLE IS INSTALLED AND BACKFILLED.

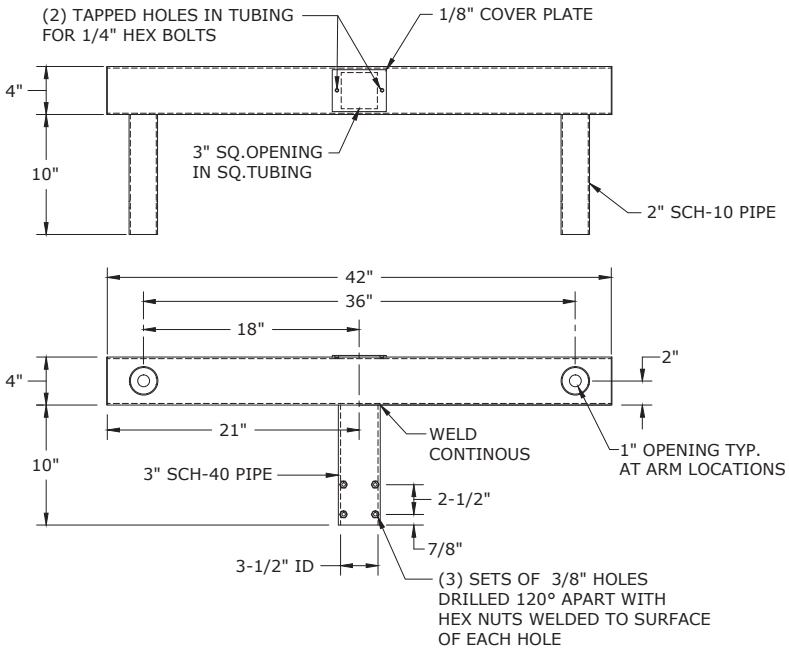
3				
2				
1	7/24/15	DEFREITAS	GUY	COWLING
0	3/31/15	DEFREITAS	COWLING	HENSON
REVISED		BY	CK'D	APPR.

BRACKETS - LARGE LED SHOEBOX LUMINAIRES

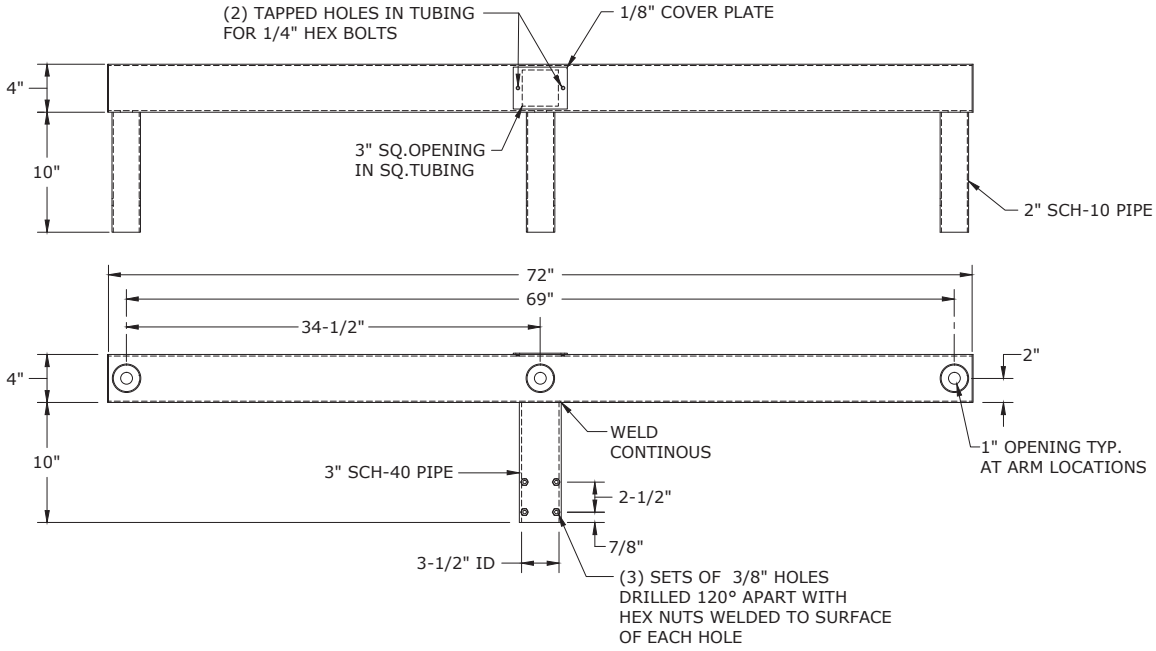
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

30.02-27A



DOUBLE SIDE MOUNT BRACKET	
BLACK	9220278684
BRONZE	9220278681



TRIPLE SIDE MOUNT BRACKET	
BLACK	9220278682
BRONZE	9220278765

NOTES:

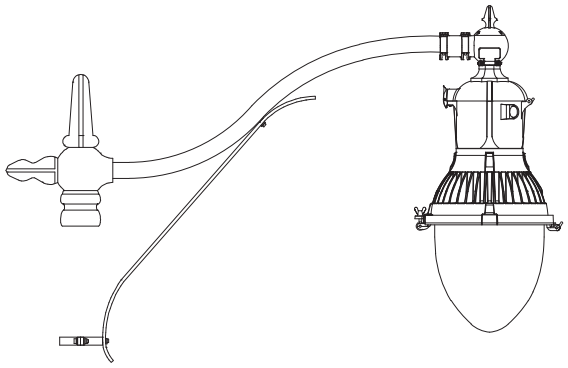
1. BRACKETS ARE DESIGNED FOR 3" X 4" TALL MINIMUM TENON.
2. SAFETY BOLT INCLUDED WITH LUMINAIRES.
3. DO NOT INSTALL LIGHT FIXTURES UNTIL POLE IS INSTALLED AND BACKFILLED.

3				
2				
1				
0	3/31/15	DEFREITAS	COWLING	HENSON
REVISED		BY	CK'D	APPR.

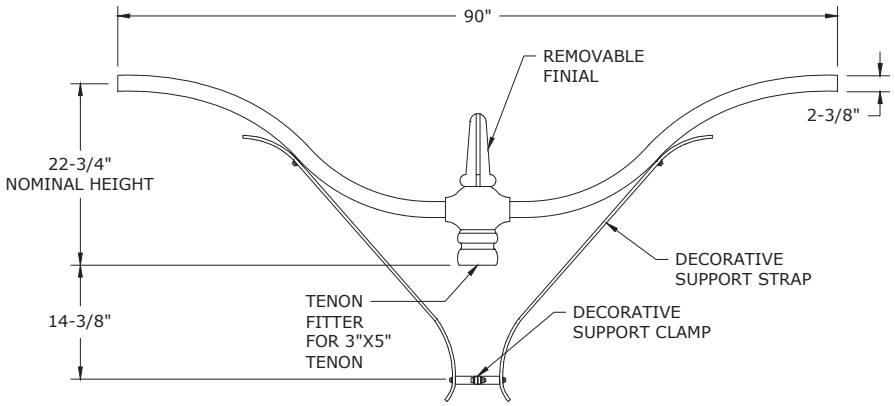
BRACKETS - LARGE LED SHOEBOX LUMINAIRES

DEC	DEM	DEP	DEF
			X

30.02-27B

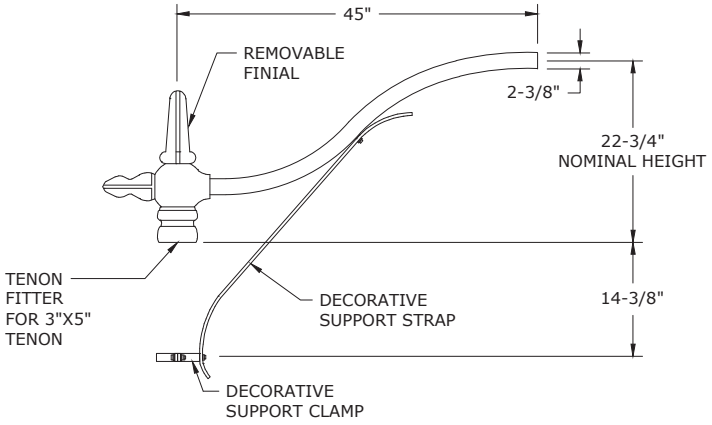


SINGLE MOUNT TEARDROP LUMINAIRE



DOUBLE TEARDROP BRACKET

CU LBKTTD2BLF
ITEM # 9220283379



SINGLE TEARDROP BRACKET

CU LBKTTD1BLF
ITEM # 9220283377

NOTES:

1. BRACKETS AS DESIGNED FOR 3"X5" MINIMUM TENON.
2. LEVELING FITTER INCLUDED WITH LUMINAIRE.
3. SEE DWG. 30.09-14 FOR POLE DETAILS.
4. SEE DWG. 30.08-10 FOR LUMINAIRE DETAILS.
5. DO NOT INSTALL LUMINAIRE DRIVER/BALLAST HOUSING AND GLOBE ASSEMBLY UNTIL POLE IS INSTALLED AND BACKFILLED.

DUKE ENERGY.

3				
2				
1				
0	5/6/15	DEFREITAS	BLOCKER	COWLING
REVISED		BY	CK'D	APPR.

BRACKETS - TEARDROP SIDE MOUNT

DEC	DEM	DEP	DEF
			X

30.02-28

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

INSTALLATION

PHOTOCONTROLS ARE SENSITIVE INSTRUMENTS AND CARE MUST BE EXERCISED IN THEIR HANDLING TO AVOID POSSIBLE DAMAGE. PHOTOCONTROLS SHOULD BE INSTALLED WITH THE WINDOW FACING NORTH UNLESS SUCH ORIENTATION WOULD CAUSE THE WINDOW TO FACE REFLECTED LIGHT FROM THE LUMINAIRE OR TOWARD OTHER TYPES OF LIGHTING. THE MANUFACTURERS OF THESE PHOTOCONTROLS RECOMMEND THAT THE WINDOW FACE NORTH FOR OPTIMAL TURN-ON AND TURN-OFF TIME.

FOR MOST LUMINAIRES, PROPER ORIENTATION IS ACHIEVED BY LOOSENING ONE OR TWO SCREWS IN THE PHOTOCONTROL RECEPTACLE, TURNING THE "N" ARROW TOWARD NORTH, TIGHTENING THE SCREWS, THEN INSERTING THE PHOTOCONTROL INTO THE RECEPTACLE AND TURNING CLOCKWISE TO LOCK IN POSITION. FOR OTHER LUMINAIRES, PLACE THE PHOTOCONTROL INTO THE RECEPTACLE, LIFT UPWARD AND TURN UNTIL 'N' ARROW POINTS TOWARD NORTH. THEN TURN CLOCKWISE UNTIL IT IS ORIENTED TO "NORTH". THIS ALSO LOCKS THE PHOTOCONTROL IN THE RECEPTACLE.

SOME DECORATIVE POST TOP FIXTURES REQUIRE ROTATING THE ENTIRE LUMINAIRE TO ACHIEVE A NORTHERLY ORIENTATION OF PE.

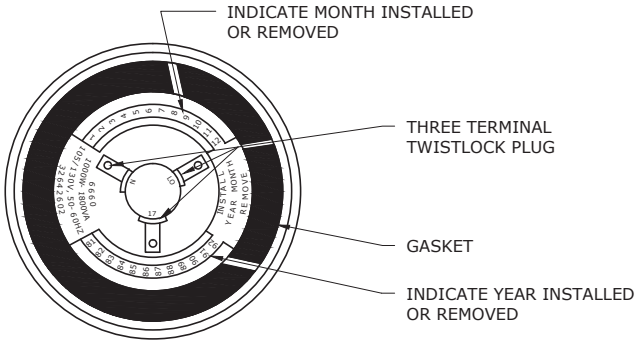
DO NOT INSERT PHOTOCONTROL INTO RECEPTACLE UNTIL THE BRACKET AND LUMINAIRE HAVE BEEN MOUNTED. THE ROUGH HANDLING ASSOCIATED WITH BRACKET AND LUMINAIRE INSTALLATION CAN CAUSE DAMAGE TO THE PHOTOCONTROL.

OPERATIONAL TESTING

AFTER THE PHOTOCONTROL IS INSERTED INTO THE RECEPTACLE, IT SHOULD BE TESTED BY SIMULATING DARKNESS. THE PE CONTROL BOXES ARE EXCELLENT TO USE TO COVER THE CONTROL FOR TESTING. A WORKMAN SHOULD NOT TAKE OFF HIS SAFETY GLOVE TO MAKE THE TEST. (REFER TO SAFETY MANUAL) THE PHOTOCONTROL SHOULD BE OPERATED A COUPLE OF TIMES TO LOOSEN THE CONTACTS AND THEN VERY SLOWLY UNCOVER THE CONTROL WINDOW. IF SEVERE CHATTERING OF THE CONTACTS IS EVIDENT, THE UNIT SHOULD BE RETURNED. A SLIGHT HUM AND CLICK ARE TO BE EXPECTED. PHOTOCONTROLS ARE PURCHASED FROM VARIOUS SUPPLIERS. SOME REACT INSTANTANEOUSLY WHILE OTHERS HAVE A BUILT-IN TIME DELAY. ALLOW UP TO 20 SECONDS FOR PROPER SWITCHING.

DATE CODING

IN ORDER TO DETERMINE PHOTOCONTROL LIFE PERFORMANCE, EACH NEW PHOTOCONTROL SHALL BE DATE CODED AS SHOWN BELOW:



SYMBOL FOR INSTALLATION SHALL BE (/) OR (\).
SYMBOL FOR REMOVAL SHALL BE (X).

MONTH
1 /̸ 3 4 5 6 7 8 9 10 11 X 12

YEAR
81 82 83 8X THROUGH 92

INSTALLED FEBRUARY, 1981; REMOVED OCTOBER, 1984

THESE SLASHES CAN BE SCRATCHED INTO PHOTOCONTROL BASE WITH ANY POINTED INSTRUMENT; I.E., KNIFE KNIFE, SCREWDRIVER, ETC.

NOTE: SOME MANUFACTURERS OF PHOTOCONTROLS PLACE THE DATE CODING SYMBOLS AT DIFFERENT LOCATIONS OR MAY NEED TO BE HAND WRITTEN IN AN ASSIGNED SPACE. IN ALL CASES, DATE CODING IS REQUIRED.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

PHOTOCONTROL INSTALLATION AND TESTING

Duke Energy®

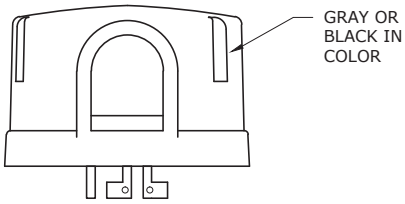
FLA

DWG. 30.03-01

FIG. 1

CN 243104

(STANDARD 120V)



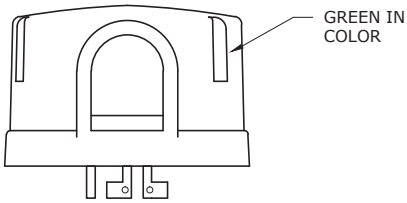
NOTES:

1. USE STANDARD BLACK/OR GRAY HIGH TEMP 120V PHOTOCONTROL ON ALL 120V INSTALLATIONS OF 70W-1000W HPS, MV, OR MH.
2. THIS STANDARD CONTROL IS REDESIGNED FOR HIGH TEMP RATING.

FIG. 2

CN 9220208023

(STANDARD 120-277V)

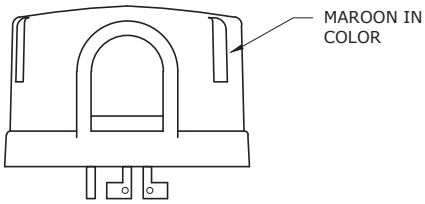


NOTES:

1. USE GREEN SSL 120-277V PHOTOCONTROL ON ALL INSTALLATIONS OF LED LUMINAIRES.
2. THIS PHOTOCONTROL IS A "FAIL-OFF" TYPE.

FIG. 3

CN 243106
(HIGH VOLTAGE 200-300V)



NOTES:

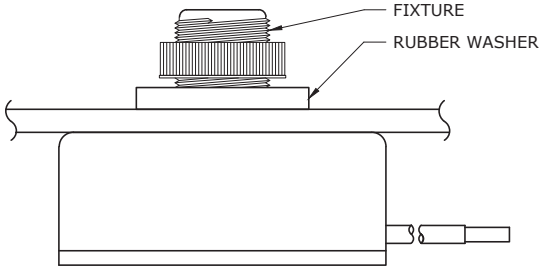
1. THESE HIGH VOLT-HIGH TEMPERATURE CONTROLS ARE TO BE USED ON INSTALLATIONS SERVED FROM A 277 VOLT SOURCE. A DRY TYPE TRANSFORMER IS NOT NEEDED WHEN USING THIS PHOTOCONTROL.
2. THIS HIGH VOLTAGE CONTROL WILL NOT OPERATE ON A 120 VOLT SOURCE.
3. WHEN A 277 VOLT SOURCE IS USED TO FEED A FIXTURE WITH A MULTI-VOLTAGE BALLAST, CHANGE THE VOLTAGE TAP TO 277 VOLTS AND MOVE THE COMMON LEAD TO THE N POSITION. (SEE DWG. 30.12-20, FIGURE C).

FIG. 4

BUTTON-TYPE

CN 243108

*FOR MAINTENANCE ONLY



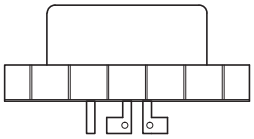
NOTES:

1. BUTTON-TYPE HAS A 20 SEC. TIME-DELAY BEFORE OPERATING.

FIG. 5

RECEPTACLE BY-PASS/SHORTING CAP

CN 242803



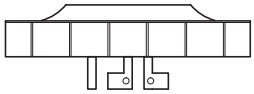
NOTES:

1. USE FOR SWITCHING LIGHTS THAT ARE GROUP CONTROLLED ON A LIGHTING CIRCUIT.

FIG. 6

RECEPTACLE OPEN-CAP

CN 13431101



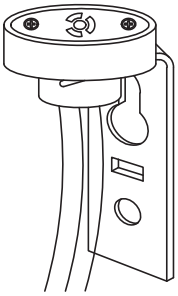
NOTES:

1 .TO BE USED FOR DISCONNECTING CUSTOMER FOR NON-PAY WITHOUT REMOVING THE FIXTURE FROM SERVICE.

FIG. 7

BRACKET FOR PE RECEPTACLE
MOUNTED ON WOOD POLES ONLY

CN 243304



NOTES:

1. THIS CU INCLUDES A RECEPTACLE BRACKET AND A STANDARD PE CONTROL (OUTLINED IN FIG. 1).

REVISED		BY	CK'D	APPR.
3				
2				
1	4/2/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN

PHOTOCONTROLS, BYPASS CAPS, OPEN CAPS AND BRACKET

Progress Energy

FLA

DWG. 30.03-05

CONVENTIONAL SODIUM VAPOR LUMINAIRES (GOLD BACKGROUND)

5	10	15	20	25	40
50 WATT, 4000 LUMEN CN 250603	100 WATT, 9500 LUMEN CN 250601	150 WATT, 16,000 LUMEN CN 250605	200 WATT, 22,000 LUMEN CN 250606	250 WATT, 28,500 LUMEN CN 250602	400 WATT, 50,000 LUMEN CN 250604

METAL HALIDE (RED BACKGROUND)

17	10	40	X1
175 WATT, 14,000 LUMEN CN 250683	100 WATT, 9000 LUMEN CN 250686	400 WATT, 40,000 LUMEN CN 250687	1000 WATT, 110,000 LUMEN CN 250688

METAL HALIDE - PULSE START (RED BACKGROUND)

15	32
150 WATT, 12,000 LUMEN UNIVERSAL BURN CN 9220183630	320 WATT, 30,000 LUMEN BASE UP HORIZONTAL BURN CN 9220183634

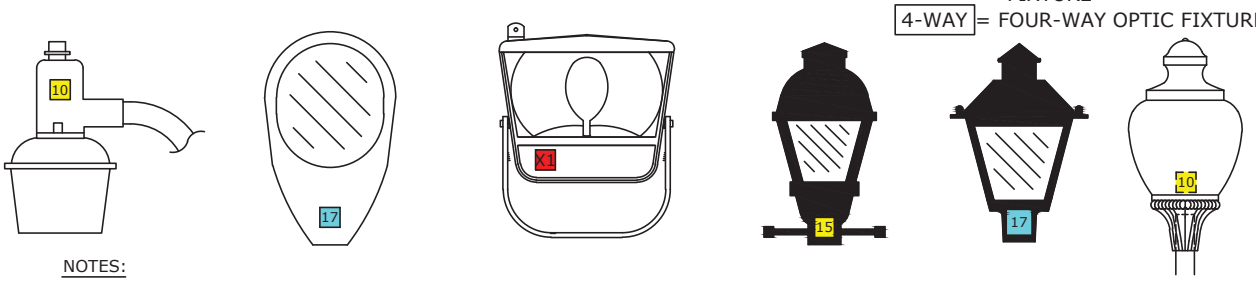
MERCURY VAPOR LUMINAIRES (BLUE BACKGROUND)

17	40	X1
175 WATT, 7000 LUMEN CN 250103	400 WATT, 21,000 LUMEN CN 250106	1000 WATT, 60,000 LUMEN CN 250108

LOCATION OF DECAL ON LUMINAIRES

FWT = FORWARD THROW FIXTURE

4-WAY = FOUR-WAY OPTIC FIXTURE



NOTES:

1. FIXTURE WILL COME FROM MANUFACTURER WITH DECALS ATTACHED.
2. DECAL NUMERALS ARE THE FIRST TWO DIGITS OF RATED LAMP WATTAGE, WITH THE EXCEPTION OF THE NUMERAL "X1".
3. WHEN INSTALLING A FLOODLIGHT, POST LUMINAIRE, OR AN OLDER UNIDENTIFIED ROADWAY OR SEMI-ENCLOSED LUMINAIRE, ATTACH PROPER DECAL ON LUMINAIRE IN LOCATION SHOWN. MAKE SURE SURFACE IS CLEAN AND DRY BEFORE ATTACHMENT. RUB OVER DECAL AFTER ATTACHMENT TO ELIMINATE ANY BUBBLES BENEATH THE SURFACE.
4. MOUNT DECALS ON ROADWAY LUMINAIRES SUCH THAT THEY APPEAR UPRIGHT WHEN STANDING BENEATH THE LUMINAIRE, FACING THE POLE AND LOOKING UP. DECALS ON FLOODLIGHTS, SEMI-ENCLOSED LUMINAIRES AND POST LUMINAIRES SHALL BE MOUNTED UPRIGHT AND PLUMB. DECALS ON SEMI-ENCLOSED FIXTURES SHALL BE INSTALLED ON THE SIDE FACING ONCOMING TRAFFIC.
5. DO NOT ATTACH LARGE (3" X 3") DECALS TO POST LUMINAIRES. USE SMALLER (2" X 2") DECALS AND MOUNT ON TENON SLIPFITTER. MOUNT DECAL APPROXIMATELY 1/4" FROM BOTTOM OF FIXTURE.
6. WHEN REPLACING A WORN DECAL, ATTEMPT TO REMOVE THE OLD DECAL AND REPLACE IT WITH THE PROPER DECAL IN THE SAME LOCATION. IF THE OLD DECAL CANNOT BE REMOVED, CUT OFF ALL RAISED EDGES OR CORNERS, CLEAN AND ATTACH NEW DECAL OVER THE OLD DECAL.
7. DECALS FOR LUMINAIRES OTHER THAN THOSE SHOWN ABOVE SHALL BE INSTALLED IN LOCATIONS WHERE THEY WILL BE MOST VISIBLE FROM THE ROADWAY OR OTHER AREA BEING LIGHTED.
8. CLASS CODE WILL NO LONGER BE REQUIRED.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

LUMINAIRE IDENTIFICATION DECALS

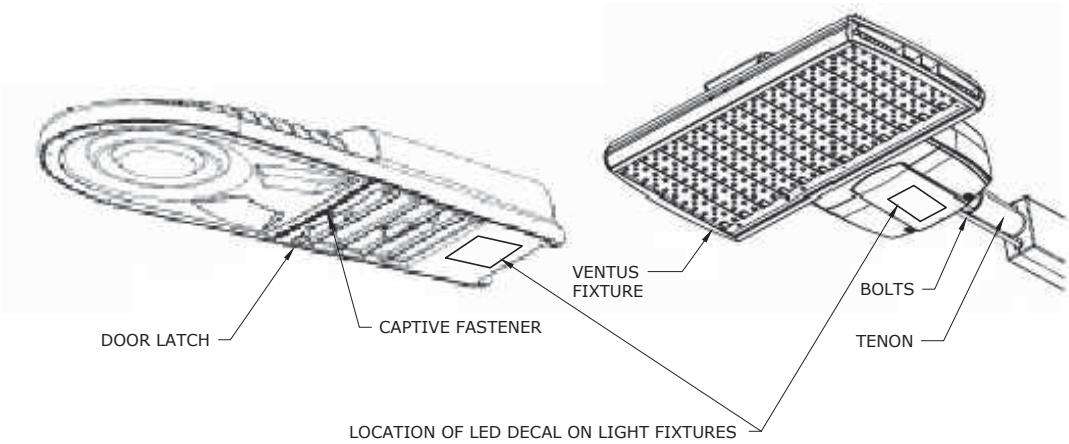
Duke Energy®

FLA

DWG. 30.04-01

LED (LIGHT EMITTING DIODE) LUMINAIRES (WHITE BACKGROUND)

95 LED	157 LED	206 LED	309 LED
95W LED 5000 DELIVERED LUMENS	157W LED 10,000 DELIVERED LUMENS	206W LED 13,500 DELIVERED LUMENS	309W LED 21,000 DELIVERED LUMENS



NOTES:

1. FIXTURE TO COME FROM MANUFACTURER WITH DECALS ATTACHED.
2. DECAL NUMBERS ARE THE FIRST TWO OF THREE DIGITS RELATED TO WATTAGE.
3. MOUNT DECALS ON FIXTURES SUCH THAT APPEAR UPRIGHT WHEN STANDING BENEATH THE FIXTURE, FACING THE POLE LOOKING UP.
4. WHEN REPLACING A WORN DECAL, ATTEMPT TO REMOVE THE OLD DECAL AND REPLACE IT WITH THE PROPER DECAL IN THE SAME LOCATION. IF THE OLD DECAL CANNOT BE REMOVED, CUT OFF THE RAISED EDGES OR CORNERS, CLEAN AND ATTACH NEW DECAL OVER THE OLD DECAL.

3				
2				
1				
0	4/2/12	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

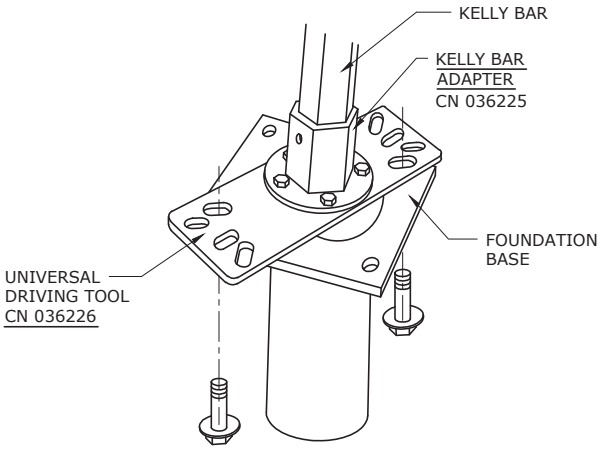
LED LUMINAIRE IDENTIFICATION DECALS

Progress Energy

FLA

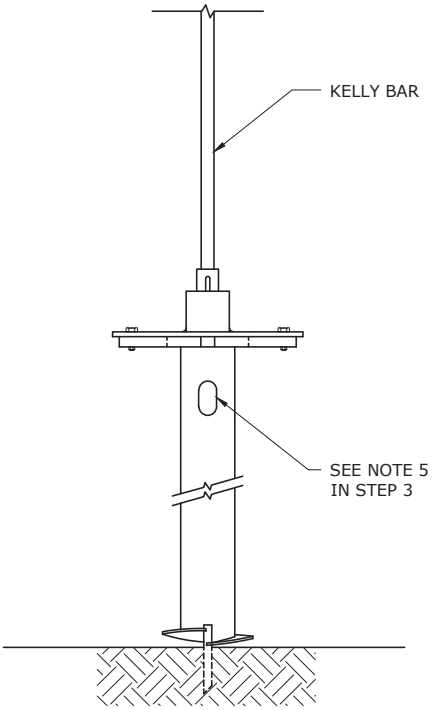
DWG. 30.04-02

STEP 1



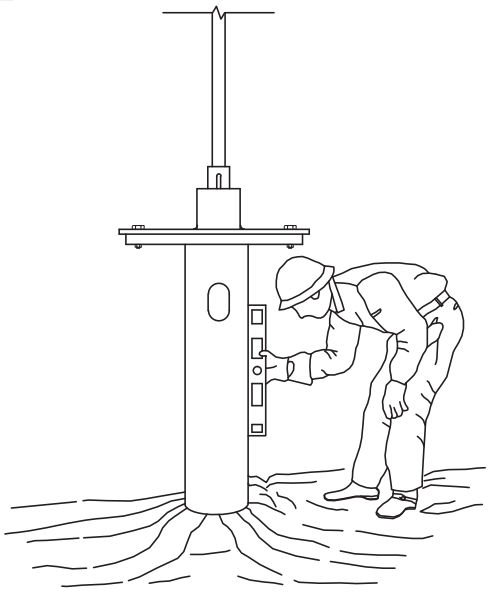
1. REMOVE AUGER IF ATTACHED.
2. ATTACH DRIVE TOOL AND KELLY BAR ASSEMBLY TO SCREW-IN FOUNDATION.
3. USE BOLTS SUPPLIED WITH FOUNDATION TO ATTACH DRIVE TOOL ASSEMBLY.

STEP 2



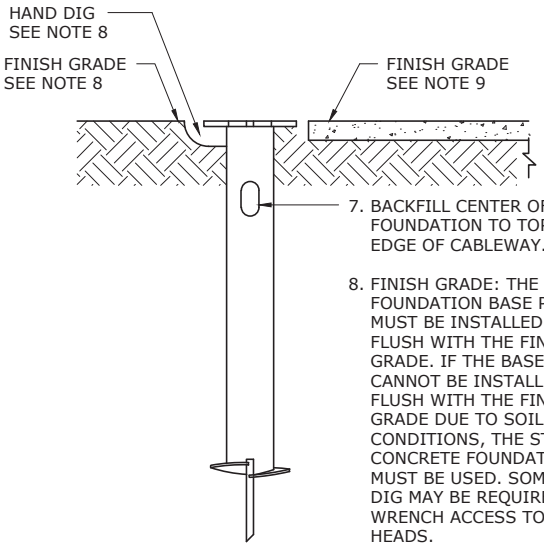
4. RAISE THE KELLY BAR UNTIL THE FOUNDATION SWINGS FREE OF THE GROUND POSITION WITH THE POINT OF THE FOUNDATION OVER THE STAKED LOCATION OF THE STREETLIGHT. LOWER THE KELLY BAR UNTIL THE POINT OF THE FOUNDATION IS FORCED INTO THE GROUND AND THE HELIX IS FLUSH WITH THE GROUND SURFACE.

STEP 3



5. TAPE OVER BOTH CABLE ENTRANCE HOLES (TAPE AROUND FOUNDATION) WITH BLACK VINYL ELECTRICAL TAPE TO PREVENT FILL DIRT FROM ENTERING CABLEWAY.
6. APPLY DOWNWARD PRESSURE ON THE FOUNDATION AND ROTATE IT IN THE "DIG" DIRECTION. WHEN THE HELIX HAS PENETRATED APPROXIMATELY 1'-0" INTO THE GROUND, PLUMB THE FOUNDATION USING A CARPENTER'S LEVEL. CONTINUE TO INSTALL FOUNDATION AND REPLUMB AS NECESSARY. WHEN THE BASEPLATE OF THE FOUNDATION IS TO THE CORRECT ELEVATION, REMOVE THE KELLY BAR AND DRIVE TOOL FROM THE FOUNDATION.

STEP 4



7. BACKFILL CENTER OF FOUNDATION TO TOP EDGE OF CABLEWAY.
8. FINISH GRADE: THE FOUNDATION BASE PLATE MUST BE INSTALLED FLUSH WITH THE FINISHED GRADE. IF THE BASEPLATE CANNOT BE INSTALLED FLUSH WITH THE FINISHED GRADE DUE TO SOIL CONDITIONS, THE STANDARD CONCRETE FOUNDATION MUST BE USED. SOME HAND DIG MAY BE REQUIRED FOR WRENCH ACCESS TO BOLT HEADS.
9. CONCRETE SIDEWALK: THE FOUNDATION MUST BE INSTALLED PRIOR TO THE SIDEWALK BEING POURED. LEVEL THE TOP OF THE BASEPLATE SO THAT IT WILL BE FLUSH WITH THE FINISHED SIDEWALK GRADE.

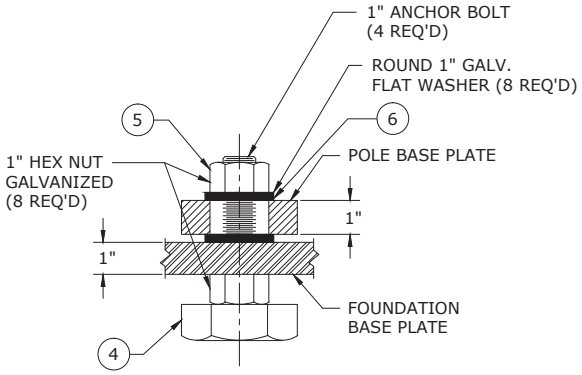
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

INSTALLATION DETAILS FOR SCREW ANCHOR FOUNDATION USING ALUMINUM POLES

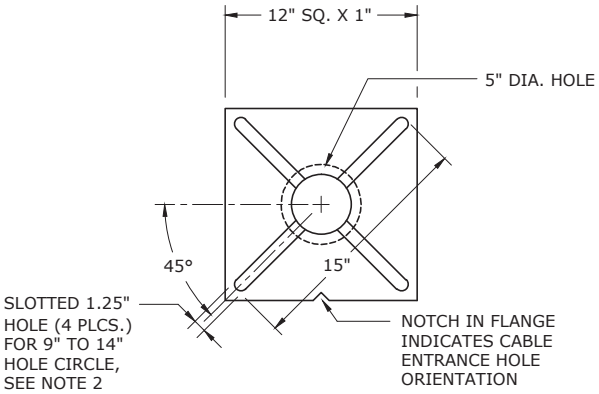
Duke Energy®

FLA

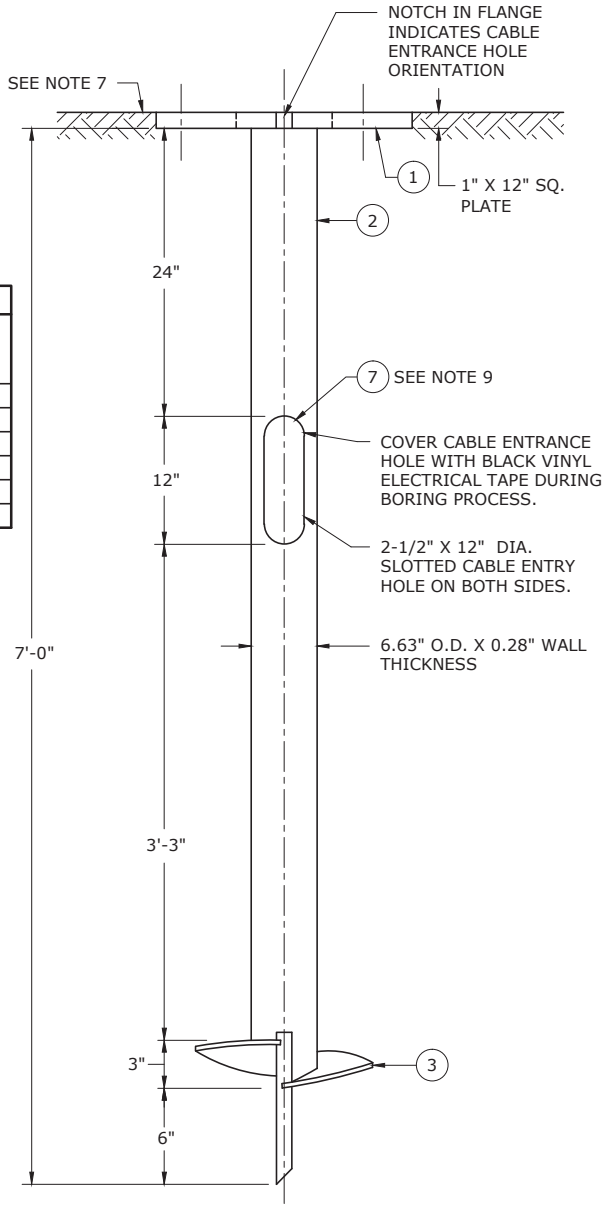
DWG. 30.05-15



HEX HEAD BOLT
NOT TO SCALE



FOUNDATION PLATE TOP VIEW



ITEM NO.	MATERIAL DESCRIPTION
1	TOP PLATE, STEEL, 1" X 12" SQ. X 6-VBC. BASE PLATE IS PERMANENTLY STAMPED WITH MANUFACTURER'S ID CODE AND DATE OF MANUFACTURE IN 1/2" LETTERS.
2	PIPE SHAFT, STEEL, 6.63" SCH. 84" X 6"
3	HELIX, STL. 3/8" X 12" X 6"
4	BOLT, HEX HD MACH, 1" X 4", 4 REQ'D
5	NUT, HEX, 1" X 4", 8 REQ'D
6	WASHER, PLAIN, 1" X 4", 8 REQ'D
7	RUBBER GROMMET FOR CABLE ENTRY HOLE

NOTES:

1. HARDWARE BAG OF BOLTS, NUTS AND WASHERS TO COME ATTACHED TO EACH FOUNDATION.
2. FOUR 1.25" SLOTTED HOLES FOR MOUNTING DECORATIVE POLES WITH BOLT HOLE CIRCLE OF 9" TO 14" WITH A MAXIMUM HEIGHT OF 35 FT.
3. SEE DWG. 30.05-15 FOR INSTALLATION INSTRUCTIONS.
4. DO NOT USE THIS FOUNDATION IN ROCKY SOIL CONDITIONS.
5. DO NOT USE THIS FOUNDATION IN LOOSE FINE SOIL CONDITIONS.
6. DO NOT USE THIS FOUNDATION IF THE UNIT CANNOT BE INSTALLED PER DWG. 30.05-15 OR IF THE SOIL HAS BEEN DISTURBED BELOW THE CABLE ENTRY HOLE DEPTH. IF THE HOLE IS DUG OUT THE ENTIRE DEPTH, A CONCRETE FOUNDATION MUST BE USED INSTEAD.
7. DO NOT USE FOUNDATION IF TOP CANNOT BE INSTALLED FLUSH WITH FINISHED GRADE.
8. NO GROUNDING ROD IS REQUIRED FOR SCREW-IN-FOUNDATION.
9. INSTALL THE RUBBER GROMMET AROUND THE CABLE ENTRY HOLE TO PROTECT LIGHTING CABLE.

DEP	DEF
CU LFNDSCREW6INC	CU LFNDSCREW10BCF
ITEM # 9220145150	ITEM # 240057

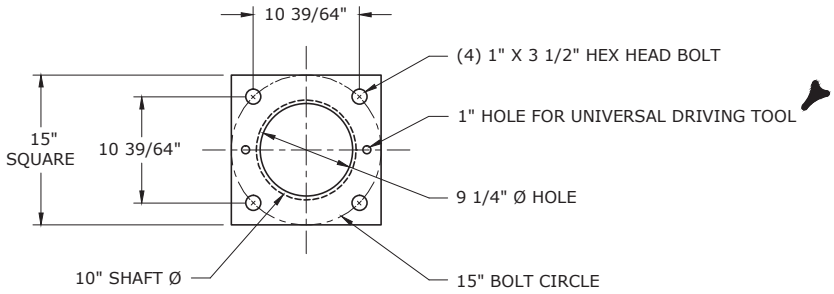
DUKE ENERGY.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 — 11/24/15	DEFREITAS	GUY	COWLING

STEEL SCREW-IN-ANCHOR FOUNDATION FOR 27'-6" (DEF) OR 30' (DEP) SQUARE AND 35' ROUND TAPERED DECORATIVE POLES

DEC	DEM	DEP	DEF
		X	X

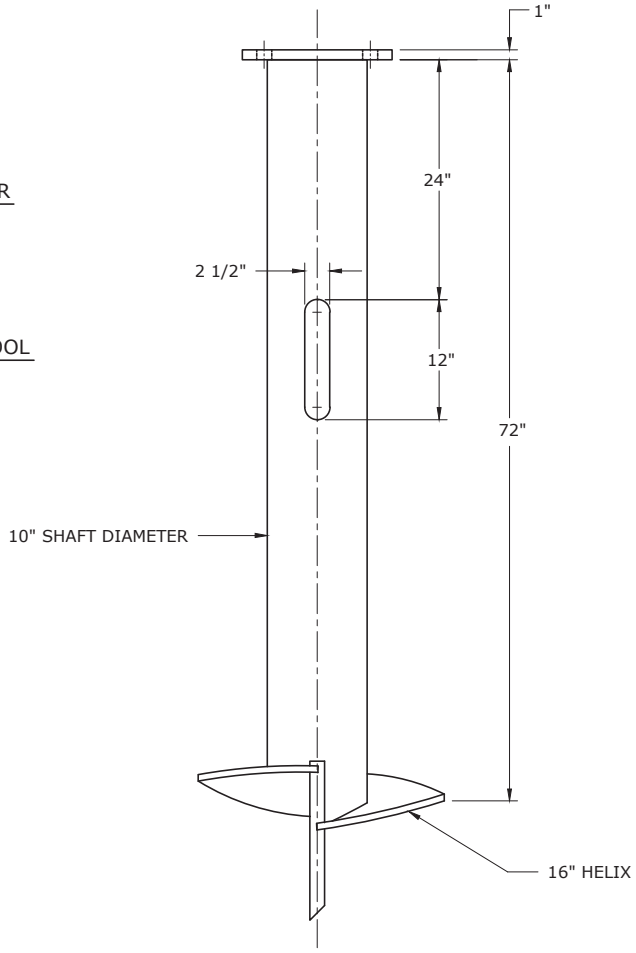
30.05-16A



FOUNDATION PLATE TOP VIEW

KELLY BAR ADAPTER
CN 036225

UNIVERSAL DRIVE TOOL
CN 036226



CN 036216

NOTES:

1. USE DWG. 30.05-15 TO INSTALL SCREW-IN FOUNDATION.
2. HARDWARE BAG OF BOLTS, NUTS AND WASHERS TO COME ATTACHED TO EACH FOUNDATION.
3. NO GROUNDING ROD IS REQUIRED FOR SCREW-IN-FOUNDATION.

3				
2				
1	3/6/12	DEFRIETAS	GUY	LARSEN
0	7/21/10	DEFRIETAS	GUY	LARSEN
REVISED		BY	CK'D	APPR.

STEEL SCREW-IN-FOUNDATION FOR
26' THROUGH 36' STEEL & ALUMINUM POLES

Duke Energy®

FLA

DWG.
30.05-17

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

LAMP INSTALLATION:

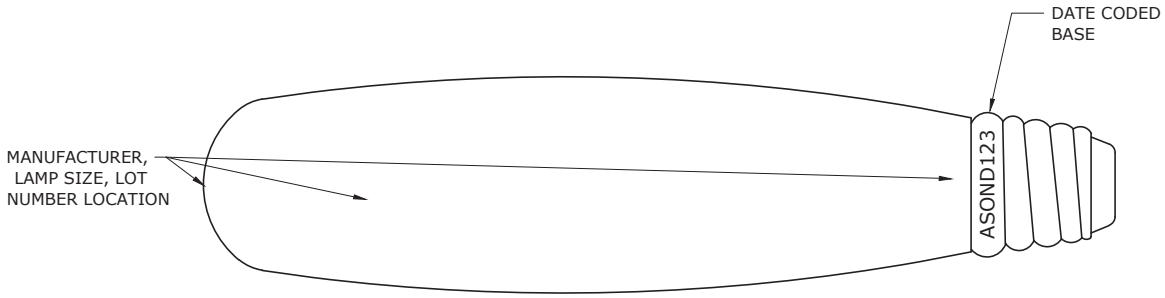
CARE SHOULD BE TAKEN WITH THE HANDLING AND STORAGE OF LAMPS PRIOR TO INSTALLATION TO PREVENT DAMAGE. IN ALL LAMP INSTALLATIONS, THE LAMP SHOULD BE SCREWED TIGHTLY INTO THE SOCKET TO INSURE A PROPER CONTACT BETWEEN THE BASE OF THE LAMP AND THE SPRING LOADED BASE OF THE LAMP SOCKET. IMPROPER INSTALLATION WILL RESULT IN ARCING AND BURNING OF THE LAMP BASE AND SOCKET AND EARLY LAMP FAILURE.

LAMP SELECTION:

CAREFUL ATTENTION SHOULD BE PAID TO THE INSTALLATION OF THE PROPER LAMP FOR THE GIVEN LUMINAIRE. AN INCORRECTLY SIZED LAMP MAY FUNCTION AT INSTALLATION BUT WILL RESULT IN IMPROPER LIGHT OUTPUT AND SHORTENED LAMP LIFE.

DATE CODING:

IN ORDER TO DETERMINE LAMP LIFE PERFORMANCE, EACH NEW LAMP INSTALLED SHOULD BE DATE CODED AS SHOWN BELOW AND LIKEWISE CODED UPON REMOVAL.



SYMBOL FOR INSTALLATION SHALL BE (/) OR (\).
SYMBOL FOR REMOVAL SHALL BE (X).

MONTH	LAST DIGIT OF YEAR
J F M A M J J A S O N D	1 2 3 4 5 6 7 8 9 0

INSTALLED MARCH, 1978; REMOVED NOVEMBER, 1980.

J F M A M J J A S O N D	1 2 3 4 5 6 7 8 9 0

INSTALLED APRIL, 1981; REMOVED DECEMBER, 1981.

THESE SLASHES CAN BE SCRATCHED INTO THE LAMP BASE WITH ANY POINTED INSTRUMENT; I.E., KNIFE, SCREWDRIVER, ETC.

REFLECTOR, LENS (REFRACTOR) SHALL BE CLEANED AT EACH LAMP REPLACEMENT.

3				
2				
1	3/6/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

LAMP INSTALLATION AND CODING

Duke Energy®

FLA

DWG. 30.06-01

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

CONVENTIONAL HIGH PRESSURE SODIUM VAPOR LAMPS

TYPES OFFERED AS COMPANY STANDARD

LAMP WATTAGE	TYPE	LAMP LUMENS	CATALOG NUMBER
50	HPS	4000	250603
70	HPS	5800	250608
100	HPS	9500	250601
150	HPS	16,000	250605
200	HPS	22,000	250606
250	HPS	27,500	250602
400	HPS	50,000	250604

*MAINTENANCE ITEM ONLY

THESE LAMPS ARE TO ONLY BE USED IN CONVENTIONAL HIGH PRESSURE SODIUM VAPOR LUMINAIRES.

OPERATING CHARACTERISTICS

UNDER NORMAL OPERATING CONDITIONS, THESE LAMPS SLOWLY INCREASE IN BRIGHTNESS AND ACHIEVE FULL OUTPUT IN 4 TO 5 MINUTES. WHEN THIS LAMP TYPE REACHES END OF LIFE ITS NORMAL FAILURE MODE IS TO CYCLE ON AND OFF WITH CYCLE LASTING UP TO 20 MINUTES.

REVISED		BY	CK'D	APPR.
3				
2				
1	3/6/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN

SODIUM VAPOR LAMPS

Progress Energy

FLA

DWG. 30.06-05

METAL HALIDE LAMPS
TYPES OFFERED AS COMPANY STANDARD

#	LAMP WATTAGE	LAMP LUMENS	CATALOG NUMBER
A	100	9,000 (COATED)	250686
B	150	11,600 (COATED)	9220183630
C	175	14,400	250683
D	320	30,000 (COATED)	9220183634
E	400	40,000 (CLEAR)	250684
F	*400 (RDE)	40,000 (COATED)	250687
G	1,000	110,000 (CLEAR)	250685
H	*1,000 (RDE)	110,000 (CLEAR)	250688

* SEE NOTE 4

NOTE:

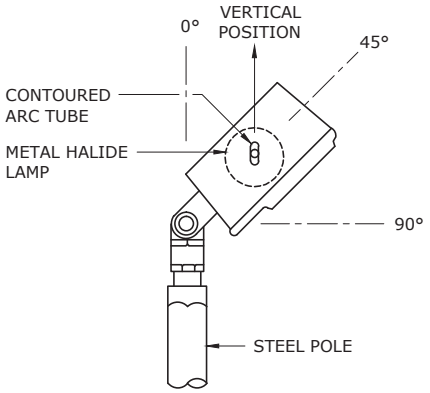
1. THE ABOVE METAL HALIDE LAMPS ARE TO BE USED WITH ONLY THE RECOMMENDED METAL HALIDE FIXTURES. SEE DWGS. 30.08-02 THROUGH 30.08-05 FOR CORRECT FIXTURES.
2. INSTALLATION INSTRUCTIONS COME WITH EACH FIXTURE FOR PROPER AIMING ANGLE.
3. A LOW PERCENTAGE OF NEWLY INSTALLED METAL HALIDE LAMPS ARE VERY SLOW IN STARTING, THEY MAY REQUIRE A STARTING TIME OF UP TO 5 MINUTES.
4. LAMPS 'F' AND 'H' ARE REDUCED SIZE ENVELOPE (RDE) LAMPS AND ARE ONLY USED IN FLAT GLASS CUBE FIXTURES.

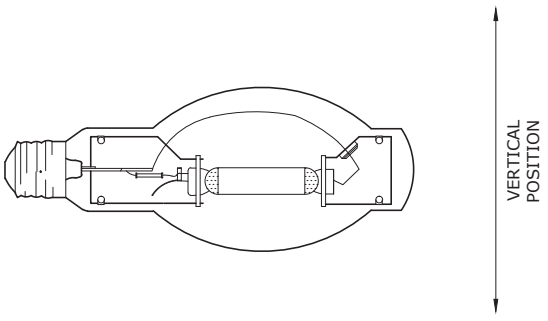
OPERATING CHARACTERISTICS

SUPER METAL HALIDE LAMPS DIFFER VERY SIGNIFICANTLY FROM MERCURY. THE FIXTURE SHOULD BE INSTALLED WITH A 45° TILT FROM VERTICAL. THE LAMP WHEN INSTALLED MUST OPERATE WITHIN PLUS OR MINUS 15° HORIZONTAL POSITION. THE LAMP MAY REQUIRE 10 TO 20 MINUTES TO RESTART IF THERE IS A POWER INTERRUPTION. THE SUPER METAL HALIDE LAMP WILL NOT OPERATE IN A MERCURY OR SODIUM VAPOR FIXTURE. THE ARC TUBE CONTAINS METAL HALIDE COMPOUNDS TO IMPROVE COLOR APPEARANCE, INCREASE LUMINOUS EFFICIENCY AND LUMEN MAINTENANCE. THE ARC TUBE IS ENCLOSED IN A CLEAR OR PHOSPHOR-COATED HARD GLASS OUTER BULB. THE FAILURE MODE OF THESE LAMPS WILL NORMALLY BE FAILURE TO RESTRIKE. THE LAMP WILL GO OFF AT DAYBREAK AND FAIL TO COME ON THE FOLLOWING EVENING.

SAFETY: WARNING

1. THE ARC TUBES OF METAL HALIDE LAMPS ARE DESIGNED TO OPERATE UNDER HIGH PRESSURE AND AT TEMPERATURES UP TO 900°F [482°C]. IF THE ARC TUBE RUPTURES FOR ANY REASON THE OUTER BULB MIGHT BREAK AND THE PIECES OF EXTREMELY HOT GLASS MIGHT DISCHARGE WITH AN ASSOCIATED RISK OF PROPERTY DAMAGE OR PERSONAL INJURY. MAKE SURE FIXTURE DOOR IS CLOSED AND SECURE BEFORE ENERGIZING THE LAMP.
2. DAY BURNING METAL HALIDE LAMPS NEED RAPID MAINTENANCE ATTENTION WHEN REPORTED. SINCE THE LAMP NEEDS TO BE TURNED OFF AT LEAST ONCE PER WEEK FOR AT LEAST 15 MINUTES TO HELP PREVENT LAMP RUPTURE, REPAIR DAY BURNERS PROMPTLY. NEVER OPEN THE DOOR OF A DAY BURNER WHILE TROUBLE SHOOTING THE LUMINAIRE.
3. DON'T EXPOSE THE LAMP TO MOISTURE WHILE IT IS IN OPERATION.
4. ALWAYS REPLACE LAMP IF THE OUTER BULB IS SCRATCHED, CRACKED OR DAMAGED IN ANY WAY. TURN OFF FIRST AND ALLOW TIME FOR LAMP TO COOL BEFORE REPLACING.





3					METAL HALIDE LAMPS
2					
1					
0	7/21/10	DEFREITAS	JUDAH	LARSEN	
REVISED		BY	CK'D	APPR.	

Duke Energy®

FLA | DWG. 30.06-10

PROGRESS ENERGY FLORIDA

STANDARD PROCEDURES BULLETIN

MERCURY VAPOR LAMPS:

TYPES OFFERED AS COMPANY STANDARD

LAMP WATTAGE	LAMP LUMENS	CATALOG NUMBER
175	7,000 (COATED)	*250103
400	21,000 (COATED)	*250106
1,000	60,000 (COATED)	*250108

APPLICATION NOTES:

1. MERCURY VAPOR LAMPS ARE TO BE INSTALLED IN THE CORRECT SIZE FIXTURES. (CHECK FIXTURE WATTAGE DECAL.)
2. THE COATED (COLOR-CORRECTED) LAMP WILL BE USED IN STREET LIGHTING AND AREA LIGHTING APPLICATIONS.

EXCEPTION: 60,000 LUMEN LAMPS ARE AVAILABLE IN THE COATED STYLE ONLY, AND THEREFORE ARE USED IN ALL 60,000 LUMEN APPLICATIONS.

OPERATING CHARACTERISTICS

UNDER NORMAL OPERATING CONDITIONS THESE LAMPS SLOWLY INCREASE IN BRIGHTNESS AND ACHIEVE FULL OUTPUT IN 4-5 MINUTES. THE LAMP STOPS OPERATING COMPLETELY WHEN IT REACHES END OF LIFE AS OPPOSED TO THE CYCLING WHICH TAKES PLACE WITH THE SODIUM VAPOR.

* MERCURY VAPOR LAMPS ARE FOR MAINTENANCE.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

MERCURY VAPOR LAMPS

Duke Energy®

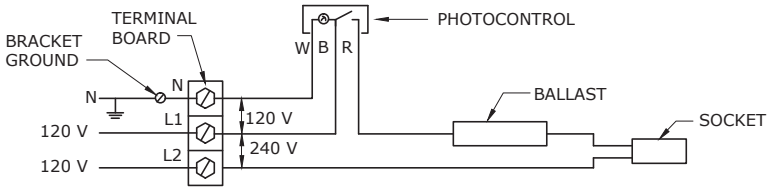
FLA

DWG. 30.06-15

ROADWAY LUMINAIRES

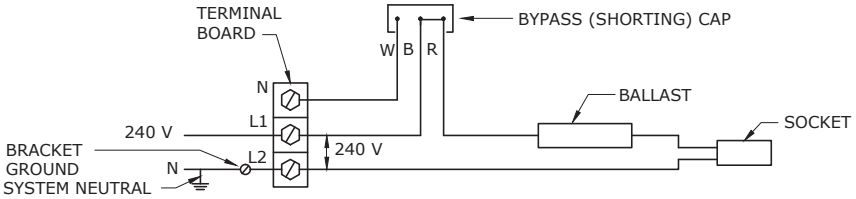
240 VOLT LUMINAIRES

CAUTION: BALLAST AND SOCKET ALWAYS ENERGIZED



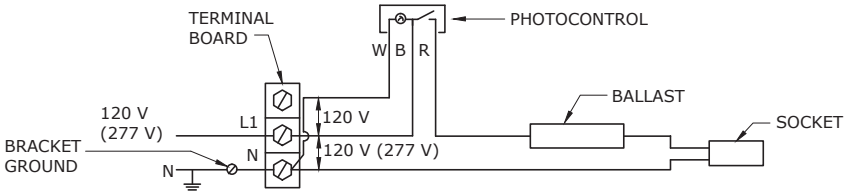
CONNECTION FOR 120/240 V INDIVIDUAL CONTROL

240/480 VOLT LUMINAIRES



CONNECTION FOR 240 V TO GROUND GROUP CONTROL (240/480 VOLT LIGHTING TRANSFORMER)

120 (277 V) VOLT LUMINAIRES



CONNECTION FOR 120 V (277 V) TO GROUND INDIVIDUAL CONTROL

FLOODLIGHTS

FLOODLIGHTS ARE CONNECTED THE SAME AS SHOWN ABOVE FOR ROADWAY LUMINAIRES. FLOODLIGHTS ARE RECEIVED PREWIRED TO OPERATE ON A 120/240 VOLT SYSTEM, BUT THE INTERNAL WIRING CAN BE CHANGED IN THE FIELD TO ALLOW FOR OPERATION ON A 120 VOLT TO GROUND SYSTEM. INSTRUCTIONS FOR THIS REWIRING ARE INCLUDED IN EACH FLOOD-LIGHT.

TO OPERATE A FLOODLIGHT ON A 240 VOLT TO GROUND GROUP SYSTEM, FIRST INSURE THAT THE INTERNAL WIRING IS CORRECT FOR A 120/240 VOLT SYSTEM. THEN CONNECT AS SHOWN ABOVE FOR GROUP CONTROL.

NOTES:

1. TERMINAL BOARD LAYOUTS ABOVE ARE TYPICAL EXAMPLES ONLY, ACTUAL LAYOUT MAY VARY.

2. FOR DISCONNECTING A CUSTOMER'S FIXTURE FOR NON-PAY USE THE OPEN CAP DISCONNECT. (CN 13431101). SEE DWG. 30.03-05.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

LUMINAIRE CONNECTIONS TO LIGHTING CIRCUITS

Duke Energy

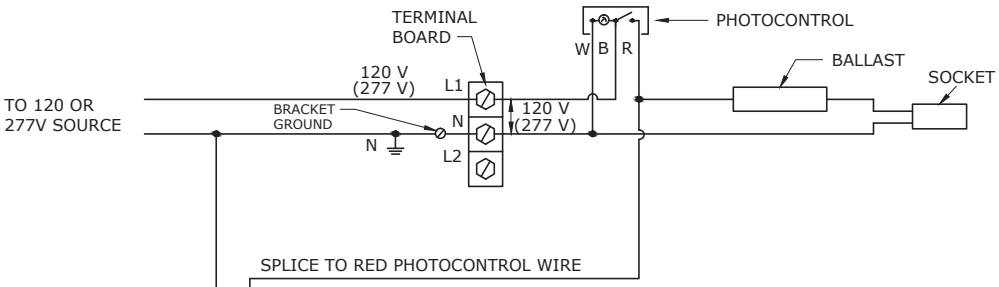
FLA

DWG. 30.07-01

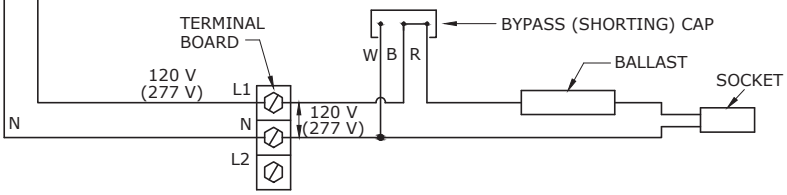
ROADWAY LUMINAIRES

120 OR (277) VOLT LUMINAIRES

TOP FIXTURE ON POLE



BOTTOM FIXTURE ON POLE

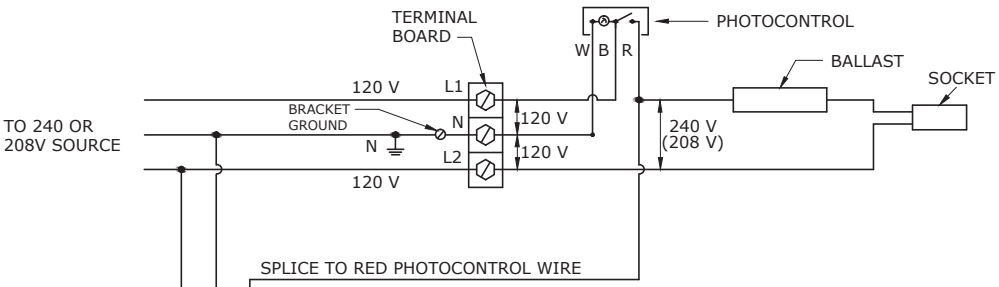


NOTES:

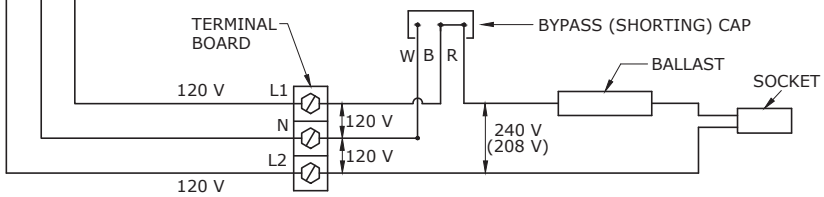
1. CONNECT THE (N) LEAD FROM TERMINAL BOARD TO SOURCE NEUTRAL.
2. SPLICE (L1) LEAD FROM TERMINAL BOARD OF BOTTOM FIXTURE TO RED LEAD ON PE OF TOP FIXTURE.
3. PUT A BYPASS CAP IN PE SOCKET OF BOTTOM FIXTURE.
4. TOTAL FIXTURE LOAD CONNECTED THROUGH ONE PHOTOCONTROL **MUST NOT EXCEED** 1800VA.

240 OR (208) VOLT LUMINAIRES

TOP FIXTURE ON POLE



BOTTOM FIXTURE ON POLE



NOTES:

1. CONNECT THE (N) LEAD FROM TERMINAL BOARD TO SOURCE NEUTRAL.
2. CONNECT THE (L2) LEAD FROM TERMINAL BOARD TO SOURCE L2.
3. SPLICE (L1) LEAD FROM TERMINAL BOARD OF BOTTOM FIXTURE TO RED LEAD ON PE OF TOP FIXTURE.
4. PUT A BYPASS CAP IN PE SOCKET OF BOTTOM FIXTURE.
5. TOTAL FIXTURE LOAD CONNECTED THROUGH ONE PHOTOCONTROL **MUST NOT EXCEED** 1800VA.

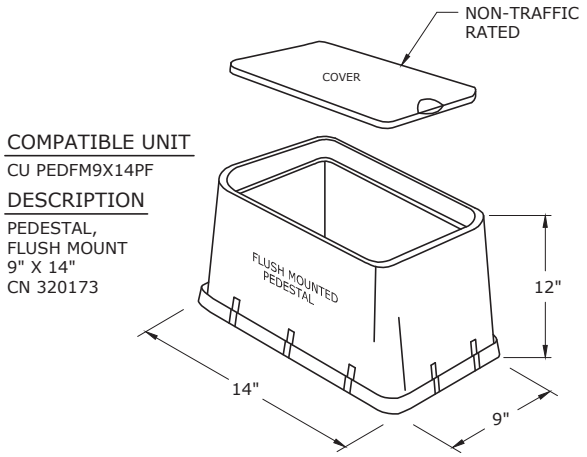
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

CONNECTING MULTIPLE FIXTURES USING ONE PHOTOCONTROL

Duke Energy®

FLA

DWG. 30.07-03



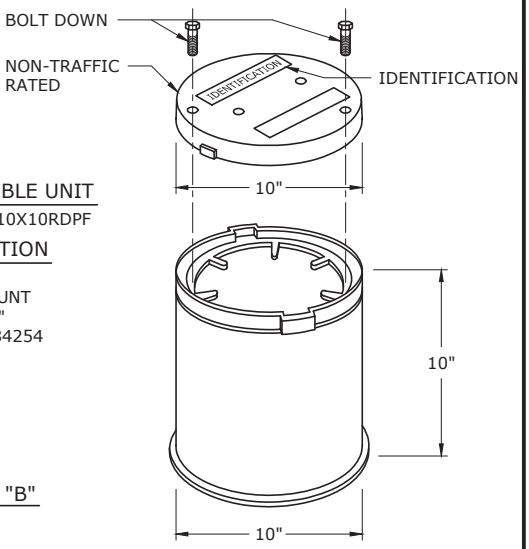
COMPATIBLE UNIT

CU PEDFM9X14PF

DESCRIPTION

PEDESTAL,
FLUSH MOUNT
9" X 14"
CN 320173

DETAIL "A"
FLUSH MOUNTED
PEDESTAL



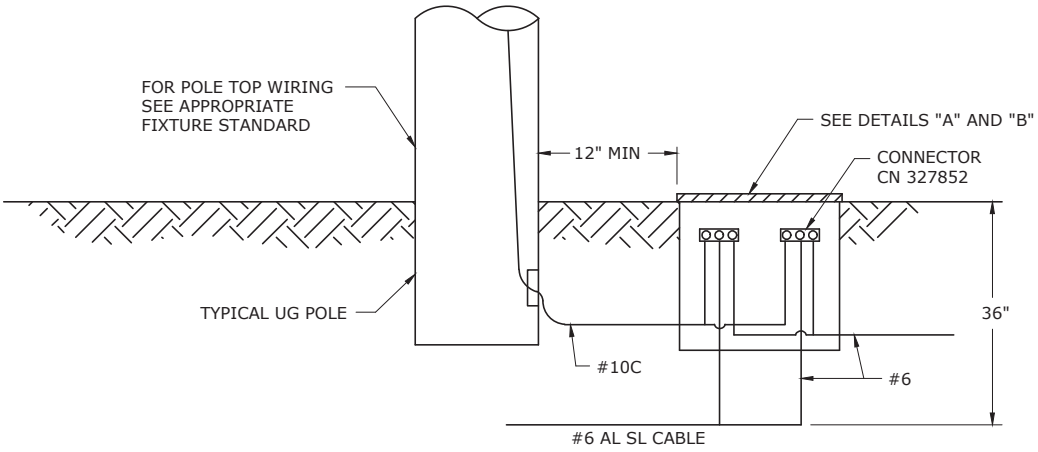
COMPATIBLE UNIT

CU PEDFM10X10RDPF

DESCRIPTION

PEDESTAL,
FLUSH MOUNT
ROUND 10"
CN 9220184254

DETAIL "B"



NOTES:

1. SOIL ON WHICH THE PEDESTAL WILL REST SHOULD BE COMPACTED TO THAT OF UNDISTRIBUTED EARTH. WHEN COVER IS INSTALLED, THE PEDESTAL SHOULD BE FLUSH WITH FINAL GRADE.
2. TRAIN THE CABLE TO POSITION SHOWN ON DWG. 25.04-05. ALL CABLES SHOULD ENTER THE PEDESTAL AT AT ONE END. VERIFY THAT THE CABLE MAY BE BENT OVER TO A POSITION BENEATH THE PEDESTAL COVER, BUT STILL ABLE TO RETURN TO AN UPRIGHT POSITION.
3. ALL CONNECTIONS IN FLUSH MOUNTED PEDESTALS MUST BE WATERPROOF (CN 327852).
4. FOR STREET LIGHT USE ONLY.
5. SEE DWG. 25.04-05 FOR MAXIMUM CABLE SIZE AND PROPER CABLE INSTALLATION.
6. ELECTRONIC MARKER IN LID.
7. SEE DWG. 25.04-05 FOR LIGHT TRAFFIC RATED PEDESTAL (CN 381612).

MAINTENANCE NOTES:

1. EMPTY CONDUIT INSTALLED IN PEDESTAL MUST BE CAPPED UNTIL SUCH TIME CABLE IS PULLED IN.
2. CIC CONDUIT SHOULD BE CUT OFF 2" ABOVE BOTTOM OF PEDESTAL PRIOR TO INSTALLING PEDESTAL.
3. CIC MUST BE CAPPED WITH CIC CAP AFTER CUTTING TO LENGTH TO PREVENT FOREIGN MATTER FROM ENTERING DUCT.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

TYPICAL NON-TRAFFIC RATED PEDESTAL CONSTRUCTION UNDERGROUND LIGHTING INSTALLATIONS

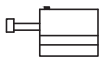
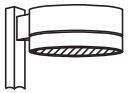
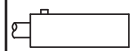
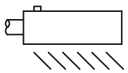
Duke Energy®

FLA

DWG. 30.07-36

REVISED	BY	CK'D	APPR.
0 7/26/10	DEFREITAS	JUDAH	LARSEN
1 3/8/12	DEFREITAS	JUDAH	LARSEN
2			
3			

STREET AND AREA LIGHTING LUMINAIRES

DECORATIVE FIXTURES											
FIXTURE	CN	DESCRIPTION	TYPE	WATTAGE	BALLAST	PRE-WIRED	IES TYPE	COLOR	STATUS	LUMEN	COMPATIBLE UNIT
CUBE  GALLERIA	241862	CUBE	MH	1000W	CWA	120V	V	BRONZE	STOCKED	110,000	L110KMHKCFG1F
	9220183637	CUBE	MH	320	CWA	120V	V	BRONZE	STOCKED	30,000	L40KPM32CUBR1F
	241863	CUBE	MH	400W	CWA	120V	V	BRONZE	STOCKED	36,000	L36KMH40CFGMF *
 HATBOX	241717	HATBOX	HPS	250W	CWA	120V	II	BRONZE	STOCKED	28.5K	L28KSV25HBMF **
	241717	HATBOX	HPS	400W	CWA	120V	II	BRONZE	STOCKED	50K	L50KSV40HBMF **
	241865	HATBOX	MH	400W	CWA	120V	II	BRONZE	STOCKED	36,000	L36KMH40HB1F *
 SHOEBOX	241567	SHOEBOX	HPS	250W	CWA	120V	III	BRONZE	STOCKED	28.5K	L28KSV25SBMF
	241567	SHOEBOX	HPS	400W	CWA	120V	III	BRONZE	STOCKED	50K	L50KSV40SBMF
	9220183641	SHOEBOX	MH	320	CWA	120V	III	BRONZE	STOCKED	30,000	L30KPM32SBBR1F
	241864	SHOEBOX	MH	400W	CWA	120V	III	BRONZE	STOCKED	36,000	L38KMH40SB1F *
 SHOEBOX FWT *	9220183643	SHOEBOX FWT	MH	320W	CWA	120V	IV	BRONZE	STOCKED	30,000	L30KPM32SFBR1F
	241867	SHOEBOX FWT	MH	400W	CWA	120V	IV	BRONZE	NON-STOCKED	36,000	L38KMH40SF1F *
	241857	SHOEBOX FWT	MH	1000W	CWA	120V	IV	BRONZE	NON-STOCKED	110,000	L110KMHKSF1F
	* FWT DENOTES FORWARD THROW LIGHT DISTRIBUTION										

* THIS FIXTURE IS DISCONTINUED

** THIS FIXTURE IS "FOR MAINTENANCE ONLY". THE COMPATIBLE UNIT FOR THIS FIXTURE IS INACTIVE

Duke Energy®

FLA

DWG. 30.08-02

REVISED	BY	CK'D	APPR.
0 7/21/10	DEFREITAS	JUDAH	LARSEN
1 3/8/12	DEFREITAS	JUDAH	LARSEN
2			
3			

STREET AND AREA LIGHTING LUMINAIRES

FIXTURES										
FIXTURE	CATALOG NUMBER	AVG. MTG. HEIGHT	TYPE	WATTAGE	BALLAST	PRE-WIRED	COLOR	STATUS	LUMEN	COMPATIBLE UNIT OH/UG
 FLOODLIGHT	241353	25'-30'	HPS	250W	CWA	120V	BRONZE	STOCKED	27,500	L28KSV25FL1F
	241353	25'-30'	HPS	250W	CWA	120V	BRONZE	STOCKED	27,500	L28KSV25UF1F **
	241357	30'-35'	HPS	400W	CWA	120V	BRONZE	STOCKED	50,000	L50KSV40FL1F
	241357	30'-35'	HPS	400W	CWA	120V	BRONZE	STOCKED	50,000	L50KSV40UF1F **
	9220183633	30'-35'	MH	320W	CWA	120V	BRONZE	STOCKED	30,000	L30KPM32FLBR1F
	241851	30'-35'	MH	400W	CWA	120V	BRONZE	STOCKED	36,000	L36KMH40FLMF*
	241853	35-40'	MH	1000W	CWA	120V	BRONZE	NON-STOCKED	110,000	L110KMHKFLMF
 MONGOOSE	9220157695	-	HPS	100W	CWA	120V	BLACK	NON-STOCKED	9,500	L95SV10MGBL1F
	9220107742	-	HPS	250W	CWA	120V	WHITE	STOCKED	28,500	L28KSV25MGL1F
	9220162931	-	HPS	400W	CWA	120V	WHITE	STOCKED	50,000	L50KSV40SPPW1F
	9220207210	-	LED	95W	DRIVER	120V/277V	GRAY	NON-STOCKED	6,000	L06LED10RWGEMF
	9220207209	-	LED	157W	DRIVER	120V/277V	GRAY	NON-STOCKED	9,600	L10LED16RWGEMF
	9220209541	-	LED	309W	DRIVER	120V/277V	BRONZE	NON-STOCKED	20,500	L21KLED32SBCPMF
	9220209543	-	LED	206W	DRIVER	120V/277V	BRONZE	NON-STOCKED	13,500	L13KLED21SFCPMF
	9220209540	-	LED	206W	DRIVER	120V/277V	BRONZE	NON-STOCKED	14,500	L14KLED21CCPMF

* THIS FIXTURE IS DISCONTINUED
** UNDERGROUND FIXTURE

NOTES:

1. USE SOLID STATE "GREEN" PHOTOCELL (CN 9220208023) WITH "FAIL-OFF" FEATURE FOR ALL LED LUMINAIRES.

Duke Energy®

FLA

DWG. 30.08-03

REVISED	BY	CK'D	APPR.
0 7/21/10	DEFREITAS	JUDAH	LARSEN
1 3/8/12	DEFREITAS	JUDAH	LARSEN
2			
3			

STREET AND AREA LIGHTING LUMINAIRES

FIXTURES

FIXTURE	CATALOG NUMBER	DESCRIPTION	TYPE	WATTAGE	BALLAST	PRE-WIRED	IES TYPE	COLOR	LUMEN	COMPATIBLE UNIT OH/UG
SEMI ENCLOSED 	241420	SEMI ENCLOSED	HPS	50W	REACTOR	120V	V	GRAY	4,000	L40SV05OB1F**
	241442	SEMI ENCLOSED	HPS	70W	REACTOR	120V	V	GRAY	6,500	L70SV07OB1F**
	241875	SEMI ENCLOSED	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10HT1F
ENCLOSED  NOTE: ALL SAG LENS (ENCLOSED) FIXTURES ARE DISCONTINUED. USE "CUT-OFF" TYPE FOR REPLACEMENT	241503	ENCLOSED	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10RW1F *
	241503	ENCLOSED	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10SL1F *,***
	241508	ENCLOSED	HPS	100W	REACTOR	120V	II-4 WAY	GRAY	9,500	L95SV10RW4W1F*
	241529	ENCLOSED	HPS	150W	REACTOR	120V	III	GRAY	16,000	L16KSV15RW1F*
	241529	ENCLOSED	HPS	150W	REACTOR	120V	III	GRAY	16,000	L16KSV15SL1F *,***
	241542	ENCLOSED	HPS	200W	CWA	120V	III	GRAY	22,000	L22KSV20RW1F*
	241542	ENCLOSED	HPS	200W	CWA	120V	III	GRAY	22,000	L22KSV20SL1F *,***
	241553	ENCLOSED	HPS	250W	CWA	120V	III	GRAY	28,000	L28KSV25SL1F *
	241553	ENCLOSED	HPS	250W	CWA	120V	III	GRAY	28,000	L28KSV25USL1F*,***
	241601	ENCLOSED	HPS	400W	CWA	120V	III	GRAY	50,000	L50KSV40SL1F *
	241601	ENCLOSED	HPS	400W	CWA	120V	III	GRAY	50,000	L50KSV40USL1F*,***
FULL CUTOFF 	241401	FULL CUTOFF	HPS	50W	REACTOR	120V	III	GRAY	4,000	L40SV05RW1F
	241505	FULL CUTOFF	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10RWC1F
	241505	FULL CUTOFF	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10UR1F ***
	241506	FULL CUTOFF	HPS	150W	REACTOR	120V	III	GRAY	16,000	L16KSV15RWC1F
	241506	FULL CUTOFF	HPS	150W	REACTOR	120V	III	GRAY	16,000	L16KSV15UR1F ***
	241504	FULL CUTOFF	HPS	200W	CWA	120V	III	GRAY	22,000	L22KSV20RWC1F
	241504	FULL CUTOFF	HPS	200W	CWA	120V	III	GRAY	22,000	L22KSV20UR1F ***
	241507	FULL CUTOFF	HPS	250W	CWA	120V	III	GRAY	28,000	L28KSV25RWC1F
	241507	FULL CUTOFF	HPS	250W	CWA	120V	III	GRAY	28,000	L28KSV25UR1F ***
	241551	FULL CUTOFF W/ BKT	HPS	250W	CWA	120V	III	BLACK	28,000	L28KSV25DRBLMF
	241610	FULL CUTOFF	HPS	400W	CWA	120V	III	GRAY	50,000	L50KSV40RW1F
	241610	FULL CUTOFF	HPS	400W	CWA	120V	III	GRAY	50,000	L50KSV40UR1F ***
	241888	FULL CUTOFF	HPS	400W	CWA	120V	III	BLACK	50,000	L50KSV40DRBL1F **
	241512	NO LENS	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10TUR1F
	241512	NO LENS	HPS	100W	REACTOR	120V	III	GRAY	9,500	L95SV10UTUR1F ***
CLERMONT 	9220144211	CLERMONT, NO BKT	HPS	100W	REACTOR	120V	III	BLACK	9,500	L95SV10TCH1NF
	9220144212	CLERMONT, NO BKT	HPS	250W	CWA	120V	III	BLACK	28,000	L28KSV25TCH1F
	9220144213	CLERMONT, NO BKT	MH	175W	CWA	120V	III	BLACK	14,000	L14KMH17TCH1NF *
	9220183644	CLERMONT, NO BKT	MH PS	150W	PULSE	120V	III	BLACK	12,000	L12KPM15TCBL1F
SANIBEL 	9220126156	SANIBEL	HPS	100W	REACTOR	120V	III	BLACK	9,500	L95SV10DEC1F
	9220126155	SANIBEL	MH	175W	CWA	120V	III	BLACK	14,000	L14KMH17SAN1F *
	9220183646	SANIBEL	MH PS	150W	PULSE	120V	III	BLACK	12,000	L12KPM15SANBL1F
	9220193839	SANIBEL	MH PS	150W	PULSE	120V	III	WHITE	22,000	L22KPM15CTVW1F ****
	9220237362	SANIBEL	LED	71W	NA	120-277V	III	BLACK	5,500	L55LED07SANBLMF

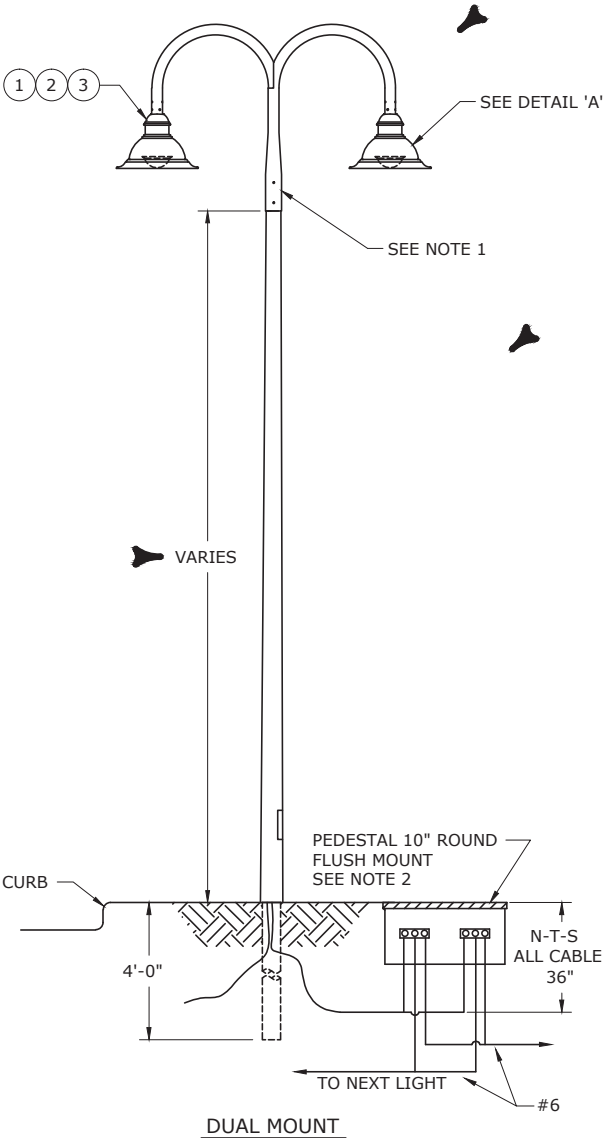
HPS - HIGH PRESSURE SODIUM
MH - METAL HALIDE
MH PS - METAL HALIDE PULSE START
LED - LIGHT EMITTING DIODE

* THIS FIXTURE IS DISCONTINUED
** THIS FIXTURE IS FOR "MAINTENANCE ONLY". THE COMPATIBLE UNIT FOR THIS FIXTURE IS INACTIVE
*** UNDERGROUND INSTALLATIONS
**** SPECIAL APPLICATION -DUAL MT SANIBEL - SEE REGIONAL LIGHTING SPECIALIST FOR USE

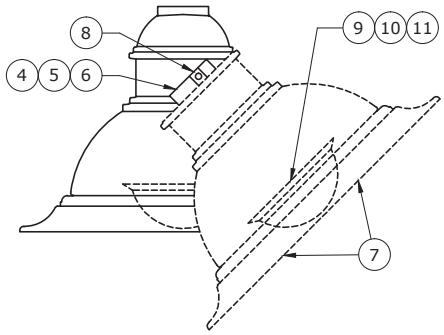
Duke Energy®

FLA

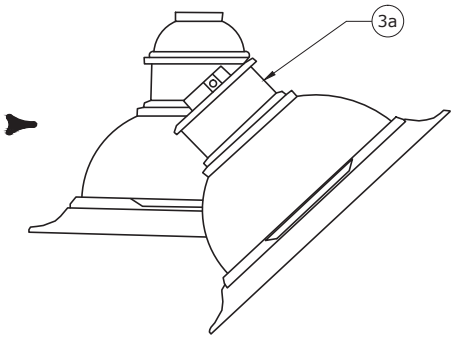
DWG. 30.08-05



DUAL MOUNT



DETAIL 'A'



DETAIL 'B'
LED

NOTES:

1. BRACKETS FOR SANIBEL FIXTURE(S) REQUIRE POST TO HAVE A 3" DIAMETER X 6" HIGH TENON.
2. PEDESTAL DETAILS, SEE DWG. 30.07-36.
3. POLE DETAILS, SEE DWG. 30.09-28.
4. DO NOT INSTALL LIGHT FIXTURE UNTIL POLE IS INSTALLED AND BACKFILLED.
5. SEE DWG. 30.02-26 FOR BRACKET DETAILS.

BILL OF MATERIALS

MACRO UNIT	CU/CN ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	L95SV10DEC1F	1	9220126156	1	SANIBEL, 120V, 100W, HPS W/FULL SIZE PE
	2	L14KMH17SAN1F	1	9220126155	1	SANIBEL, 120V, 175W, HPS W/FULL SIZE PE (REMOVAL ONLY)
	3	L12KPM15SANBL1F	1	9220183646	1	SANIBEL, 120V, 150W, MH PULSE START W/FULL SIZE PE
	3a	L55LED07SANBLMF	1	9220237362	1	SANIBEL, 120V, 71W, LED W/FULL SIZE SSL PE
	4	-	-	9220126799	1	BALLAST REPLACEMENT, 120V, 100W, HPS
	5	-	-	9220126800	1	BALLAST REPLACEMENT, 120V, 175W, HPS
	6	-	-	9220209551	1	BALLAST REPLACEMENT, 120V, 150W, MH PULSE START
	7	-	-	242230	1	REPLACEMENT LENS/DOOR
	8	-	-	243104	1	REPLACEMENT PE CONTROL
	9	-	-	250601	1	LAMP, 100W, HPS
	10	-	-	250683	1	LAMP, 175, MH
	11	-	-	9220173630	1	LAMP, 150W, MH PULSE START
	12	-	-	243608	1	REPLACEMENT STARTER, 100W, HPS (NOT SHOWN)
	13	-	-	9220148466	1	REPLACEMENT STARTER, 150W, MH PULSE START (NOT SHOWN)

3				
2				
1	4/2/12	DEFREITAS	JUDAH	LARSEN
0	7/26/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

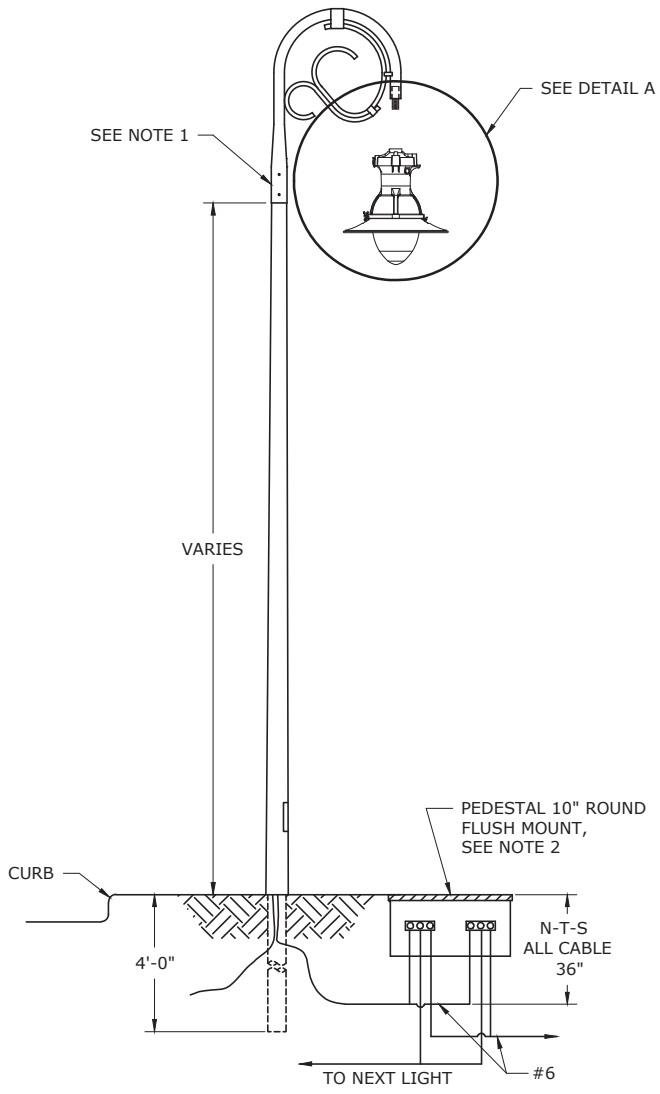
LUMINAIRE, DECORATIVE SANIBEL (HOLOPHANE)

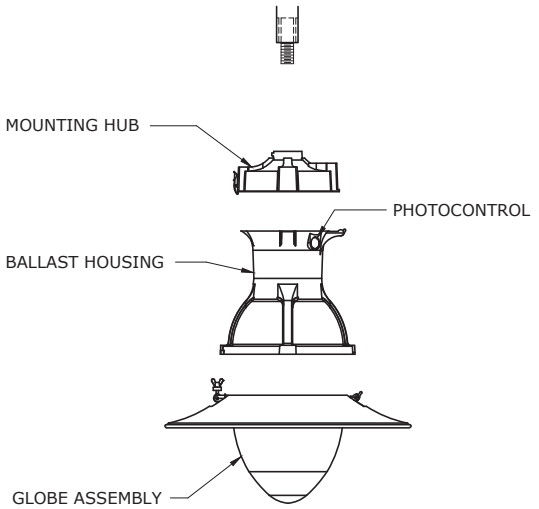
Progress Energy

FLA

DWG. 30.08-08B

SINGLE MOUNT





DETAIL A

INSTALLATION NOTES:

1. REMOVE CONNECTION COVER PLATE FROM BOTTOM OF MOUNTING HUB. COAT THREADS OF BRACKET AND MOUNTING HUB WITH SUPPLIED SEALANT. SCREW MOUNTING HUB ONTO BRACKET SECURELY, LINING UP LATCH PARALLEL TO STREET. TIGHTEN SET SCREW.
2. CONNECT STREET LIGHT LEAD WIRE TO TERMINAL BOARD AND REINSTALL COVER PLATE.
3. HOOK BALLAST HOUSING ONTO HINGE. INSERT PHOTOCONTROL, PLUG IN CONNECTOR AND RAISE HOUSING AND LATCH.
4. INSTALL LAMP.
5. HOOK GLOBE ASSEMBLY ONTO BALLAST HOUSING. RAISE AND TIGHTEN THUMB SCREW.
6. TEST FOR PROPER OPERATION.
7. DO NOT INSTALL BALLAST HOUSING OR GLOBE UNTIL POLE IS INSTALLED AND BACKFILLED.

NOTES:

1. THE BRACKETS FOR THE CLERMONT FIXTURE(S) REQUIRE THE POST TO HAVE A 3" X 5" TENON.
2. SEE DWG 30.07-36 FOR PEDESTAL DETAILS.
3. SEE DWG. 30.09-14 FOR POLE DETAILS.
4. SEE DWG. 30.08-09D FOR BILL OF MATERIALS.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

LUMINAIRE, DECORATIVE, 100W HPS,
250W HPS AND 175W MH, THE CLERMONT
HOLOPHANE

Duke Energy®

FLA

DWG. 30.08-09C

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	L95SV10TCH1NF	1	250601	1	LAMP, HPS, 100W
			9220144211	1	LUM, CL 113, 100W, HPS, CLERMONT
2	L95SV10TCH1SRF	1	250601	1	LAMP, HPS, 100W
			9220067354	1	BRACKET, SINGLE, SCROLL ARM
			9220144211	1	LUM, CL 113, 100W, HPS, CLERMONT
3	L95S10TCH1SCF	1	240320	1	BRACKET, SINGLE, SHEPARD'S CROOK, FOR SANIB
			250601	1	LAMP, HPS, 100W
			9220144211	1	LUM, CL 113, 100W, HPS, CLERMONT
4	L95SV10TCH1SMF	1	250601	1	LAMP, HPS, 100W
			9220067357	1	BRACKET, SIDE, SINGLE, SCROLL ARM
			9220144211	1	LUM, CL 113, 100W, HPS, CLERMONT
5	L28KSV25TCH1F	1	250602	1	LAMP, HPS, 250W
			9220144212	1	LUM, CL 114, 250W, HPS, CLERMONT
6	L28KSV25TCH1SCF	1	240320	1	BRACKET, SINGLE, SHEPARD'S CROOK, FOR SANIB
			250602	1	LAMP, HPS, 250W
			9220144212	1	LUM, CL 114, 250W, HPS, CLERMONT
7	L28KSV25TCH1SMF	1	250602	1	LAMP, HPS, 250W
			9220067357	1	BRACKET, SIDE, SINGLE, SCROLL ARM
			9220144212	1	LUM, CL 114, 250W, HPS, CLERMONT
8	L28KSV25TCH1SRF	1	250602	1	LAMP, HPS, 250W
			9220067354	1	BRACKET, SINGLE, SCROLL ARM
			9220144212	1	LUM, CL 114, 250W, HPS, CLERMONT
9	L14KMH17TCH1NF *	1	250683	1	LAMP, 175W, MH
			9220144213	1	LUM, CL 115, 175W, MH, CLERMONT
10	L14KMH17TCH1SCF *	1	240320	1	BRACKET, SINGLE, SHEPARD'S CROOK, FOR SANIB
			250683	1	LAMP, 175W, MH
			9220144213	1	LUM, CL 115, 175W, MH, CLERMONT
11	L14KMH17TCH1SMF *	1	250683	1	LAMP, 175W, MH
			9220067357	1	BRACKET, SIDE, SINGLE, SCROLL ARM
			9220144213	1	LUM, CL 115, 175W, MH, CLERMONT
12	L14KMH17TCH1SRF *	1	250683	1	LAMP, 175W, MH
			9220067354	1	BRACKET, SINGLE, SCROLL ARM
			9220144213	1	LUM, CL 115, 175W, MH, CLERMONT
13	L12KPM15TCBL1F	1	9220183630	1	LAMP, 150W, MH
			9220183644	1	LUM, CL 115, 150W, MH, CLERMONT
14	L12KPM15TCBLSCF	1	240320	1	BRACKET, SINGLE, SHEPARD'S CROOK, FOR SANIB
			9220183630	1	LAMP, 15OW, MH
			9220183644	1	LUM, CL 115, 150W, MH, CLERMONT
15	L12KPM15TCBLSMF	1	9220183630	1	LAMP, 150W, MH
			9220067357	1	BRACKET, SIDE, SINGLE, SCROLL ARM
			9220183644	1	LUM, CL 115, 150W, MH, CLERMONT
16	L12KPM15TCBLSRF	1	9220183630	1	LAMP, 150W, MH
			9220067354	1	BRACKET, SINGLE, SCROLL ARM
			9220183644	1	LUM, CL 115, 150W, MH, CLERMONT

*THIS FIXTURE DISCONTINUED

ADDITIONAL PARTS - REPLACEMENT					
CU/CN ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
17	-	-	9220148457	1	BALLAST REPLACEMENT, 120V, 100W HPS
18	-	-	9220148458	1	BALLAST REPLACEMENT, 120V, 250W HPS
19	-	-	9220148463	1	BALLAST REPLACEMENT, 120V, 175W MH
20	-	-	9220209545	1	BALLAST REPLACEMENT, 120V, 150W, PULSE START MH
21	LPE120F	1	243104	1	REPLACEMENT PE CONTROL
22	-	-	9220148478	1	STARTER AID, 100W, HPS
23	-	-	9220148466	1	STARTER AID, 250W HPS AND 150W MH

NOTES:

1. SEE DWG. 30.08-09C FOR DESIGN SPECIFICATIONS.

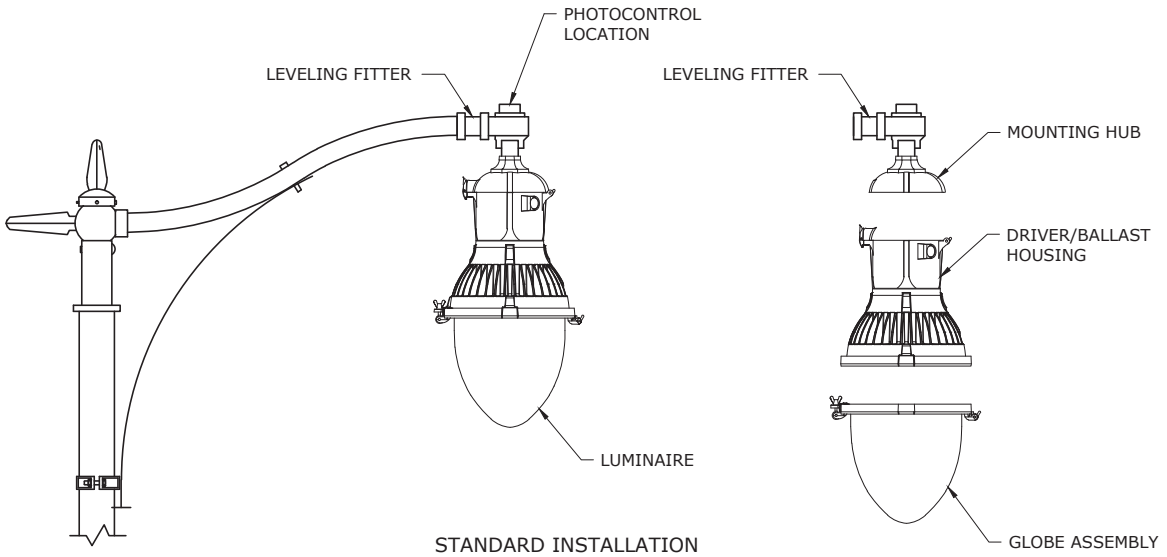
REVISED		BY	CK'D	APPR.
3				
2				
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN

LUMINAIRE, DECORATIVE, 100W HPS, 250W HPS AND 175W MH, THE CLERMONT HOLOPHANE

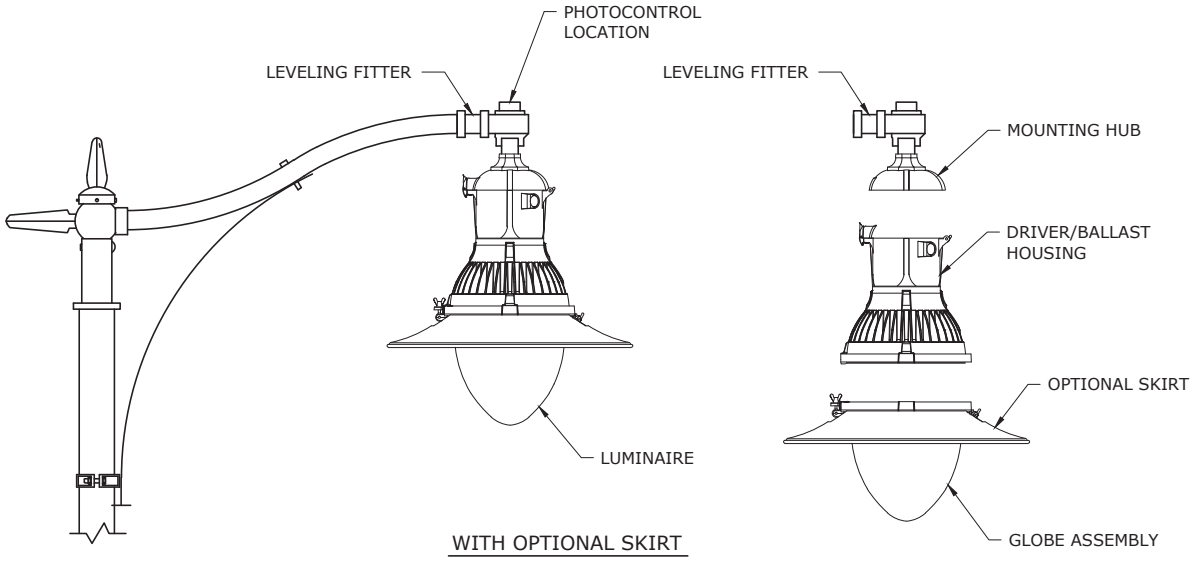
Progress Energy

FLA

DWG. 30.08-09D



STANDARD INSTALLATION



WITH OPTIONAL SKIRT

COMPATIBLE UNIT	ITEM NUMBER	DESCRIPTION
L39LED05TDBLMF	9220282828	LED TEARDROP LUMINAIRE SIDE MOUNT 50 WATT, BLACK
L85LED15TDBLMF	9220282862	LED TEARDROP LUMINAIRE SIDE MOUNT 150 WATT, BLACK
LGSLED05TDHLBLF	9220284515	GLARE SHIELD/SKIRT DEFLECTOR FOR PEDESTRIAN LED TEARDROP 50 WATT
LGSLED15TDHLBLF	9220284514	GLARE SHIELD/SKIRT DEFLECTOR FOR LARGE LED TEARDROP 150 WATT

NOTES:

1. LEVELING FITTER INCLUDED WITH LUMINAIRE.
2. BRACKET ORDERED SEPARATELY. SEE DWG. 30.02-28 FOR BRACKET DETAILS.
3. POLE ORDERED SEPARATELY. SEE DWG. 30.09-14 FOR POLE WITHOUT TENON TOP ADAPTER.
4. PHOTOCELL LOCATED EXTERNALLY ON LEVELING FITTER ON TEARDROP LUMINAIRE.
5. USE PHOTOCELL (ITEM # 9220208023) GREEN LONG LIFE FOR ALL LED LUMINAIRES.
6. DO NOT INSTALL LUMINAIRE BALLAST/DRIVER HOUSING AND GLOBE ASSEMBLY UNTIL POLE IS INSTALLED AND BACKFILLED.
7. TEN FEET OF LEAD WIRE INCLUDED WITH LUMINAIRE ASSEMBLY. MAKE UP CONNECTION AT POLE TOP.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	5/6/16	DEFREITAS	BLOCKER	COWLING

LED TEARDROP SIDE MOUNT LUMINAIRE

DEC	DEM	DEP	DEF
			X

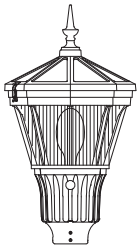
30.08-10

FIG. 1

FLAGLER BILL OF MATERIALS				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	L95SV10FG1F	241520	1	FLAGLER LUMINAIRE WITH ACRYLIC GLOBE, 100W, HPS
		250601	1	LAMP, HPS, 100 WATT

REPLACEMENT BALLAST				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	-	242163	1	100W, HPS FLAGLER BALLAST

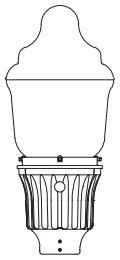
FIG. 2



MONTICELLO BILL OF MATERIALS				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	L95SV10MONT1F	241854	1	MONTICELLO W/CUTOFF OPTICS, GLASS REFRACTOR, 100W HPS
		250601	1	LAMP, HPS, 100 WATT

REPLACEMENT BALLAST				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	-	242163	1	100W, HPS MONTICELLO BALLAST

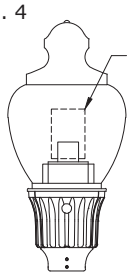
FIG. 3



BISCAYNE BILL OF MATERIALS				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QTY.	DESCRIPTION
1	L95SV10BC1F	241522	1	BISCAYNE LUMINAIRE WITH GLASS GLOBE, 100W, HPS
		250601	1	LAMP, HPS, 100 WATT
2	L12KMH17BC1F	241860	1	REMOVAL ONLY, BISCAYNE, LUMINAIRE W/ GLASS GLOBE, 175W, MH
		250683	1	LAMP, MH, 175W
3	L12KPM15BCBL1F	9220188699	1	BISCAYNE, LUMINAIRE W/ GLASS GLOBE, 150W, PULSE START MH, SEE LIGHTING SPECIALIST FOR APPLICATION
		9220183630	1	LAMP, PULSE START MH, 150W, MED. BASE

REPLACEMENT BALLAST				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QTY.	DESCRIPTION
1	-	242163	1	100W, HPS BISCAYNE BALLAST
2	-	242167	1	175W, MH, BISCAYNE BALLAST
3	-	9220209549	1	150W, PULSE START MH BISCAYNE, BALLAST

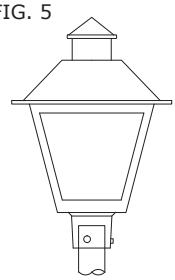
FIG. 4



OCALA BILL OF MATERIALS				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	L95SV10OC1F	241501	1	OCALA LUMINAIRE, BASE ONLY, 100W, HPS
		241502	1	ACRYLIC GLOBE
		250601	1	LAMP, HPS, 100 WATT

REPLACEMENT BALLAST				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	-	242163	1	100W, HPS OCALA BALLAST

FIG. 5



SEBRING BILL OF MATERIALS				
ITEM NO.	COMP. UNIT	CAT. NUMBER	QUANTITY	DESCRIPTION
1	L95SV10SB1F	241511	1	SEBRING LUMINAIRE, 100W, HPS
		250601	1	LAMP, HPS, 100W
2	L40SV05PT1F	241430	1	SEBRING LUMINAIRE, 50W, HPS
		250603	1	LAMP, HPS, 50W

NOTE: REPLACEMENT BALLASTS ARE NOT AVAILABLE FOR L95SV10PT1F AND L40SV05PT1F LIGHT FIXTURES.

NOTES:

1. USE PHOTOCELL CN 243104 FOR ABOVE LUMINAIRES.
2. SEE LIGHTING SPECIALIST FOR BISCAYNE 150W PULSE START MH APPLICATION.

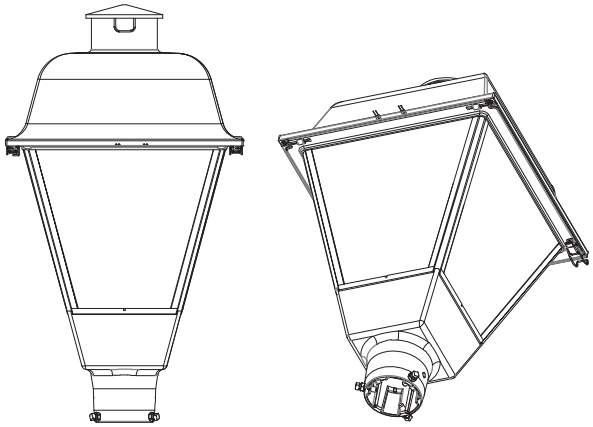
REVISED		BY	CK'D	APPR.
3				
2				
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN

DECORATIVE POST LUMINAIRES WITH NON-TRAFFIC RATED PEDESTAL CONSTRUCTION

Progress Energy

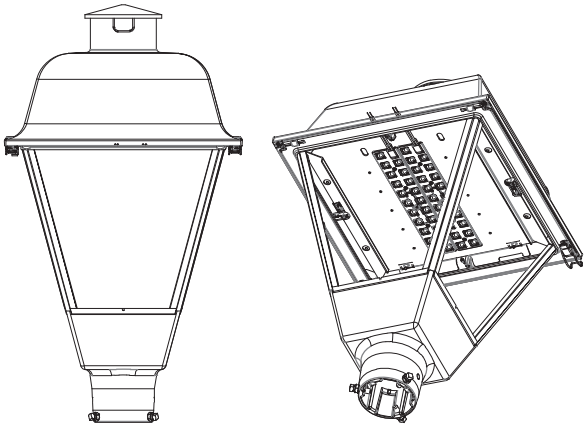
FLA

DWG. 30.08-13



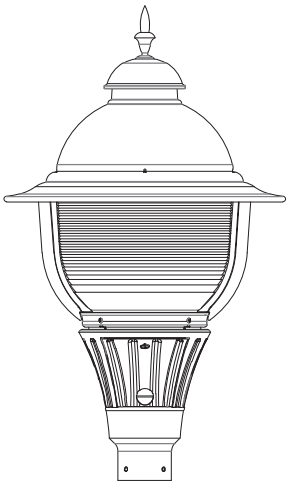
LED 50W
CU L24LED05TRMF
ITEM # 9220272280
TRADITIONAL (SEBRING), LED 50W

FIG. 1



LED 50W
CU L33LED05TROMF
ITEM # 9220272291
TRADITIONAL OPEN, LED 50W

FIG. 2

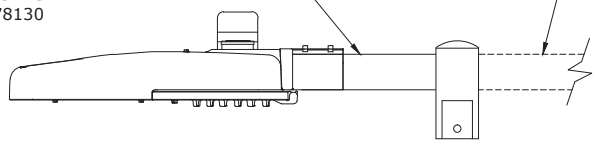


LED 50W
CU L29LED05BELLMF
ITEM # 9220272279
BELL LED 50W

FIG. 3

DUAL PEDESTRIAN SHOEBOX BRACKETS 2" PIPE
BLACK - CU LBKTDPMSBLF
ITEM # 9220278158
BRONZE - CU LBKTDPMSBRF
ITEM # 9220278134

SINGLE PEDESTRIAN SHOEBOX BRACKETS 2" PIPE
BLACK - CU LBKTSPMSBLF
ITEM # 9220278129
BRONZE - CU LBKTSPMSBRF
ITEM # 9220278130



LED 50W
L31LED05PMSBLMF
ITEM # 9220273342
SHOEBOX PEDESTRIAN, 50W BLACK

LED 50W
L31LED05PMSBRMF
ITEM # 9220273343
SHOEBOX PEDESTRIAN, 50W BRONZE

FIG. 4

NOTES:

1. USE PHOTOCELL (ITEM # 9220208023, CU LPE3FOF) GREEN LONG LIFE FOR ALL LED LUMINAIRES.
2. ALL POST TOP LUMINAIRES REQUIRE 3" X 3" TENON.
3. DO NOT INSTALL LED POST TOP LUMINAIRES ON FIBERGLASS POLES.
4. USE POST TOP BRACKET (ITEM # 240365, CU LBKTPTOP36DBF) FOR DUAL LIGHT APPLICATION.

3				
2				
1				
0	4/6/16	DEFREITAS	BLOCKER	COWLING
REVISED		BY	CK'D	APPR.

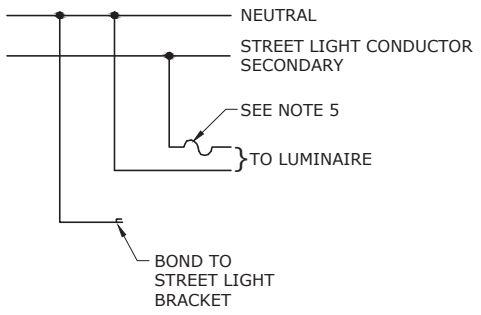
LED POST MOUNTED
LUMINAIRE IDENTIFICATION

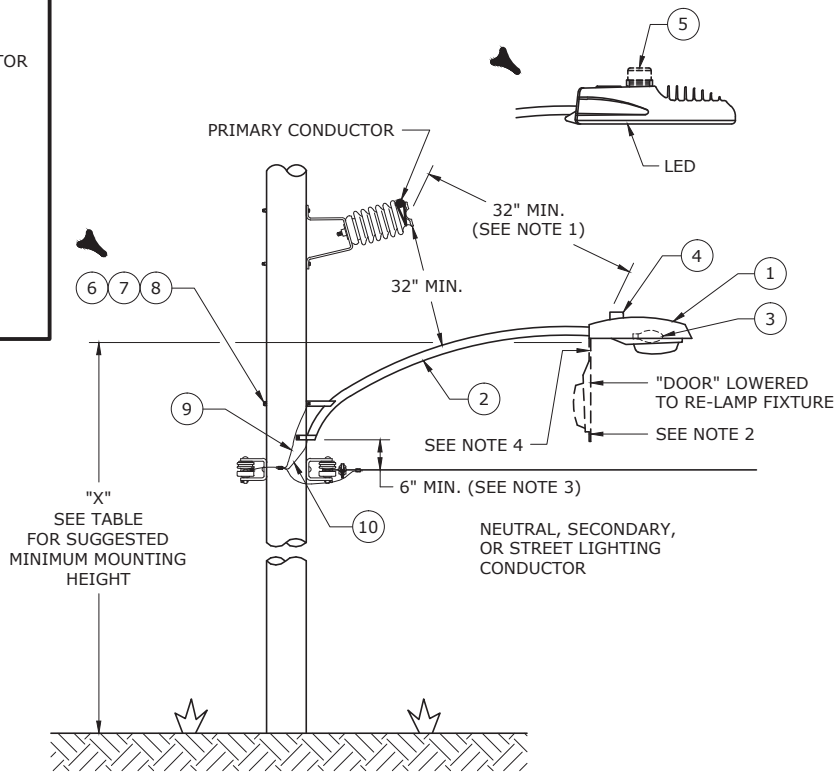
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

30.08-15

WIRING SCHEMATIC





ITEM	QUANTITY		CATALOG NUMBER	DESCRIPTION
	WITH TIE RODS	W/O TIE RODS		
1	1	1	-	LUMINAIRE, ROADWAY (VARIES WITH CLASS)
2	1	1	-	BRACKET, STREET LIGHT (VARIES WITH LENGTH)
3	1	1	-	LAMP (VARIES WITH CLASS)
4	1	1	241104	PHOTOELECTRIC CELL
5	1	1	9220208023	PHOTOELECTRIC CELL, GREEN, FAIL OFF
6	3	2	013308	WASHER, SQUARE FLAT, 5/8"
7	3	2	152107	BOLT, MACHINE, 5/8" X 12"
8	3	2	013264	WASHER, SPRING COIL, 5/8"
9	1	1	190404	WIRE, COPPER, #6 SOFT DRAWN (FEET) (GROUND WIRE)
10	15	10	-	CABLE, STREET LIGHTING #6 ALUMINUM

SUGGESTED MINIMUM MOUNTING HEIGHTS

50-100 W HPS 95 W LED		150-400 W HPS 157 W LED	
BRACKET LENGTH	X	BRACKET LENGTH	X
20"	23'-0"	20"	27'-6"
* 4'	22'-2"	*4'	26'-0"
6'	22'-2"	6'	26'-0"
* 8'	22'-2"	*8'	26'-0"
10'	22'-2"	10'	26'-0"
*12'	22'-2"	*12'	26'-0"
*14'	22'-2"	*14'	26'-0"

ON 40'-3Ø VERTICAL CONSTRUCTION "X" IS TO BE REDUCED TO PROVIDE CLEARANCE TO PRIMARY. LUMINARIES ON OPPOSITE SIDE OF ROAD SHOULD ALSO BE LOWERED.

*MAINTENANCE ONLY

NOTES:

1. THIS MINIMUM DISTANCE (32") MUST BE MAINTAINED FROM THE PRIMARY CONDUCTORS TO ANY PART OF THIS LUMINAIRE A PERSON MUST TOUCH TO RE-LAMP OR TO REPLACE THE PHOTOCONTROL.
2. NO MINIMUM DISTANCE SPECIFIED - "DOOR" MUST NOT TOUCH AND CONDUCTOR LOCATED BELOW LUMINAIRE.
3. WHEN SPECIFIED BY ENGINEER, LIGHTING UNIT MAY BE INSTALLED AT SECONDARY LEVEL, OPPOSITE THE SECONDARY TO AVOID REPLACING AN EXISTING POLE.
4. A WATTAGE STICKER IS SUPPLIED WITH FIXTURE.
5. INSTALL 20 AMP FLAG FUSE IN SUPPLY LINE OF LUMINARIES THAT ARE CONTROLLED BY MULTIPLE RELAY.
6. FOR SECONDARY LIGHTNING ARRESTER APPLICATIONS SEE DWG. 30.08-36.
7. SEE SECTION 09 FOR REQUIRED CLEARANCES BETWEEN BRACKET AND FOREIGN ATTACHMENTS.
8. AVOID INSTALLATIONS ON SWITCH POLES.
9. USE PHOTOCELL CN 9220208023 FAIL OFF, GREEN FOR LED LUMINAIRES.

REVISED	BY	CK'D	APPR.
3			
2			
1 6/26/12	DEFREITAS	JUDAH	LARSEN
0 7/26/10	DEFREITAS	JUDAH	LARSEN

LUMINAIRE, ROADWAY WITH BRACKET

Progress Energy

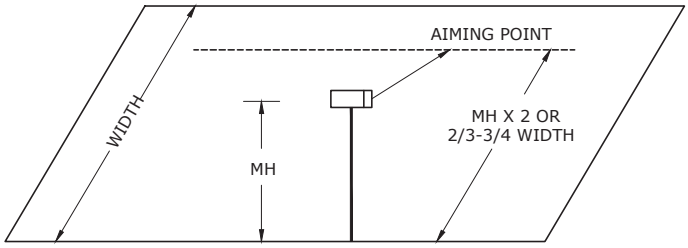
FLA

DWG. 30.08-19

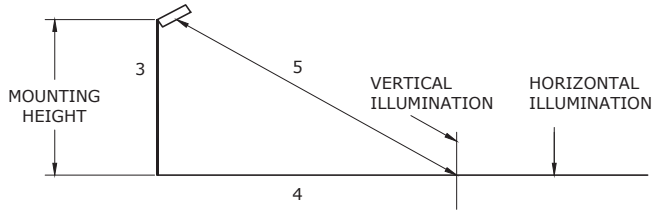
FLOODLIGHT AIMING INSTRUCTIONS

VERTICAL AIMING

FOR NORMAL AREA LIGHTING THE AIMING POINT SHOULD BE 2/3 - 3/4 THE DISTANCE ACROSS THE AREA OR TWICE THE MOUNTING HEIGHT WHICHEVER IS THE LOWEST VALUE. HIGHER AIMING ANGLES WILL NOT IMPROVE UTILIZATION OR UNIFORMITY.



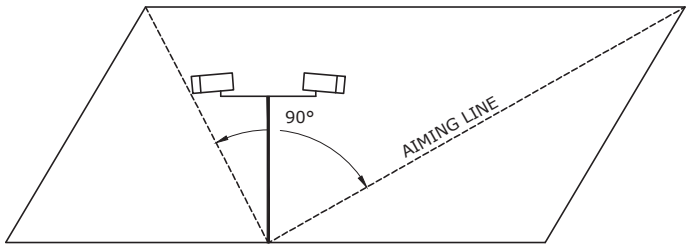
THE HIGHEST LEVEL A FLOODLIGHT CAN PRODUCE AT A DISTANCE FROM THE POLE OCCURS WHEN THE MAXIMUM INTENSITY OR CANDLEPOWER IS AIMED TO FORM APPROXIMATELY A 3, 4, 5 TRIANGLE. THIS IS USEFUL WHEN DETERMINING SETBACK FOR BUILDING FLOODLIGHTING.



ILLUMINATION ON VERTICAL SURFACES IS OFTEN AS IMPORTANT AS HORIZONTAL ILLUMINATION. THIS IS ESPECIALLY TRUE IN OUTDOOR WORK AREA AND SECURITY LIGHTING. THE VERTICAL ILLUMINATION IN LINE WITH THE FLOODLIGHT CAN BE DETERMINED BY THE RATIO OF THE HORIZONTAL DISTANCE TO THE MOUNTING HEIGHT. IF, FOR EXAMPLE, THE HORIZONTAL DISTANCE IS TWICE THE MOUNTING HEIGHT, THE VERTICAL ILLUMINATION WILL BE TWICE THE HORIZONTAL.

HORIZONTAL AIMING

COMPANY FLOODLIGHTS WILL EFFECTIVELY LIGHT AN AREA 45 DEGREES ON EITHER SIDE OF THE AIMING LINE. PERIMETER POLES THEREFORE SHOULD HAVE TWO FLOODLIGHTS TO ADEQUATELY COVER THE FULL 180 DEGREES (AREA IN FRONT OF AND TO THE SIDES OF THE FLOODLIGHT). INTERIOR POLES SHOULD HAVE FOUR FLOODLIGHTS TO COVER THE AREA IN ALL DIRECTIONS.



NOTES:

1. SEE DWG. 30.13-07 FOR SHIELD INFORMATION.

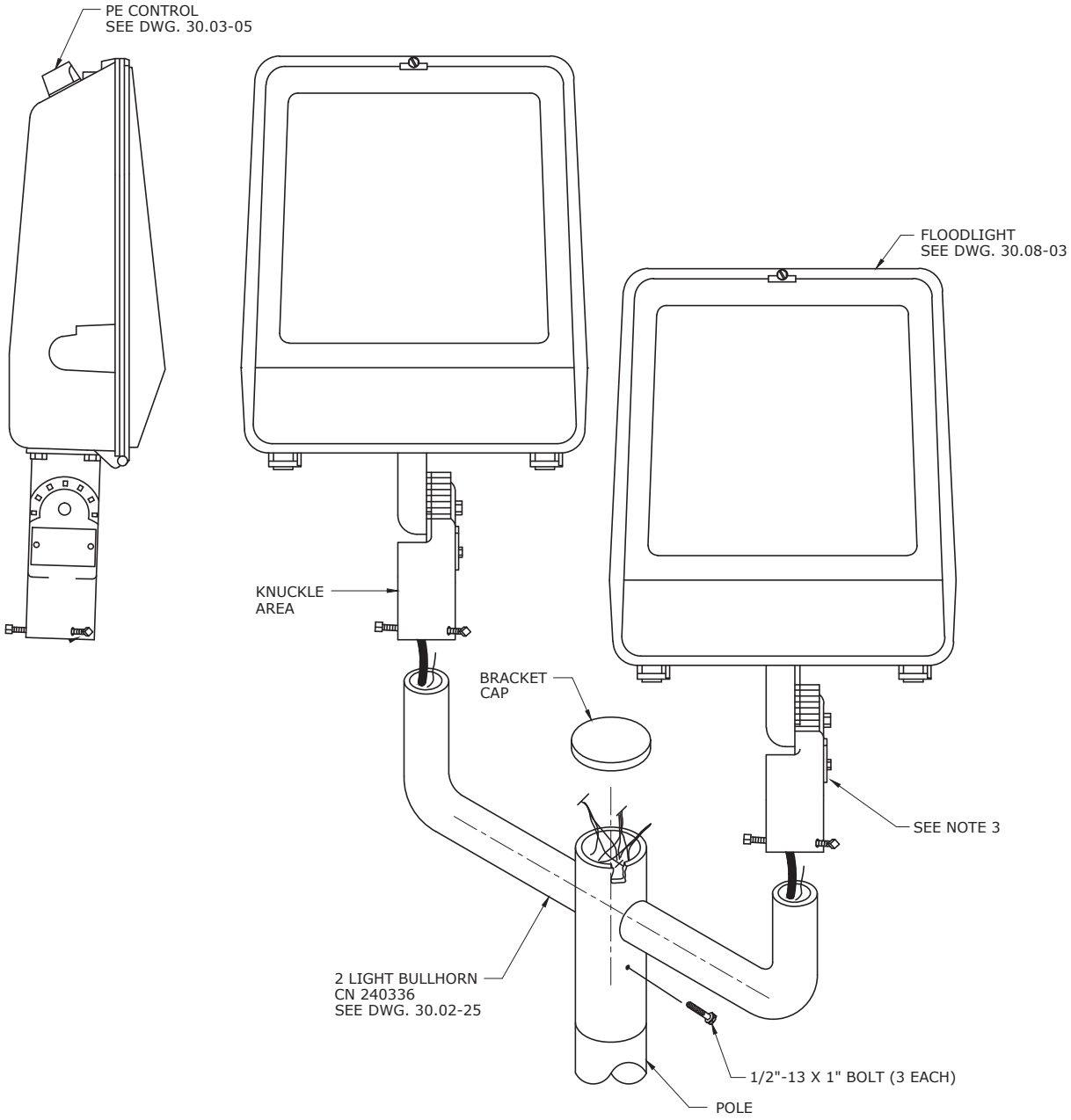
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

FLOODLIGHT AIMING INSTRUCTIONS

Duke Energy®

FLA

DWG. 30.08-25



NOTES:

1. DO NOT MOUNT FLOODLIGHT FIXTURE DIRECTLY FACE DOWN OR DIRECTLY FACE UP POSITION, PARALLEL TO GROUND. THIS CAN CAUSE OVERHEATING OF FIXTURE, AND SUBSEQUENT PREMATURE FAILURES OF INTERNAL BALLAST AND/OR OTHER COMPONENTS.

2. FIXTURE CAN BE MOUNTED TO ANY BRACKET IN FIG. 8, SEE DWG. 30.02-25.

3. IF CONDUCTOR PIGTAILS ARE NOT REQUIRED AND SEPARATE CONDUCTOR IS PULLED TO FIXTURE, PIGTAIL CAN BE REMOVED. A WIRING ACCESS PLATE AT SIDE OF KNUCKLE AREA CAN BE REMOVED TO ACCESS CONDUCTOR CONNECTIONS. REMOVE PIGTAIL CABLE AND RECONNECT NEW SERVICE CONDUCTOR.

4. FIXTURES ARE PROVIDED WITH 36" LONG CONDUCTOR PIGTAILS.

5. SEE DWG. 30.13-07 FOR SHIELD INFORMATION.

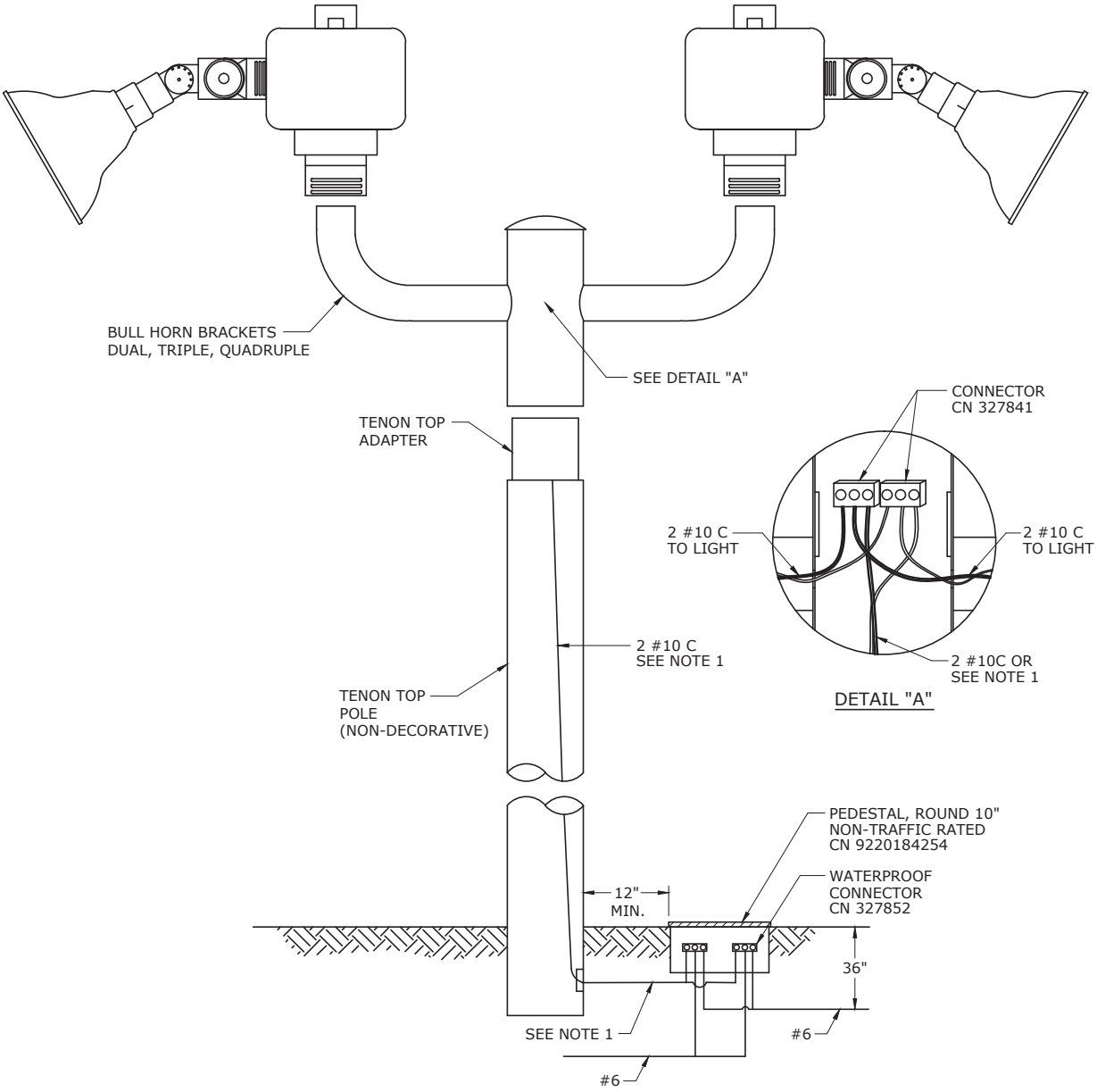
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

DIRECTIONAL FLOODLIGHTS WITH KNUCKLE-SLIPFITTER, TENON-TOP MOUNT, (CLASS 29 & 30, HPS) (CLASS 68 & 79 MH)

Duke Energy®

FLA

DWG. 30.08-27



NOTES:

1. WHEN THREE OR MORE SPORTS LIGHTS ARE INSTALLED ON THE SAME POLE, #6 AL IS REQUIRED.
2. FOR PEDESTAL DETAILS, SEE DWG. 30.07-36.
3. FOR BRACKET DETAILS, SEE DWG. 30.02-25.

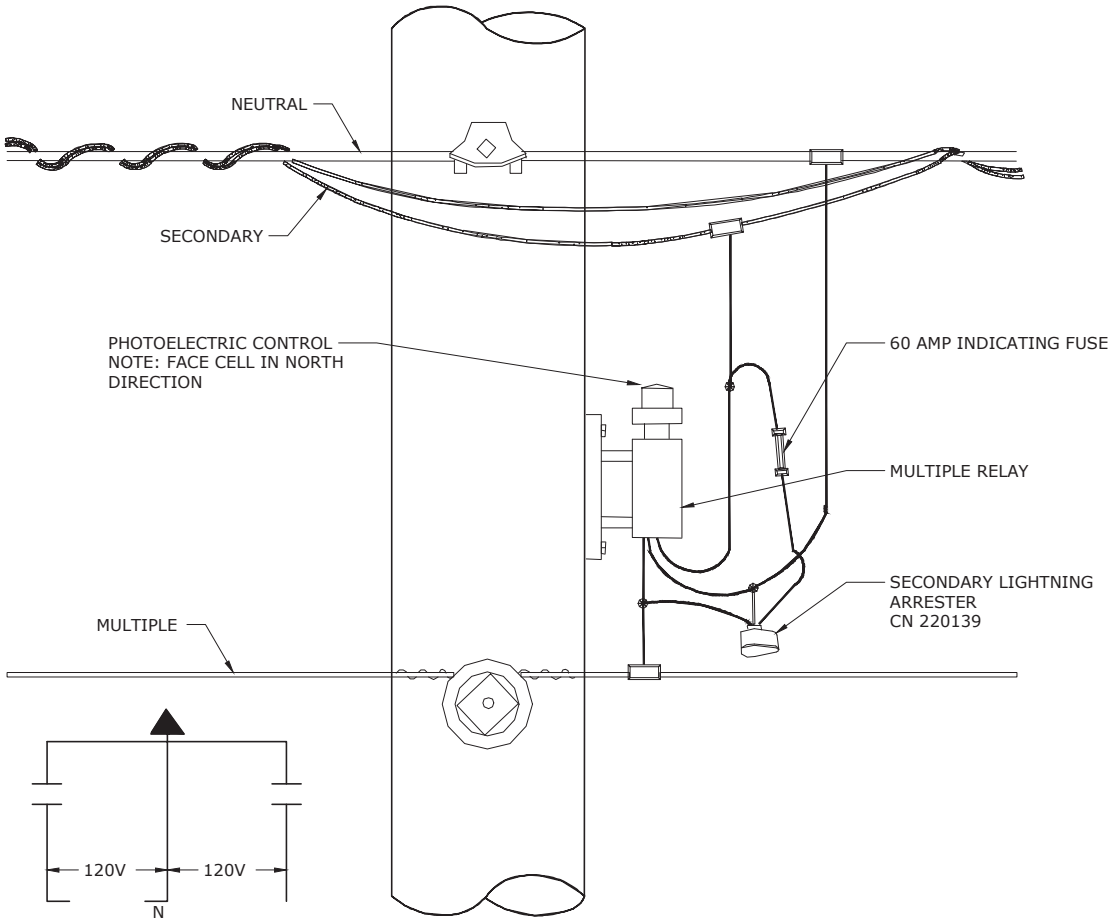
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

METAL HALIDE SPORTS LIGHT
(CLASS 69)

Duke Energy®

FLA

DWG. 30.08-28



G.E. ARRESTER SCHEMATIC
CN 220139

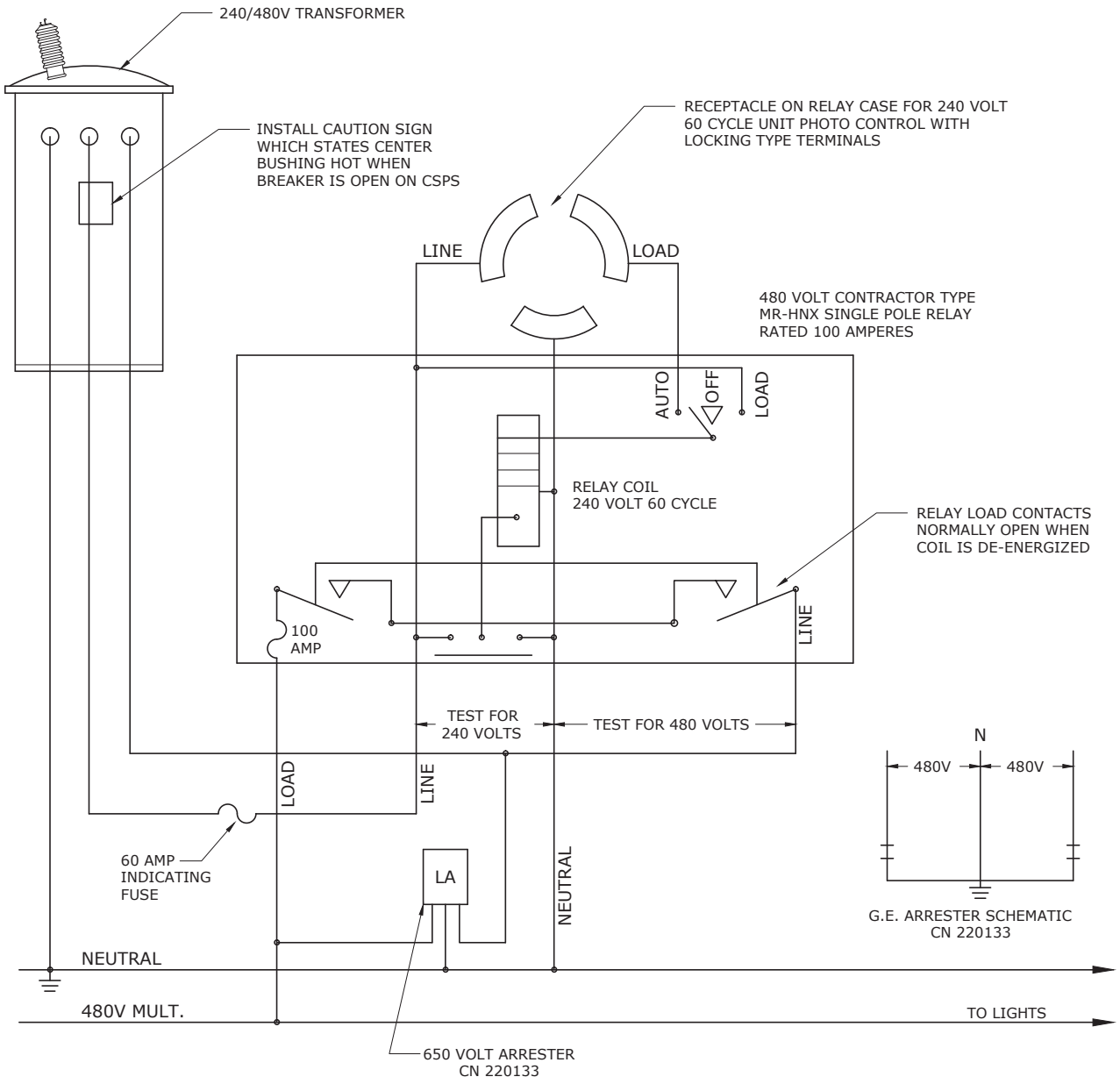
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

INSTALLATION DETAIL, 120 VOLT MULTIPLE RELAY AND P.E. CELL

Duke Energy®

FLA

DWG. 30.08-31



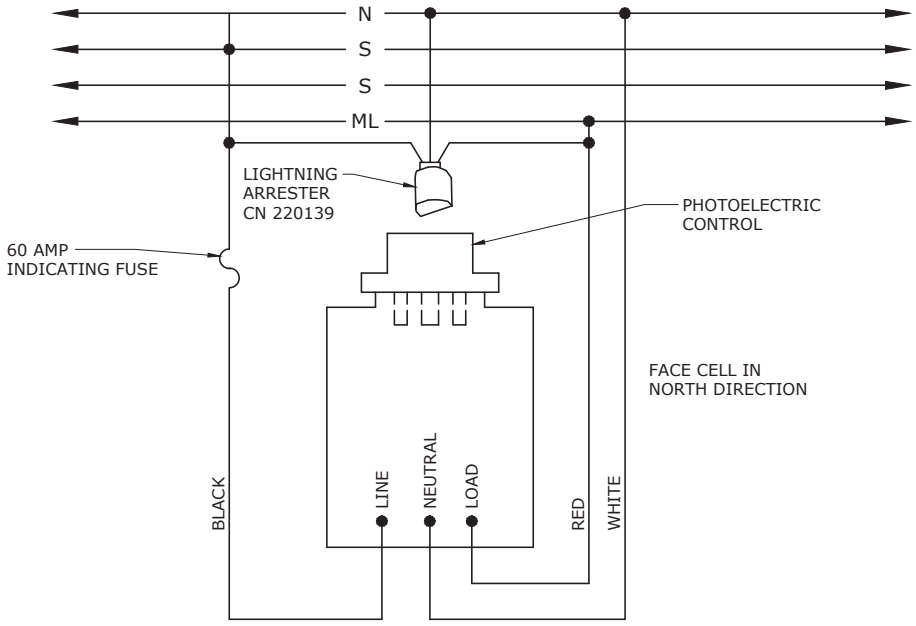
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

INSTALLATION DETAIL, TWIN 100 AMP., 480 VOLT MULTIPLE RELAY

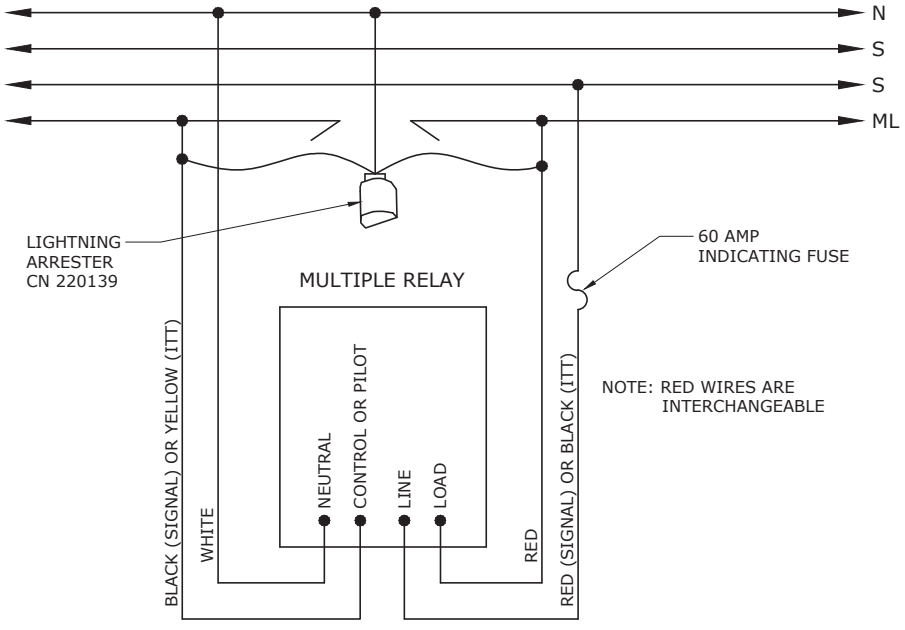
Duke Energy®

FLA

DWG. 30.08-32



MULTIPLE RELAY CONTROLLED
WITH P.E. CELL



FISHER PIERCE AND AMERICAN ELECTRIC
(SIGMA INSTRUMENTS, INC) (ITT)

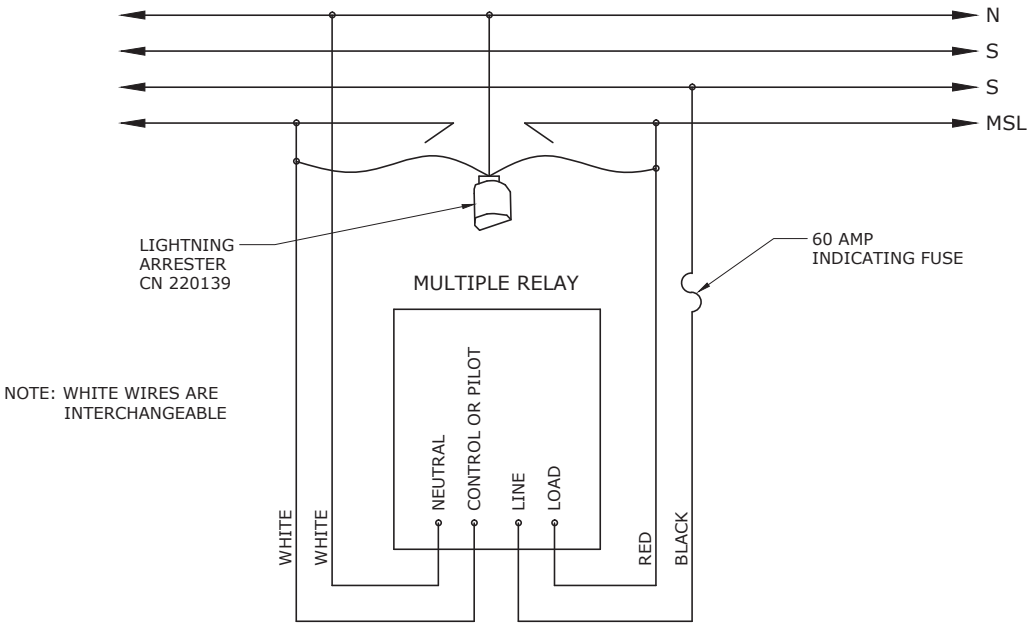
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

SCHEMATIC DIAGRAMS
PHOTOELECTRIC MULTIPLE RELAY
CONTROLS FOR 120 VOLT CIRCUITS

Duke Energy®

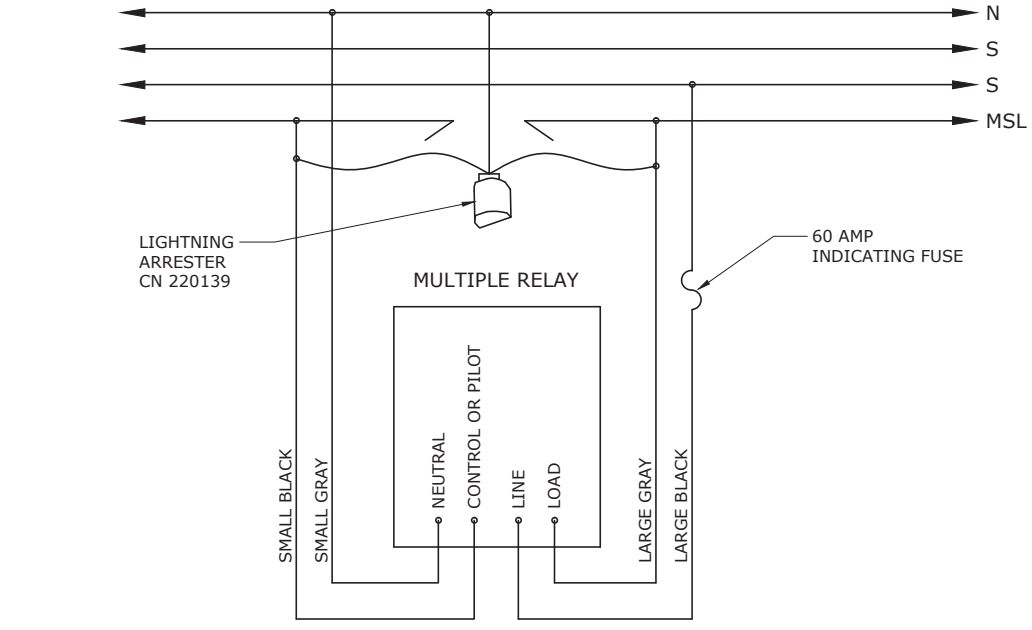
FLA

DWG.
30.08-33



NOTE: WHITE WIRES ARE INTERCHANGEABLE

PRECISION MULTIPLE CONTROLS
(PERMATROL)



RIPLEY CO., INC.

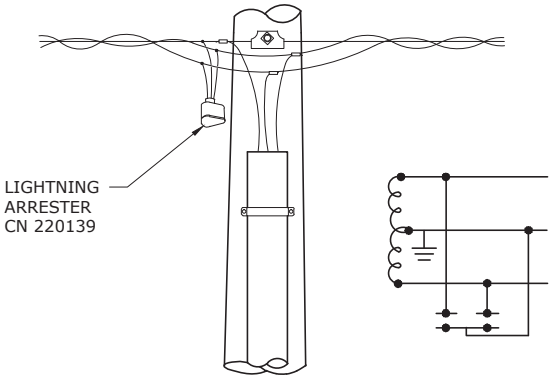
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

SCHEMATIC DIAGRAMS
PHOTOELECTRIC MULTIPLE RELAY
CONTROLS FOR 120 VOLT CIRCUITS

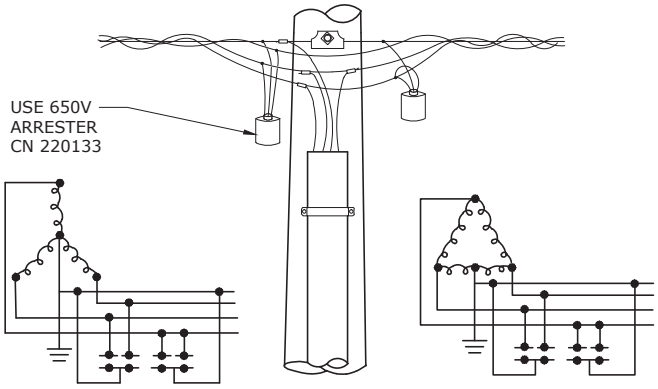
Duke Energy®

FLA

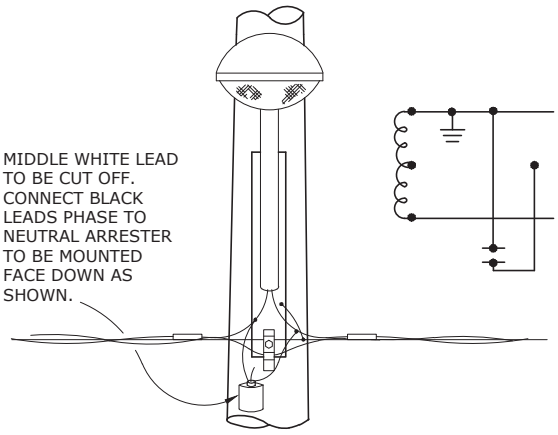
DWG. 30.08-35



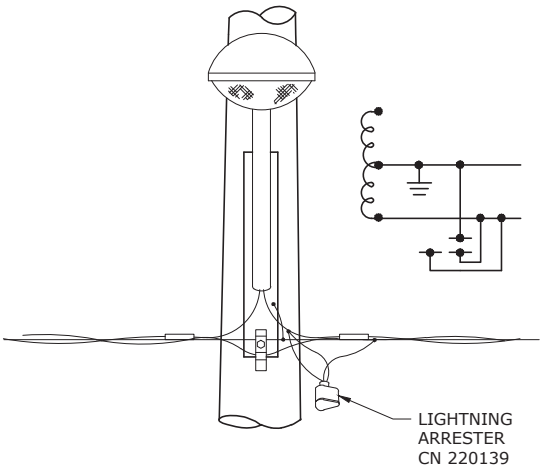
SINGLE-PHASE UNDERGROUND
RISER OVERHEAD FEED



THREE-PHASE UNDERGROUND
WYE OR DELTA OVERHEAD FEED
120/209V OR 277/480V



480V MULTIPLE STREET LIGHT



120V MULTIPLE STREET LIGHT

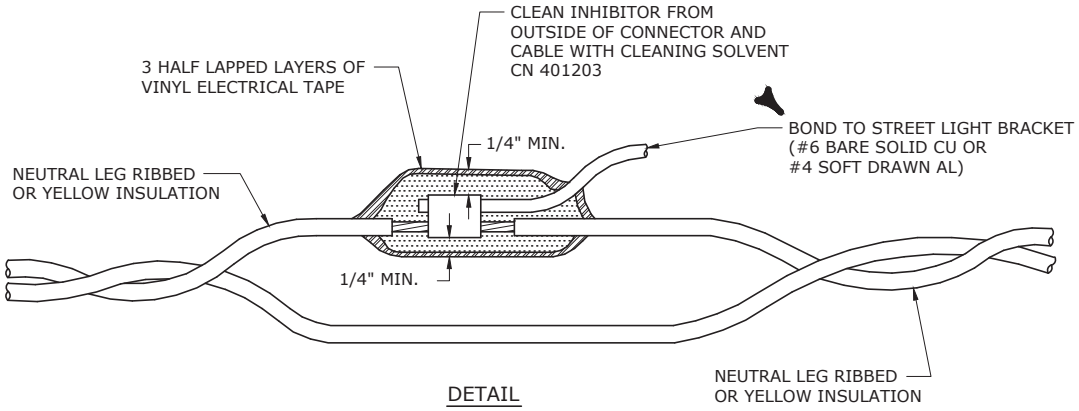
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

PROPER INSTALLATION OF SECONDARY LIGHTNING ARRESTERS WHEN SPECIFIED

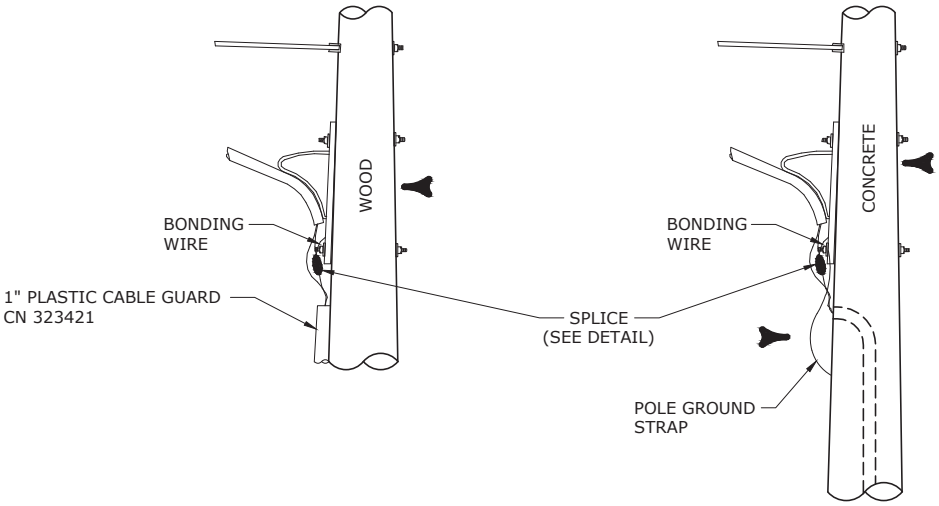
Duke Energy®

FLA

DWG. 30.08-36



DETAIL



NOTES:

1. BOND STREET LIGHT BRACKET TO SYSTEM NEUTRAL.

2. ON CONCRETE POLES, BOND POLE GROUND STRAP TO STREET LIGHT BRACKET.

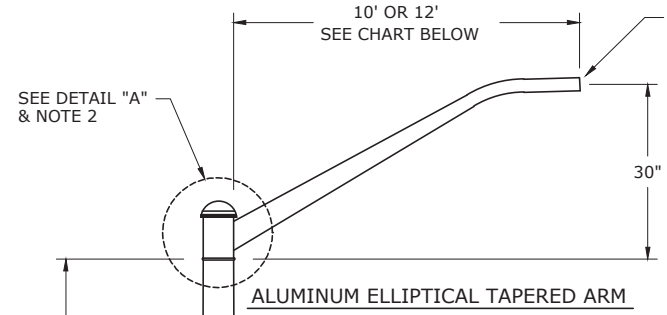
3				
2				
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

TYPICAL SPLICE FOR STREET LIGHT INSTALLATION
USING UNDERGROUND CABLE

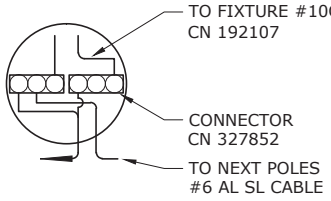
Progress Energy

FLA

DWG.
30.08-37

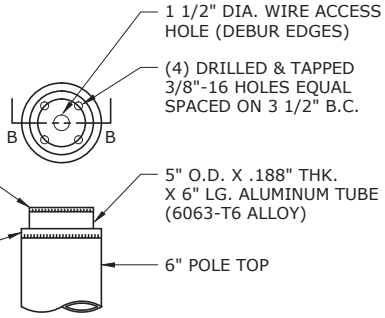


ALUMINUM ELLIPTICAL TAPERED ARM



ELECTRICAL CONNECTION
DETAIL "C"

LIGHTPOLE SHAFT FABRICATED FROM 6063-T4 ALUMINUM ALLOY TUBE (LIGHTPOLE ASSEMBLY IS HEAT TREATED TO T6 CONDITION AFTER WELDING)

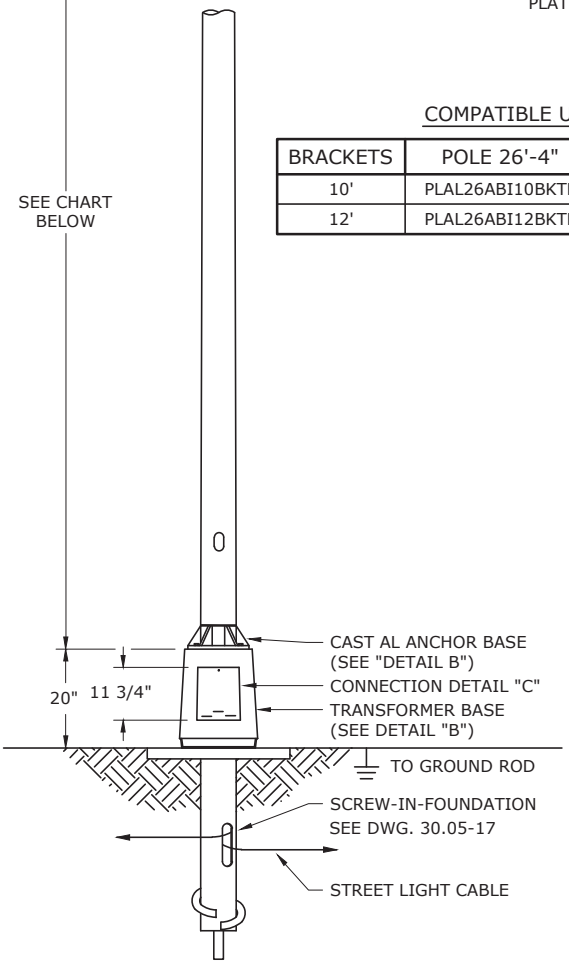


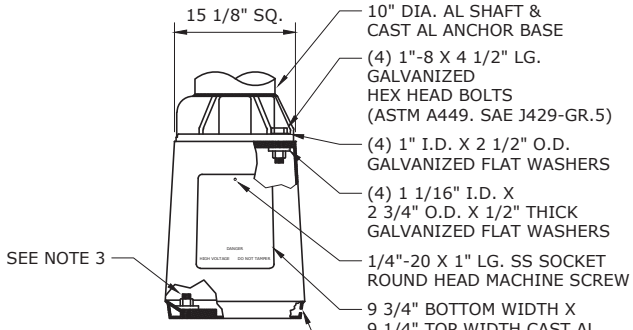
DETAIL "A"

COMPATIBLE UNIT

BRACKETS	POLE 26'-4"	POLE 36'-4"
10'	PLAL26ABI10BKTF	PLAL36ABI10BKTF
12'	PLAL26ABI12BKTF	PLAL36ABI12BKTF

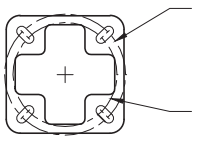
SEE CHART BELOW



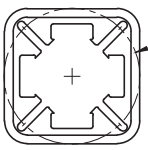


TRANSFORMER BASE
DETAIL "B"
CN 036218

CN	LENGTH	WEIGHT
036160	26'-4"	220 LBS.
036162	36'-4"	392 LBS.



TOP BOLT CIRCLE



BOTTOM BOLT CIRCLE

NOTES:

1. TRANSFORMER BASE AND LIGHTPOLE TO BE LEVELED AS ONE UNIT, USING LEVELING SHIMS IF REQUIRED.
2. BRACKET SUPPLIED WITH 3/8"-16 UNC X 2" ZP GRADE 8 HIGH STRENGTH HEX HEAD CAP SCREWS WITH (4) LOCK WASHERS AND (4) FLAT WASHERS.
3. HARDWARE FOR SECURING T-BASE TO SCREW ANCHOR IS SUPPLIED WITH SCREW ANCHOR.
4. LUMINAIRE AND BRACKET MUST BE INSTALLED IMMEDIATELY AFTER POLE INSTALLATION.

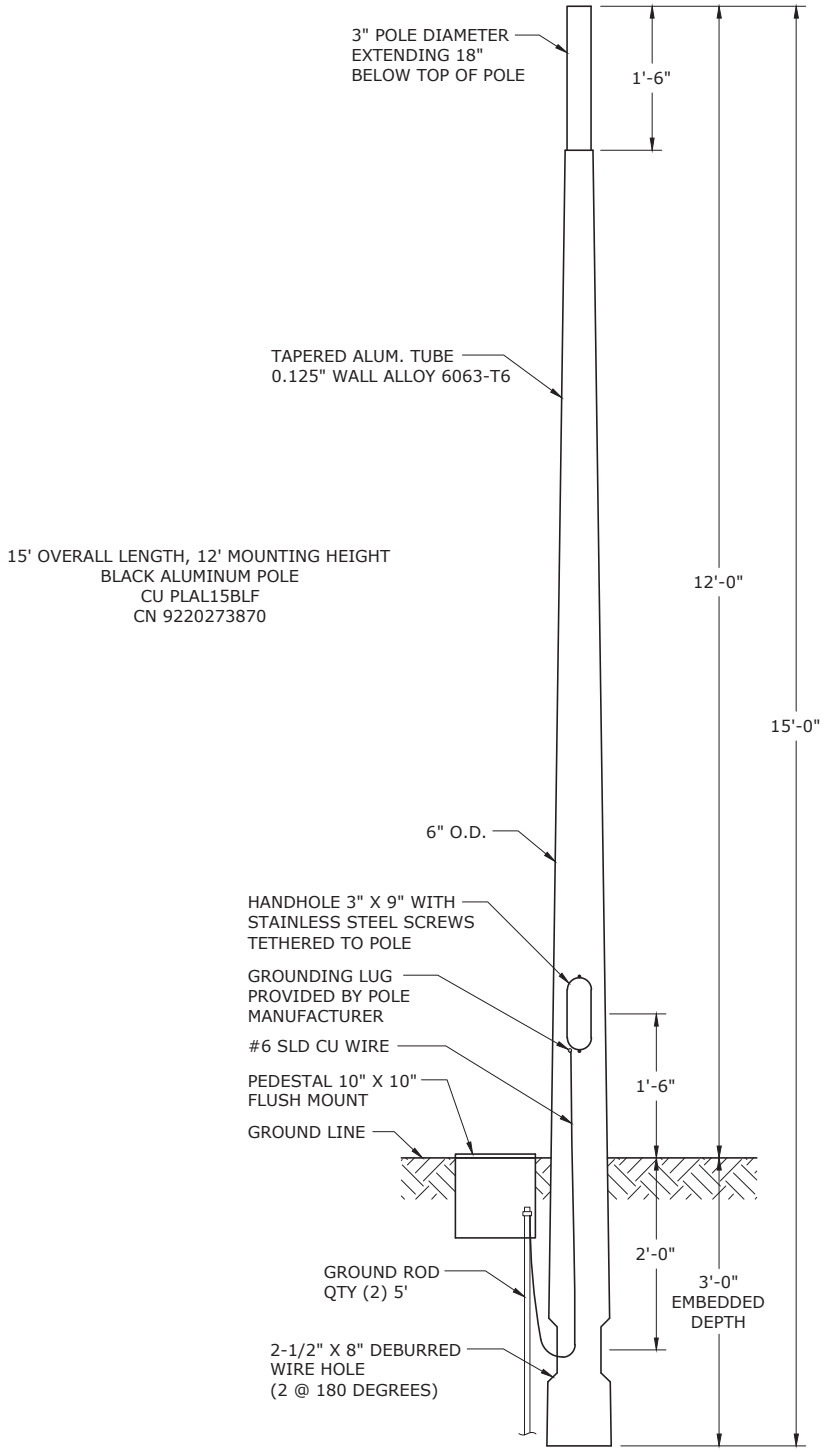
3				
2				
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

ALUMINUM FRANGIBLE POLE

Progress Energy

FLA

DWG. 30.09-06



NOTES:

1. POLES ARE BLACK POWDER COATED.

2. NO BANNER ARM OR RECEPTACLES PERMITTED ON ALUMINUM POLES.

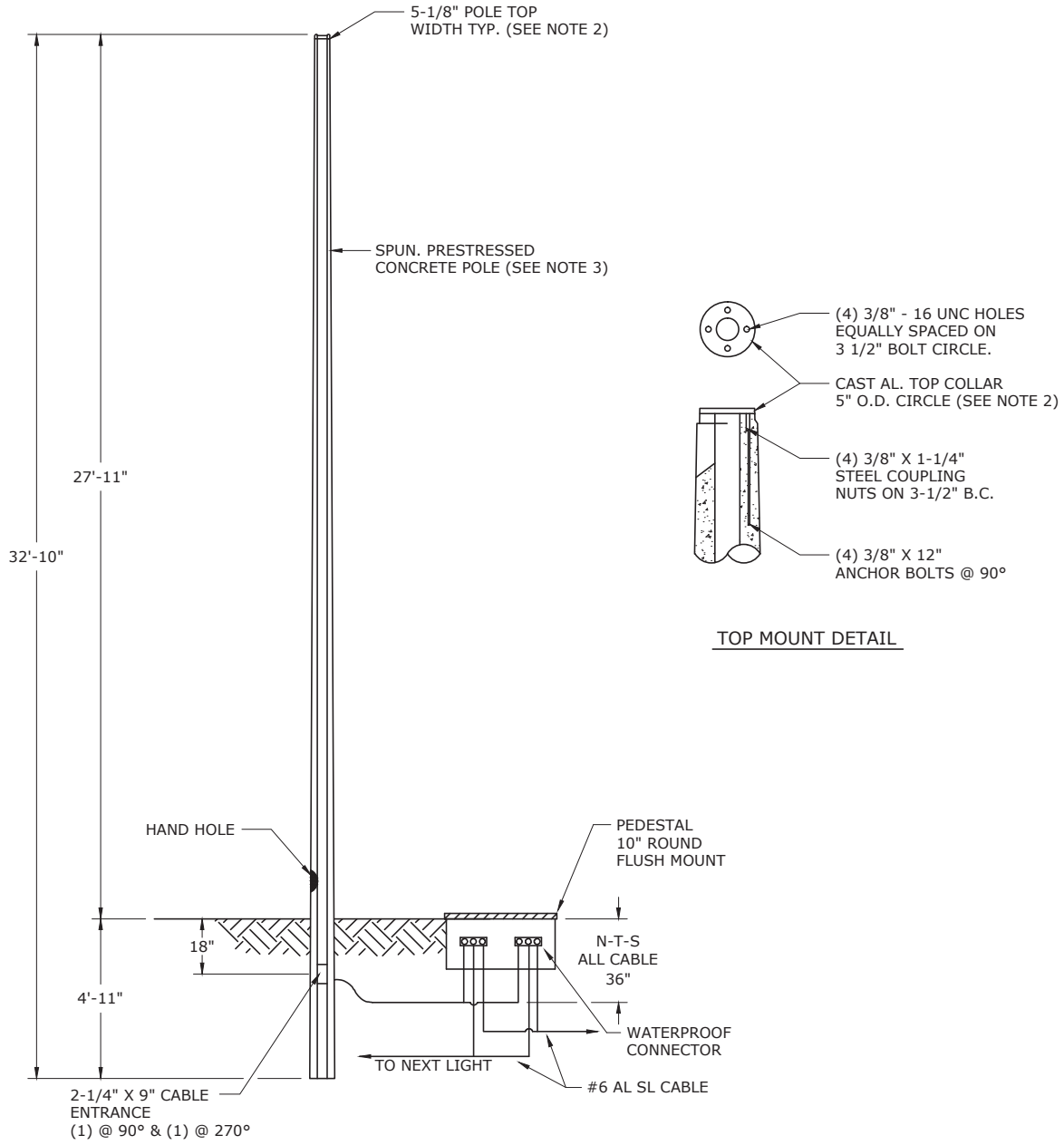
3. A DRIVEN GROUND, 2 - 5' RODS, SHALL BE INSTALLED AND INTERCONNECTED WITH THE NEUTRAL CONDUCTOR WITHIN THE PEDESTAL. USE CU GUAS6F (#6 SLD CU WIRE), CU GURODFRF (5' ROD AND CONNECTOR), CU GUAR1F (ADDITIONAL ROD).

3				
2				
1				
0	1/27/14	DEFREITAS	COWLING	HENSON
REVISED		BY	CK'D	APPR.

ALUMINUM LIGHTING POST
DIRECT EMBEDDED
15' OVERALL LENGTH WITH 3" POLE TOP

DEC	DEM	DEP	DEF
			X

30.09-07



TOP MOUNT DETAIL

CU PLCC32F
CN 034145

NOTES:

1. FINISH #6F3 AMERON COLOR MIX.
2. POLE COLLAR TO BE ROUND.
3. ANTI-GRAFFITI FINISH.
4. STREET LIGHT POLE BRACKET (NOT SHOWN), 6' ELLIPTICAL CN 034179, COLOR BLACK, SEE FIGURES ON DWG. 30.02-25.
5. POLE WEIGHT: 1,250 LBS.
6. FOR PEDESTAL CONSTRUCTION, SEE DWG. 30.07-36.
7. POLE FOR USE WITH 6 FT. BLACK BRACKET CN 034179 AND 250W HPS BLACK ROADWAY FIXTURE CN 241551 ONLY.

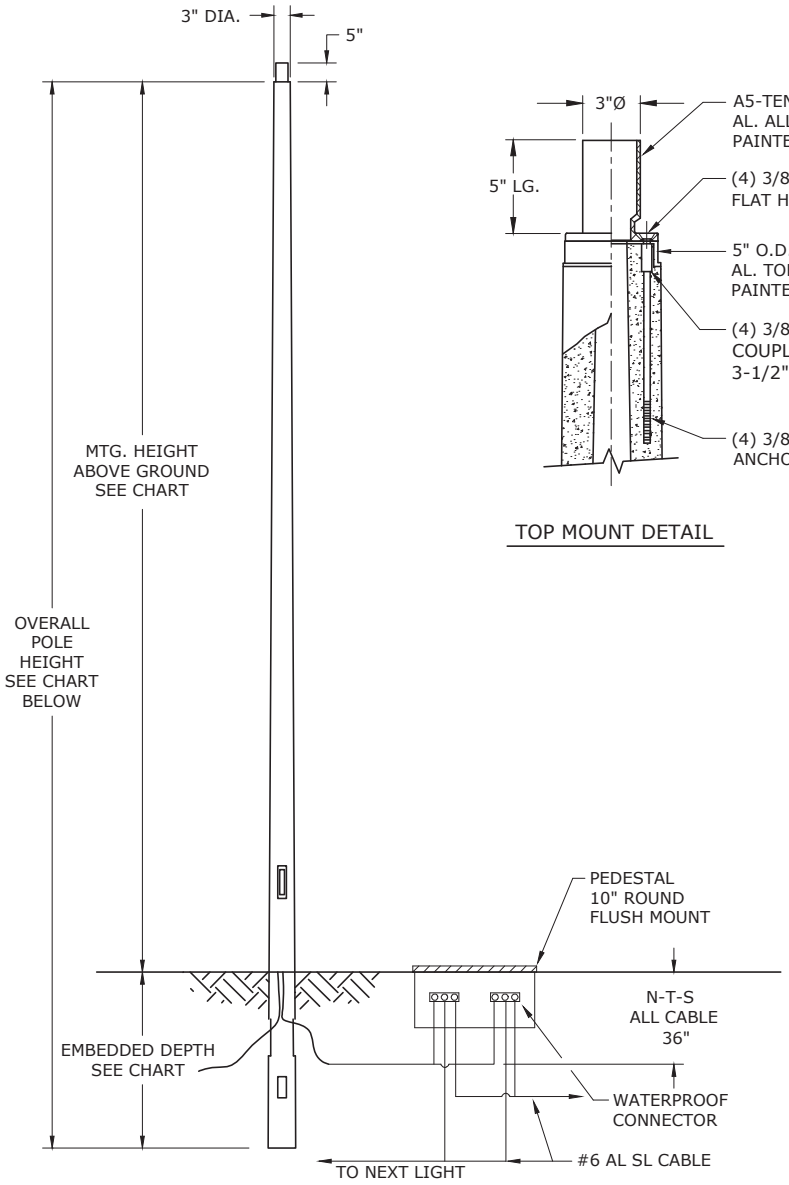
3				
2				
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

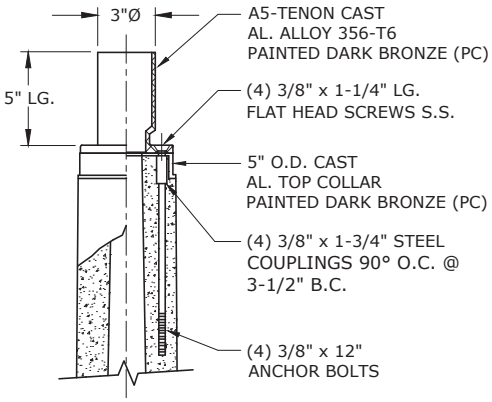
OCTAGONAL MAITLAND DECORATIVE CONCRETE STREET LIGHT POLE - 32'-10"

Progress Energy

FLA

DWG. 30.09-12





TOP MOUNT DETAIL

CATALOG NUMBER	LENGTH	WEIGHT	EMBEDDED DEPTH	COMPATIBLE UNIT	COMPATIBLE UNIT W/O TENON TOP ADAPTER	MOUNTING HEIGHT
9220087189	24'-7"	710 LBS	4'-11"	PLCC25BRBZTAF	PLCC25BRF	19'-8"
034133	29'-6"	950 LBS	4'-11"	PLCC30BRBZTAF	PLCC30BRF	24'-7"
034134	34'-9"	1200 LBS	5'-3"	PLCC35BRBZTAF	PLCC35BRF	29'-6"
034135	42'-8"	1980 LBS	6'-8"	PLCC41BRBZTAF	PLCC41BRF	36'-0"

NOTES:

1. POLES FOR AREA LIGHTING CONSTRUCTION, SEE DWG. 30.08-02 FOR FIXTURES.
2. FOR PEDESTAL DETAILS, SEE DWG. 30.07-36.
3. USE CU "W/O TENON TOP ADAPTER" FOR CLERMONT FIXTURE.

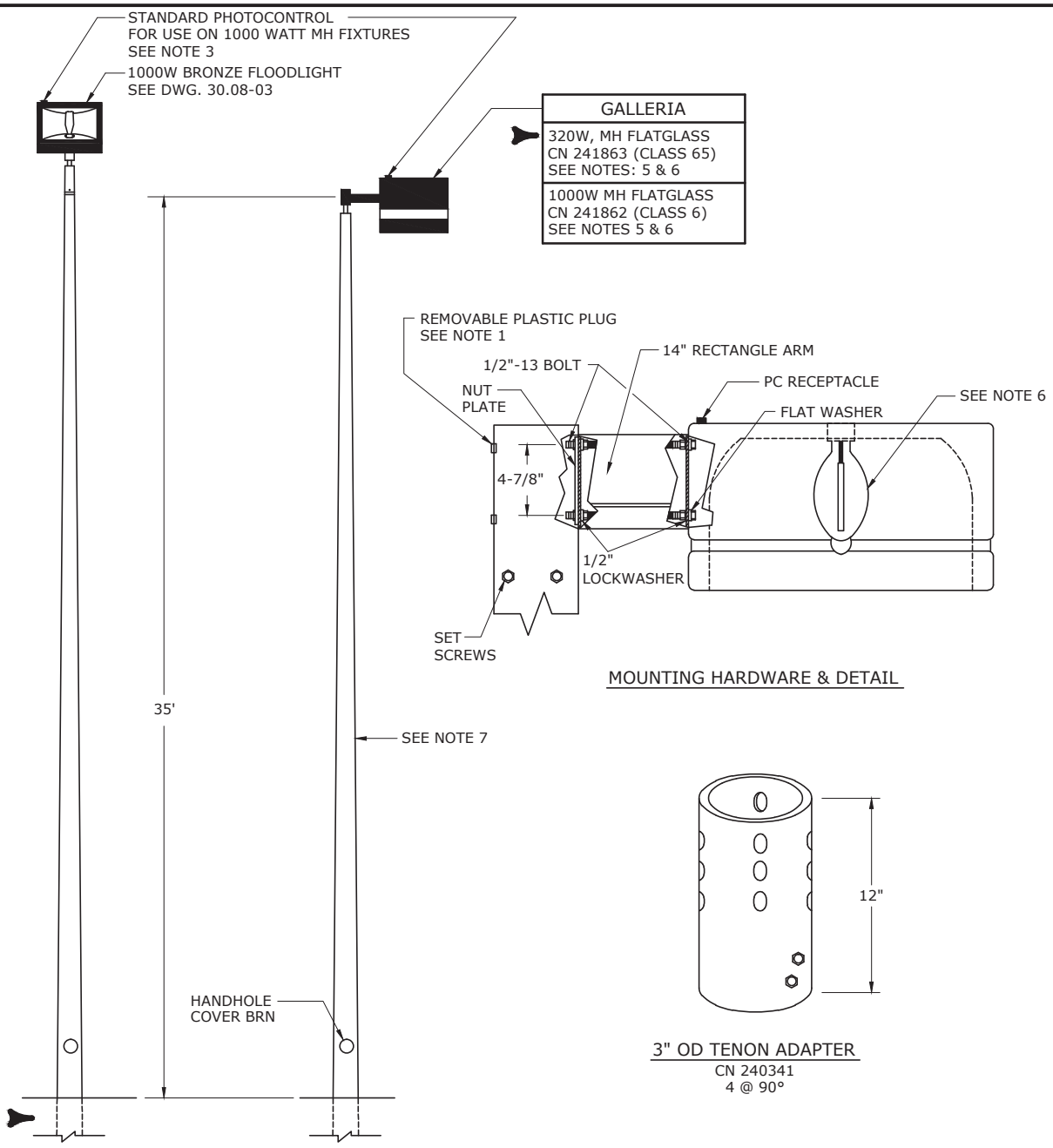
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

BRONZE PROMENADE SPUN CONCRETE POLES

Duke Energy®

FLA

DWG. 30.09-14



MOUNTING HARDWARE & DETAIL

3" OD TENON ADAPTER
CN 240341
4 @ 90°

NOTES:

1. THE ROUND POLE TENON ADAPTER IS DRILLED ON FOUR SIDES FOR MOUNTING UP TO FOUR CUBE FIXTURES PER POLE. ONE TENON ADAPTER COMES WITH EVERY POLE ASSEMBLY.
2. WHEN APPLICABLE, POLE SHALL BE POSITIONED SUCH THAT THE HANDHOLE IS FACING AWAY FROM THE TRAFFIC.
3. THE STANDARD TEMPERATURE PHOTOCONTROL CAN BE USED ON THESE FIXTURES, SEE DWG. 30.03-05, FIG. 1.
4. CUBE FIXTURES ARE UL APPROVED.
5. GALLERIA FIXTURE MOUNT ON A 3" O.D. TENON ON A SPUN CONCRETE POLE.
6. SEE DWG. 30.06-10 FOR METAL HALIDE LAMP DATA.
7. SEE DWG. 30.09-14 FOR POLE PART NUMBERS.

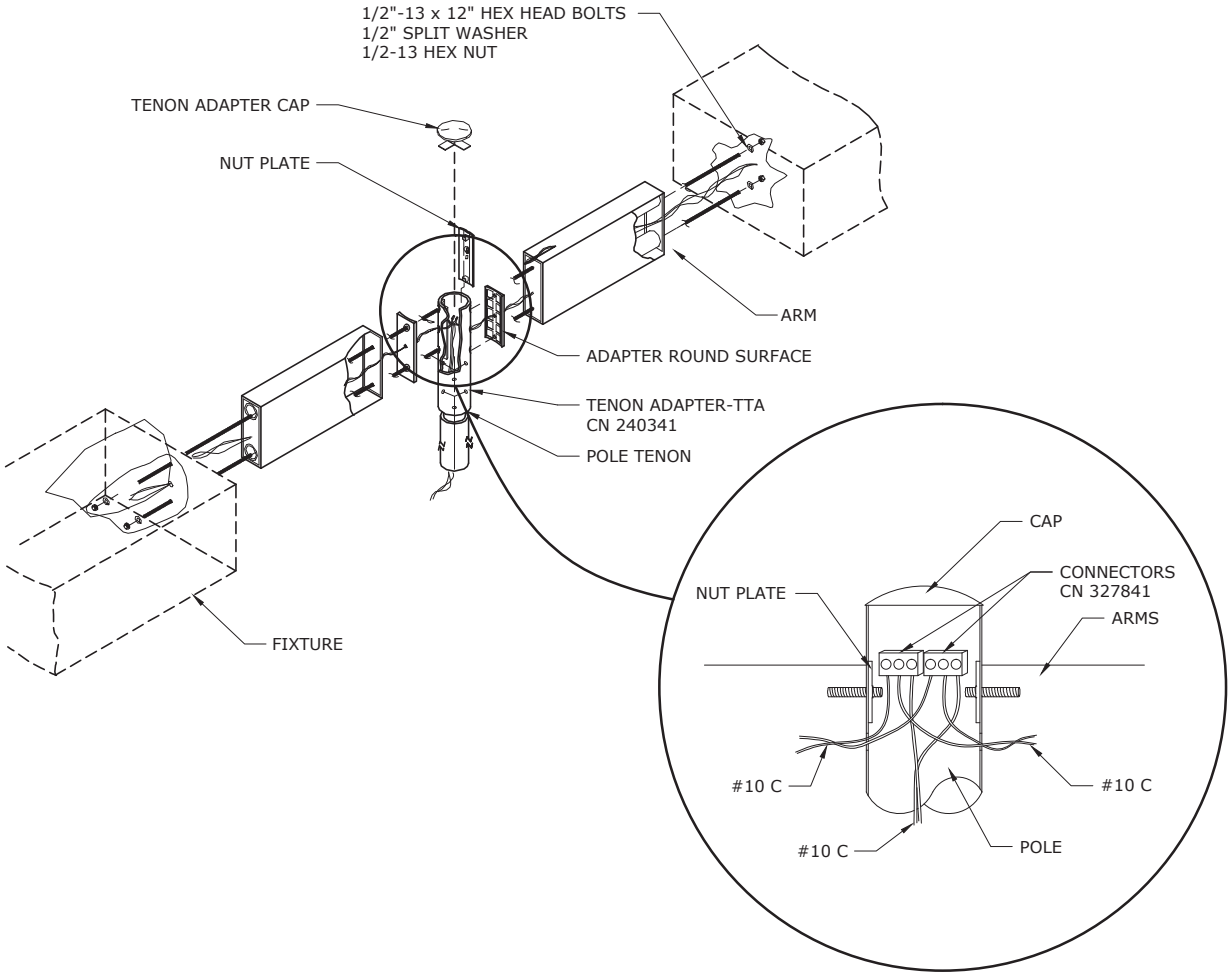
REVISED	BY	CK'D	APPR.
3			
2			
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/27/10	DEFREITAS	JUDAH	LARSEN

1000W BRONZE CUBE FIXTURE AND 41' ROUND POLE

Progress Energy

FLA

DWG. 30.09-15



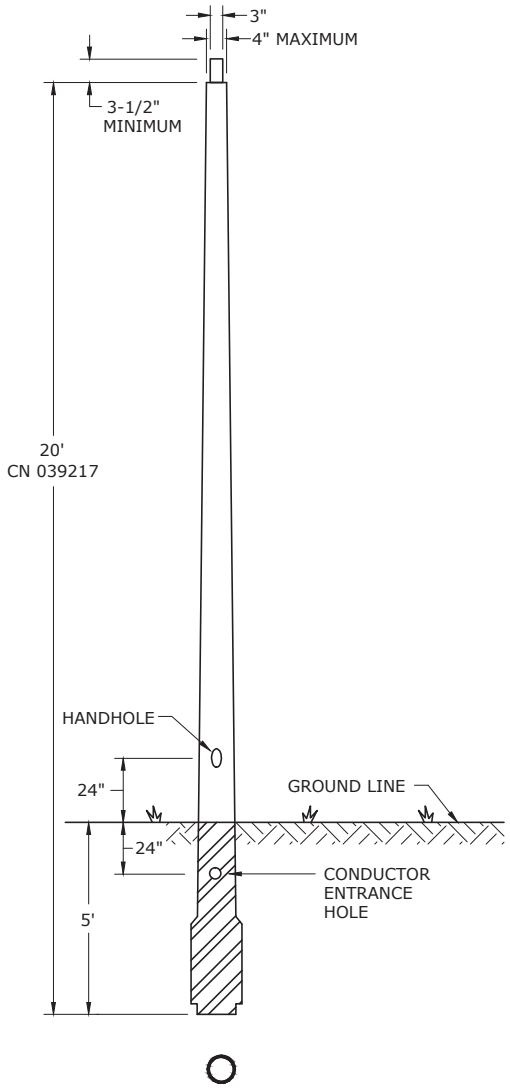
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

TENON-TOP MOUNTED FIXTURES

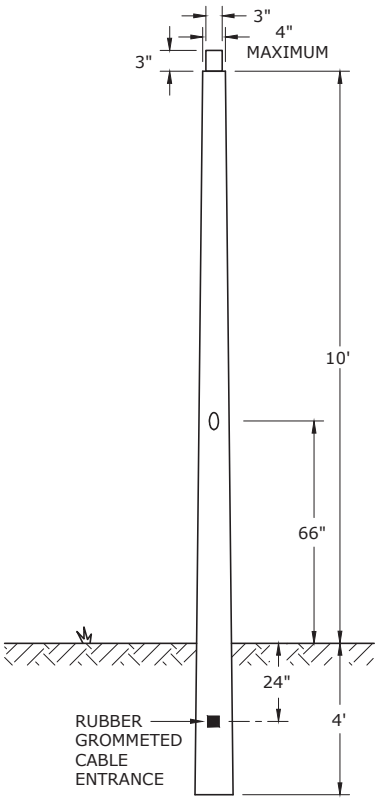
Duke Energy®

FLA

DWG. 30.09-16



FIBERGLASS
BLACK
CN 039217



FIBERGLASS BLACK
CN 039214
FOR MAINTENANCE ONLY.
SEE DWG. 30.09-28
FOR NEW POLE INSTALLATION
DETAILS

NOTES:

1. ALL POLES WILL BE MARKED WITH A MANUFACTURER'S I.D. TAG LOCATED 10' FROM THE BASE OF THE POLE (APPROX. 6' ABOVE GROUND) DIRECTLY ABOVE THE CONDUCTOR ENTRANCE HOLE TO FACILITATE CONDUCTOR LOCATION UPON REPAIRS.
2. APPLICABLE, POLE SHALL BE POSITIONED SUCH THAT THE HANDHOLE IS FACING AWAY FROM THE STREET.
3. INSTALL THE ANTI-ROTATION DEVICE SO AS TO KEEP POLES FROM ROTATING AFTER INSTALLATION.
4. NO BANNER CAN BE ATTACHED TO ANY OF THE ABOVE POLES.

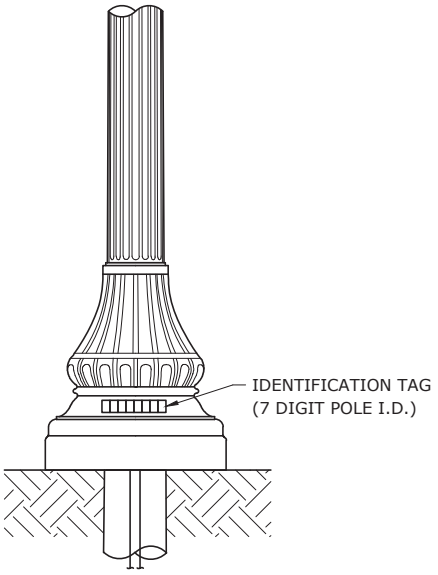
3				
2				
1				
0	7/26/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

STANDARD FIBERGLASS LIGHTING POLES

Duke Energy®

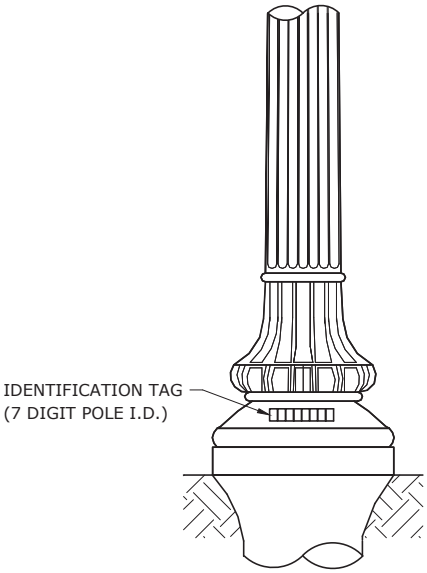
FLA

DWG. 30.09-26



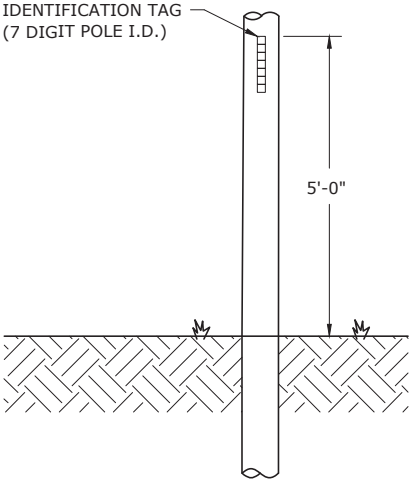
16' DECORATIVE
CONCRETE POLE

FIG. 1



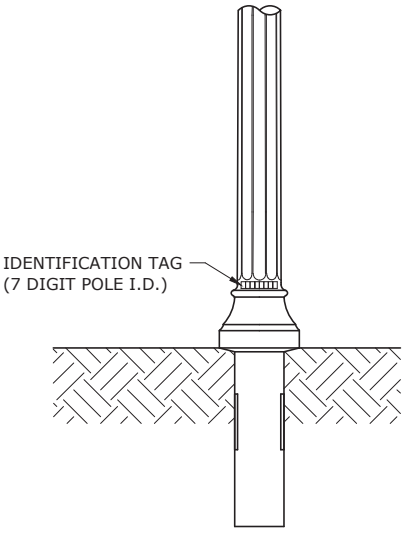
16' DECORATIVE
FIBERGLASS POLE
REPLACEMENT ONLY

FIG. 2



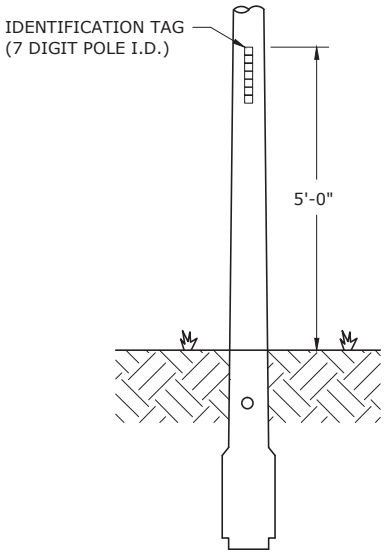
WOOD, ALUMINUM, STATIC
CAST & SMOOTH SPUN
CONCRETE POLES

FIG. 3



VICTORIAN EMBEDDED
FLUTED POLE

FIG. 4



FIBERGLASS STREET LIGHT POLE

FIG. 5

NOTES:

1. TAGS FOR WOOD POLES ARE TO BE INSTALLED WITH NAILS (CN 015171). ALL OTHER POLES ARE TO USE RTV ADHESIVE (CN 152240).
2. THE CABLE ACCESS HOLE SHOULD FACE AWAY FROM THE STREET ON ALL APPLICABLE POLES.
3. THE LOCID TAG SHOULD BE LOCATED FACING THE STREET, AS SHOWN, FOR EASY IDENTIFICATION DURING MAINTENANCE OR INVENTORY EFFORTS.

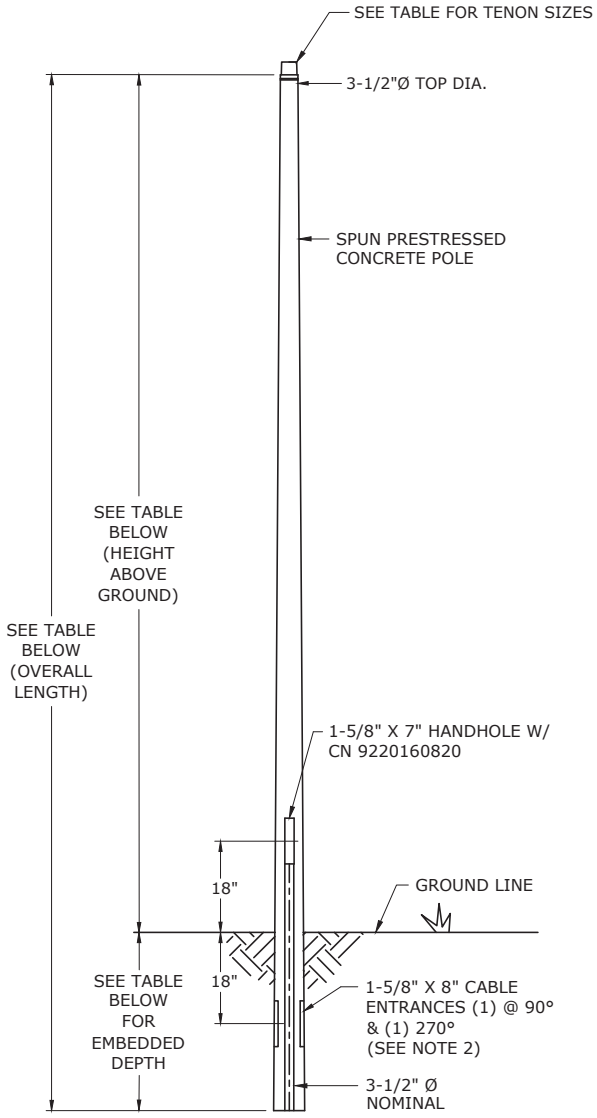
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

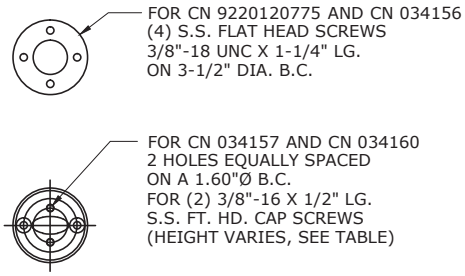
STREET LIGHT POST TAG LOCATION

Duke Energy®

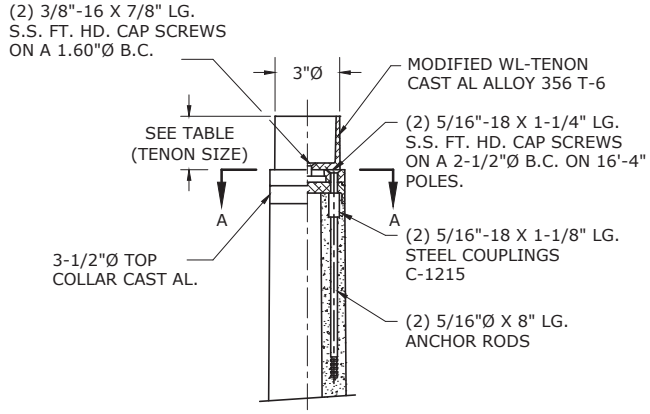
FLA

DWG.
30.09-27





WL TENON BASE
VIEW A-A



TOP MOUNT DETAIL

NOTES:

1. FINISH: SMOOTH, TEXTURED, BLACK, EXPOSED FINISH WITH ANTI-GRAFFITI COATING.
2. SEE DWG. 30.07-36 FOR PEDESTAL INSTALLATION
3. COLOR IS THE SAME FOR ALL POSTS.

EMBEDDED ROUND POLE DESCRIPTION								
CATALOG NUMBER	POLE HT. ABOVE GND.	EMBEDDED DEPTH	OVERALL LENGTH	BUTT DIAMETER	WT. (LBS)	TENON SIZE	COMPATIBLE UNIT	DESCRIPTION
034157	12'-4"	4'-0"	16'-4"	6-1/8"	280	3"X6"	PLCC16BLSSF	16' POST FOR SINGLE SHEPHERD ARM INSTALLATION
034157	12'-4"	4'-0"	16'-4"	6-1/8"	280	3"X6"	PLCC16BLSDF	16' POST FOR DOUBLE SHEPHERD ARM INSTALLATION
034160	12'-4"	4'-0"	16'-4"	6-1/8"	280	3"X3"	PLCC16BLF	16' POST FOR SINGLE POST TOP FIXTURE
034160	12'-4"	4'-0"	16'-4"	6-1/8"	280	3"X3"	PLCC16BLDBF	16' POST FOR DOUBLE POST TOP FIXTURE (POST & BRACKET)
9220120735	17	5'	22'	7-7/8"	700	3"X3"	PLCC22F	22' POST FOR SINGLE POST TOP FIXTURE
9220120735	17	5'	22'	7-7/8"	700	3"X3"	PLCC22DBF	22' POST FOR DOUBLE POST TOP FIXTURE (POST & FIXTURE)
034156	17	5'	22'	7-7/8"	700	3"X6"	PLCC22BLSSF	22' POST FOR SINGLE SHEPARD ARM INSTALLATION
034156	17	5'	22'	7-7/8"	700	3"X6"	PLCC22BLSDF	22' POST FOR DOUBLE SHEPARD ARM INSTALLATION

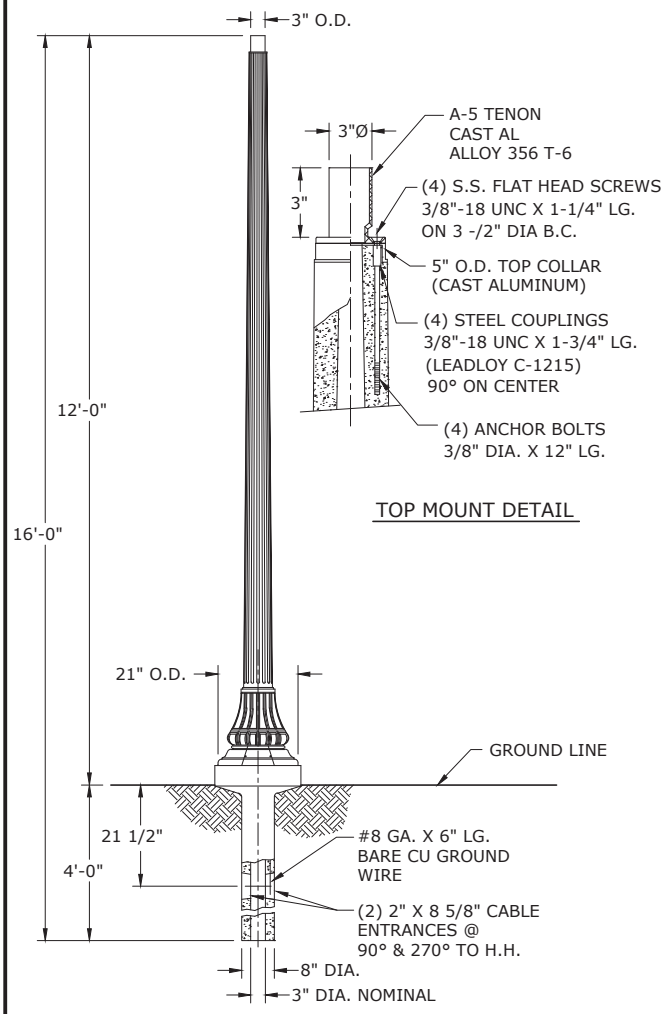
3					
2					
1					
0	7/21/10	DEFREITAS	JUDAH	LARSEN	
REVISED		BY	CK'D	APPR.	

COLONIAL BLACK SPUN CONCRETE POST

Duke Energy®

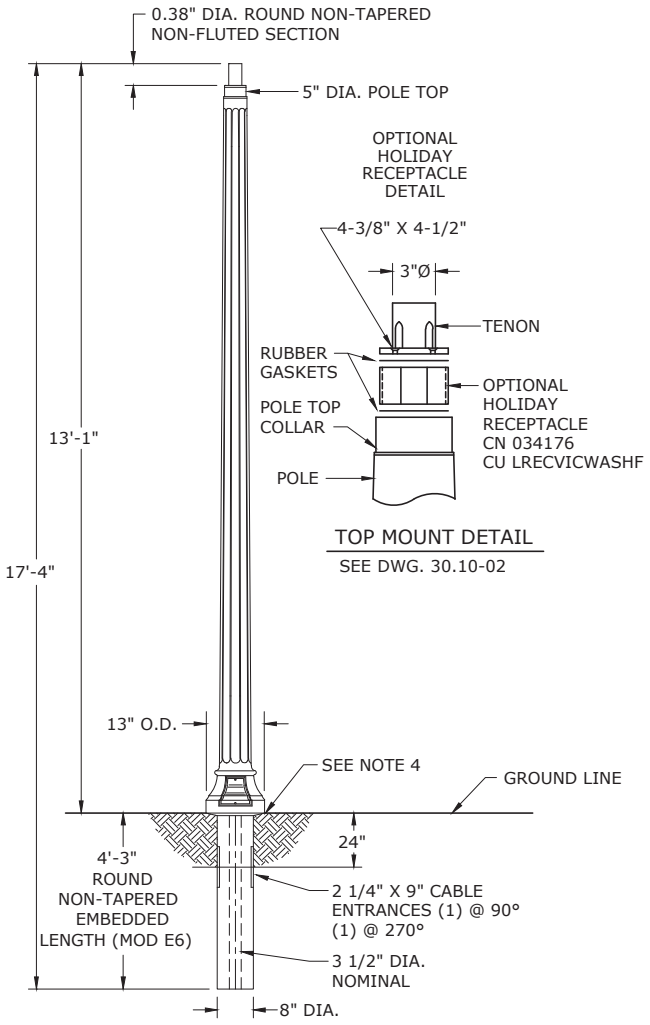
FLA

DWG. 30.09-28



TOP MOUNT DETAIL

WASHINGTON FLUTED DECORATIVE
CONCRETE POLE



TOP MOUNT DETAIL
SEE DWG. 30.10-02

VICTORIAN FLUTED DECORATIVE
CONCRETE POLE

CN	COLOR	WEIGHT (LBS)	COMP. UNIT
034164	LT BLACK	740	PLCC16WALBLF
034167	BLACK	740	PLCC16WADBKF

CN	COLOR	WEIGHT (LBS)	COMP. UNIT
034162	GRAY	550	PLCC16VICF
9220148857	BLACK	550	PLCC16VICBKF

NOTES:

1. THE FINISH ON THE POLES IS NATURAL EXPOSED FINISH WITH ANTI-GRAFFITI COATING.
2. SEE DWG. 30.07-36 FOR USING THE PEDESTAL BOX.
3. A DUPLEX RECEPTACLE IS SUPPLIED BY THE POLE MANUFACTURER FOR WIRING DECORATIVE LIGHTS. SEE CATALOG NUMBER IN DETAIL.
4. IF FINISHED GRADE CAN NOT BE DETERMINED, USE 4"-6" ABOVE ROUGH GRADE AS A GUIDE.

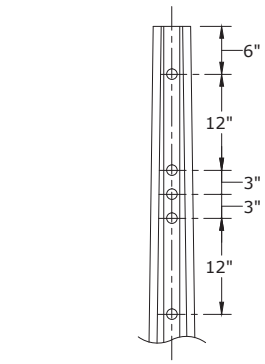
3				
2				
1	5/24/12	DEFREITAS	JUDAH	LARSEN
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

DECORATIVE FLUTED CONCRETE LIGHTING POSTS

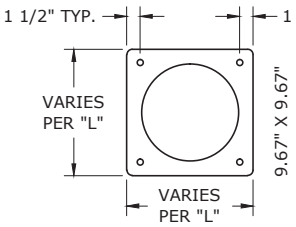
Progress Energy

FLA

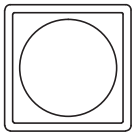
DWG. 30.09-29



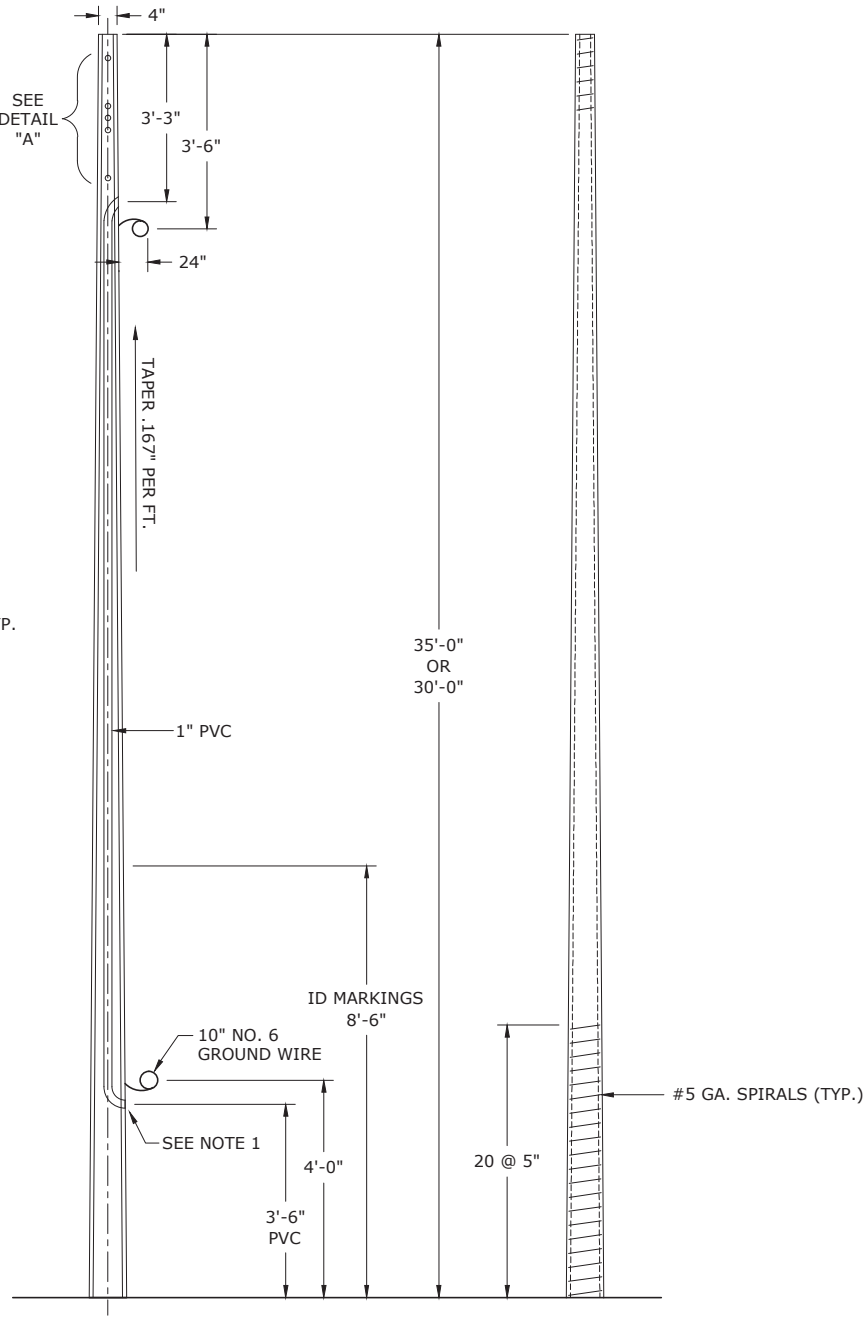
TOP FACE
DETAIL "A"



VIEW AT BUTT



SECT. @ 6'-0" FROM BUTT



POLE ELEVATION
NOT TO SCALE

REINFORCING
NOT TO SCALE

CATALOG NUMBER	COLOR	COMPATIBLE UNIT	WEIGHT	OVERALL HEIGHT "A"	HEIGHT ABOVE GRADE	I.D. MARK #
034301	GRAY	PLCC30T1F	1550 LBS.	30'-0"	24'-0"	8'-6"
034351	GRAY	PLCC35T1F	1840 LBS.	35'-0"	28'-0"	8'-6"

NOTES:

1. SEE DWG 30.07-36 FOR PEDESTAL CONNECTION INSTRUCTIONS.

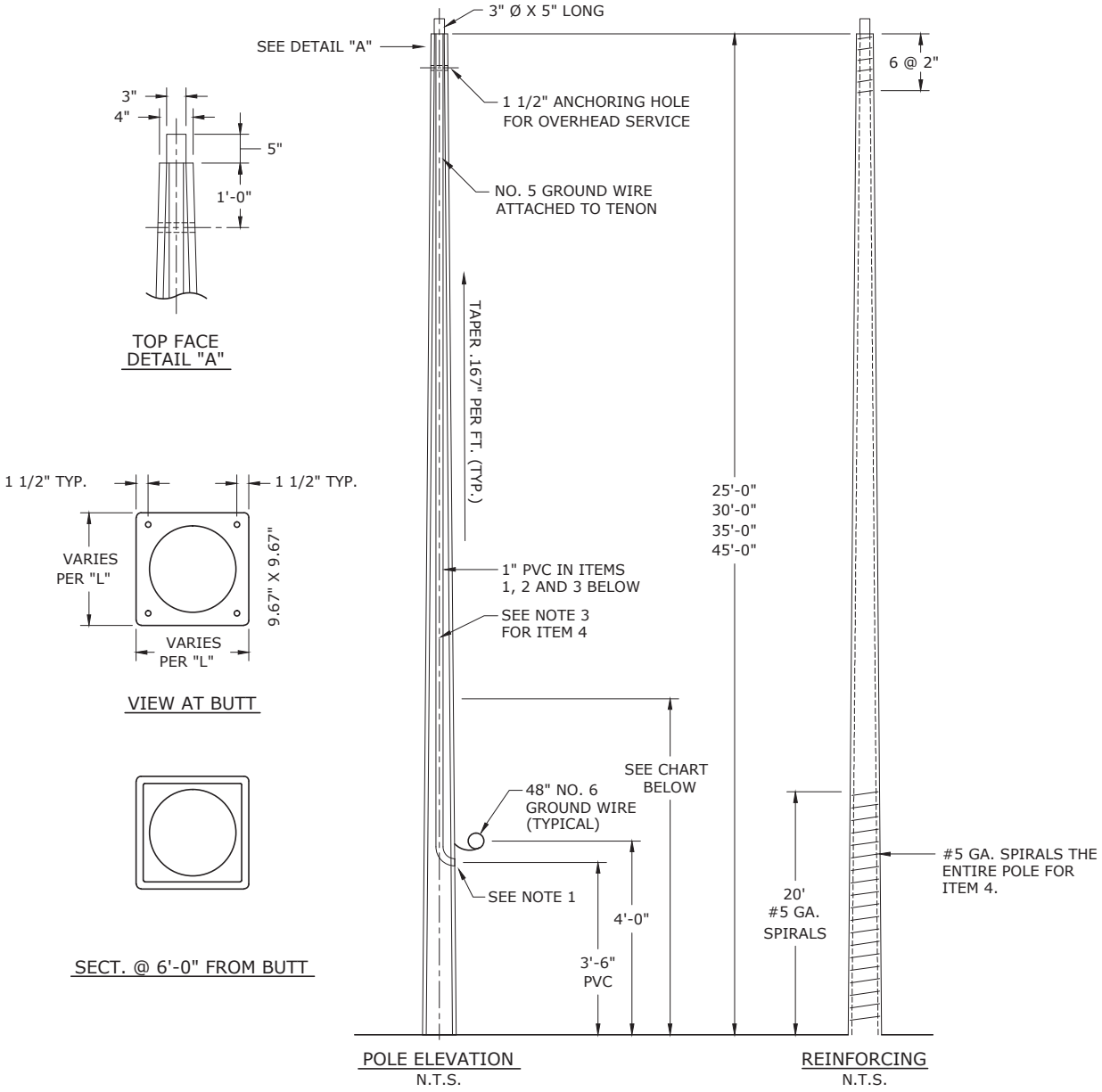
3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

(NON-TENON) CONCRETE STATIC CAST POLES

Duke Energy®

FLA

DWG. 30.09-32



ITEM	CN	COLOR	COMP. UNIT	WEIGHT	OVERALL HEIGHT "A"	HEIGHT ABOVE GRADE	I.D. MARK #
1	034020	GRAY	PLCC25T1TNBZTAF	1050 LBS.	25'-0"	19'-6"	8'-6"
2	034302	GRAY	PLCC30T1TNBZTAF	1550 LBS.	30'-0"	24'-0"	8'-6"
3	034352	GRAY	PLCC35T1TNBZTAF	1840 LBS.	35'-0"	28'-0"	8'-6"
4	034452	GRAY	PLCC45T2TNBZTAF	3480 LBS.	45'-0"	38'-0"	12'-0"

NOTES:

1. SEE DWG. 30.07-36 FOR PEDESTAL CONNECTION INSTRUCTIONS.
2. SEE DWG. 30.09-16 FOR SHOEBOX FIXTURES.
3. SEE DWG. 30.08-27 FOR FLOODLIGHT FIXTURES.
4. SEE DWG. 30.09-15 FOR CUBE FIXTURES.
5. SEE DWG. 30.08-28 FOR SPORTSLIGHT FIXTURES.
6. POLE MUST BE PICKED UP AND STORED AT TWO POINTS APPROX. 9 FT. FROM TOP AND 6 FT. FROM BUTT. CAUTION: LIFTING THIS POLE WITH A SINGLE PICK POINT WILL RESULT IN DAMAGE TO THE POLE.

3				
2				
1				
0	7/21/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

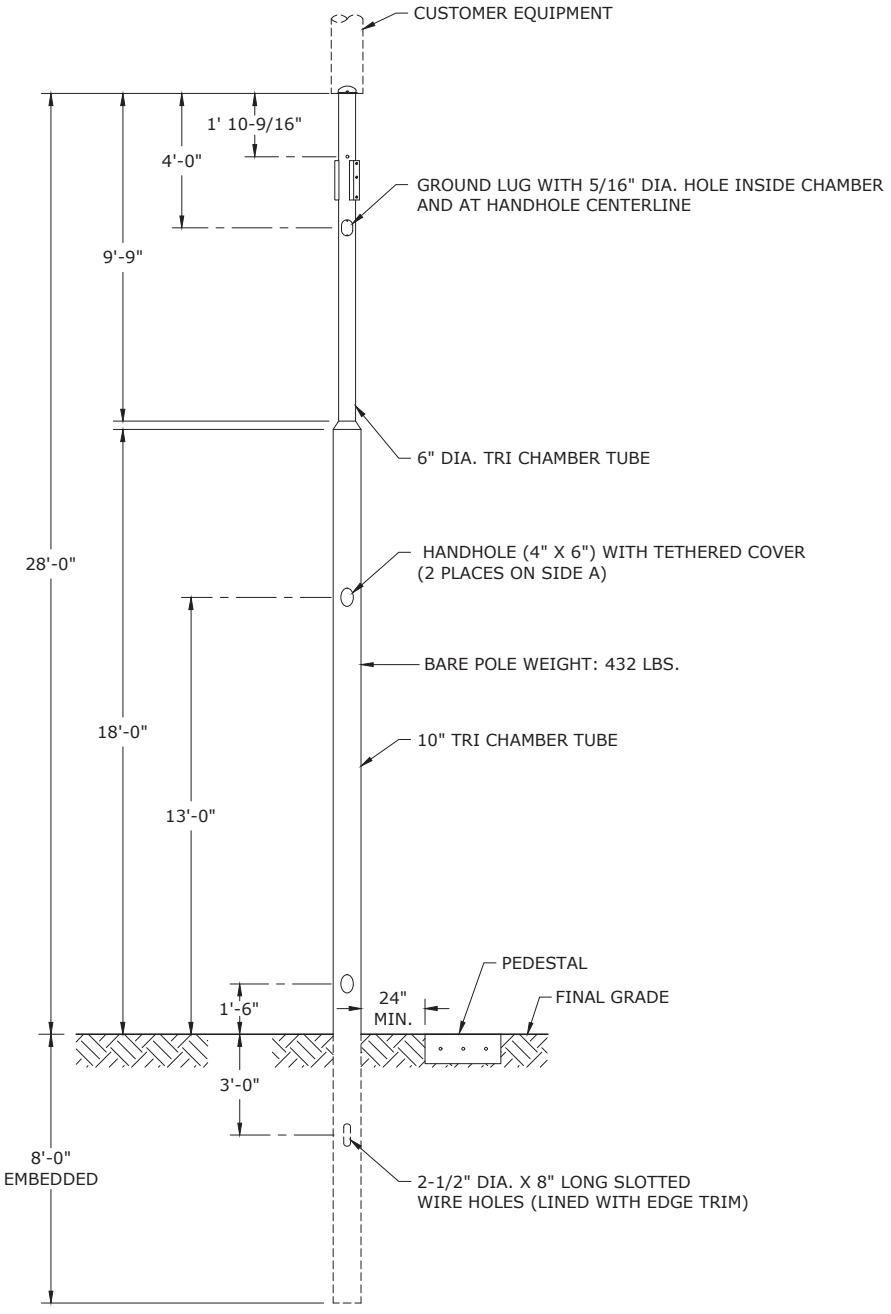
TENON CONCRETE STATIC CAST POLES

Duke Energy®

FLA

DWG. 30.09-33

KEY PLAN



SIDE A

NOTES:

1. SEE DWG. 30.09-710B FOR SIDE B AND DWG. 30.09-710C FOR SIDE C.
2. SEE DWG. 30.09-710D FOR WIND LOADING COMBINATIONS ON ZONES 1 THRU 4.
3. SEE DWG. 30.09-710E FOR BILL OF MATERIALS AND NOTES.
4. SEE DWG. 30.09-710F FOR ARM ASSEMBLY OPTIONS.

3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING
REVISED		BY	CHK'D	APPR.

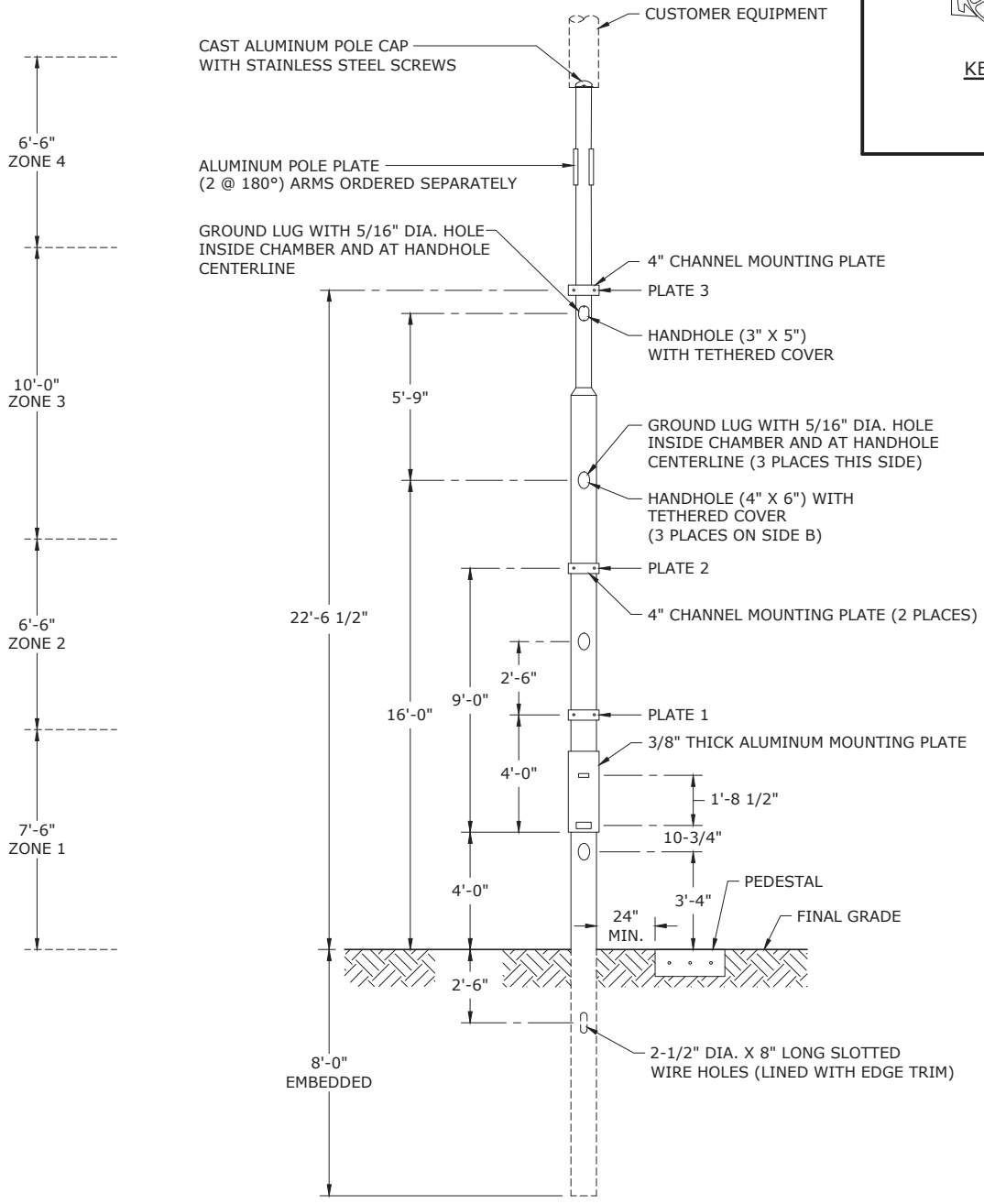
36' OVERALL LENGTH
SMOOTH ALUMINUM TRI-CHAMBER
MULTI USE POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

30.09-710A

KEY PLAN



SIDE B

NOTES:

1. SEE DWG. 30.09-710A FOR SIDE A AND DWG. 30.09-710C FOR SIDE C.
2. SEE DWG. 30.09-710E FOR BILL OF MATERIALS AND NOTES.
3. CUSTOMER EQUIPMENT, CABINETS, DISCONNECTS AND METER BASE INSTALLED BY OTHERS.

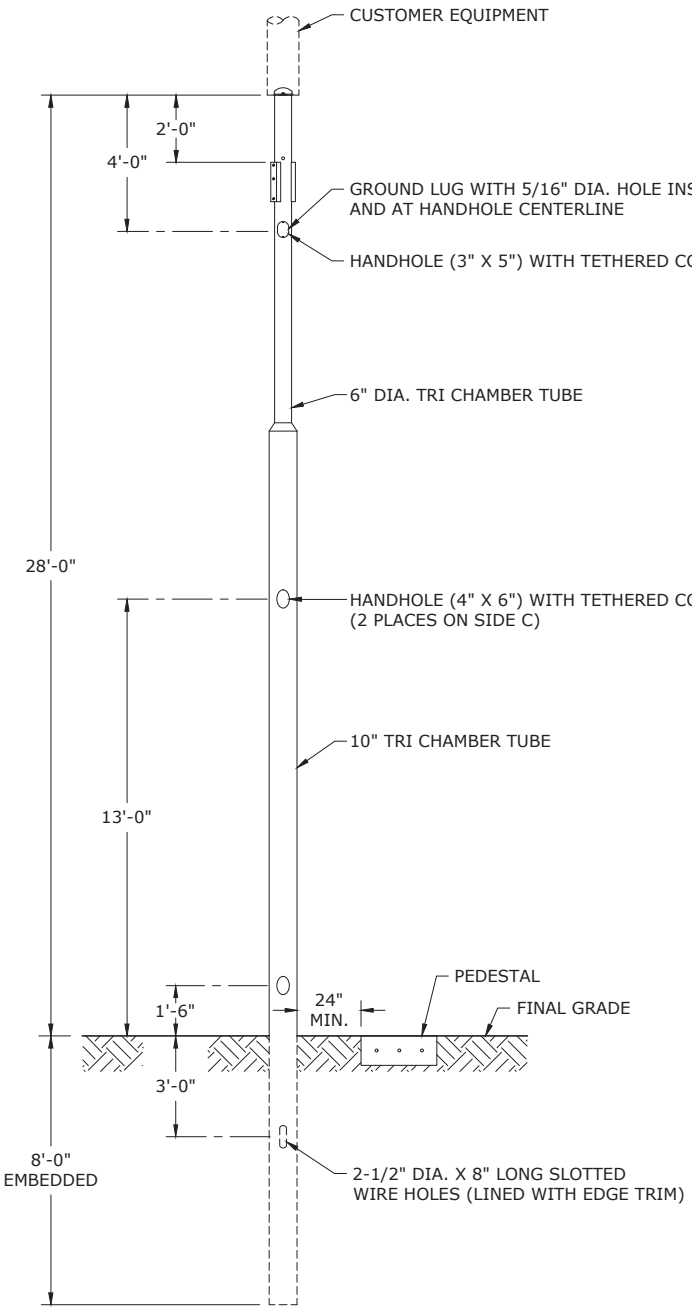
3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING
REVISED		BY	CHK'D	APPR.

36' OVERALL LENGTH SMOOTH ALUMINUM TRI-CHAMBER MULTI USE POLE

DEC	DEM	DEP	DEF
X	X	X	X

30.09-710B

KEY PLAN



SIDE C

NOTES:

1. SEE DWG. 30.09-710A FOR SIDE A AND DWG. 30.09-710B FOR SIDE B.

2. SEE DWG. 30.09-710E FOR BILL OF MATERIALS AND NOTES.

3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING
REVISED		BY	CHK'D	APPR.

36' OVERALL LENGTH SMOOTH ALUMINUM TRI-CHAMBER MULTI USE POLE

DUKE ENERGY.

DEC	DEM	DEP	DEF
X	X	X	X

30.09-710C

120 MPH LOAD COMBINATIONS								
	ZONE 1		ZONE 2		ZONE 3		ZONE 4	
	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)
OPTION 1	50	4	500	14	100	4	300	26
OPTION 2	75	6	525	16	150	6	275	23
OPTION 3	100	8	550	18	200	8	250	20

140 MPH LOAD COMBINATIONS								
	ZONE 1		ZONE 2		ZONE 3		ZONE 4	
	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)	WEIGHT (LBS)	EPA (SQ. FT.)
OPTION 1	50	4	500	10	50	1	300	18
OPTION 2	75	6	525	12	100	2	275	16
OPTION 3	100	8	550	14	125	3	250	14

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING

36' OVERALL LENGTH
SMOOTH ALUMINUM TRI-CHAMBER MULTI USE POLE
WIND LOADING COMBINATIONS

DEC	DEM	DEP	DEF
X	X	X	X

30.09-710D

BILL OF MATERIALS - POLES		
COMPATIBLE UNIT	ITEM NUMBER	COLOR
LPOLE-DB-AL-36FT-BLK-MULTI-F	1567290	BLACK
LPOLE-DB-AL-36FT-BRZ-MULTI-F	1567288	BRONZE
-	1567292	GRAY
-	1567293	GREEN
-	1571793	WHITE

BILL OF MATERIALS - UPSWEEP 6' BRACKETS		
COMPATIBLE UNIT	ITEM NUMBER	COLOR
LBKT-SIDE-AL-6FT-BLK-HAPCO-MULTI-F	1568173	BLACK
LBKT-SIDE-AL-6FT-BRZ-HAPCO-MULTI-F	1568174	BRONZE
-	1568176	GRAY
-	1568175	GREEN
-	1571803	WHITE

BILL OF MATERIALS - STRAIGHT 6' BRACKETS		
COMPATIBLE UNIT	ITEM NUMBER	COLOR
LBKT-SIDE-AL-6FT-STRAIGHT-BLK-HAPCO-MULTI-F	1571003	BLACK
LBKT-SIDE-AL-6FT-STRAIGHT-BRZ-HAPCO-MULTI-F	1571009	BRONZE
-	1571005	GRAY
-	1571007	GREEN
-	1571805	WHITE

BILL OF MATERIALS - STRAIGHT 2' BRACKETS FOR POST FIXTURE		
COMPATIBLE UNIT	ITEM NUMBER	COLOR
-	1571524	BLACK
-	1571522	BRONZE
-	1571525	GRAY
-	1571529	GREEN
-	1571796	WHITE

NOTES:

1. SEE DWGS. 30.09-710A, 30.09-710B AND 30.09-710C FOR DESIGN SPECIFICATIONS.
2. FOR DEC AND DEM, PROVIDE PROPER POLE GROUNDING PER DWG. 30.07-102. FOR DEP, SEE NOTE 1 ON DWG. 30.05-01.
3. BRACKET IS NOT INCLUDED WITH POLE. ORDER CORRECT BRACKET(S) AS REQUIRED.
4. ORIENT POLE SO METER AND EQUIPMENT CABINETS ARE OPPOSITE TO TRAFFIC FLOW.

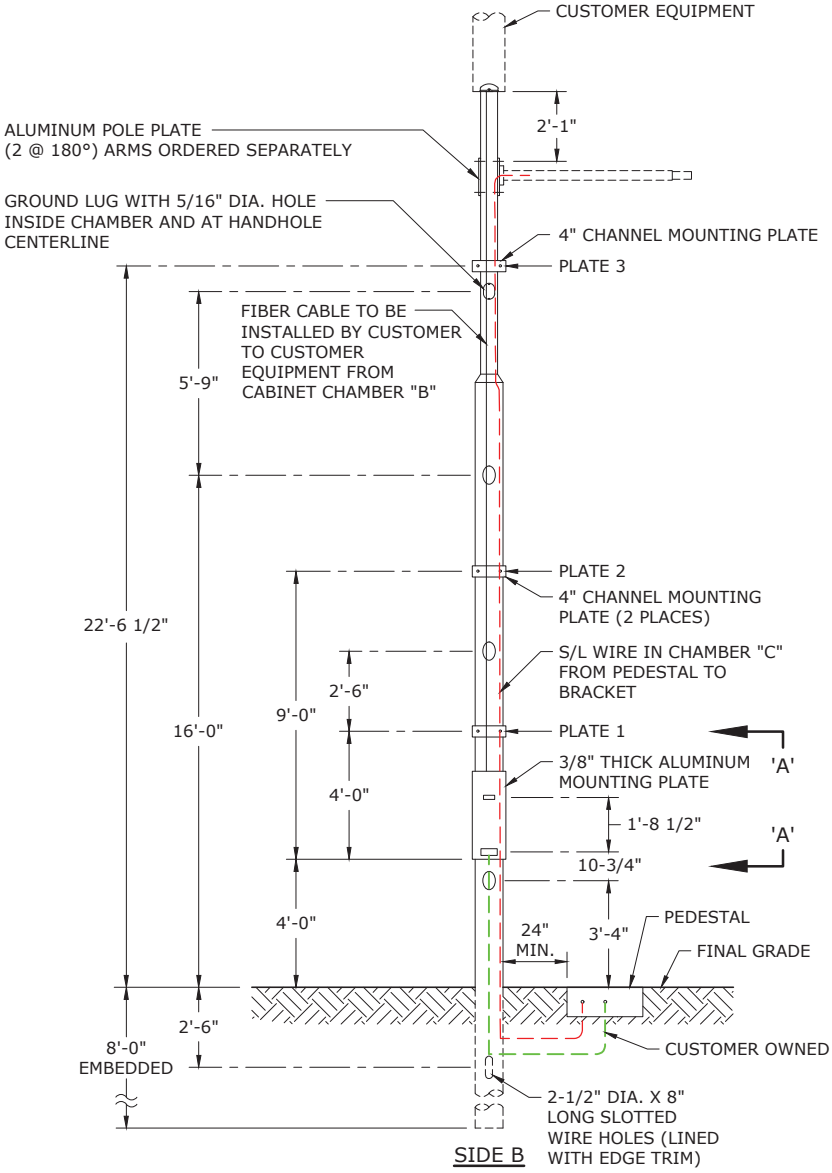
DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING

36' OVERALL LENGTH
TRI-CHAMBER MULTI USE POLE
BILL OF MATERIALS

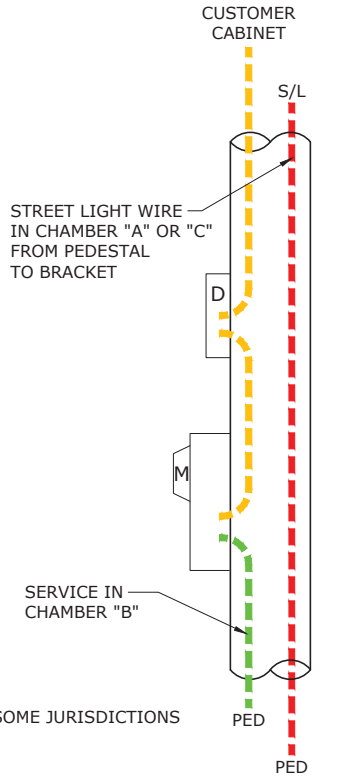
DEC	DEM	DEP	DEF
			X

30.09-710E

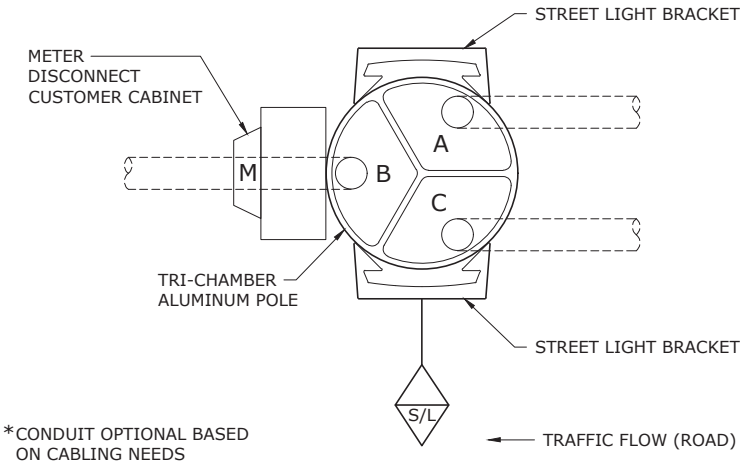


SIDE B

KEY PLAN



SECTION 'A'-'A'



*CONDUIT OPTIONAL BASED ON CABLING NEEDS

FOUNDATION PLAN VIEW

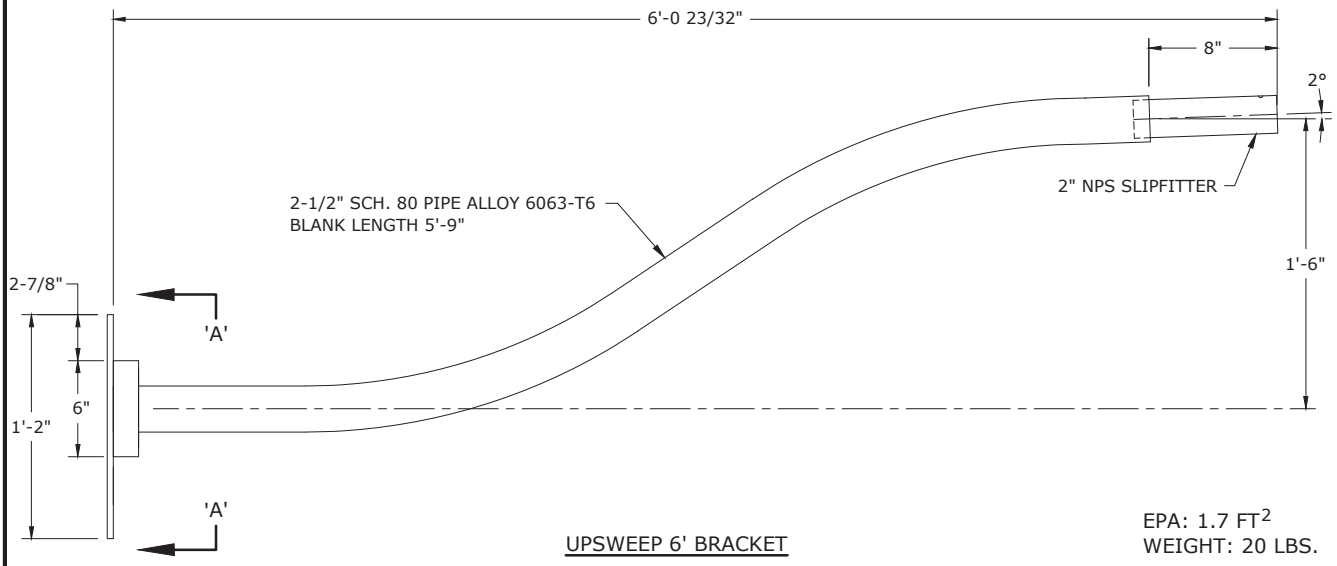
CHAMBER WIRING	
A	DUKE
B	CUSTOMER/DUKE
C	DUKE

3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING
REVISED		BY	CHK'D	APPR.

36' OVERALL LENGTH
SMOOTH ALUMINUM TRI-CHAMBER MULTI USE POLE
UNDERGROUND VERSION

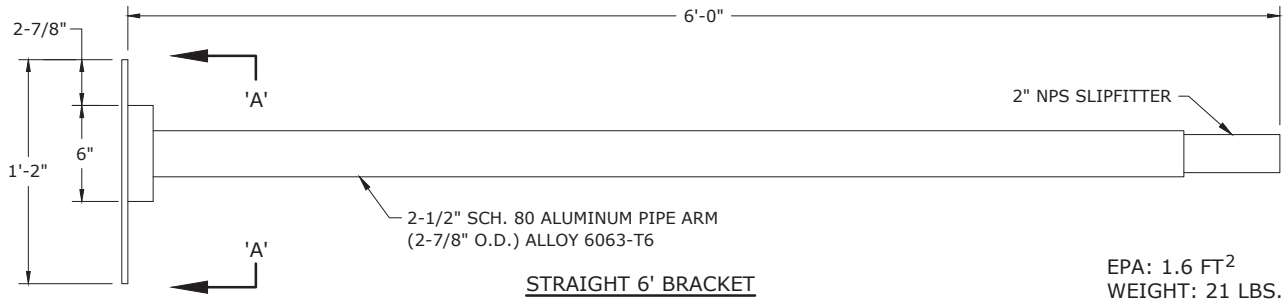
DEC	DEM	DEP	DEF
X	X	X	X

30.09-710F



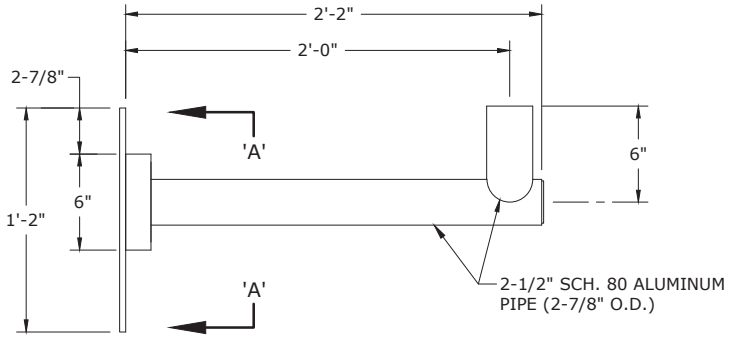
UPSWEEP 6' BRACKET

EPA: 1.7 FT^2
WEIGHT: 20 LBS.



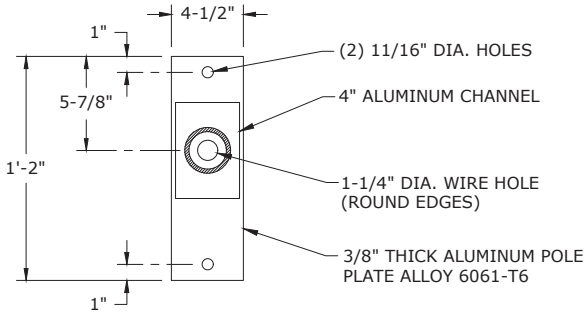
STRAIGHT 6' BRACKET

EPA: 1.6 FT^2
WEIGHT: 21 LBS.

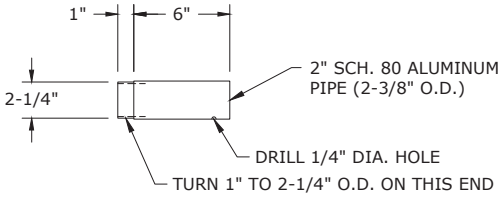


STRAIGHT 2' BRACKET FOR POST FIXTURE

EPA: 0.72 FT^2
WEIGHT: 12 LBS.



SECTION 'A'-'A'



SLIPFITTER DETAIL

DUKE ENERGY.

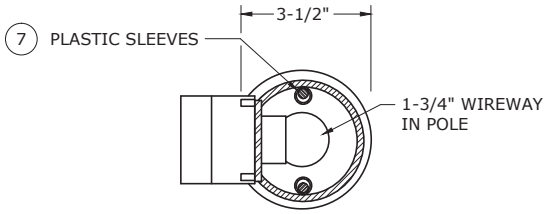
3				
2				
1				
0	11/8/18	SIMPKINS	BLOCKER	COWLING
REVISED		BY	CHK'D	APPR.

TRI-CHAMBER, MULTI USE POLE BRACKET AND ARM ASSEMBLIES

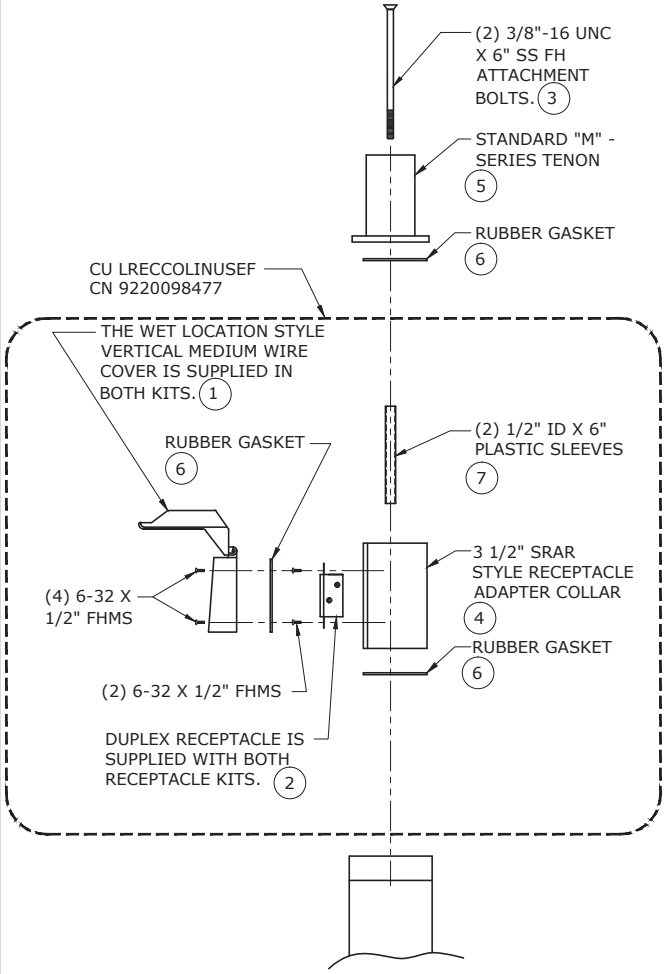
DEC	DEM	DEP	DEF
X	X	X	X

30.09-710G

FIGURE 1



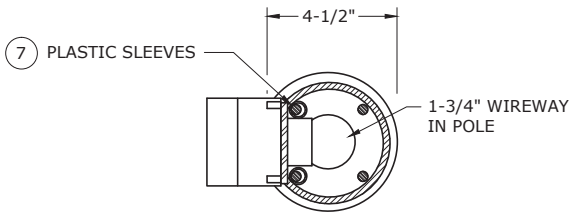
RECEPTACLE COLLAR DETAIL



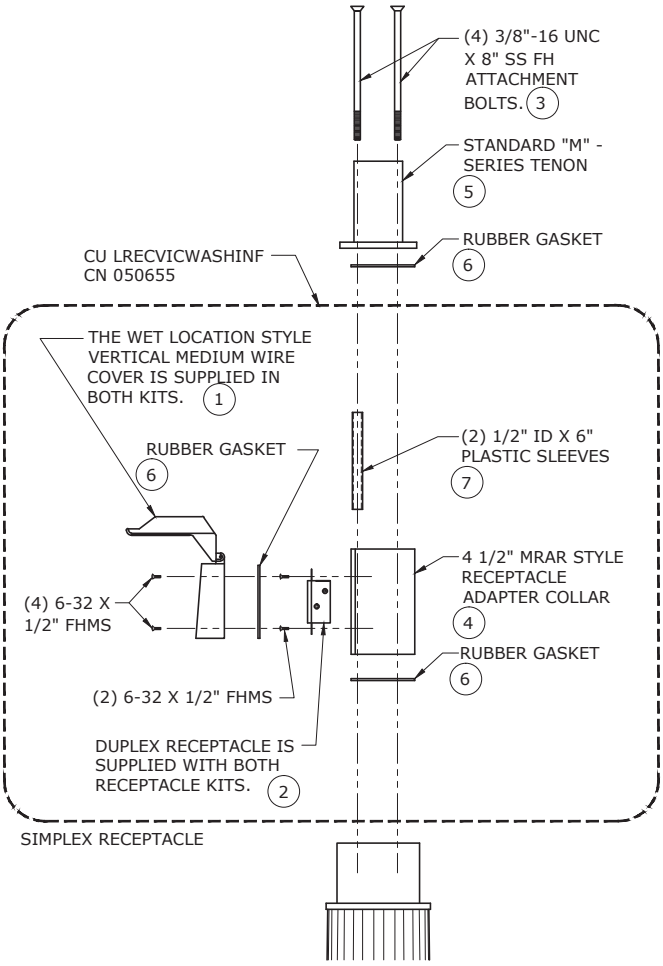
DECORATIVE COLONIAL CONCRETE POST
CU LRECCOLINUSEF

SEE DWG. 30.09-28 FOR POST

FIGURE 2



RECEPTACLE COLLAR DETAIL



VICTORIA II OR WASHINGTON POST
CU LRECVICWASHINF

SEE DWG. 30.09-29

BILL OF MATERIALS			
ITEM NO.	QUANTITY FIGURE 1	QUANTITY FIGURE 2	DESCRIPTION
1	1	1	RECEPTACLE COVER COMES WITH MOUNTING FASTENERS, FOR ALL POSTS ON DWGS. 30.09-28 AND 30.09-29
2	1	1	RECEPTACLE & MTG. HARDWARE INCLUDED IN BOTH HARDWARE KITS
3	2	4	3/8"-16 UNC X 8" SS F.H. ATTACHMENT BOLTS
4	1	1	MRAR STYLE RECEPTACLE ADAPTER PAINTED SEMI-GLOSS BLACK
5	1	1	3" DIA. X 3" LONG POLE TENON
6	2	2	RUBBER GASKET
7	2	2	1/2" ID X 6" PLASTIC SLEEVES

NOTES:

1. RECEPTACLE KITS ARE NOT TO BE INSTALLED ON POLES WITH MORE THAN ONE LUMINAIRE.

REVISED	BY	CK'D	APPR.
3			
2	2/25/14	DEFREITAS	COWLING	HENSON
1	5/23/12	DEFREITAS	JUDAH	LARSEN
0	7/22/10	DEFREITAS	JUDAH	LARSEN

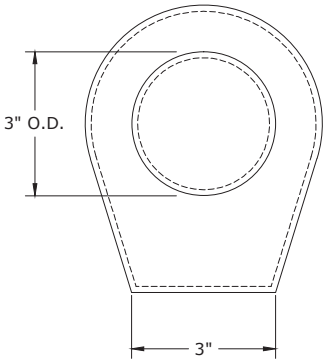
DUPLEX HOLIDAY ADD-ON RECEPTACLE KIT FOR THE VICTORIA, WASHINGTON FLUTED AND SPUN DECORATIVE CONCRETE POST ATTACHMENT DETAILS

DUKE ENERGY.

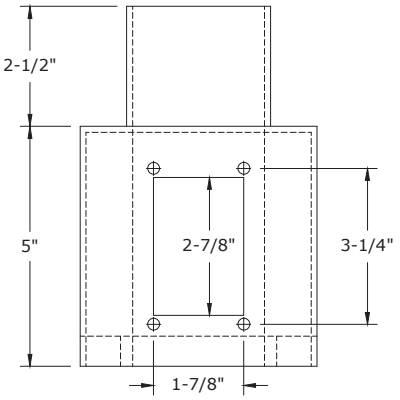
FLA

DWG. 30.10-02

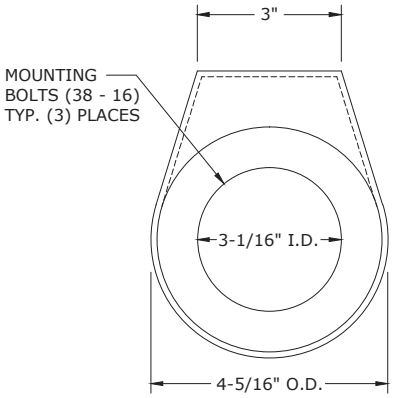
RETROFIT POLE TOP RECEPTACLE KIT
CN 9220173039
LRECTENINCF



PLAN VIEW



FRONT VIEW



BOTTOM VIEW

NOTES:

1. THE RETROFIT RECEPTACLE KIT (CN 9220173039) IS FOR CUSTOMERS WITH SINGLE MOUNT POST TOP LIGHT FIXTURES INSTALLED ON EXISTING POLES WITH 3" DIAMETER TENONS WITHOUT RECEPTACLES.
2. REMOVE EXISTING FIXTURE AND INSTALL RETROFIT KIT ON POLE TENON.
3. TENON RECEPTACLE KIT WILL ACCOMMODATE ONLY ONE LUMINAIRE.
4. AN ADDITIONAL RENTAL MUST BE CHARGED WHEN RECEPTACLE KIT IS INSTALLED.

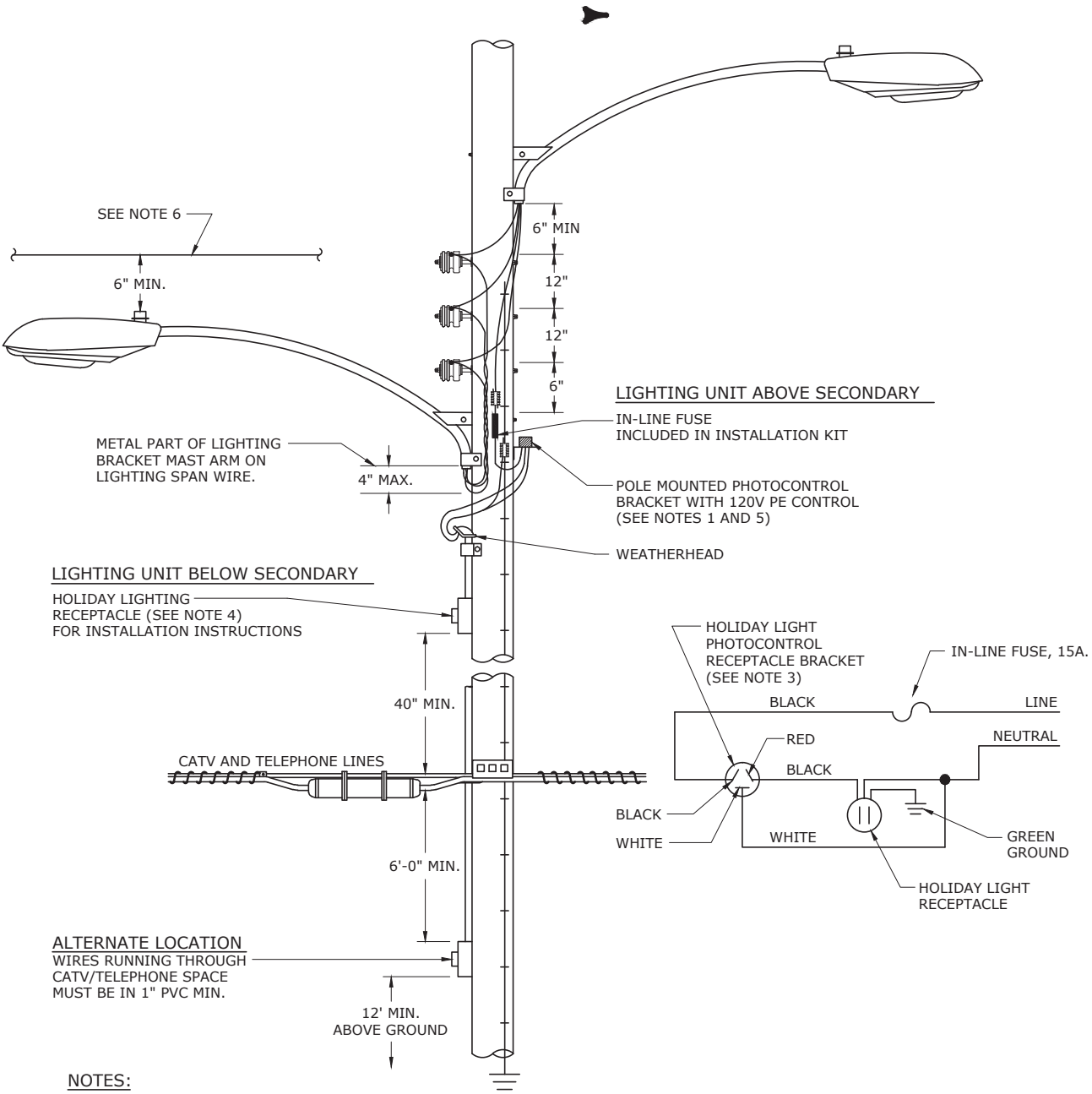
3				
2				
1				
0	5/2/14	DEFREITAS	COWLING	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

DUPLEX HOLIDAY ADD-ON RECEPTACLE KIT
WITH 3" X 3" TENON

DEC	DEM	DEP	DEF
			X

30.10-03



NOTES:

1. MOUNT THE HOLIDAY LIGHT PHOTOCONTROL RECEPTACLE BRACKET (CN 243304) ON THE OPPOSITE SIDE OF OF POLE FROM ELECTRICAL RECEPTACLE AND LIGHT.
2. PHOTOCONTROL BRACKET MUST BE WIRED IN SERIES WITH THE RECEPTACLE; SEE WIRING DIAGRAM.
3. ALL LIGHTING BRACKETS MUST BE GROUNDED.
4. RECEPTACLE FOR HOLIDAY LIGHTS. TO INSTALL RECEPTACLES ON WOOD POLES FOR HOLIDAY LIGHTS, THE FOLLOWING CU'S WILL BE REQUIRED:
   RECEPTACLE KIT "LRECHDAY20WCF" CUSTOMER OWNED
   "LRECHDAY20F" DEF OWNED

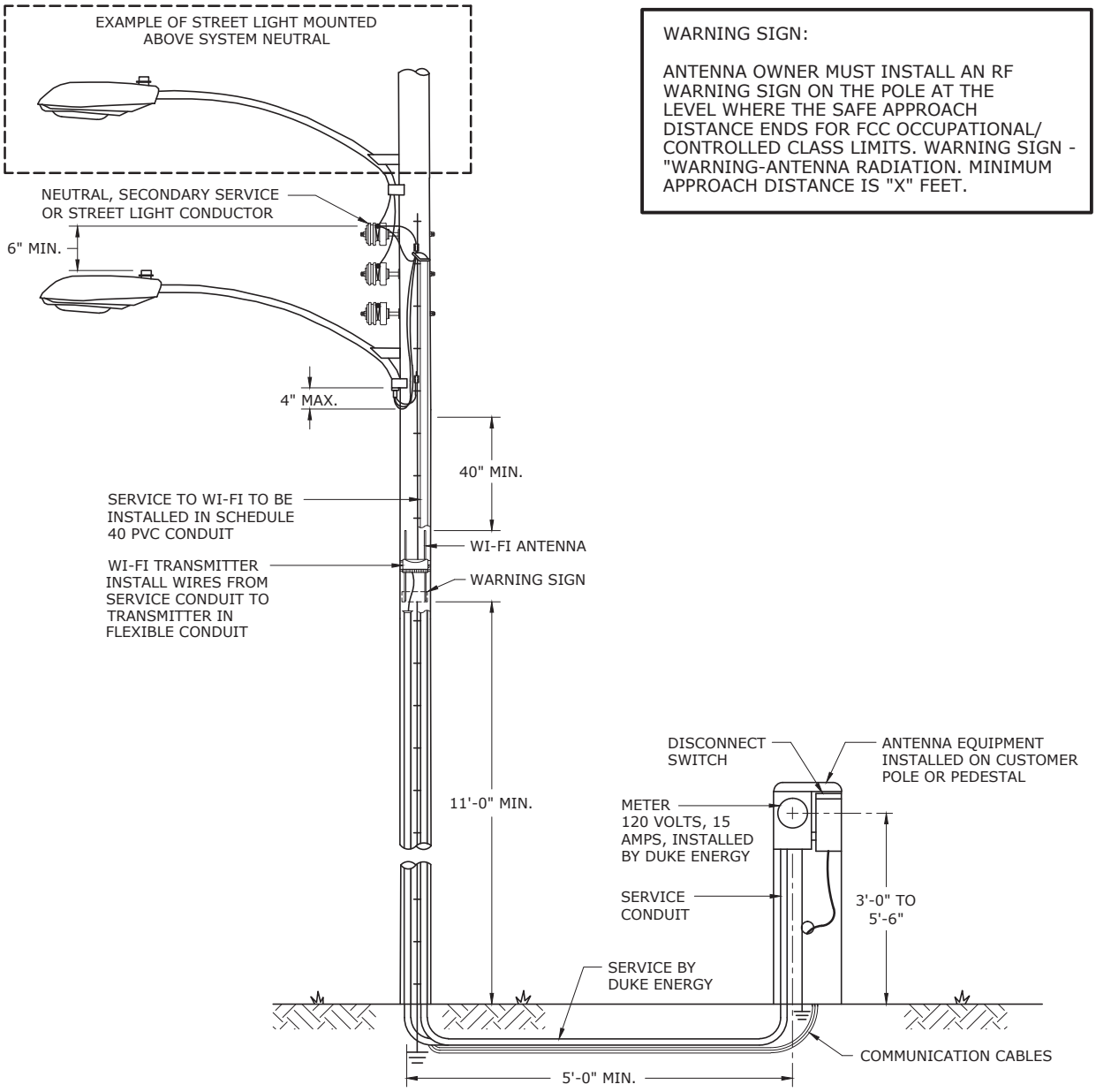
   BOX MUST BE A MINIMUM OF 40" CLEARANCE FROM ANY TELEPHONE OR CATV ATTACHMENTS.
5. WHEN HOLIDAY LIGHTS ARE TO BE KEPT ON CONTINUOUSLY, PLACE A SHORTING CAP IN THE HOLIDAY LIGHT PE RECEPTACLE (CN 242803).
6. ANY NEUTRAL, SECONDARY, SERVICE OR STREET LIGHT CONDUCTOR RUNNING ABOVE THE LUMINAIRE SHALL MAINTAIN A 6" MIN. CLEARANCE FROM THE TOP OF PHOTOCELL OR ANY PART OF THE FIXTURE.

3				
2	8/6/14	EANES	EANES	ADCOCK
1	10/12/11	DEFREITAS	JUDAH	LARSEN
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

HOLIDAY DECORATIONS RECEPTACLE INSTALLATION

DEC	DEM	DEP	DEF
			X

30.10-20



WARNING SIGN:

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" FEET.

NOTES:

1. WHEN UTILIZING LIGHTING ONLY RENTAL POLES (STATIC CAST OR WOOD) CONTRACT MUST BE EXECUTED BY CUSTOMER OF RECORD FOR LIGHTING FACILITIES.
2. NO WI-FI EQUIPMENT SHALL BE INSTALLED ON DECORATIVE STREET LIGHT POLES.
3. ONLY ONE WI-FI UNIT IS ALLOWED PER POLE.
4. ALL POTENTIAL WI-FI LOCATIONS MUST BE INSPECTED FOR ELECTRICAL AND MECHANICAL SUITABILITY FOR THE SPECIFIC WI-FI EQUIPMENT THAT WILL BE INSTALLED AT THE SITE.
5. WI-FI EQUIPMENT VOLTAGE MUST MATCH THE LOCATIONS SOURCE VOLTAGE.
6. ALL WI-FI EQUIPMENT INSTALLED ON STREET LIGHT POLES MUST BE APPROVED BY DUKE ENERGY LIGHTING SOLUTIONS.
7. MANUFACTURER MUST SUPPLY THE WEIGHT OF THE EQUIPMENT AND THE EFFECTIVE PROJECTED AREA(S).
8. ALL WI-FI EQUIPMENT (INCLUDING ANTENNA) TO MAINTAIN A MINIMUM OF 40" BELOW ALL ENERGIZED CONDUCTORS INCLUDING DRIP LOOPS.
9. WHERE INSUFFICIENT SPACE RESULTS IN THE WI-FI UNIT BEING INSTALLED BELOW COMMUNICATIONS, WI-FI SERVICE WIRE TO BE INSTALLED IN 1 INCH, SCHEDULE 40 PVC CONDUIT NO CLOSER THAN 12 INCHES BELOW COMMUNICATION/CATV CABLE.
10. SEE DWG. 10.08-01 FOR JOINT USE ON DISTRIBUTION FACILITIES.

REVISED		BY	CK'D	APPR.
3				
2	8/5/14	EANES	EANES	ADCOCK
1	8/5/13	ROBESON	GUINN	ADCOCK
0	7/22/10	DEFREITAS	JUDAH	LARSEN

INSTALLATION OF WI-FI EQUIPMENT FOR WOOD AND STATIC CAST CONCRETE STREET LIGHT POLES

DEC	DEM	DEP	DEF
			X

30.10-22

CATALOG NUMBER	TYPE	DESCRIPTION
30624803	POLYCARBONATE	FOR GENERAL ELECTRIC 400W AND WESTINGHOUSE 400W, 1000W MERCURY VAPOR FLOODS. TO BE USED IN CONJUNCTION WITH STANDARD GLASS LENS IN AREAS OF HIGH INCIDENCE OF VANDALISM. USE EXISTING GLASS LENS RETAINING BOLTS TO ATTACH BOTH GLASS LENS AND POLYCARBONATE LENS TO WESTINGHOUSE FLOODS.
30624902	POLYCARBONATE	FOR GENERAL ELECTRIC 1000W MERCURY VAPOR FLOOD. TO BE USED IN CONJUNCTION WITH STANDARD GLASS LENS IN AREAS OF HIGH INCIDENCE OF VANDALISM.
30625107	GLASS	FOR GENERAL ELECTRIC 400W FLOOD, TYPE P-400C, INCLUDING LENS, GASKET AND HARDWARE.
30625206	GLASS	FOR GENERAL ELECTRIC 1000W MERCURY VAPOR FLOOD, TYPE P-1000, INCLUDING LENS, GASKET AND HARDWARE. STOP PURCHASE ITEM BUT MAY BE AVAILABLE.
30625305	POLYCARBONATE	FOR AMERICAN ELECTRIC 250W SODIUM VAPOR AND 400W MERCURY VAPOR FIXTURES IN AREAS OF HIGH INCIDENCE OF VANDALISM.
30625404	GLASS	FOR CROUSE-HINDS OR WESTINGHOUSE 250W, 400W SODIUM VAPOR FLOODS, TYPE VRF, INCLUDING LENS, GASKET AND DOOR.
13082409	GLASS	FOR THE MCGRAW SMALL 250W, 400W SODIUM VAPOR FLOODS, TYPE UF, INCLUDING LENS, GASKET AND DOOR.
30625503	GLASS	FOR GENERAL ELECTRIC 100W, SODIUM VAPOR FLOODS, TYPE PE, INCLUDING LENS, GASKET AND DOOR
30625602	GLASS	FOR AMERICAN ELECTRIC 100W, SODIUM VAPOR FLOODS, TYPE FM, INCLUDING LENS, GASKET AND DOOR

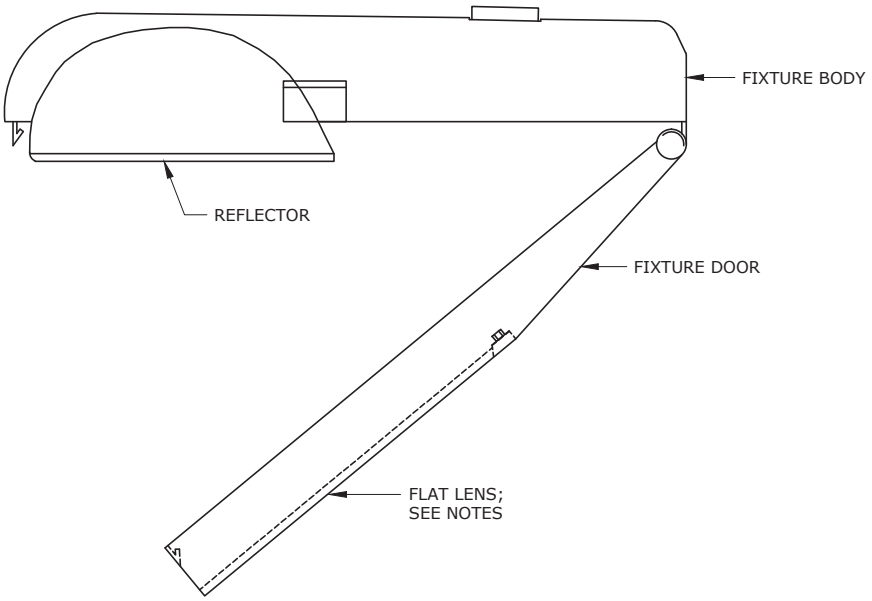
3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

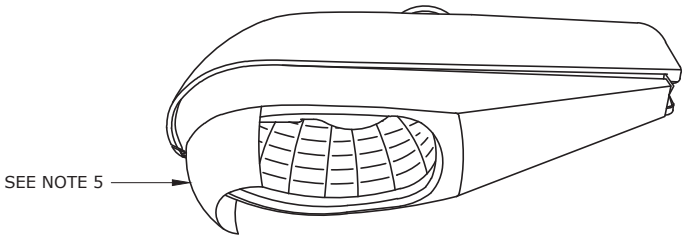
REPLACEMENT LENSES FOR FLOODLIGHTS

Duke Energy®

FLA

DWG. 30.11-10





VOLTAGE	WATTAGE	CATALOG NUMBER	FIXTURE DESCRIPTION
120	100	241505	CUTOFF ENCLOSED COBRAHEAD
120	100	241512	CUTOFF ENCLOSED COBRAHEAD W/O LENS (USE FOR NEW INSTALLATIONS - ADD AMBER LENS)
120	50	241401	CUTOFF ENCLOSED COBRAHEAD

NOTES:

1. REMOVE EXISTING FLAT GLASS LENS.

2. REPLACE WITH AMBER ACRYLIC TURTLE LENS CN 242269.

3. RETURN ORIGINAL GLASS LENS TO STOREROOM.

4. SHIELDS AVAILABLE:

   A. FOR POLE SIDE, USE CU LGSCCPF, CN 242705.
   B. FOR STREET SIDE, USE CU LGSCSSF, CN 242706.
   C. FOR SIDE FIXTURE, USE CU LGSCSF, CN 242708.

5. INSTALL ALL SHIELDS WITH A SILICONE SEALANT, CN 152240.

6. SEE SECTION 30.13 FOR ADDITIONAL INFORMATION ON LIGHT SHIELDS.

7. DO NOT USE AMBER LENS FOR FIXTURES OVER 100 WATTS.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DEFREITAS	JUDAH	LARSEN
0	7/22/10	DEFREITAS	JUDAH	LARSEN

AMBER ACRYLIC REPLACEMENT LENS AND SHIELDS FOR SEA TURTLE HATCHLING AREAS

Progress Energy

FLA

DWG. 30.11-14

READ THOROUGHLY BEFORE INSTALLING

WARNING: DO NOT PERFORM MAINTENANCE ON A LUMINAIRE WHILE IT IS ELECTRICALLY ENERGIZED.

GENERAL

THIS IS A HIGH QUALITY ELECTRONIC DEVICE WHICH GENERATES HIGH VOLTAGE PULSES FOR RELIABLE STARTING OF HPS LAMPS WHEN USED IN CONJUNCTION WITH THE PROPER LAMP AND BALLAST COMBINATION. RELIABILITY AND LONG LIFE ARE ACHIEVED BY STARTER DESIGN. HIGH QUALITY COMPONENTS, AND FACTORY BURN-IN TEST PERFORMED ON EACH DEVICE BEFORE SHIPMENT. THIS STARTED IS SELF-CONTAINED, AND THE HIGH VOLTAGE PULSES ARE GENERATED BY THE STARTER ITSELF AND DOES NOT REQUIRE A TAPPED COIL ON THE BALLAST AS WITH A STANDARD STARTER. THIS STARTER WILL START 35 THROUGH 400 WATT HPS LAMPS AND SHOULD ONLY BE USED IN ENCLOSURES WHERE THE TEMPERATURE DOES NOT EXCEED 90°, SEE DWG. 30.11-25 FOR CATALOG NUMBERS.

APPLICATION

THE PULSE REQUIREMENTS FOR PROPER STARTING OF 35 THROUGH 400 WATT HPS LAMPS ARE 2500 VOLTS MINIMUM PEAK WITH A PULSE WIDTH OF ONE MICROSECOND AT 2250 VOLTS. THE TWO MOST IMPORTANT FACTORS WHICH AFFECT THE LAMP STARTER OPERATION ARE THE SOCKET POLARITY AND THE WIRING LENGTHS (BALLAST TO STARTER AND STARTER TO SOCKET).

SOCKET POLARITY - THE BLUE LEAD FROM STARTER TERMINAL #3 MUST BE CONNECTED TO THE EYE OF THE SOCKET. MISWIRING COULD RESULT IN INADEQUATE STARTING PULSE TO THE LAMP.

WIRING LENGTH - THE DISTRIBUTED CAPACITANCE OF THE LEADS USED TO CONNECT HPS LAMPS AND BALLASTS REDUCES THE PULSE VOLTAGE. A MAXIMUM DISTANCE OF 10' MAY EXIST BETWEEN THE BALLAST AND THE HPS LAMP SOCKET FOR THE STARTER TO PROPERLY START THE LAMP.

INSTALLATION

1. TURN OFF THE POWER TO THE LUMINAIRE.

2. DISCONNECT AND REMOVE THE OLD STARTER.

3. DETERMINE THE HPS LAMP TYPE AND SEE TABLE #1 TO CONFIRM LAMP VOLTAGE AND WHETHER OR NOT TO CUT THE JUMPER. CAUTION: DO NOT CUT OR REMOVE JUMPER IF THE LAMP VOLTAGE IS BETWEEN 50 AND 55 VOLTS. IF THE VOLTAGE IS BETWEEN 90 AND 100 VOLTS REMOVE A SECTION OF THE STARTER JUMPER BY CUTTING IT ON BOTH ENDS OR SIDES (SEE DWG. 30.11-25).

4. IF A GE "PLUG-IN" STARTER IS BEING REPLACED, INSERT THE REPLACEMENT STARTER INTO THE EXISTING STARTER RECEPTACLE BASE. NO OTHER CHANGES ARE REQUIRED.

5. SOME SMALL FIXTURES SUCH AS THE SHOE BOX AND THE SMALL FLOODLIGHT MAY NOT HAVE ENOUGH ROOM FOR REPLACEMENT STARTER AID; MAKE THIS DETERMINATION BEFORE REMOVING BAD STARTER.

6. FOR ALL OTHER CONFIGURATIONS, CONNECT THE GE REPLACER STARTER DIRECTLY TO THE LUMINAIRE WIRING AS FOLLOWS (SEE DWG. 30.11-25).

   A. CONNECT TERMINAL #3 (BLUE LEAD) OF THE STARTER ASSEMBLY TO THE LUMINAIRE LEAD CONNECTING THE BALLAST AND THE EYE OF THE SOCKET BY CUTTING THE LUMINAIRE LEAD, STRIPPING THE LEAD ENDS AND SPLICING ALL THREE LEAD ENDS WITH A WIRE NUT SUPPLIED IN THE KIT.

   B. CONNECT TERMINAL #1 (WHITE LEAD) OF THE STARTER ASSEMBLY TO THE LUMINAIRE LEAD CONNECTING THE BALLAST AND THE SHELL OF THE SOCKET BY CUTTING THE LUMINAIRE LEAD, STRIPPING THE LEAD ENDS AND SPLICING ALL THREE LEAD ENDS WITH A WIRE NUT SUPPLIED IN THE KIT.

   C. TERMINAL LEAD #3 BLUE AND #1 WHITE CAN BE CONNECTED EASIER AND DIRECTLY TO THE TERMINAL BOARD OR BALLAST BY USING PANDUIT DISCONNECTS, SPLICES, OR WIRE JOINTS, NO. DNF14-250FIM-C & DNF14-250FIB-C. THE TWO CONNECTORS COME IN QUANTITIES OF 100 PER BOX AND MAY BE OBTAINED THROUGH LOCAL ELECTRICAL DISTRIBUTORS.

   D. TERMINATE OLD STARTER/BALLAST UNUSED LEAD(S) BY COVERING THE ENDS WITH A WIRE NUT.

   E. SECURE THE STARTER ASSEMBLY TO THE LUMINAIRE HOUSING WITH THE SCREW(S) PROVIDED IN THE KIT. CARE SHOULD BE TAKEN IN LOCATING STARTER TO MAINTAIN A MINIMUM OF 1/2" CLEARANCE FROM OTHER ELECTRICALLY OR THERMALLY "HOT" COMPONENTS.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN

G.E. UNIVERSAL REPLACEMENT STARTING AID

INSTALLATION INSTRUCTIONS

Duke Energy®

FLA

DWG. 30.11-20

TABLE 1					
ANSI LAMP TYPE	LAMP WATTAGE	LAMP VOLTAGE	OPERATING VOLTAGE	REMOVE JUMPER	DO NOT REMOVE JUMPER
S62	70	55	120V		X
S54	100	55			X
S55	150	55			X
S66	200	100		X	
S50	250	100		X	
S51	400	100		X	
S66	200	100	240V	X	
S50	250	100		X	
S51	400	100		X	

CAUTION: FAILURE TO REMOVE OR CUT JUMPER WHEN REQUIRED ON THE GE OR AEL CAN CAUSE EARLY STARTER FAILURES

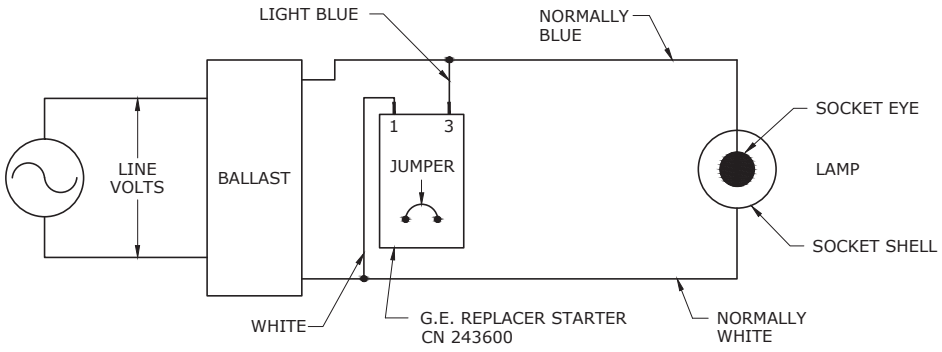
WARNING: IF THIS STARTER IS USED TO START HPS LAMPS ON ANYTHING OTHER THAN A HPS BALLAST, THE BALLAST AND STARTER MAY BE DAMAGED AND THE HPS LAMP LIFE COULD BE SHORTENED. THERE ARE MANY BALLAST SYSTEM VARIATIONS AND NOT EVERY DESIGN HAS BEEN TESTED. THE GE & AEL ACCEPTS NO RESPONSIBILITY OR LIABILITY FOR THE IMPROPER APPLICATION OR INSTALLATION OF THIS STARTER. PROPER REPLACER STARTER OPERATION INSTRUCTIONS ARE ENCLOSED WITH EACH STARTER:

1. CORRECT BALLAST OPEN CIRCUIT VOLTAGE (SOCKET WITH LAMP REMOVED):

2. LOW DISTRIBUTED CAPACITANCE ON BALLAST SECONDARY:

   THE BALLAST, SOCKET AND WIRING CAPACITANCE MUST BE LOWER THAN 200 PICOFARADS. DISTANCE BETWEEN BALLAST HPS LAMP SOCKET MUST BE NO MORE THAN 10'.

3. GOOD ELECTRICAL INSULATION INTEGRITY CAPABLE OF 2500 VOLT HI-POT.



NOTE: THE FOLLOWING CATALOG NUMBERS HAVE BEEN SET UP AS MAINTENANCE PARTS ONLY. THE STARTERS CAN NOW BE ORDERED THROUGH THE WILDWOOD WAREHOUSE. EACH OPERATIONS CENTER CAN STOCK FOR MAINTENANCE ONLY.

COOPER ORIGINAL REPLACEMENT STARTERS

A. CN 243607 - 35W THROUGH 100W HPS LAMPS
B. CN 243606 - 100W THROUGH 400W HPS
C. CN 9220120016 - 100W METAL HALIDE
D. CN 9220223265 - 320W METAL HALIDE PULSE START

HOLOPHANE ORIGINAL REPLACEMENT STARTERS

A. CN 243608 - 100W THROUGH 150W HPS
B. CN 9220122160 - 100W METAL HALIDE AND 250W/400W HPS TEARDROP
C. CN 9220148466 - 150W METAL HALIDE PULSE START

AMERICAN ELECTRIC

A. CN 9220144077 - 50W THROUGH 400W HPS LAMP, SEE STARTER FOR JUMPER WIRE POSITION

REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DEFREITAS	JUDAH	LARSEN
0	7/22/10	DEFREITAS	JUDAH	LARSEN

G.E. & AEL UNIVERSAL, COOPER, AND HOLOPHANE REPLACEMENT STARTING AID INSTALLATION INSTRUCTIONS

Progress Energy

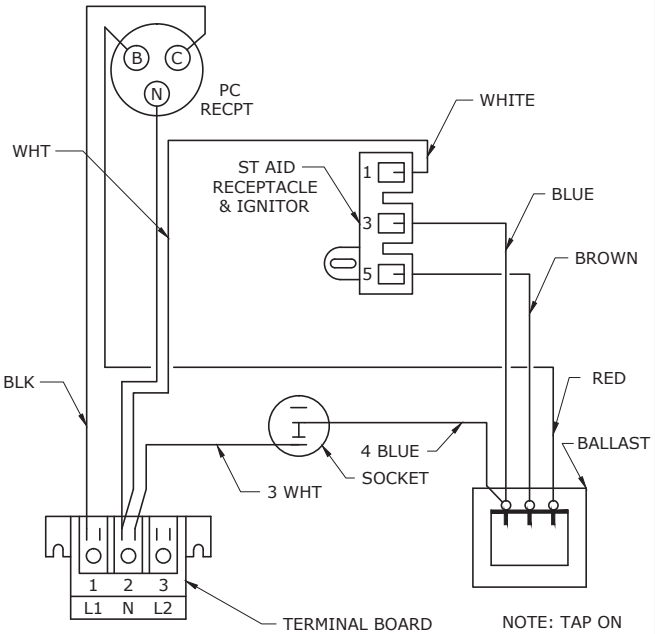
FLA

DWG. 30.11-25

ORIGINAL WIRING DIAGRAM
120V

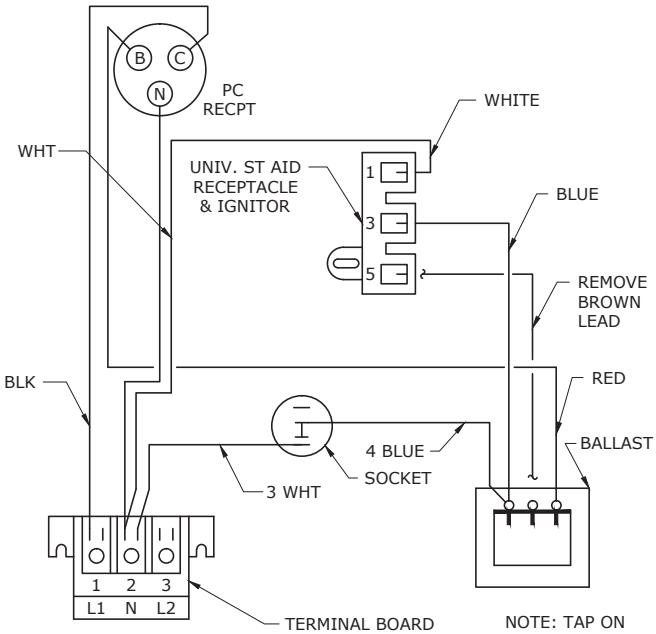
DIAGRAM AFTER REPLACEMENT
OF UNIVERSAL STARTER AID

G.E. 70W, 100W & 150W



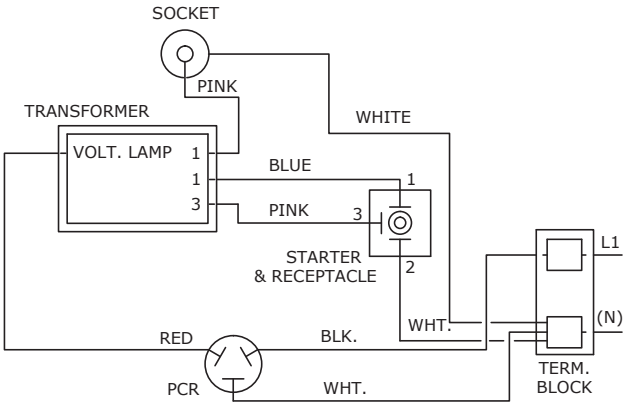
NOTE: TAP ON REACTOR MAY BE LOCATED ON OPPOSITE END OF COIL.

G.E. 70W, 100W & 150W, 120V

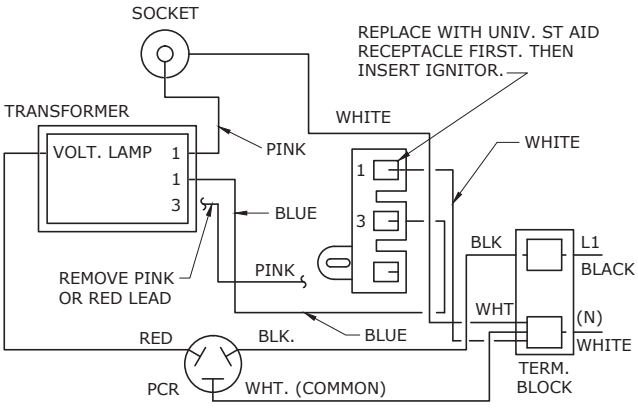


NOTE: TAP ON REACTOR MAY BE LOCATED ON OPPOSITE END OF COIL.

CROUSE-HINDS & MCGRAW EDISON
70W, 100W & 150W



CROUSE-HINDS & MCGRAW EDISON
70W, 100W & 150W



NOTES:

1. WIRING DIAGRAM WILL VARY DUE TO THE NUMBER OF WIRING CHANGES OVER THE YEARS. USE DIAGRAM IN THE FIXTURE FIRST. IF ONE IS NOT PRESENT, THEN REFER TO THESE.

2. THE UNIVERSAL STARTING AID WILL WORK IN ALL HPS LUMINAIRES UP TO 400W, JUST FOLLOW INSTRUCTIONS IN EACH BOX AND DWGS. 30.11-20 THROUGH 30.12-15.

3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

WIRING DIAGRAM FOR 120 VOLT HPS LUMINAIRES AND REPLACEMENT WITH UNIVERSAL (2-WIRE) STARTING AID

Duke Energy®

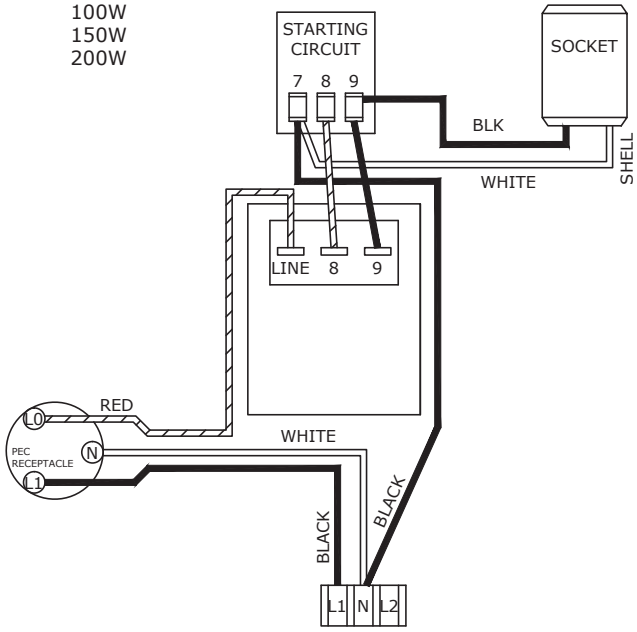
FLA

DWG. 30.12-01

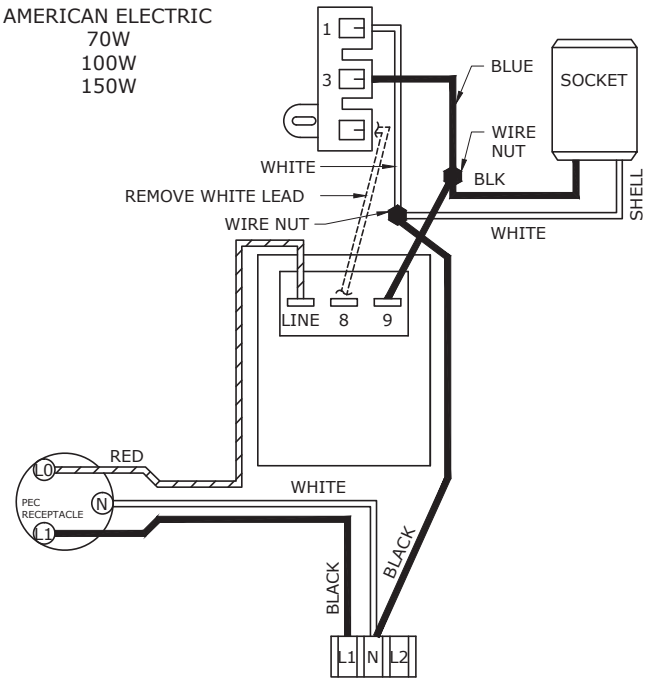
ORIGINAL WIRING DIAGRAM
120V

DIAGRAM AFTER REPLACEMENT
OF UNIVERSAL STARTER AID

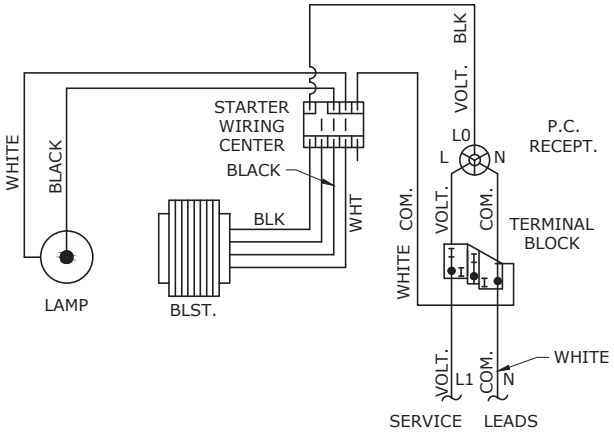
AMERICAN ELECTRIC
70W
100W
150W
200W



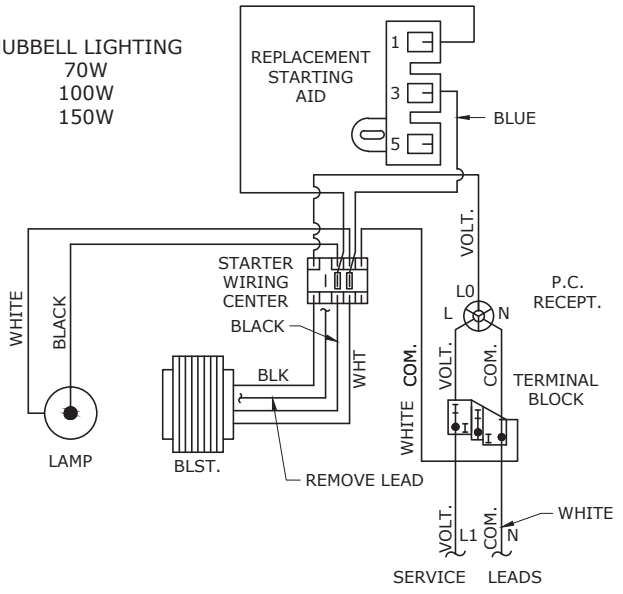
AMERICAN ELECTRIC
70W
100W
150W



HUBBELL LIGHTING
70W
100W
150W



HUBBELL LIGHTING
70W
100W
150W



3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

WIRING DIAGRAM FOR 120 VOLT HPS LUMINAIRES AND REPLACEMENT WITH UNIVERSAL (2-WIRE) STARTING AID

Duke Energy®

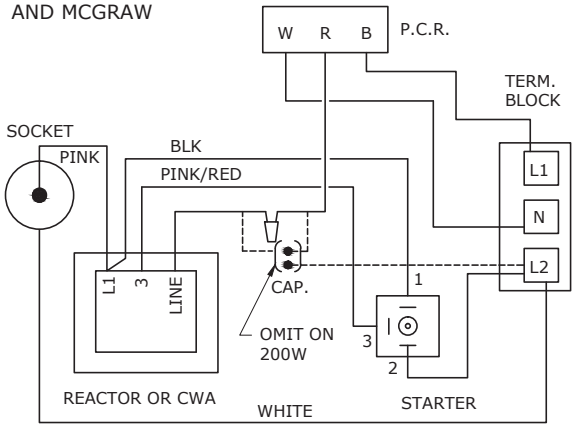
FLA

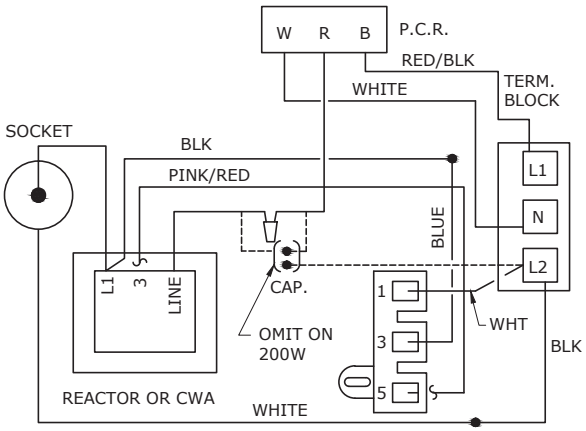
DWG. 30.12-05

ORIGINAL WIRING DIAGRAM
240V

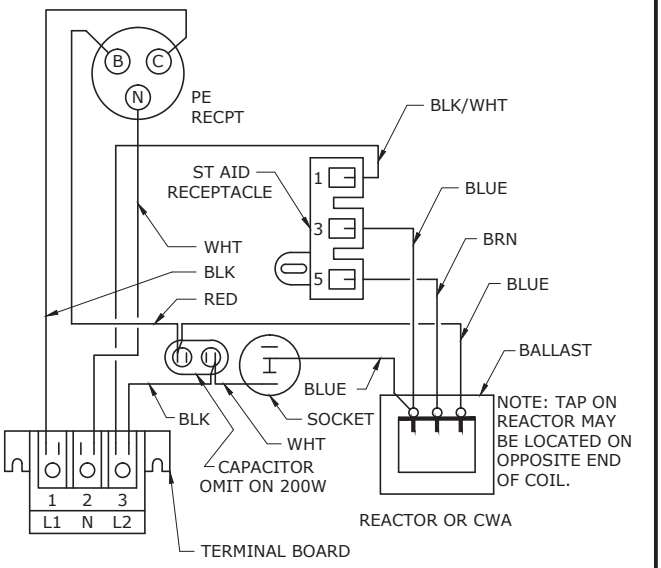
DIAGRAM AFTER REPLACEMENT
OF UNIVERSAL STARTER AID

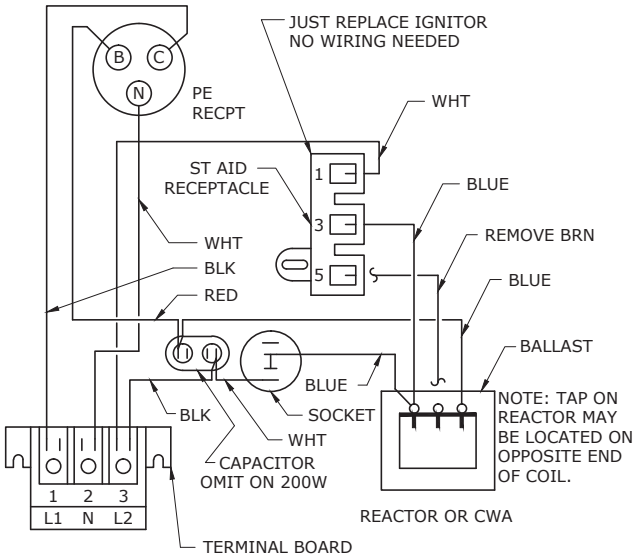
CROUSE-HINDS 200W, 400W
AND MCGRAW



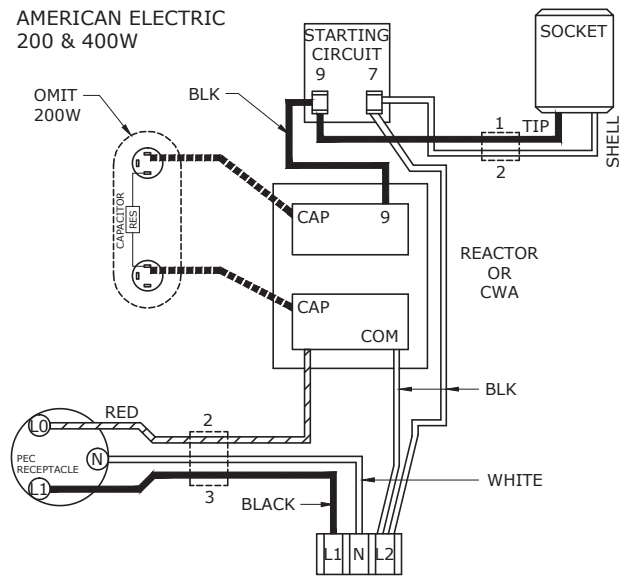


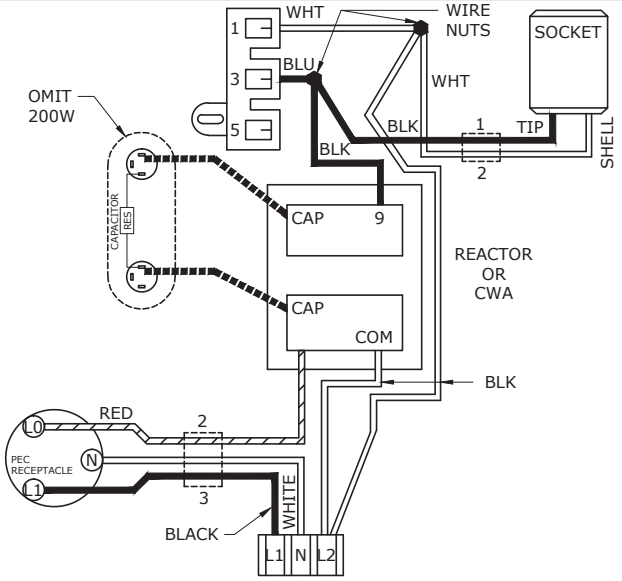
G.E. 240V. 200W & 400W





AMERICAN ELECTRIC
200 & 400W





3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

WIRING DIAGRAM FOR 240 VOLT HPS LUMINAIRES AND REPLACEMENT WITH UNIVERSAL (2-WIRE) STARTING AID

Duke Energy®

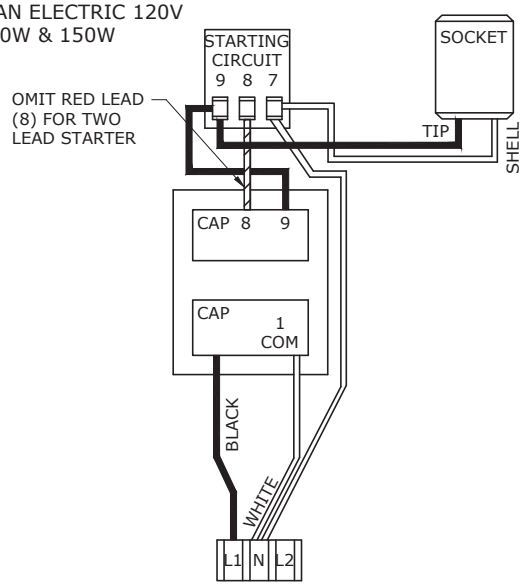
FLA

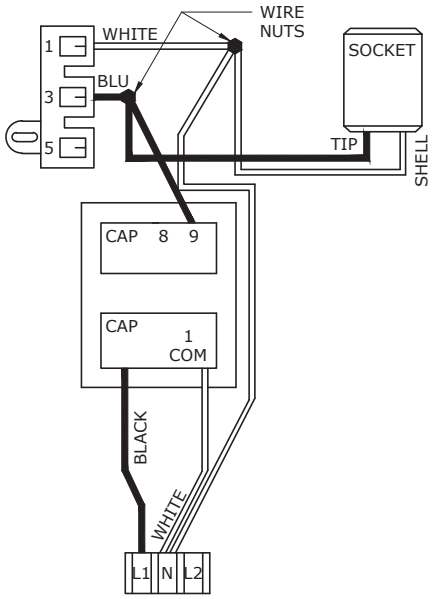
DWG. 30.12-10

ORIGINAL WIRING DIAGRAM
120V & 240V

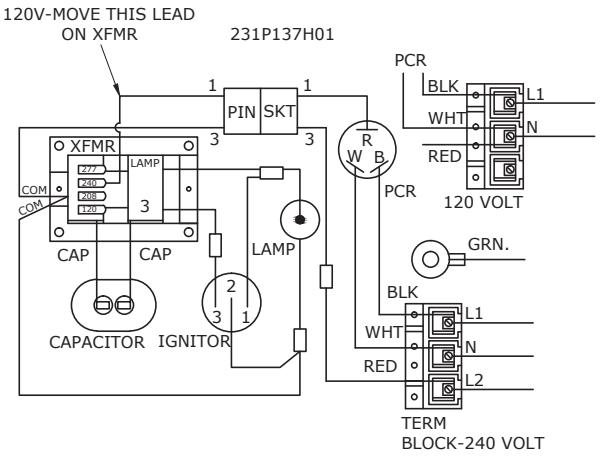
DIAGRAM AFTER REPLACEMENT
OF UNIVERSAL STARTER AID

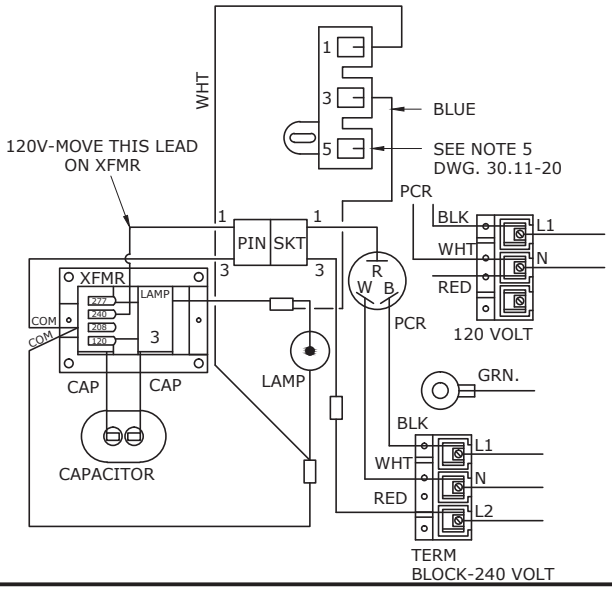
AMERICAN ELECTRIC 120V
70W, 100W & 150W



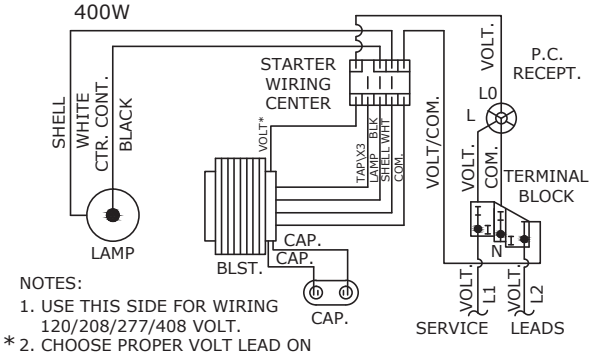


MCGRAW 240V
200W, 250W & 400W
SHOEBOX & SMALL FLOODLIGHT
MULTI-TAP VOLTAGE BALLAST

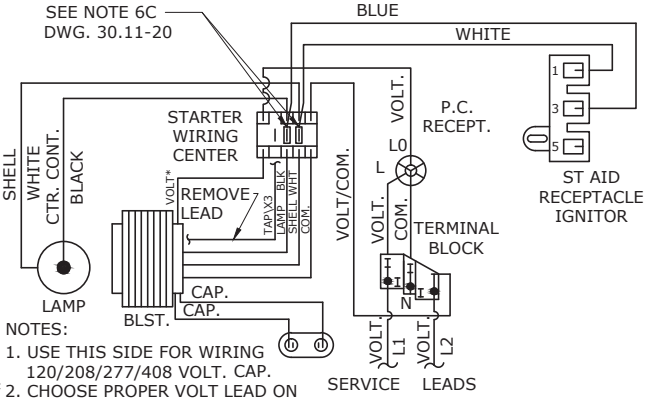




HUBBELL LIGHTING 240V
200W
400W



NOTES:
1. USE THIS SIDE FOR WIRING 120/208/277/408 VOLT.
* 2. CHOOSE PROPER VOLT LEAD ON MULTI-TAP BALLAST.



NOTES:
1. USE THIS SIDE FOR WIRING 120/208/277/408 VOLT. CAP.
* 2. CHOOSE PROPER VOLT LEAD ON MULTI-TAP BALLAST.

3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

WIRING DIAGRAM FOR 120 & 240 VOLT HPS LUMINAIRES AND REPLACEMENT WITH UNIVERSAL (2-WIRE) STARTING AID

Duke Energy®

FLA

DWG. 30.12-15

ORIGINAL WIRING DIAGRAM 120V & 240V

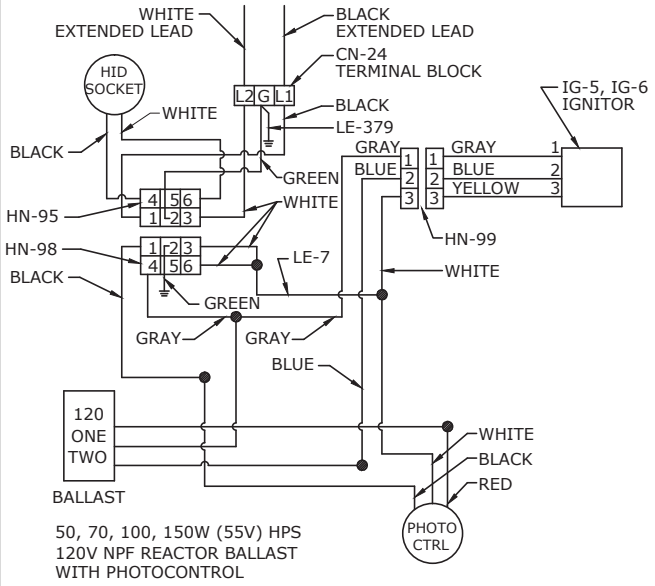
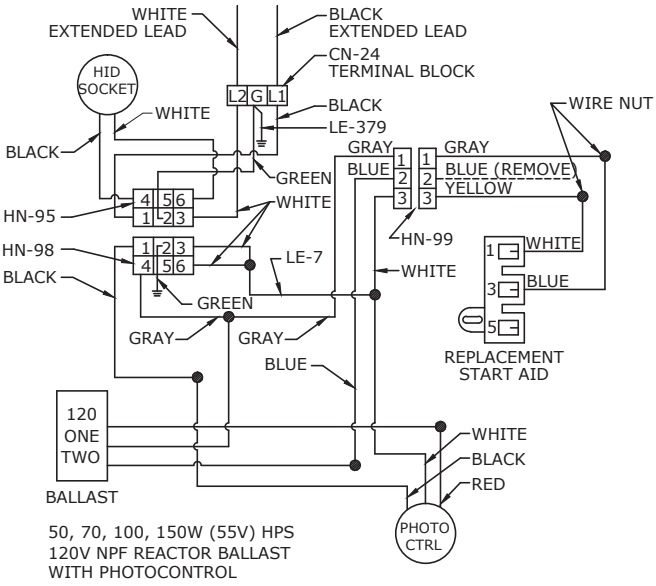
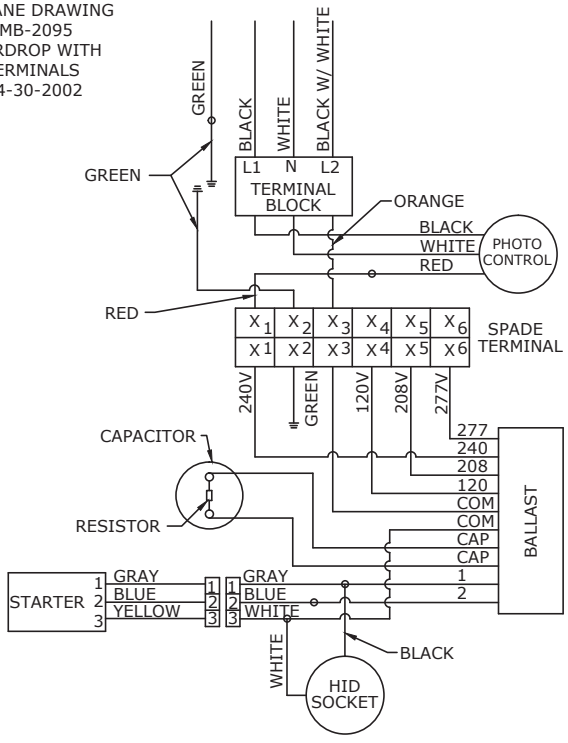


DIAGRAM AFTER REPLACEMENT OF UNIVERSAL STARTER AID



MITCHELL DECORATIVE POST FIXTURE

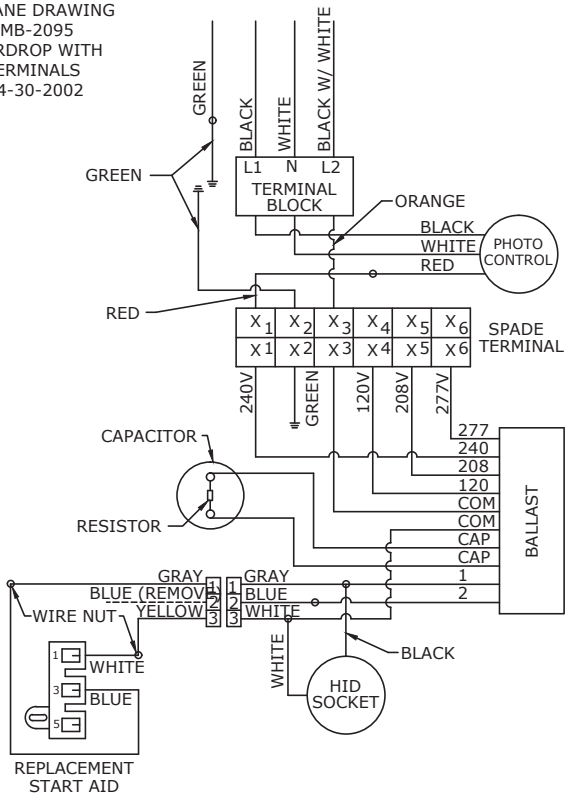
WIRING DIAGRAM FROM
HOLOPHANE DRAWING
NUMBER MB-2095
HPS TEARDROP WITH
SPADE TERMINALS
DATED 04-30-2002



TEARDROP FIXTURE

MITCHELL DECORATIVE POST FIXTURE

WIRING DIAGRAM FROM
HOLOPHANE DRAWING
NUMBER MB-2095
HPS TEARDROP WITH
SPADE TERMINALS
DATED 04-30-2002



TEARDROP FIXTURE

3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

WIRING DIAGRAM FOR 120 & 240 VOLT HPS LUMINAIRES AND REPLACEMENT WITH UNIVERSAL (2-WIRE) STARTING AID

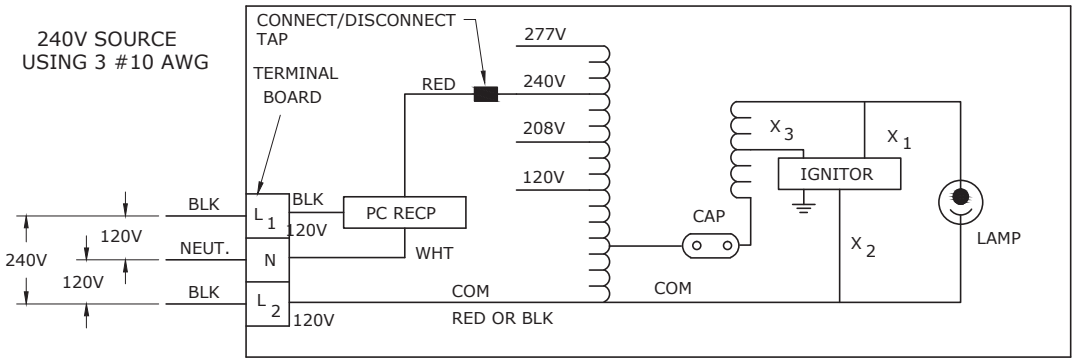
Duke Energy®

FLA

DWG. 30.12-16

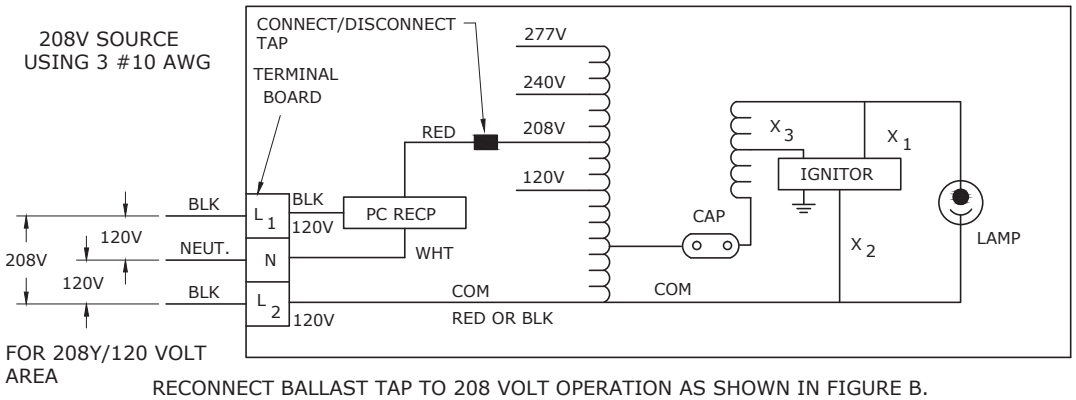
THE LUMINAIRES WITH MULTI-VOLTAGE CONNECTIONS ARE THE HPS AND METAL HALIDE 200W THROUGH 1000W, ALL TYPES. THE VOLTAGE TAPS ON THESE BALLASTS ARE 120, 208, 240 AND 277 VOLTS. THE FIXTURES COME FROM THE FACTORY CONNECTED TO THE 120V TAP. THE 120 VOLT TAP IS THE STANDARD CONNECTION. LEAVE THIS TAP AS IS WHEN SUPPLYING 120 VOLTS TO THE UNIT. SEE FIGURE C FOR 277 VOLT OPERATION.

FIGURE A. TYPICAL WIRING DIAGRAM-HPS OR MH CWA LUMINAIRE 240V BALLAST CONNECTION



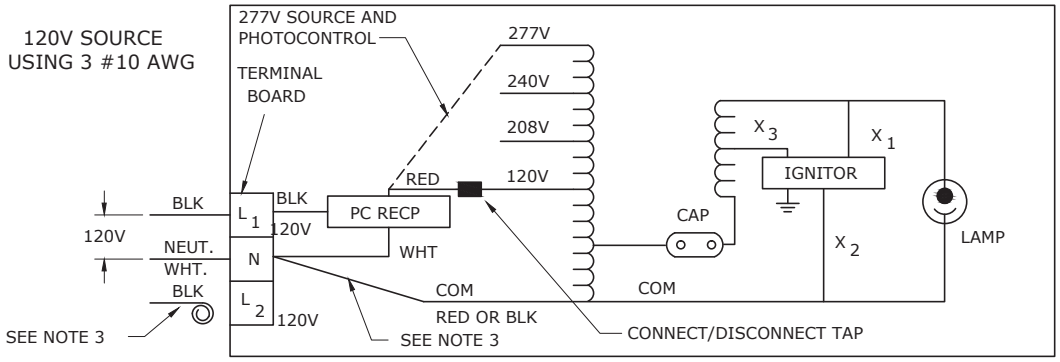
CHECK TAP TO INSURE THE BALLAST IS CONNECTED FOR 240V OPERATION.

FIGURE B. TYPICAL WIRING DIAGRAM-HPS OR MH CWA LUMINAIRE 208V BALLAST CONNECTION



RECONNECT BALLAST TAP TO 208 VOLT OPERATION AS SHOWN IN FIGURE B.

FIGURE C. TYPICAL WIRING DIAGRAM-HPS OR MH CWA LUMINAIRE 120V BALLAST CONNECTION



NOTES:

1. FOR 240V OPERATION RECONNECT BALLAST TAP AS SHOWN IN FIGURE A, RECONNECT THE TERMINAL COMMON LEAD FROM N TO L_2 AS SHOWN IN FIGURE A.
2. DO NOT TIE TWO HOT LEADS TOGETHER ON 120V OPERATION. THE EXTRA PHASE LEAD OF #10 AWG IS TO BE TAPED AT BOTH ENDS AND SPIRALED BACK TO MAINTAIN ELECTRICAL CLEARANCE. (NOTE: THIS LEAD MAY BE NEEDED IF THE EXISTING LUMINAIRE IS REPLACED WITH A 240V LUMINAIRE.)
3. THE SHOEBOX HAS FOUR EXTERNAL LEADS ATTACHED TO FIXTURE TERMINAL BOARD. THE L_2 COM LEAD MUST BE CONNECTED TO THE WHITE NEUTRAL LEAD INTERNALLY FOR 120V OR 277V OPERATION.

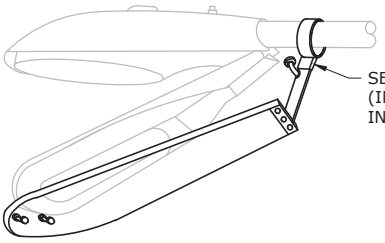
3				
2				
1				
0	7/26/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

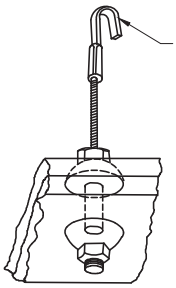
LUMINAIRES WITH MULTI-TAP BALLASTS,
200W THROUGH 1000W, ALL TYPES

Duke Energy®

FLA

DWG. 30.12-20





VANDAL PROOF SHIELD

50-250W
CU LBPSF
CN 242714
400W
CU LBPMF
CN 9220157694

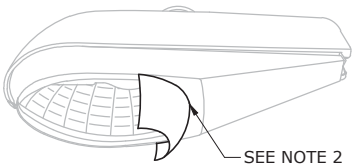
APPLICATION: TO BE USED WITH FOLLOWING LUMINAIRES.

WATTAGE	CLASS	CN
100	71	241505
150	72	241506
200	70	241504
250	73	241507
400	78	9220157694

INSTALLATION INSTRUCTIONS:

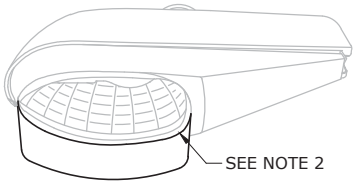
1. REMOVE CLAMP FROM SHIELD.
2. INSTALL CLAMP ON EXISTING POLE ARM AND ATTACH SHIELD TO CLAMP.
3. POSITION LENS DOOR SO THAT IT IS ONE INCH FROM BEING CLOSED. ADJUST CARRIAGE BOLT TO TOUCH POLE ARM.
4. ATTACH HOOK TO LENS DOOR.
5. CLOSE LENS DOOR BY APPLYING PRESSURE WITH YOUR HANDS. MAKE SURE LENS DOOR IS LOCKED.
6. GO BACK TO THE CLAMP BOLT AND TIGHTEN.

FIG. 1 THESE FIXTURES ARE FLAT GLASS "CUTOFF LUMINARIES" WITH A REFLECTOR DESIGNED FOR FLAT GLASS INSTALLATIONS.



POLE SIDE SHIELD
100W - 250W HPS
CU LGSCCPF
CN 242705

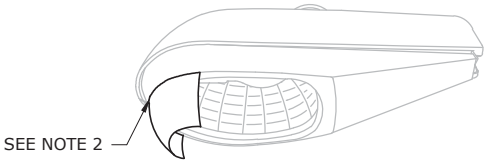
FIG. 2



SIDE FIXTURE SHIELD
50W - 250W HPS
GE AND COOPER FIXTURES
CU LGSCSF
CN 242708

AEL FIXTURES
CU LGSCSAELF
CN 9220152985

FIG. 3



STREET SIDE SHIELD
100W - 250W HPS
CU LGSCSSF
CN 242706

FIG. 4

NOTES:

1. SEE DWG. 30.08-05 FOR STOCKED CUTOFF COBRA HEADS.
2. INSTALL ALL SHIELDS USING THE SILICONE SEALANT FOR ALL CUTOFF ENCLOSED FIXTURE SHIELDS.
3. THESE VANDAL SHIELDS FIT GE CUTOFF ENCLOSED FIXTURES ONLY. IF THESE SHIELDS ARE TO BE ADDED TO EXISTING FIXTURES THAT ARE NOT GE, THE FIXTURES MUST BE CHANGED TO GE TO ALLOW VANDAL SHIELDS TO ATTACH PROPERLY.

REVISED		BY	CK'D	APPR.
3				
2				
1	5/24/12	DEFREITAS	JUDAH	LARSEN
0	7/22/10	DEFREITAS	JUDAH	LARSEN

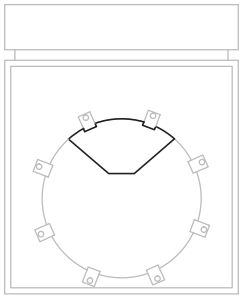
SHIELDS AND VANDAL PROOF SHIELDS FOR CUTOFF ENCLOSED FIXTURES NON-STOCK GLARE CONTROL

Progress Energy

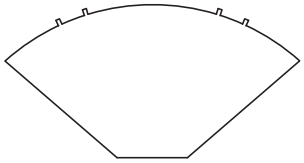
FLA

DWG. 30.13-01

CUBE LIGHT FIXTURE



BOTTOM VIEW



INTERNAL SHIELD (COOPER ONLY)

CUBE	SHIELD CU	SHIELD CN
400W, MEDIUM HOUSING	LGSMGF	242717
1000W, LARGE HOUSING	LGSLGF	242718

3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

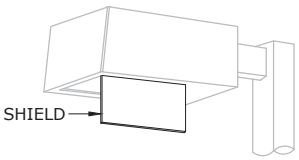
SHIELDS FOR CUBE AND
SEMI-ENCLOSED FIXTURES
NON-STOCK GLARE CONTROL

Duke Energy®

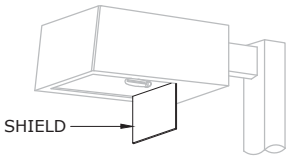
FLA

DWG.
30.13-03

FIG 1



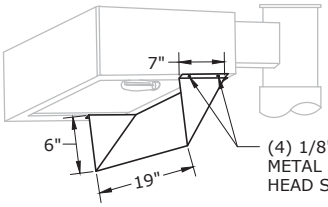
SIDE SHIELD (COOPER)
22" X 7"
250W THRU 1,000W
CU LGSSBSF



HOUSE SHIELD (COOPER)
14-1/2" X 7"
250W THRU 1,000W
CU LGSSBPSF
CN 9220127356

FIG 2

FORWARD THROW (COOPER) HOUSE OR STREET SHIELD
6" X 7 X 19"
400W AND 1000W
CU LGSFWTF
CN 9220179653

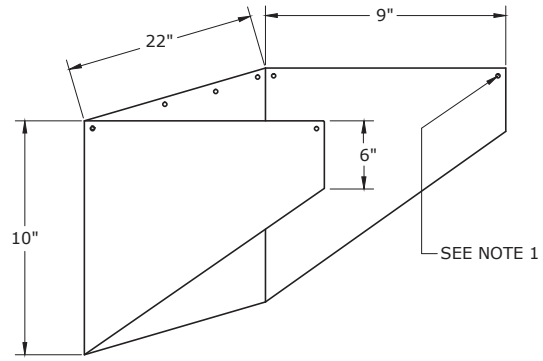


(4) 1/8" DIA. X 1/2" LONG SHEET METAL SELF-TAPPING SS PHILLIPS-HEAD SCREWS

INSTALLATION INSTRUCTIONS:

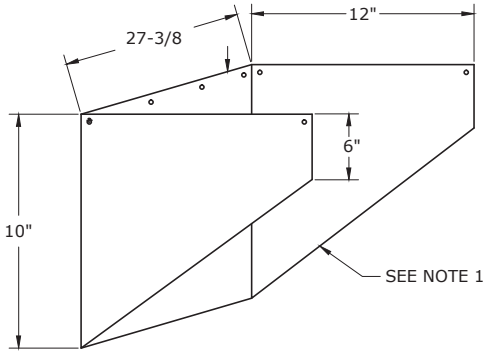
1. DRILL (4) 1/8" HOLES IN DOOR OF FIXTURE USING SHIELD AS TEMPLATE. INSTALL (4) SCREWS (1/8" X 1/2" LONG) FOUND IN SHIELD PACKAGE. POSITION SHIELD SO FIXTURE DOOR CAN BE OPENED WITH RELEASE TAB IN DOOR.

FIG 3



MEDIUM HOUSE AND SIDE SHIELD (COOPER) GALLERIA
400W
CU LGSMGEF
CN 9220179655

FIG 4



LARGE HOUSE AND SIDE SHIELD (COOPER) GALLERIA
1,000W
CU LGSLGEF
CN 9220179654

NOTES:

1. ATTACH GLARE SHIELD (FIG. 3 & 4) TO LIGHT FIXTURE WITH 1/2" LONG STAINLESS SELF-TAPPING SCREWS (PROVIDED BY MANUFACTURER).

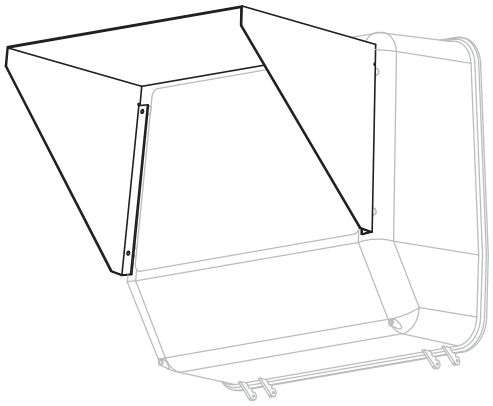
3				
2				
1				
0	7/22/10	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

SHIELDS FOR
SHOEBOX FIXTURES

Duke Energy®

FLA

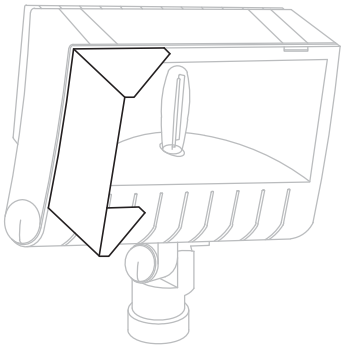
DWG.
30.13-05



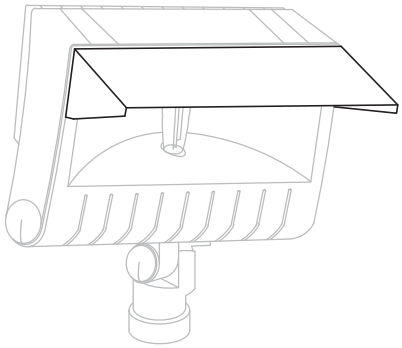
TOP AND SIDE VISOR

FLOODS	GE COMPONENTS	COOPER COMPONENTS		AEL COMPONENTS
	SHIELD CN	SHIELD CU	SHIELD CN	SHIELD CN
250W - 400W HPS AND MH	9220091611	-	-	9220198234
1000W MH	30022909	SEE BELOW	SEE BELOW	9220150110

COOPER FIXTURES



FLOOD SIDE SHIELD
CN 242712



TOP/BOTTOM SHIELD
CN 242711

1000W FLOODS	COOPER COMPONENTS	
	SHIELD CU	SHIELD CN
110,000 FLOOD SIDE SHIELD ONLY (1000W)	-	9220090954
110,000 FLOOD (1000W) COOPER TOP AND BOTTOM	-	9220090951

NOTES:

1. ATTACH GLARE SHIELD TO LIGHT FIXTURE WITH 1/4" LONG SELF-TAPPING SCREWS (PROVIDED BY MANUFACTURER). THE 1/8" PILOT HOLES ARE LOCATED 3/8" FROM EACH CORNER EDGE. USE THESE HOLES AS A GUIDE FOR DRILLING PILOT HOLES IN THE FIXTURE.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	7/26/10	DEFREITAS	JUDAH	LARSEN

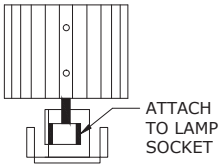
SHIELDS FOR
FLOOD FIXTURES
NON-STOCK GLARE CONTROL

Duke Energy®

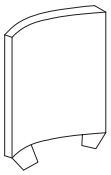
FLA

DWG.
30.13-07

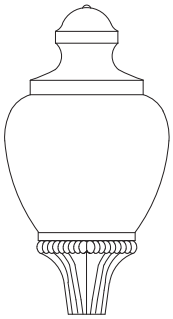
FIG. A



SIDE SHIELD ONLY
CU LGSPTF
CN 9220144802

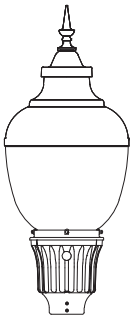


SIDE SHIELD ONLY
CU LGSOF
CN 242719



OCALA

STANDARD POST TOP			SHIELD	
TYPE	COMPATIBLE UNIT	FIXTURE CN	SHIELD CU	SHIELD CN
OCALA 9,500 HPS (SIDE)	L95SV10OC1F	241501	LGSOF	242719



POST TOP

POST TOP			SHIELD	
TYPE	COMPATIBLE UNIT	FIXTURE CN	SHIELD CU	SHIELD CN
FLAGLER 9,500 (SIDE)	L95SV10FG1F	241520	LGSPTF	9220144802
BISCAYNE 9,500 (SIDE)	L95SV10BC1F	241522	LGSPTF	9220144802
MONTICELLO 9,500 (SIDE)	L95SV10MONT1F	241854	LGSPTF	9220144802

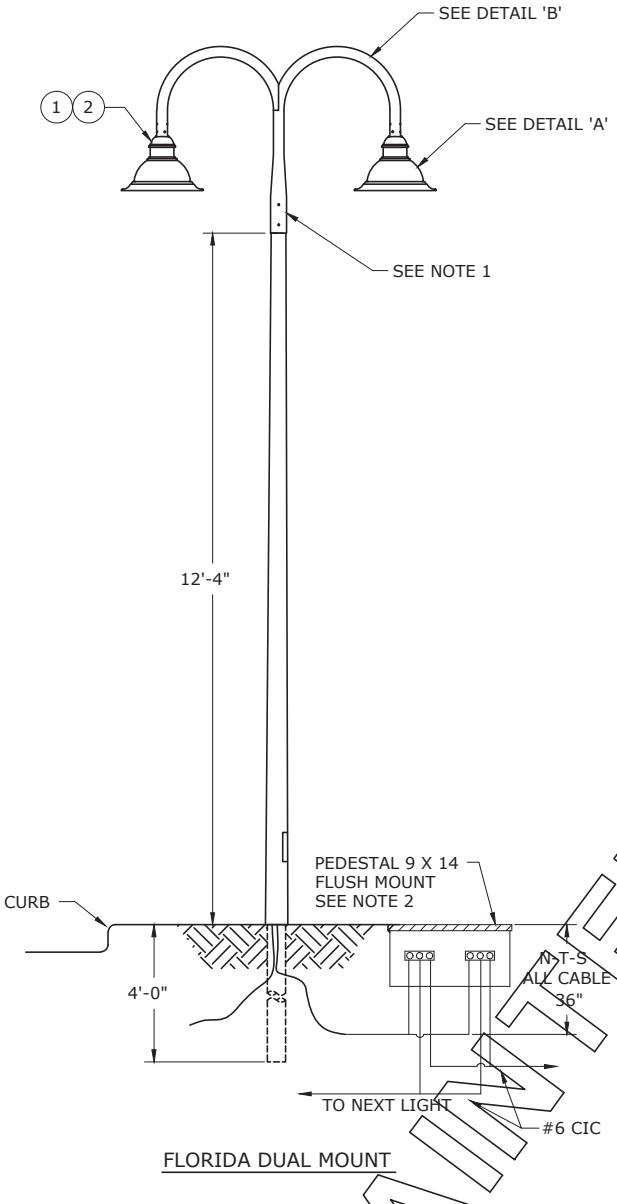
3				
2				
1	6/26/12	DEFREITAS	JUDAH	LARSEN
0	1/27/09	DEFREITAS	JUDAH	LARSEN
REVISED		BY	CK'D	APPR.

SHIELDS FOR POST TOP FIXTURES NON-STOCK GLARE CONTROL

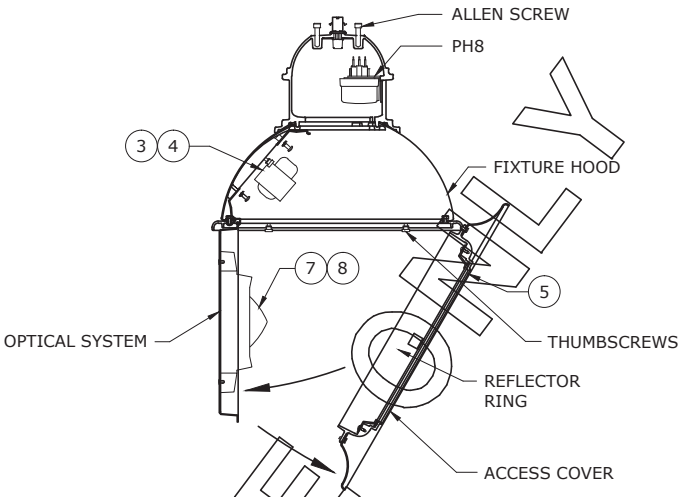
Progress Energy

FLA

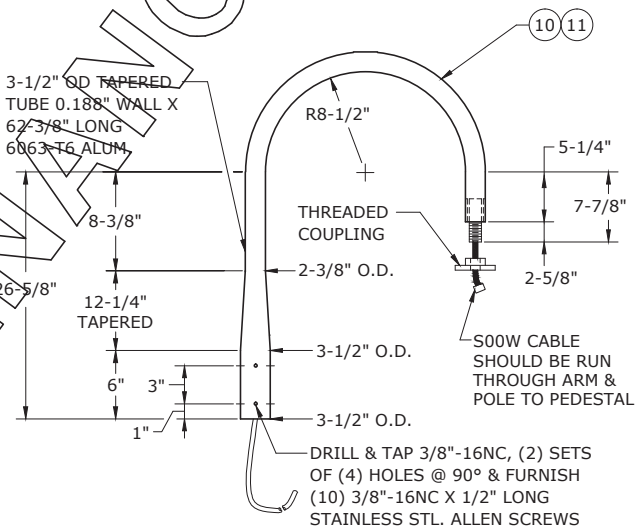
DWG. 30.13-09



FLORIDA DUAL MOUNT



DETAIL 'A'



HOLOPHANE
DETAIL 'B'

ITEM	CN	LUMEC SANIBEL FIXTURES, 120V 100W HPS & 175W MH
1	241890	SANIBEL FIXTURE, 120V, 100W HPS
2	241891	SANIBEL FIXTURE, 120V, 175W MH
3	242054	BALLAST REPLACEMENT, 120V, 100W HPS
4	242055	BALLAST REPLACEMENT, 120V, 175W MH
5	242230	REPLACEMENT LENS/DOOR
6	243104	REPLACEMENT 'FULL SIZE' PE CONTROL
7	250601	LAMP, 100W HPS
8	250683	LAMP, 175W MH
9	243610	REPLACEMENT STARTER AID
10	240320	SINGLE TENON SHEPHERD'S ARM
11	240321	DOUBLE TENON SHEPHERD'S ARMS

ITEM	CN	OLD HOLOPHANE SANIBEL FIXTURES 120V 100W HPS
12	241521	OLD SANIBEL FIXTURE, 120V, 100W HPS
13	240331	OLD SANIBEL SINGLE TENON SHEPHERD'S ARM
14	240332	OLD SANIBEL DOUBLE TENON SHEPHERD'S ARM
15	243108	OLD SANIBEL 'BUTTON' PE REPLACEMENT
16	242162	OLD SANIBEL REPLACEMENT BALLAST, 120V, 100W HPS
17	242246	OLD SANIBEL REPLACEMENT GLASS REFRACTOR LENS

NOTES:

1. BRACKETS FOR SANIBEL FIXTURE(S) REQUIRE POST (CN 034157) TO HAVE A 3" DIAMETER X 6" HIGH TENON.
2. PEDESTAL DETAILS, SEE DWG. 30.07-36.
3. POLE DETAILS, SEE DWG. 30.09-28.
4. FIXTURE PROVIDED BY PROGRESS ENERGY.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 7/21/10	DEFREITAS	JUDAH	LARSEN

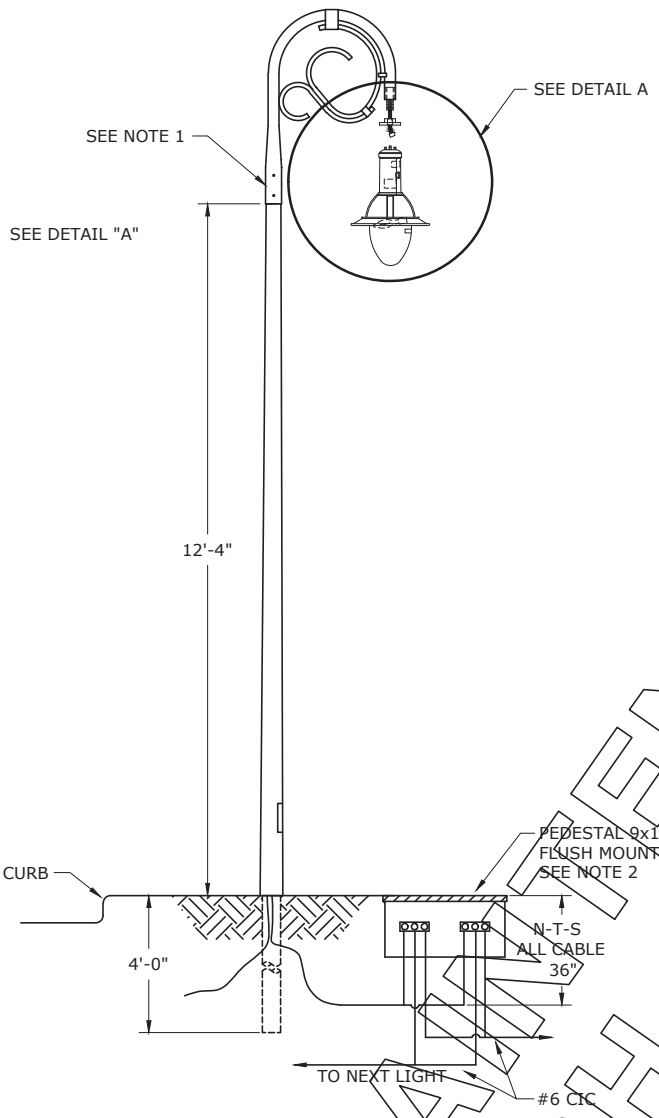
LUMINAIRE, DECORATIVE 100W HPS &
175W MH, THE SANIBEL (FMO)

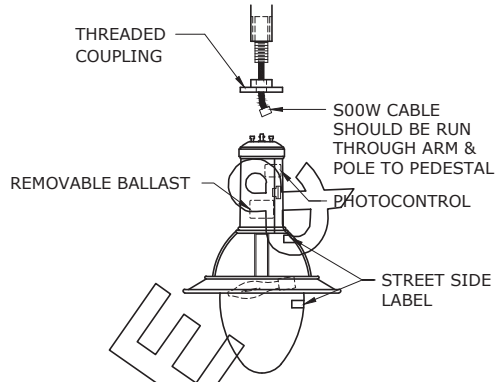
Duke Energy®

FLA

DWG. 30.08-08A

FLORIDA SINGLE MOUNT





DETAIL A

INSTALLATION NOTES:

1. LIFT THE LUMINAIRE UNDER THE CAST-SUSPENSION RING.
2. ALIGN WITH STREET SIDE ON LUMINAIRE.
3. CONNECT THE QUICK DISCONNECT TERMINALS AND PUSH THE CONNECTION IN THE MOUNTING OPENING.
4. TURN THE LUMINAIRE CLOCKWISE TO ENGAGE THE HEAD OF THE SCREWS IN THE KEYHOLE SLOTS.
5. TIGHTEN ALL FOUR SCREWS TO FIRMLY SECURE THE LUMINAIRE IN PLACE. TORQUE: 240 LBS/IN, 20 LBS/FT.
6. SEE INSTALLATION INSTRUCTION SHEET IN FIXTURE BOX FOR ADDITIONAL DETAILS.

CLERMONT FIXTURE REPLACEMENT PARTS

ITEM NO.	COMPATIBLE UNIT	MATERIAL ITEM	QUANTITY	DESCRIPTION
1	-	9220067348	1	BALLAST REPLACEMENT, 120V, 100W HPS
2	-	9220067353	1	BALLAST REPLACEMENT, 120V, 250W HPS
3	-	9220067351	1	BALLAST REPLACEMENT, 120V, 175W MH
4	-	9220067345	1	SKIRT, CLERMONT FIXTURE, 250W HPS
5	-	9220067346	1	SKIRT, CLERMONT FIXTURE, 100W HPS & 175W MH

NOTES:

1. THE BRACKETS FOR THE CLERMONT FIXTURE(S) REQUIRE THE POST TO HAVE A 3" X 5" TENON.
2. SEE DWG 30.07-36 FOR PEDESTAL DETAILS.
3. SEE DWG. 30.09-14 FOR POLE DETAILS.
4. FIXTURE PROVIDED BY THE COMPANY.
5. SEE DWG. 30.02-26 FOR OTHER BRACKET ATTACHMENTS
6. SEE DWG. 30.08-09B FOR BILL OF MATERIALS.
7. SEE DWGS. 30.06-05 AND 30.06-10 FOR REPLACEMENT LAMPS.

REVISED	BY	CK'D	APPR.
3			
2			
1			
0 7/21/10	DEFREITAS	JUDAH	LARSEN

LUMINAIRE, DECORATIVE, 100W HPS &
250W HPS AND 175W MH, THE CLERMONT LUMEC
(FMO)

Duke Energy®

FLA

DWG. 30.08-09A

BILL OF MATERIALS					
CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
1	L95SV10TCR1SCF	1	9220067342	1	CLERMONT, HPS, 120V, 100W (LUMINAIRE, LAMP, SGL SHEPHERD'S ARM BRACKET) REMOVE ONLY
2	L95SV10TCR1SMF	1			CLERMONT, HPS, 120V, 100W (LUMINAIRE, LAMP. SGL SIDE SCROLL SHEPHERD'S ARM BRACKET) REMOVE ONLY
3	L95SV10TCR1SRF	1			CLERMONT, HPS, 120V, 100W (LUMINAIRE, LAMP, SINGLE TENON SCROLL ARM BRACKET) REMOVE ONLY
4	L95SV10TCLM1NF	1			CLERMONT, HPS, 120V, 100W (LUMINAIRE, LAMP, SKIRT) LUMEC MAINTENANCE ONLY
5	L28KSV25TCR1ELF	1	9220067333	1	CLERMONT, HPS, 120V, 250W (LUMINAIRE, LAMP, 6' BLACK ARM, ARM ADAPTER) REMOVE ONLY
6	L28KSV25TCR1SCF	1			CLERMONT, HPS, 120V, 250W (LUMINAIRE, LAMP, SGL SHEPHERD'S ARM BRACKET) REMOVE ONLY
7	L28KSV25TCR1SRF	1			CLERMONT, HPS, 120V, 250W (LUMINAIRE, LAMP, SGL SIDE SCROLL SHEPHERD'S ARM BRACKET) REMOVE ONLY
8	L28KSV25TCBL1SRF	1			CLERMONT, HPS, 120V, 250W (LUMINAIRE, LAMP, SINGLE TENON SCROLL ARM BRACKET) REMOVE ONLY
9	L28KSV25TCLM1NF	1			CLERMONT, HPS, 120V, 250W (LUMINAIRE, LAMP, SKIRT) LUMEC MAINTENANCE ONLY
10	L14KMH17TCR1SCF	1	9220067343	1	CLERMONT, MH, 120V, 175W (LUMINAIRE, LAMP, SGL SHEPHERD'S ARM BRACKET)
11	L14KMH17TCR1SMF	1			CLERMONT, MH, 120V, 175W (LUMINAIRE, LAMP, SGL SIDE SCROLL SHEPHERD'S ARM BRACKET)
12	L14KMH17TCR1SRF	1			CLERMONT, MH, 120V, 175W (LUMINAIRE, LAMP, SINGLE TENON SCROLL ARM BRACKET)
13	L14KMH17TCLM1NF	1			CLERMONT, MH, 120V, 175W (LUMINAIRE, LAMP, SKIRT) LUMEC MAINTENANCE ONLY

NOTES:

1. SEE DWG. 30.08-09A FOR DESIGN SPECIFICATIONS.

REVISED	BY	CK'D	APPR.		
3					
2					
1					
0	7/21/10	DEFREITAS	JUDAH	LARSEN	

LUMINAIRE, DECORATIVE, 100W HPS &
250W HPS AND 175W MH, THE CLERMONT LUMEC
(FMO)

Duke Energy®

FLA

DWG. 30.08-09B

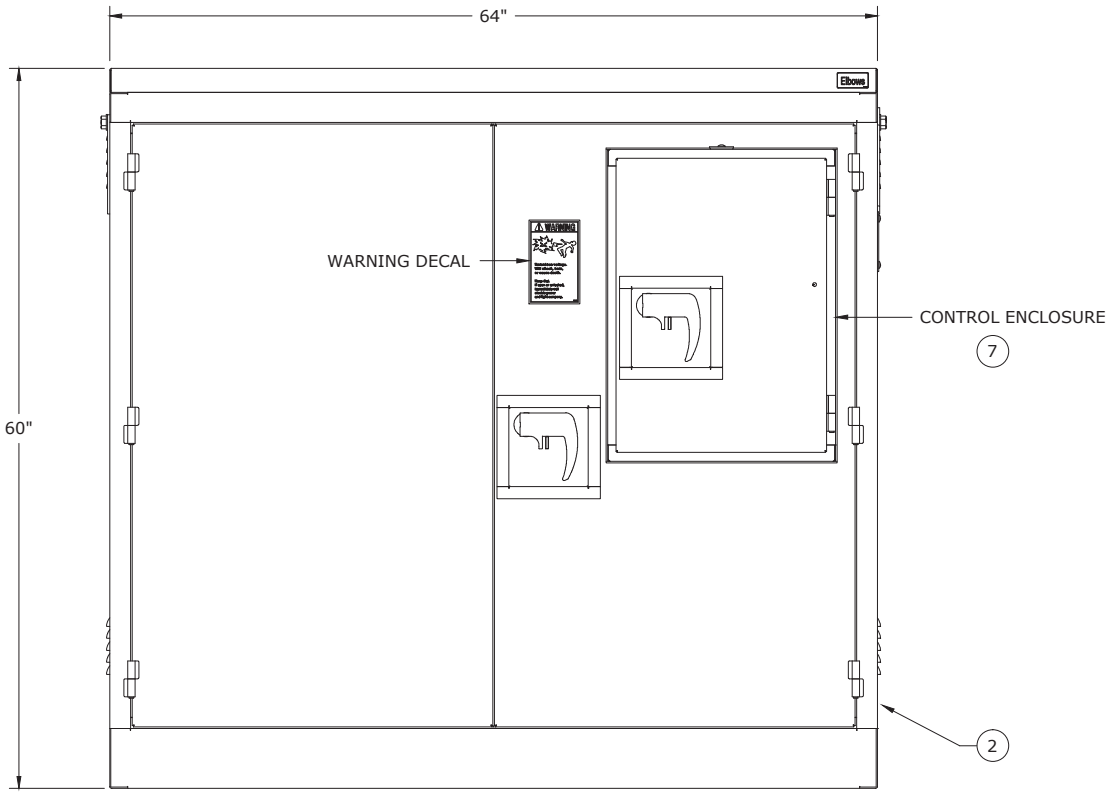
DUKE ENERGY.

3				
2				
1	1/31/18	KATIGBAK	EANES	ADCOCK
0	11/13/17	KATIGBAK	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

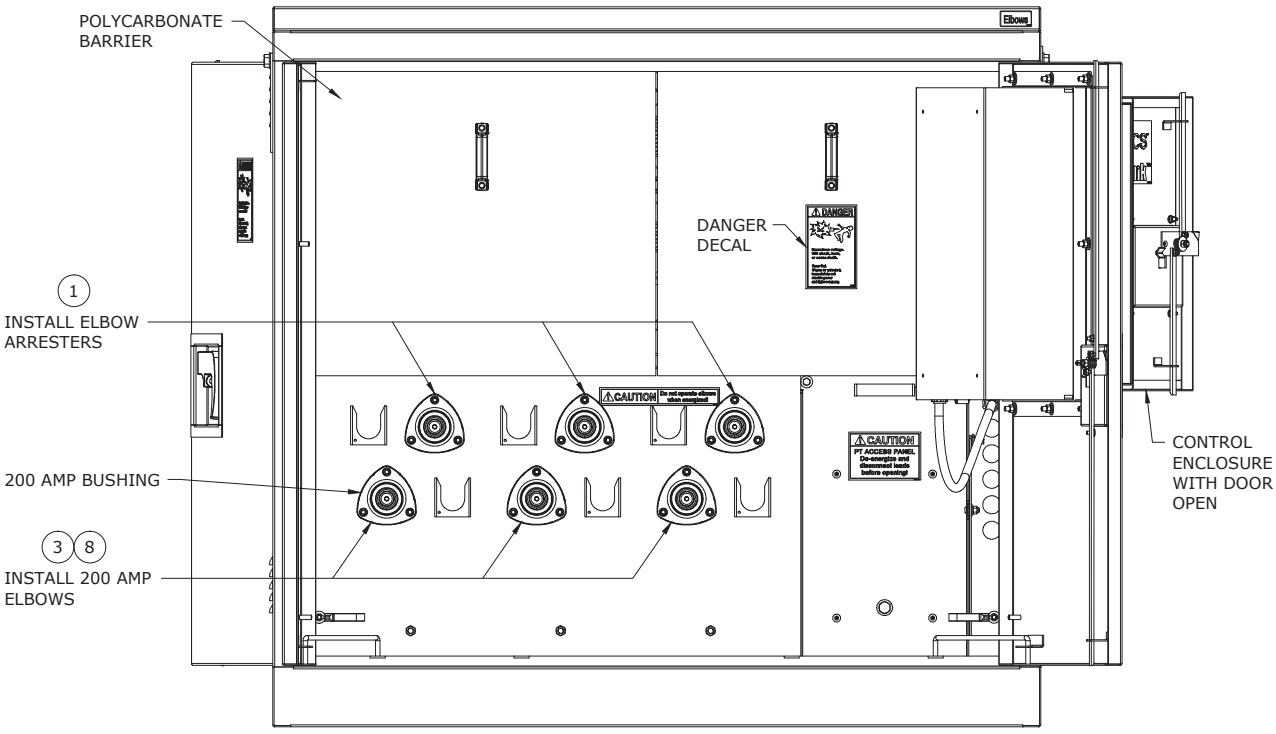
SECTION 32 - PADMOUNTED CAPACITORS
TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

32.00-00A



FRONT VIEW
(DOORS CLOSED)



FRONT VIEW
(DOORS OPEN)

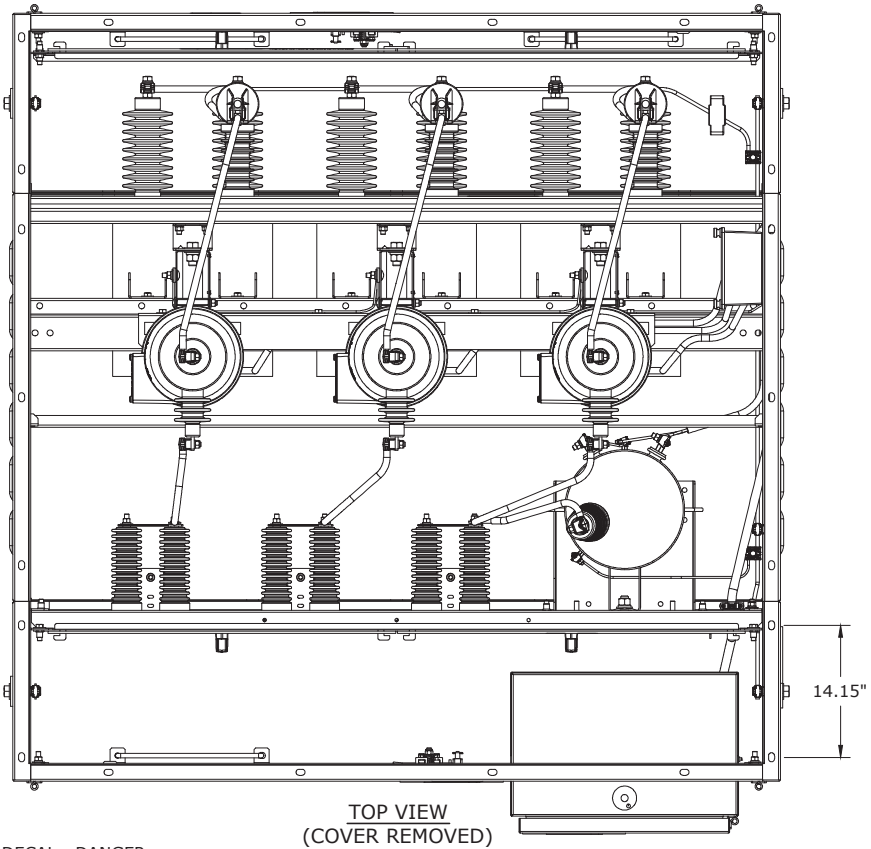
DUKE ENERGY.

3				
2				
1				
0	12/31/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

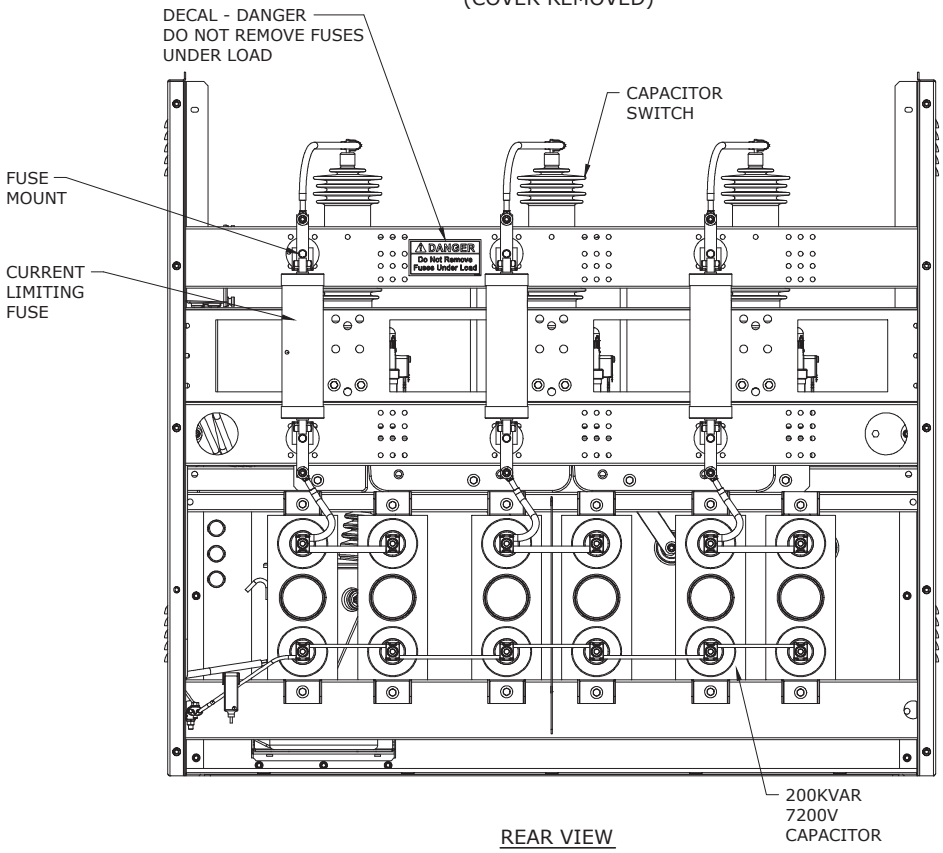
TRINETICS PAD-MOUNTED CAPACITOR BANK -
12.47/7.2KV 1200KVAR - FRONT VIEW

DEC	DEM	DEP	DEF
X	X	X	X

32.01-101A



TOP VIEW
(COVER REMOVED)



REAR VIEW
(FRAME ONLY)

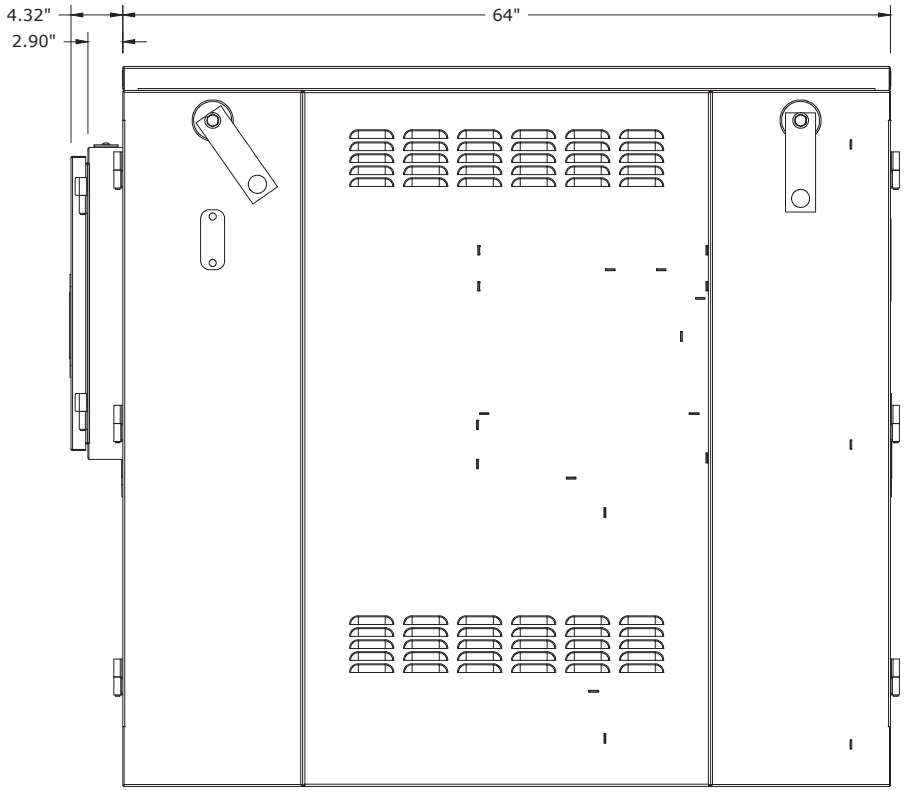
DUKE ENERGY.

3				
2				
1				
0	12/31/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

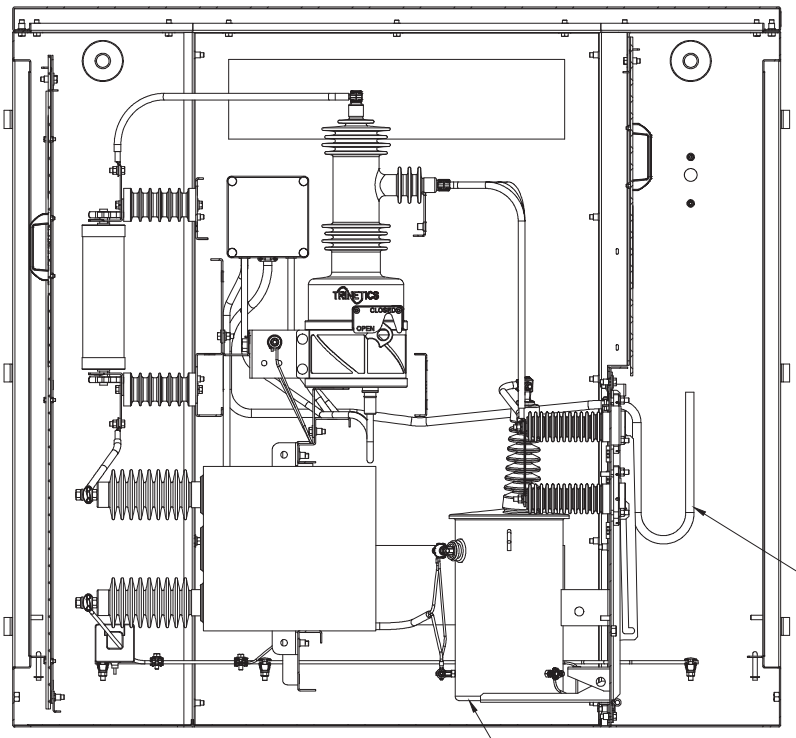
TRINETICS PAD-MOUNTED CAPACITOR BANK -
12.47/7.2KV 1200KVAR - TOP/REAR VIEW

DEC	DEM	DEP	DEF
X	X	X	X

32.01-101B



SIDE VIEW



SIDE VIEW
(FRAME ONLY)

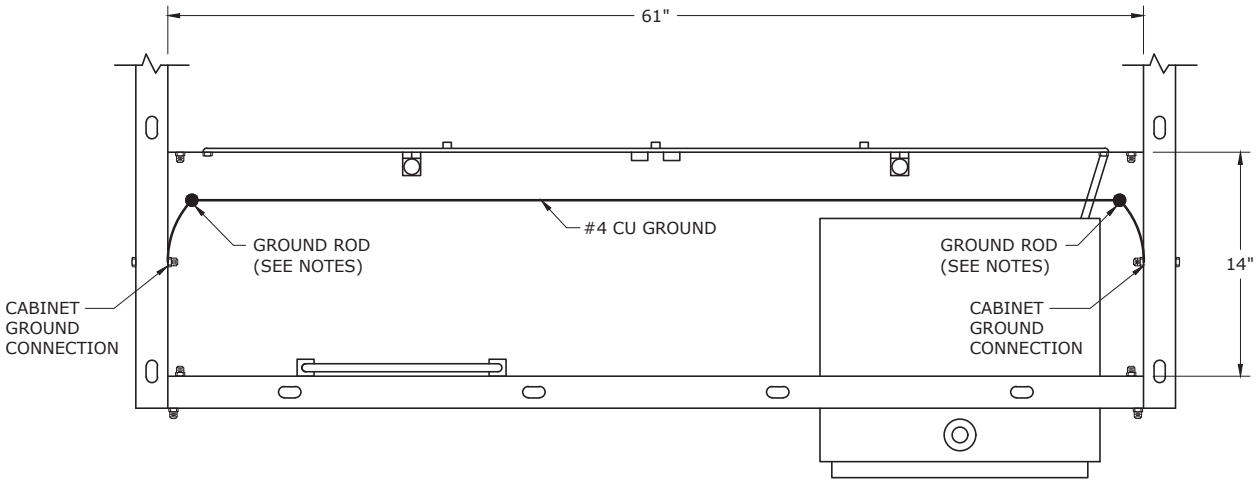
DUKE ENERGY.

3				
2				
1				
0	12/31/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

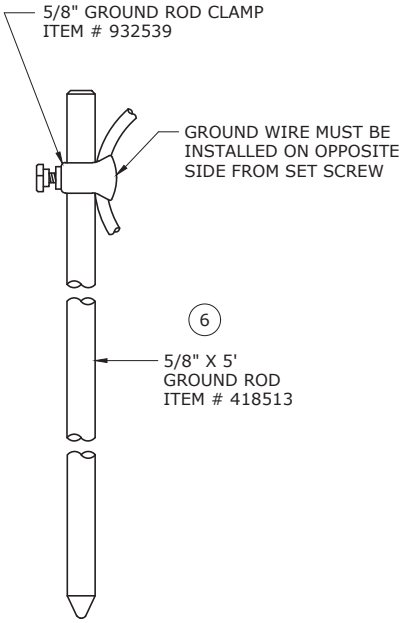
TRINETICS PAD-MOUNTED CAPACITOR BANK -
12.47/7.2KV 1200KVAR - SIDE VIEW

DEC	DEM	DEP	DEF
X	X	X	X

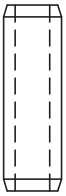
32.01-101C



TERMINATION WINDOW



GROUND ROD



5/8" COUPLING
ITEM # 50129890

NOTES:

1. INSTALL 1 - 5' GROUND ROD ON ONE END OF TERMINATION WINDOW AND 4 - 5' GROUND RODS ON THE OTHER END.

2. USE #4 CU FOR GROUND CONDUCTOR BETWEEN GROUND RODS AND TO CONNECT TO GROUND CONNECTION ON CABINET.

3. CONNECT ELBOW GROUND BRAIDS AND ARRESTER LEADS TO THE #4 CU GROUND CONDUCTOR USING SPLIT BOLT CONNECTORS.

3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

DUKE ENERGY.

GROUNDING DETAILS FOR PAD-MOUNTED CAPACITOR

DEC	DEM	DEP	DEF
		X	X

32.01-101D

BILL OF MATERIALS					
BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
1	ARR-ELBOW-10KV-F	3	4003399	1	CONNECTOR, VISE TYPE 1/0 CU
			1000572	1	ARRESTOR, 8.4KV, SURGE, 10KV
1	ELBOW-INS-AL-200A-15KV-LB-F	3	831048	1	ELBOW, INSERT, AL, 200A, 15KV, LOADBREAK
2	CAP-SWPAD-1200-3P-12KV-F	1	4004237	1	CAPACITOR, BANK, 1200KVAR, 7200/12470V, 95KV BIL, GROUND WYE
3	ELBOW-1/0-AL-200A-15KV-NLB-F	3	4004701	1	ELBOW, BOLTED, W/TAP 2-1/0
			50124557	1	KIT, ACCESSORY, 15KV CABLE, SIZE 1/0, SPRING, GROUND STRAP
4	STRUCT-PAD-CAP-FG-MD-F	1	836361	1	PAD , MOUNTING , 65X69 FIBERGLASS FOR PAD MOUNTED CAPACITOR
6	GND-EQUIP-4-RING-3P-F	1	933371	3	CONNECTOR, ELECT, PARALLEL GROOVE, 0.373"-0.292" WIRE
			4003379	6	CLAMP, GROUNDING, CABLE TO TRANSFORMER, BRZ, EYEBOLT TYPE
			4022335	20	WIRE, CABLE, BARE, SOLID SOFT DRAWN #4
6	GND-ROD-ADD-VRT-UG-F	3	50129890	1	COUPLING, 5/8" THREADLESS, COPPER
			4185013	1	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD, THREADLESS 5/8" X 5'
6	GND-ROD-UG-F	1	932539	1	CLAMP, GROUNDING CABLE TO ROD, 5/8" ROD
			4185013	1	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD, THREADLESS 5/8" X 5'
7	CTRL-CAP-CBC8000-SWPAD-F	1	4206758	1	CONTROL, CAPACITOR, AUTO, MODEL CBC8000, 2-WAYCELLULAR
8	ELBOW-COV-INSL-200A-15KV-F	3	4004688	1	COVER, INSULATING, F/ 15 KV LOADBREAK BUSHING INSERT
9	COMM-ANT-MIMO-10FT-F	1	4203385	1	ANTENNA, MULTI-BAND DIVERSITY/MIMO 4G, 694-2170MHZ, 1575MHZ

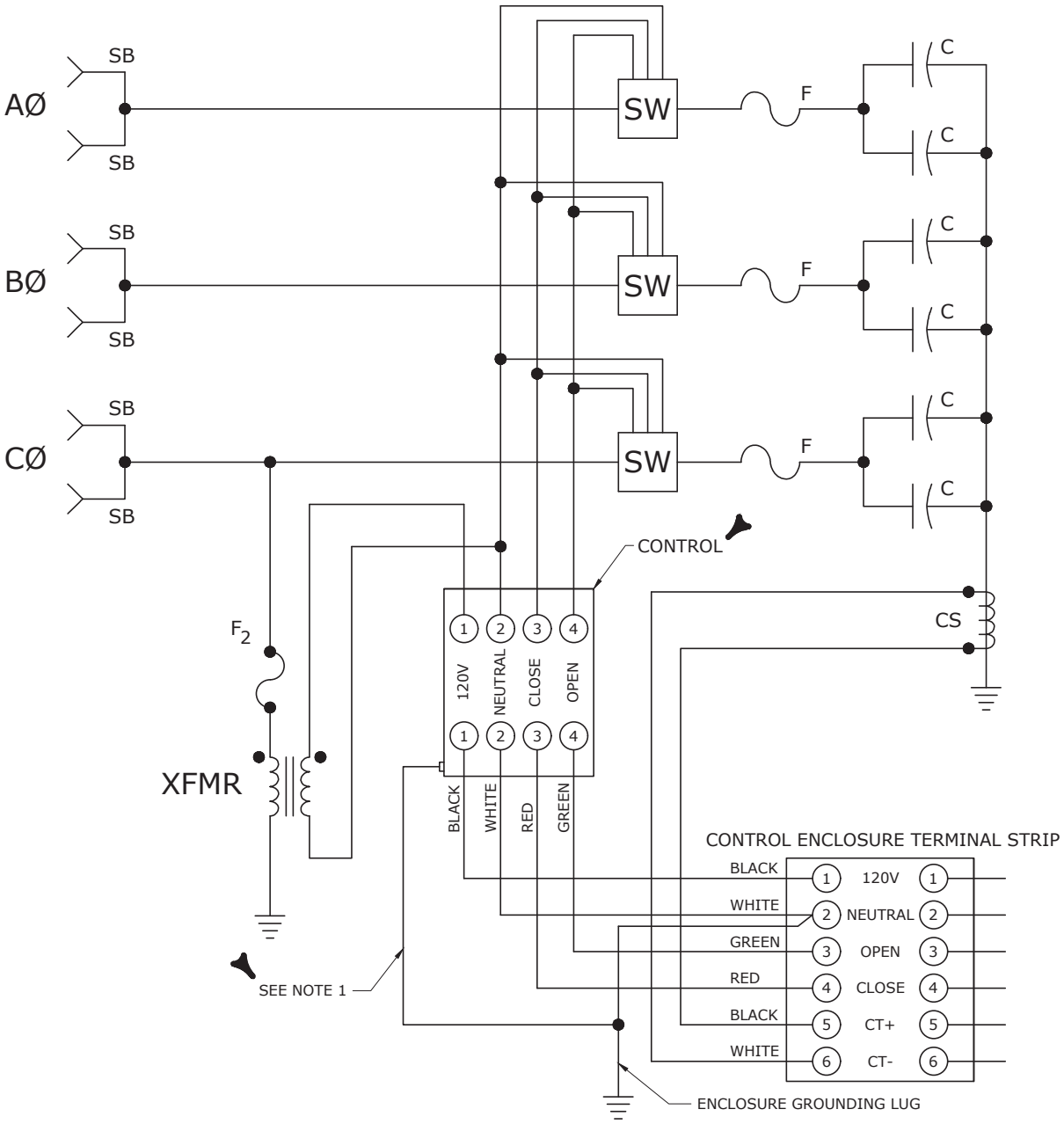
DUKE ENERGY.

3				
2				
1	3/31/18	DANNA	EANES	ADCOCK
0	11/13/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED CAPACITOR -
BILL OF MATERIALS

DEC	DEM	DEP	DEF
			X

32.01-101E



ITEM	QTY.	DESCRIPTION
XFMR	1	POWER TRANSFORMER, 7200/120V, 1.0KVA, LOW Z
SW	3	CAPACITOR SWITCH, ULTRAVACLT-15-95
SB	6	SHEDWELL BUSHING, 15KV, 200A
F	3	FUSE, X-LIMITER, 8.3KV, 100A (5) W/ IND.
CS	1	CURRENT SENSOR, NEUTRAL, 4N04-50A-5VAC-1.25
C	6	CAPACITOR, 200KVAR, 7200V, 95KV BIL, 2B
F_2	1	FUSE, X-LIMITER, 8.3KV, 1.5A

NOTES:

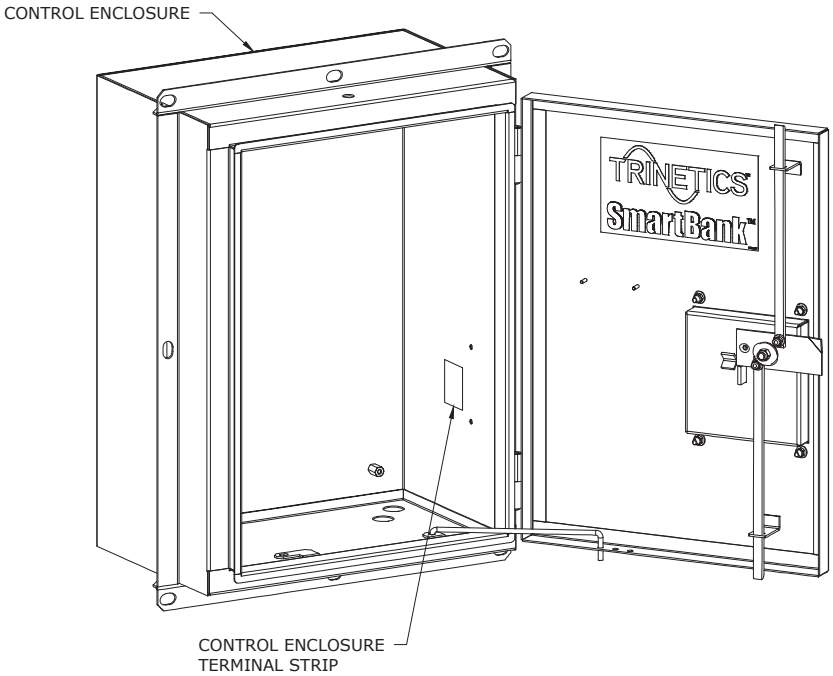
1. GROUND THE GROUNDING LUG ON THE BOTTOM OF CONTROL TO THE ENCLOSURE GROUNDING LUG.

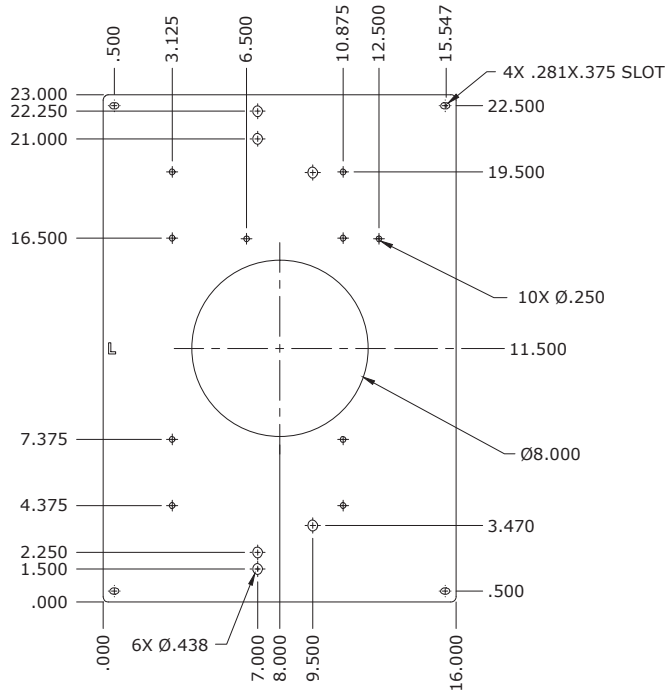
3				
2				
1	3/31/18	DANNA	EANES	ADCOCK
0	12/31/16	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED CAPACITOR - WIRING DIAGRAM

DEC	DEM	DEP	DEF
X	X	X	X

32.02-101





CONTROL MOUNTING PLATE

NOTES:

1. PAD-MOUNTED CAPACITOR DOES NOT INCLUDE THE CONTROL.
2. TYPE CONTROL IS SPECIFIED BY AREA AND LISTED ON THE BILL OF MATERIALS DRAWINGS.
3. THE CONTROL MOUNTING PLATE CONTAINS PRE-DRILLED HOLES FOR MOUNTING OF EACH TYPE OF CONTROL.
4. THE CONTROL ENCLOSURE CONTAINS 2 FEET OF CONTROL WIRE FOR DIRECT CONNECT OF CONTROL ENCLOSURE TERMINAL STRIP TO THE CONTROL TERMINAL STRIP.
5. ONCE CONTROL WIRING IS CONNECTED PER DWG. 32.02-101, THE CONTROL AND CONTROL MOUNTING PLATE ARE INSTALLED INTO THE CONTROL ENCLOSURE.

3				
2				
1				
0	12/31/16	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

DUKE ENERGY.

PAD-MOUNTED CAPACITOR -
CAPACITOR CONTROL ENCLOSURE

DEC	DEM	DEP	DEF
X	X	X	X

32.02-105

REMOVE SOCKET MOUNT ASSEMBLY IN ORDER FOR CONTROL TO BE MOUNTED DIRECTLY TO THE CONTROL MOUNTING PLATE AS SHOWN ON DWG. 32.02-105.

REMOVE 3 SCREWS

DISCONNECT 4 WIRES

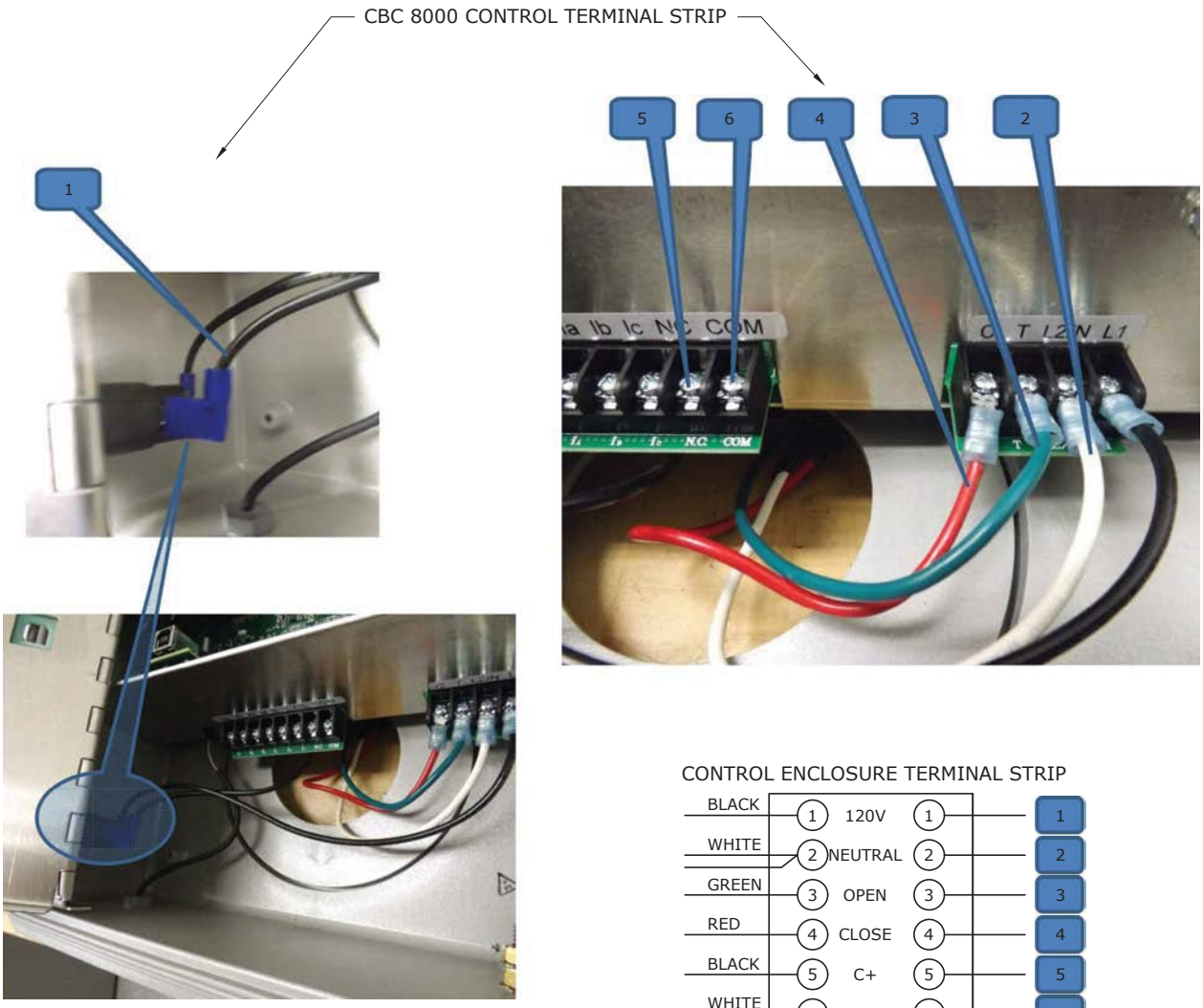
3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CBC-8000 CONTROL MOUNTING PREPARATION

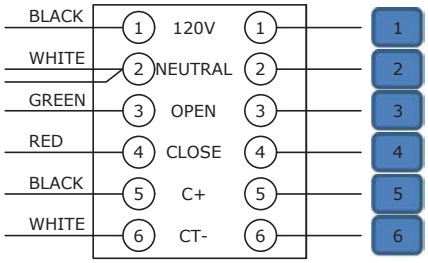
DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

32.02-107



CONTROL ENCLOSURE TERMINAL STRIP



NOTES:

1. 2 FT OF CONTROL WIRE IS INCLUDED IN THE CONTROL ENCLOSURE.
2. REMOVE EXISTING CONTROL WIRES FROM CONTROL TERMINAL STRIP AND USE THE 2 FT OF NEW CONTROL WIRE TO RUN DIRECTLY TO THE CONTROL ENCLOSURE TERMINAL STRIP.

3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

EATON CBC 8000 CONTROL WIRING DIAGRAM

DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

32.02-109

NOTES:

1. REMOVE CONTROL FUSE BEFORE INSTALLING AND REMOVING CAPACITOR CONTROL.

3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CBC-8000 2 WAY CAPACITOR CONTROL - PANEL VIEW

DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

32.03-101

MODE LABEL	INDICATES
MODE LABEL	THE CONTROL OF THE CAPACITOR BANK IS INITIATED BY **ONLY** THE TRIP AND CLOSE BUTTONS ON THE OPERATING PANEL.
REMOTE	THE CONTROL IS IN REMOTE (WIRELESS) OPERATING MODE AND CONTROL OF THE CAPACITOR BANK IS INITIATED BY REMOTELY RECEIVED COMMANDS OR LOCAL SITE CONDITIONS.
AUTOMATIC (AUTO)	THE CONTROL OF THE CAPACITOR BANK IS BASED ON LOCAL SITE CONDITIONS SUCH AS TIME, TEMPERATURE, VOLTAGE, CURRENT AND VARS.
NEUTRAL LOCKOUT	THE CONTROL HAS DETECTED A NEUTRAL CURRENT VIOLATION AND IS IN A LOCKOUT STATE.
TRACKING	IF THE **TRACKING LED** IS FLASHING, PRESSING THE **TRACKING** BUTTON DISPLAYS ON THE LCD THE HIGHEST PRIORITY CONDITION THAT IS CURRENTLY BEING TRACKED.
ALARMS	IF THE **ALARMS LED** IS FLASHING, ONE OR MORE ALARMS ARE ACTIVE IN THE CONTROL. PRESSING THE **ALARM** BUTTON DISPLAYS THE ALARMS THAT ARE CURRENTLY ACTIVE.

NOTES:

1. FOR DETAILED OPERATIONAL INSTRUCTIONS, REFER TO THE WORK METHODS MANUAL OR EATON CBC-8000 INSTRUCTION MANUAL.

DUKE ENERGY.

3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

CBC-8000 2 WAY CAPACITOR CONTROL - OVERVIEW

DEC	DEM	DEP	DEF
X		X	X

32.03-103

CAUTION:

AFTER DE-ENERGIZING CAPACITORS, IT IS VERY IMPORTANT TO ALLOW 5 MINUTES FOR THE CAPACITORS TO DISCHARGE COMPLETELY BEFORE ATTEMPTING TO RE-ENERGIZE.

REFUSING INSTRUCTIONS (FOR CAPACITOR OR PT FUSES):

1. OPEN ALL THREE SWITCHES WITH CAPACITOR CONTROL OR WITH SWITCH HANDLES USING HOT STICK.
2. VERIFY SWITCH HANDLES ARE IN THE OPEN POSITION.
3. DE-ENERGIZE SOURCE FEED AT NEXT UPSTREAM DEVICE. DO NOT REMOVE ELBOWS AT PAD-MOUNTED CAPACITOR.
4. VERIFY NO VOLTAGE ON LINE AND LOAD SIDES OF THE SWITCHES.
5. INSTALL GROUNDS PER SAFETY AND SWITCHING AND TAGGING MANUAL.
6. REMOVE BLOWN CLIP-MOUNTED FUSE(S).
7. INSTALL NEW CLIP-MOUNTED FUSE(S).

NOTES:

1. FOLLOW ALL LOCAL SAFETY RULES.
2. FOR DETAILED OPERATIONAL INSTRUCTIONS, REFER TO THE WORK METHODS MANUAL.
3. USE REPLACEMENT FUSES:
   A. FOR CAPACITOR UNIT: NX CURRENT LIMITING FUSE, 100A, 8.3KV, ITEM #195209.
   B. FOR PT: NX CURRENT LIMITING FUSE 1.5 AMP, ITEM # 50101210.

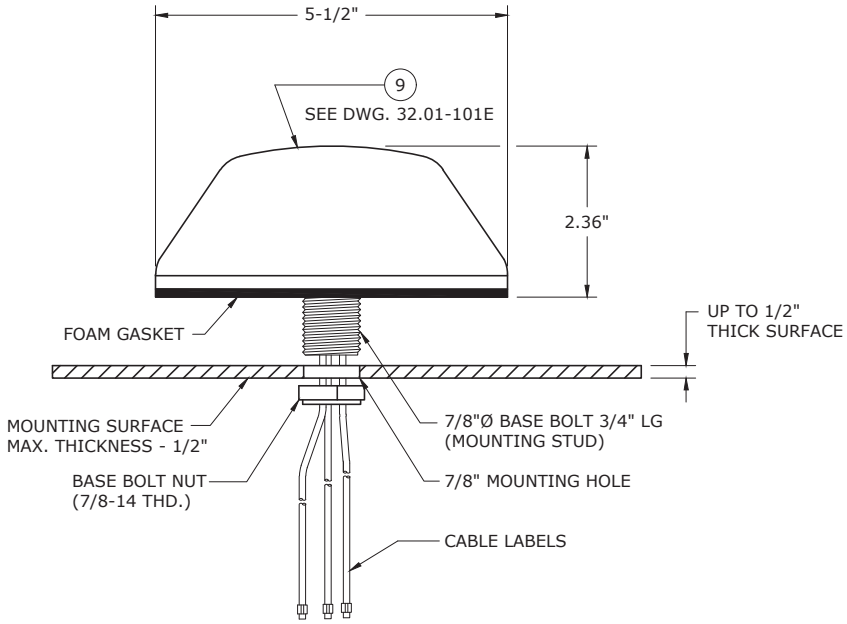
DUKE ENERGY.

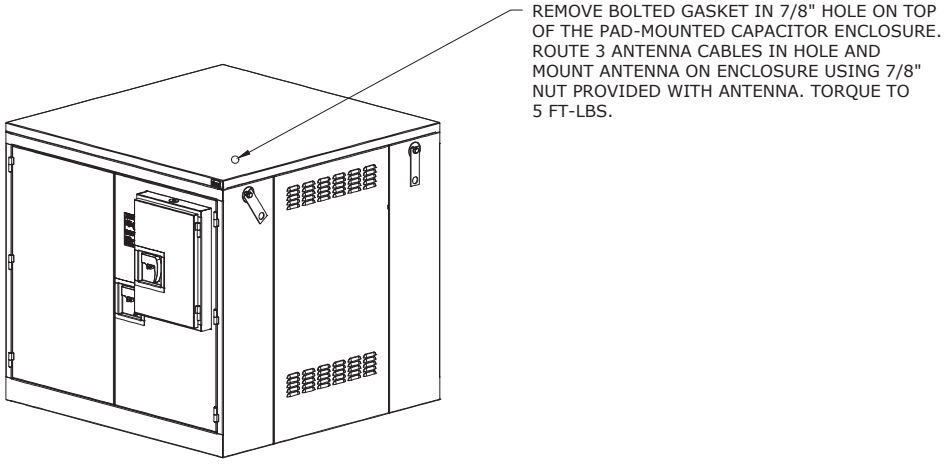
3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED CAPACITOR
REFUSING INSTRUCTIONS

DEC	DEM	DEP	DEF
X	X	X	X

32.03-109





3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED CAPACITOR
COMMUNICATIONS EQUIPMENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

32.04-101

- SHOWN IS INSIDE OF STEEL ENCLOSURE WITH CBC 8000 CONTROL MOUNTED INSIDE.
- CBC 8000 CONTROL DOOR IS SHOWN OPEN.
- ROUTE ANTENNA CABLES (3) THRU KNOCKOUT ON RIGHT SIDE OF STEEL CONTROL ENCLOSURE AND INSTALL THRU HOLE ON TOP OF CBC 8000 CONTROL TO CONNECT TO MODEM.

MODEM ON INSIDE DOOR OF CBC 8000 CONTROL. CONNECT THE ANTENNA CABLES (2) LTE (1) GPS TO THE CORRESPONDING CONNECTION POINTS ON THE MODEM.

3				
2				
1				
0	3/31/18	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

PAD-MOUNTED CAPACITOR
COMMUNICATIONS EQUIPMENT

DUKE ENERGY.

DEC	DEM	DEP	DEF
X		X	X

32.04-103

3				
2				
1				
0	12/31/15	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 33 - FLOODING AND STORM SURGE REQUIREMENTS
TABLE OF CONTENTS

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

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. 12.08-110 FOR A LISTING OF THESE TRANSFORMERS.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1	9/30/16	BURLISON	EANES	ADCOCK
0	12/31/15	DANNA	EANES	ADCOCK

FLOODING AND STORM SURGE REQUIREMENTS FOR FLORIDA

DEC	DEM	DEP	DEF
			X

33.01-100

FLOODING AND STORM SURGE HARDWARE REQUIREMENTS

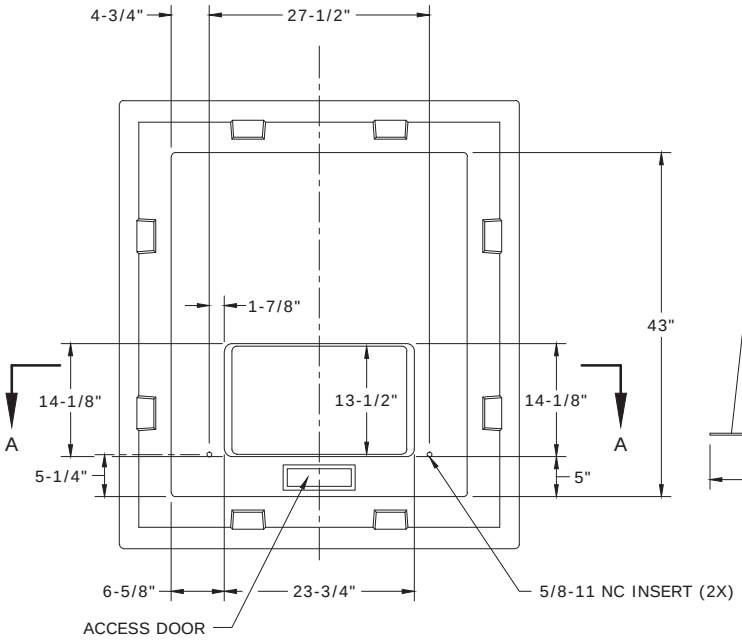
- SINGLE-PHASE TRANSFORMER BOX PAD, SEE DWG. 33.03-101.
- SUBMERSIBLE SECONDARY SET SCREW CONNECTORS. FOR SINGLE-PHASE PAD-MOUNTED TRANSFORMERS, SEE DWGS. 33.06-101 AND 33.06-102.
- STAINLESS STEEL PAD-MOUNTED TRANSFORMERS, SEE DWG. 12.08-110. (ONLY IF WITHIN 1000 FT. OF SALTWATER OR SALTWATER MARSH).
- ABOVE GROUND PEDESTALS WITH SINGLE SET SCREW, SUBMERSIBLE CONNECTORS, SEE SECTION 28.
- SUBMERSIBLE SWITCHGEAR:
  - G&W FAULT INTERRUPTER - PAD-MOUNTED. SEE DWGS. 28.04-113A THROUGH 28.04-117C.
- COLD SHRINK FOR 200 AMP LOAD BREAK ELBOW, SEE DWGS. 33.05-101 AND 33.05-103.

REVISED		BY	CHK'D	APPR.
3				
2	1/31/19	DANNA	EANES	ADCOCK
1	9/30/16	BURLISON	EANES	ADCOCK
0	12/31/15	DANNA	EANES	ADCOCK

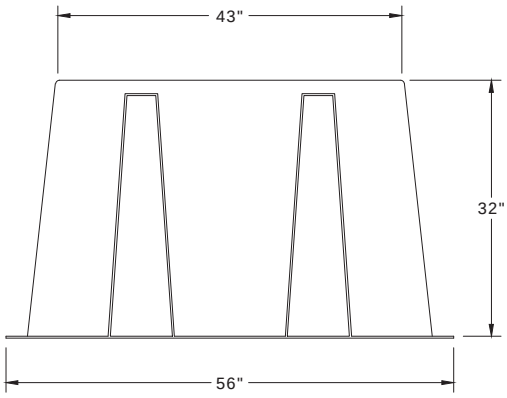
FLOODING AND STORM SURGE HARDWARE REQUIREMENTS

DEC	DEM	DEP	DEF
			X

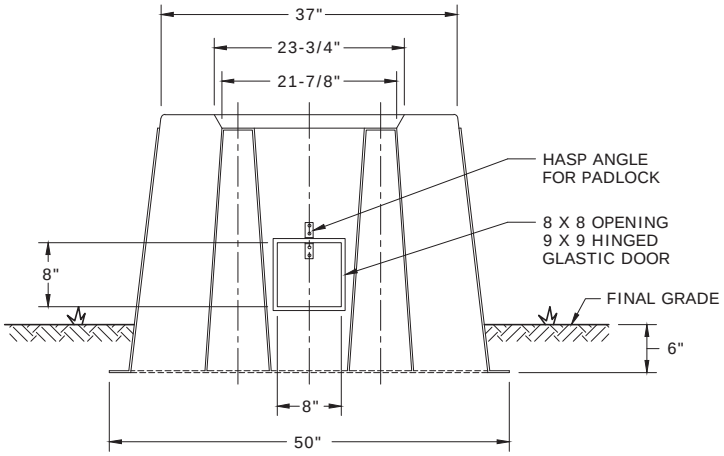
33.01-102



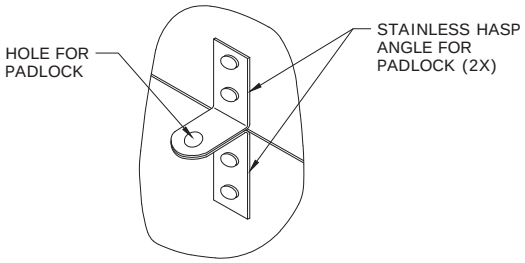
PLAN VIEW



SIDE VIEW



SECTION AA



PADLOCK HASP DETAIL

CU: STRUCT-PAD-TF-FGC-F
ITEM # 4169155

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. 36.01-103.
5. SOD MAY BE REQUIRED AROUND BOX PAD TO PREVENT SOIL EROSION.

3				
2				
1				
0	11/13/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

SINGLE-PHASE TRANSFORMER BOX PAD

DEC	DEM	DEP	DEF
			X

33.03-101

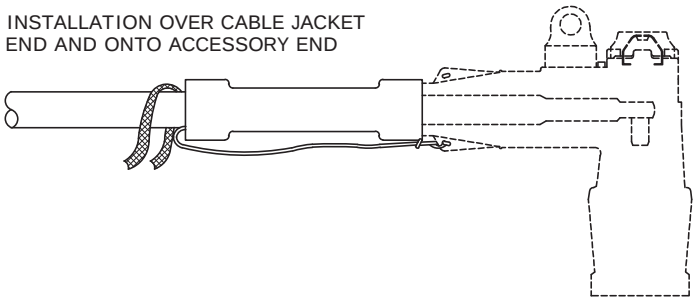
3M
COLD SHRINK
CABLE ACCESSORY SEALING KITS

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



KIT SELECTION CHART

ITEM NUMBER	MINIMUM SEAL DIAMETER	MAXIMUM INSTALLED DIAMETER	CABLE SIZE/KV CLASS		
			15KV	25KV	35KV
4205568	0.95 IN. (24 mm)	1.94 IN. (49 mm)	2-4/0	2-2/0	1/0

3				
2				
1				
0	11/13/17	DANNA	EANES	ADCOCK
REVISED		BY	CHK'D	APPR.

200 AMP LOADBREAK ELBOW -
COLD SHRINK

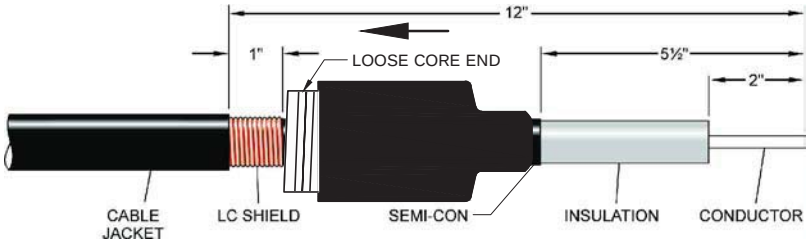
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

33.05-101

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.

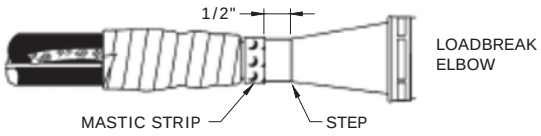


STEP 2:

SEE DWGS. 26.04-00B THROUGH 26.04-00F FOR INSTALLATION OF ELBOW.

STEP 3:

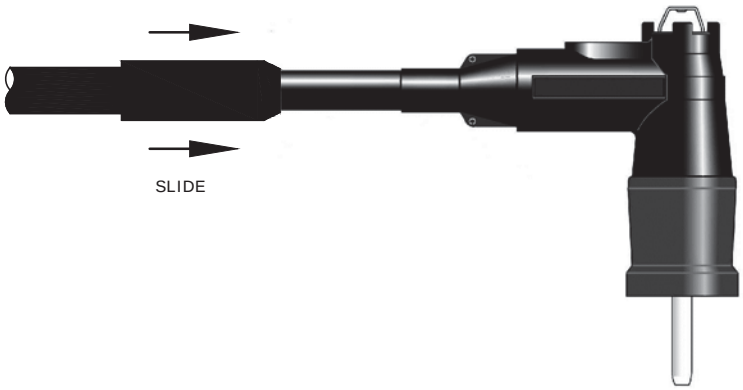
WRAP ONE LAYER OF MASTIC AROUND THE BASE OF THE ELBOW. APPLY ONE LAYER OF VINYL TAPE OVER MASTIC.



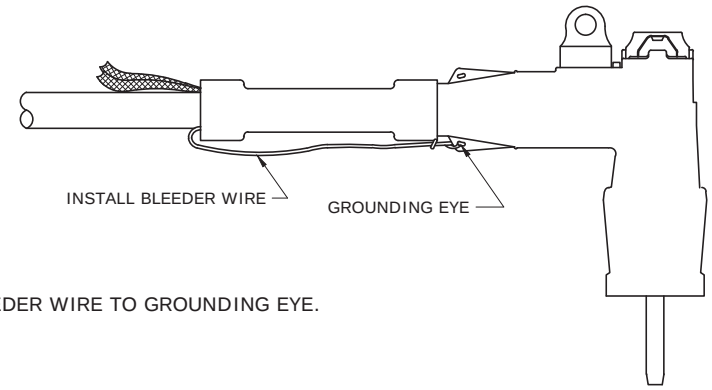
STEP 4:

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:



NOTES:

1. CONNECT BLEEDER WIRE TO GROUNDING EYE.

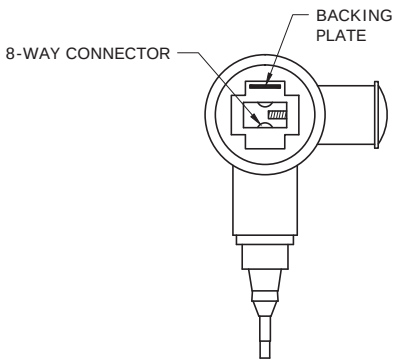
3				
2				
1				
0	12/31/15	DANNA	EANES	ADCOCK
REVISED		BY	CK'D	APPR.

INSTALLATION PROCEDURES TO SEAL
BOTH ACCESSORY END AND CABLE JACKET END

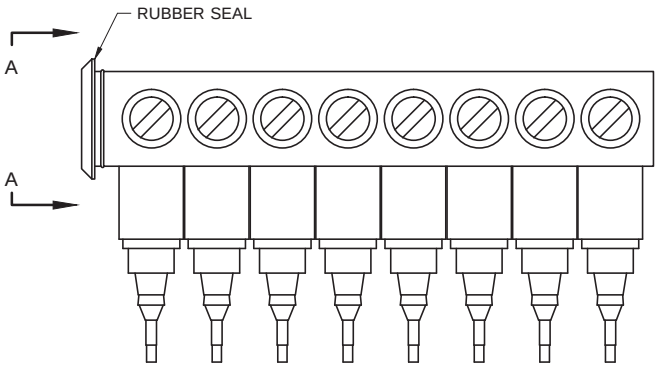
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

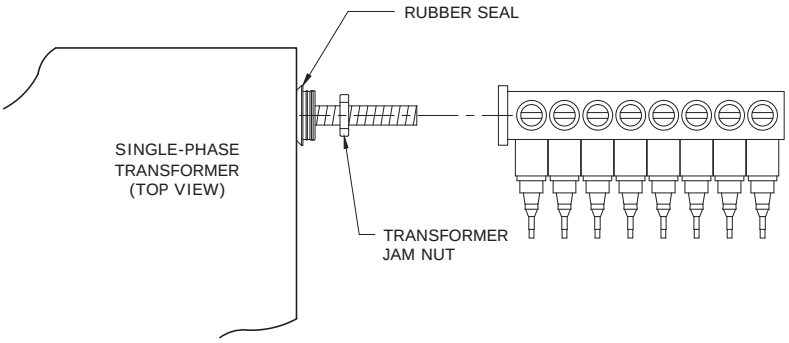
33.05-103



SECTION 'A-A'



SUBMERSIBLE SECONDARY SET SCREW CONNECTOR



DETAIL

SUBMERSIBLE CONNECTORS					
COMPATIBLE UNIT	ITEM NUMBER	RANGE	WAY	AMPACITY	DESCRIPTION
CONN-UG-TF-1P-SUB-BPOS-SM-350-F	4001133	12 - 350	8	1000	5/8" HOLE, SINGLE SET SCREW
CONN-UG-TF-1P-SUB-BPOS-LG-350-F	4172357	12 - 350	8	1600	1" HOLE, SINGLE SET SCREW

NOTES:

1. SEE DWG 33.06-102 FOR INSTALLATION NOTES.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	DANNA	EANES	ADCOCK

SUBMERSIBLE SECONDARY SET SCREW CONNECTORS
SINGLE-PHASE TRANSFORMERS

DEC	DEM	DEP	DEF
			X

33.06-101

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. REMOVE CABLE ADAPTER.
4. REMOVE PLASTIC CAP.
5. CUT ADAPTER AT PROPER RING. ADAPTER IS NOT USED FOR LARGEST CABLE THAT WILL FIT IN CONNECTOR.
6. POSITION ADAPTER OVER INSULATED CABLE. (USE SILICONE LUBRICANT ON CABLE AND INSIDE OF ADAPTER.)
7. REMOVE SCREW PLUG CAP AND BACK-OFF SCREW WITH ALLEN WRENCH.
8. WIRE BRUSH CONDUCTORS. APPLY INHIBITOR (ITEM # 663235) TO CONDUCTORS.
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.

DUKE ENERGY.

REVISED		BY	CHK'D	APPR.
3				
2				
1				
0	11/13/17	DANNA	EANES	ADCOCK

SINGLE SET SCREW
SUBMERSIBLE CONNECTORS - NOTES
SINGLE-PHASE TRANSFORMERS

DEC	DEM	DEP	DEF
			X

33.06-102

34.00 METERING GENERAL

34.02 SELF-CONTAINED METERING, SINGE-PHASE

34.03 SELF-CONTAINED METERING, THREE-PHASE

34.04 SELF-CONTAINED METERING, NETWORK (OPEN WYE)

34.07 TRANSFORMER-RATED METERING, SECONDARY, THREE-PHASE

34.08 TRANSFORMER-RATED METERING, PRIMARY, SINGLE-PHASE

34.09 TRANSFORMER-RATED METERING, PRIMARY, THREE-PHASE

34.11 TRANSFORMER-RATED METERING, PRIMARY, THREE-PHASE - UG

FOR MAINTENANCE ONLY DRAWINGS

THE FOR MAINTENANCE ONLY DRAWINGS LISTED BELOW ARE NOT CONTAINED IN THE PRINTED SPEC BOOK, BUT ARE AVAILABLE ONLINE

DUKE ENERGY.

3				
2				
1	7/18/14	KATIGBAK	DANNA	ADCOCK
0	11/5/13	KATIGBAK	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECTION 34 - METERING - OH

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
			X

NOTES:

1. ON INSTALLATIONS, REPAIRS, REPLACEMENTS OR UPGRADES OF ENCLOSURES INVOLVING MORE THAN ONE METER ON A SINGLE PREMISE, THE CUSTOMER SHALL CORRECTLY IDENTIFY EACH METER ENCLOSURE ON THE OUTSIDE BY A NONFERROUS METAL OR PLASTIC PLATE ENGRAVED OR STAMPED WITH THE APARTMENT NUMBER, OFFICE SUITE, LOT NUMBER, ETC.

2. THE PLATE SHALL BE PERMANENTLY ATTACHED TO THE METER ENCLOSURE UTILIZING AN INDUSTRIAL-STRENGTH ADHESIVE SUITABLE FOR EXTERIOR USE. TWO-SIDED TAPE IS NOT ACCEPTABLE.

3. THE INSIDE OF EACH METER ENCLOSURE SHALL BE CORRECTLY IDENTIFIED WITH A PLATE DESCRIBED ABOVE OR WITH A PERMANENT MARKER.

4. CONDUCTOR LABELING FOR MULTI-TENANT METERING APPLICATIONS: WHERE ONE SERVICE IS C.T. METERED ON THE PAD-MOUNTED TRANSFORMER **AND** OTHER CUSTOMER OWNED SERVICES ARE RUN TO THE **SAME** TRANSFORMER **BUT** ARE METERED ELSEWHERE (BUILDING WALL OR METER ROOM), BOTH ENDS OF ALL CUSTOMER CABLES MUST BE CLEARLY AND SPECIFICALLY MARKED FOR PHASE AND LABELED WITH A TAG TO IDENTIFY THE LOCATION OF THE SOURCE AND LOAD ENDS OF THE CONDUCTOR. THE LOAD END OF EACH CABLE SHALL BE LABELED TO IDENTIFY THE SOURCE (TRANSFORMER LOCID NUMBER). EACH SOURCE END SHALL BE LABELED TO IDENTIFY THE LOCATION OF THE LOAD END OF THE CABLE (TROUGH NUMBER, SWITCH PANEL NUMBER, ETC.).

DUKE ENERGY.

3				
2				
1	9/12/14	SIMPSON	SIMPSON	ADCOCK
0	10/29/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

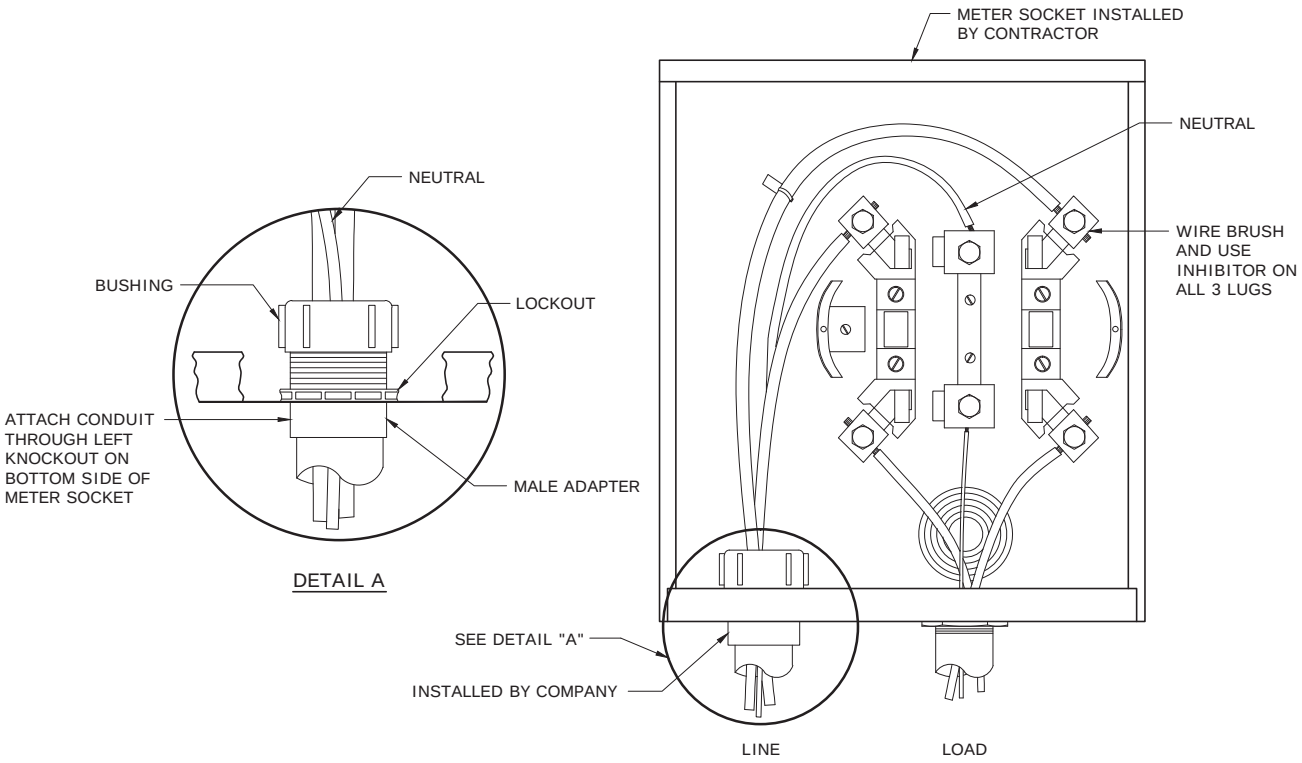
LABELING MULTIPLE METER ENCLOSURES

ON A SINGLE PREMISE

DEC	DEM	DEP	DEF
		X	X

34.00-04

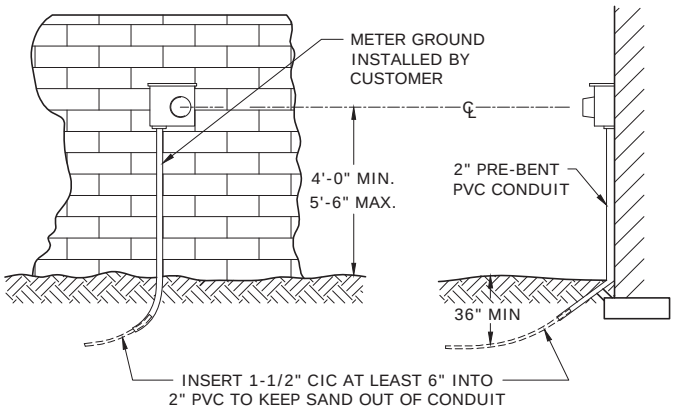
INSTALLATION DETAILS 120/240 VOLT SINGLE-PHASE
UNDERGROUND RESIDENTIAL SERVICE



THIS ILLUSTRATION IS FOR DE-ENERGIZED CONDITIONS. IF METER IS ENERGIZED USE PROPER SAFETY PROCEDURES AS OUTLINED IN THE ACCIDENT AND PREVENTION MANUAL.

METER BASE MAY BE ENERGIZED FROM CUSTOMER LOAD SIDE.

METER SOCKET CONNECTIONS



NOTE: CABLE SHOULD BE FED THROUGH CONDUIT BEFORE IT IS INSTALLED BELOW GRADE AND ATTACHED TO METER SOCKET.

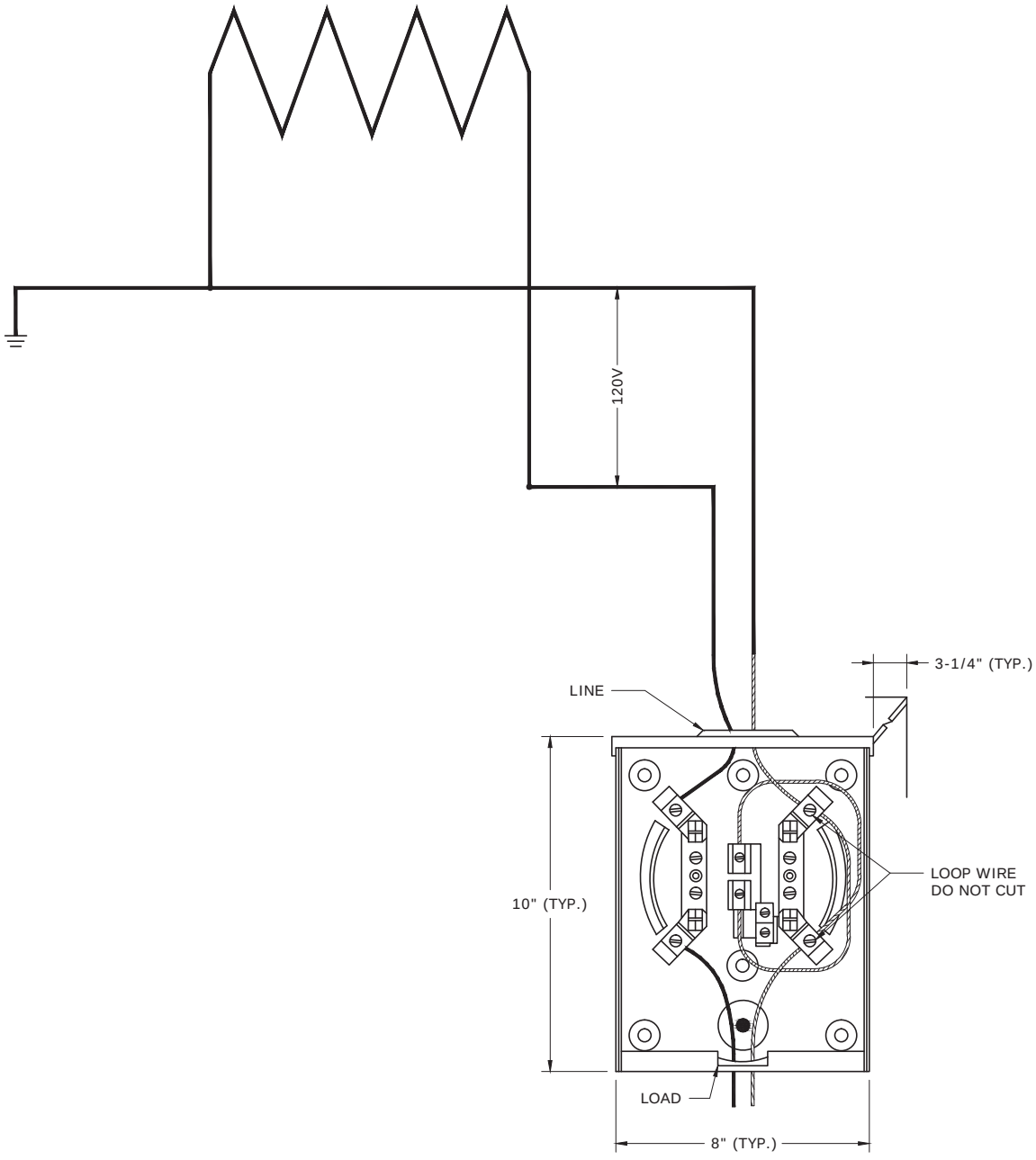
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

INSTALLATION DETAILS 120/240 VOLT
SINGLE-PHASE UNDERGROUND RESIDENTIAL SERVICE
AND METER SOCKET CONNECTIONS

DUKE ENERGY.

FLA

DWG. 34.02-08



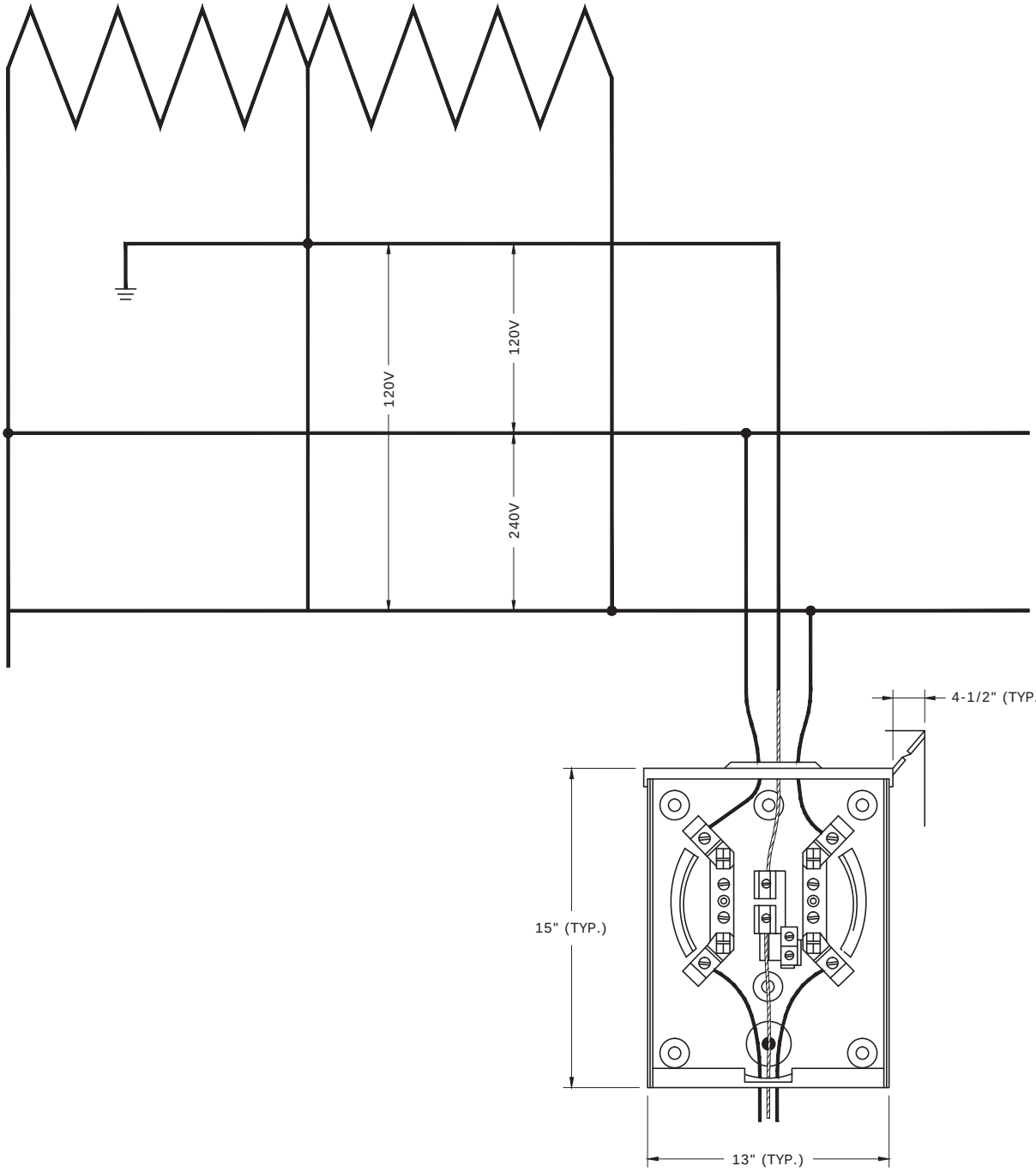
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED METER WIRING DIAGRAM, SINGLE-PHASE, 2-WIRE

DUKE ENERGY.

FLA

DWG. 34.02-12



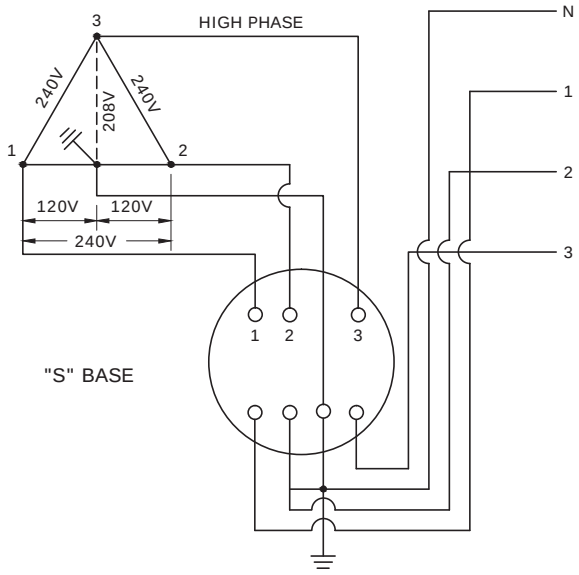
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED
METER WIRING DIAGRAM,
SINGLE-PHASE, 3-WIRE

DUKE ENERGY.

FLA

DWG.
34.02-14



THREE-PHASE, FOUR WIRE, DELTA

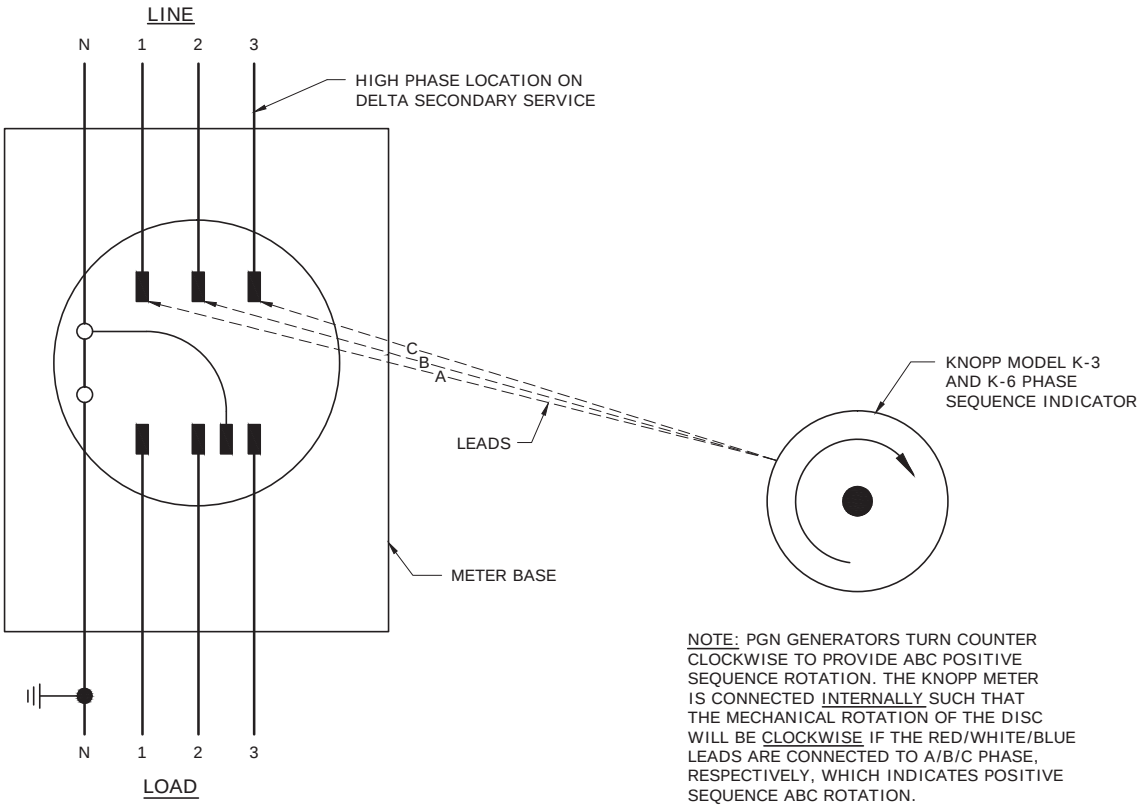
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED 4-WIRE
DELTA WIRING DIAGRAM

DUKE ENERGY.

FLA

DWG.
34.03-06



NOTE: PGN GENERATORS TURN COUNTER CLOCKWISE TO PROVIDE ABC POSITIVE SEQUENCE ROTATION. THE KNOPP METER IS CONNECTED INTERNALLY SUCH THAT THE MECHANICAL ROTATION OF THE DISC WILL BE CLOCKWISE IF THE RED/WHITE/BLUE LEADS ARE CONNECTED TO A/B/C PHASE, RESPECTIVELY, WHICH INDICATES POSITIVE SEQUENCE ABC ROTATION.

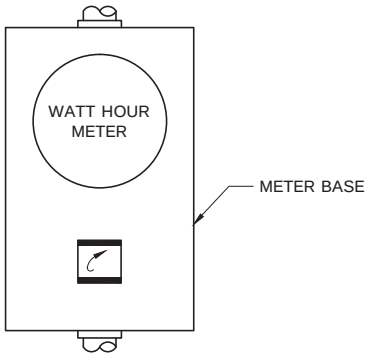
HIGH PHASE LOCATION ON DELTA SECONDARY SERVICE

NOTE: CONNECT ON LINE SIDE OF METER BASE WITH LEADS A, B, C (LEFT TO RIGHT) TO IDENTIFY CLOCKWISE OR COUNTER-CLOCKWISE ROTATION TO THIS SERVICE. THIS WILL IDENTIFY PHASE ROTATION ONLY: IT IS NOT AN INDICATION OF SOURCE PHASE IDENTIFICATION.

SEE DWGS. 23.04-03A, 23.04-03B AND 23.04-03C FOR STANDARD CABLE TAGGING.

INSTALL APPROPRIATE PHASE ROTATION INDICATION STICKER ON THE FACE OF THE METER BASE BELOW METER GLASS AND ALSO INSIDE THE METER BASE:

COUNTERCLOCKWISE: CN 440303
CLOCKWISE: CN 440302



STANDARD PHASE ROTATION IDENTIFICATION PROCEDURE
FOR SELF-CONTAINED METER BASES ONLY

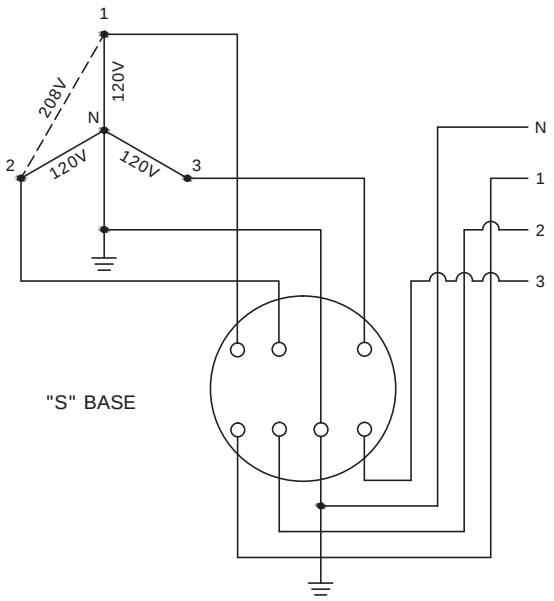
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

HIGH PHASE LOCATION ON DELTA SERVICE
AND STANDARD PHASE ROTATION
FOR SELF-CONTAINED METER BASES ONLY

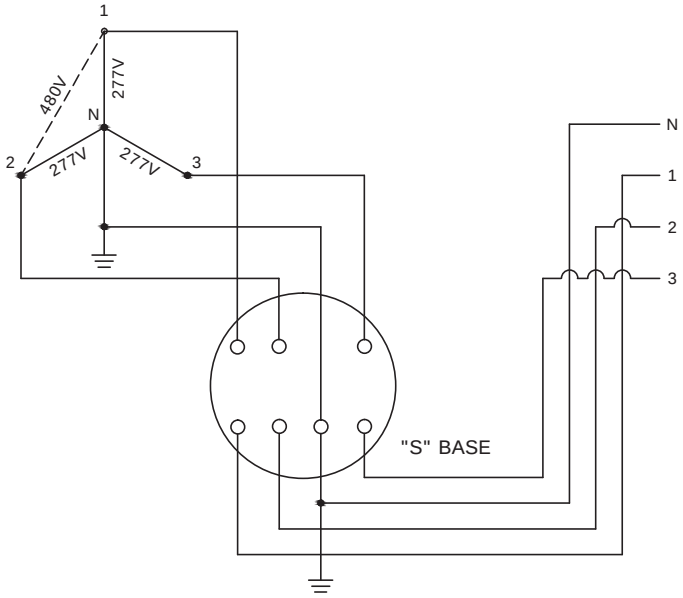
DUKE ENERGY.

FLA

DWG. 34.03-08



THREE-PHASE, FOUR WIRE, WYE 120/208 VOLTS



THREE-PHASE, FOUR WIRE, WYE 277/480 VOLTS

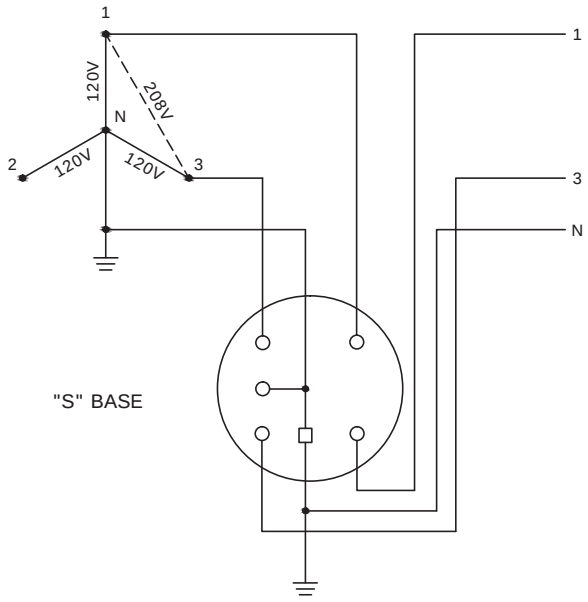
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED 4-WIRE
WYE METER WIRING DIAGRAMS

DUKE ENERGY.

FLA

DWG.
34.03-12



THREE WIRE NETWORK

3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

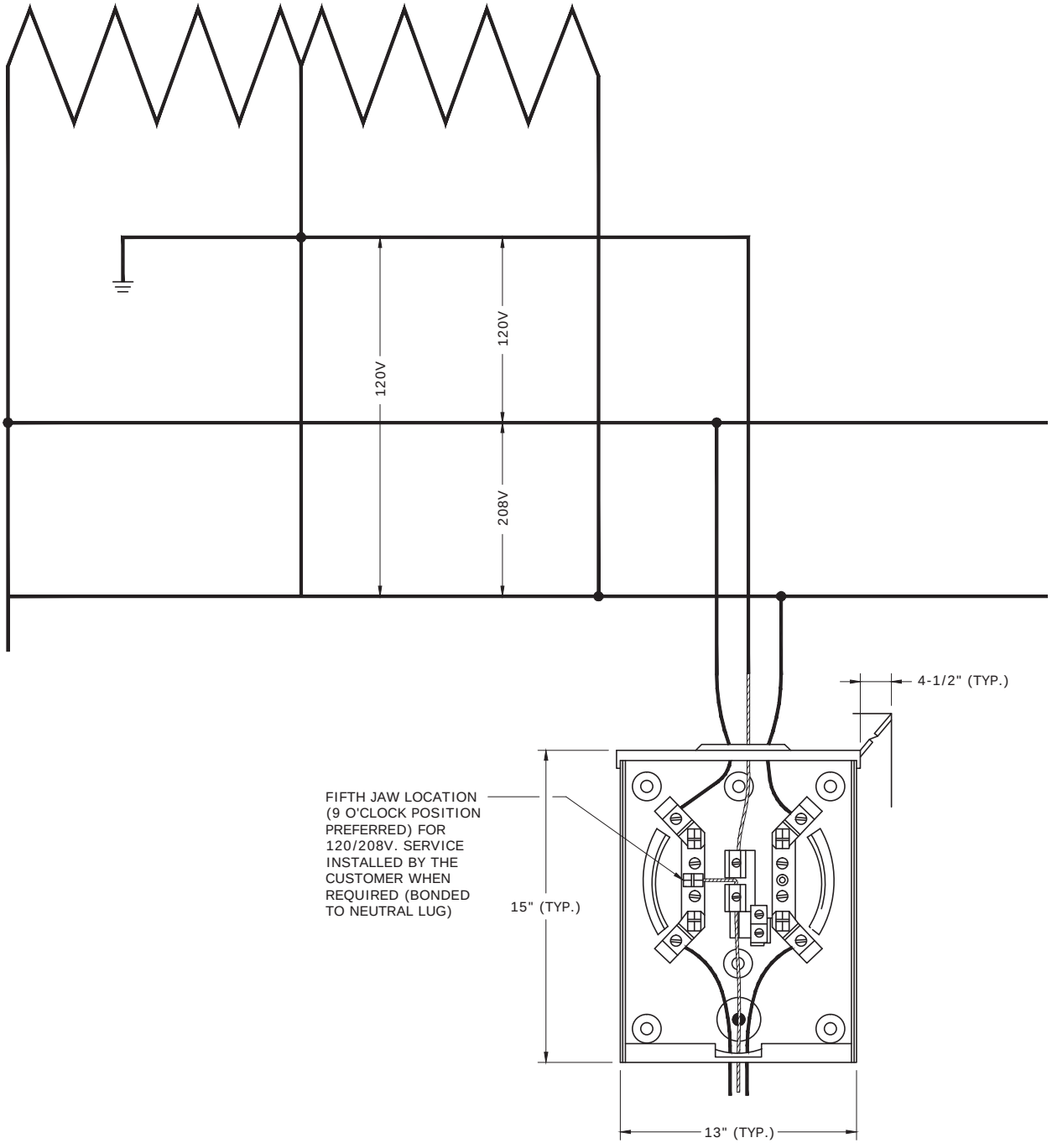
120/208 VOLT 3-WIRE NETWORK

SELF-CONTAINED METERING WIRING DIAGRAM

DUKE ENERGY.

FLA

DWG. 34.04-02



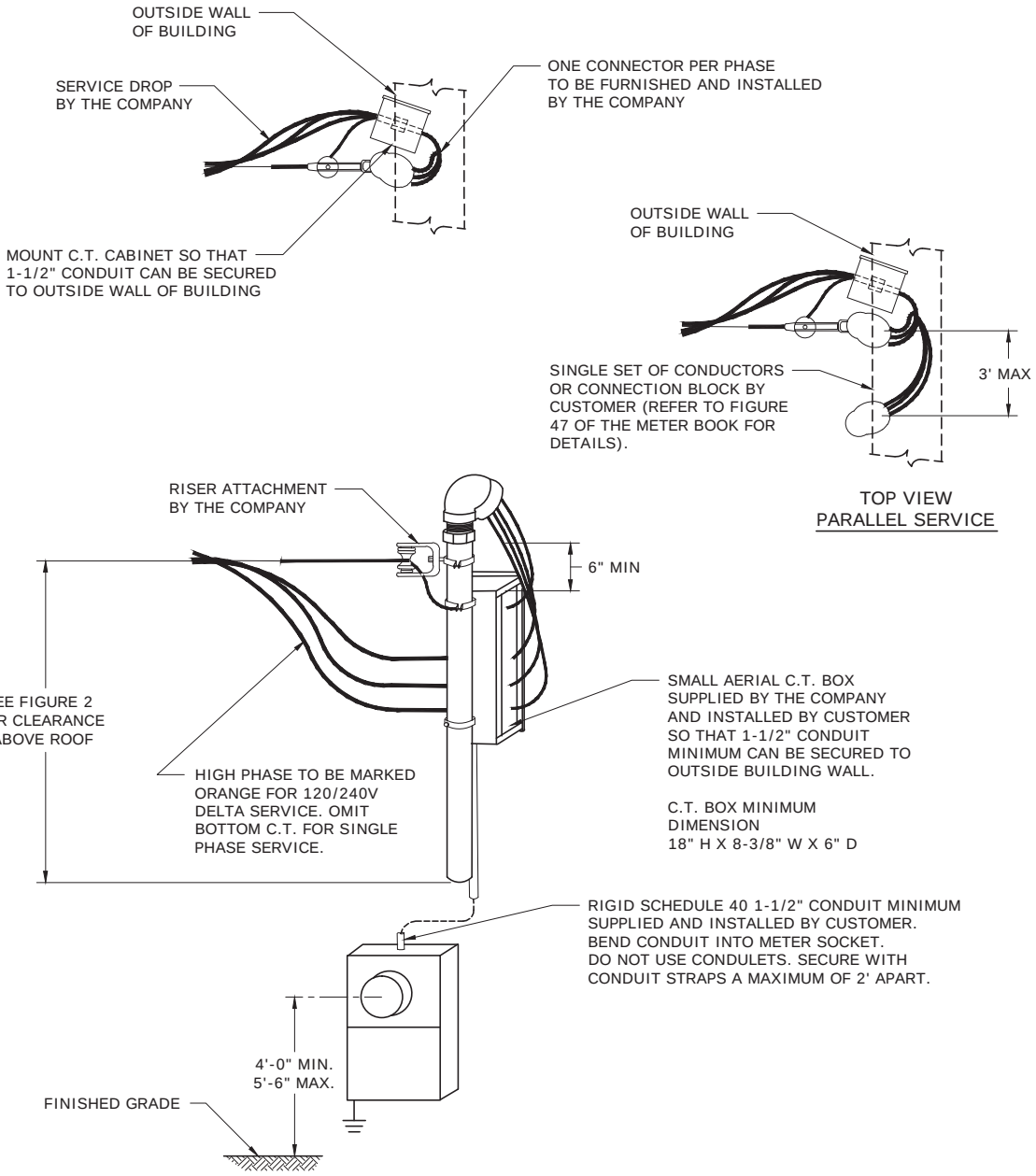
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SECONDARY SELF-CONTAINED METER WIRING CONNECTIONS, 120/208 VOLT, 3-WIRE - NETWORK

DUKE ENERGY.

FLA

DWG. 34.04-03



NOTE: ALL METER CONTROL WIRE CONNECTIONS TO BE MADE INSIDE CURRENT TRANSFORMER ENCLOSURE.

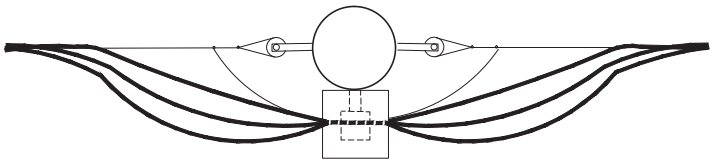
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

CT CABINET INSTALLATION ON SERVICE RISER, THREE-PHASE, 4-WIRE OR SINGLE-PHASE, 3-WIRE SERVICE

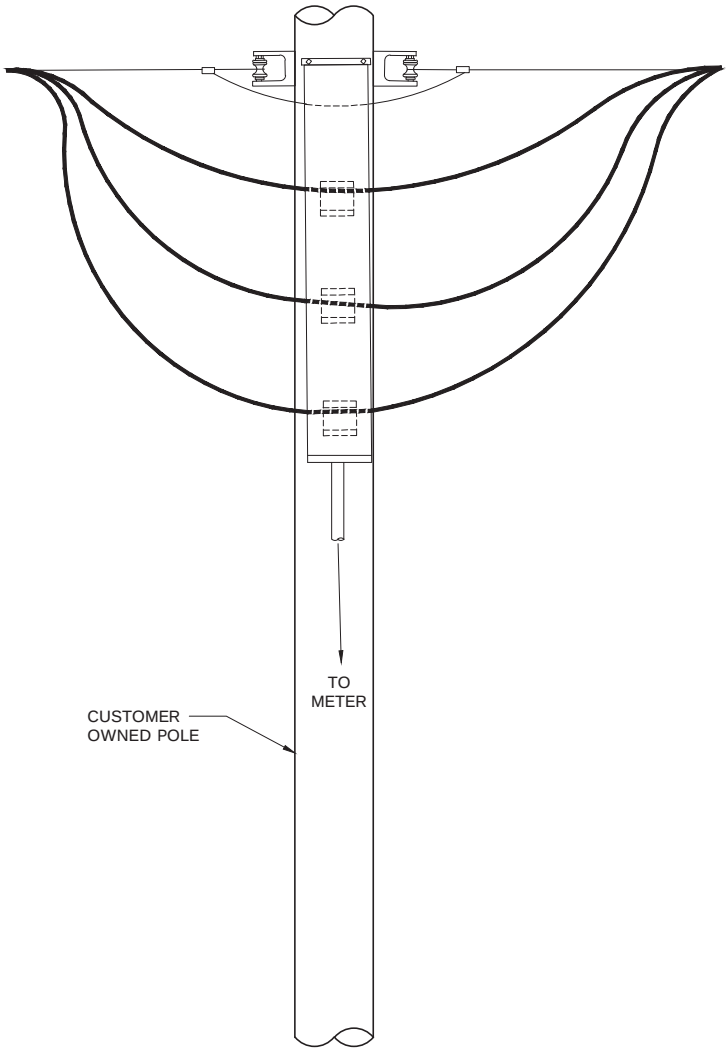
DUKE ENERGY.

FLA

DWG. 34.07-08



PLAN VIEW



FRONT VIEW

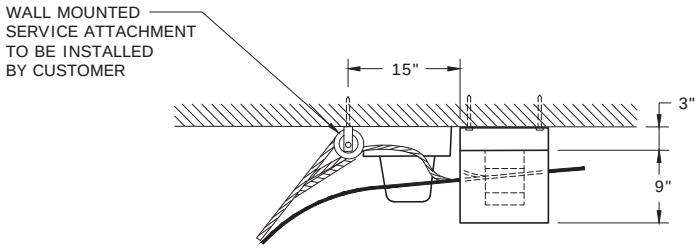
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

CURRENT TRANSFORMER INSTALLATION FOR SECONDARY METERING

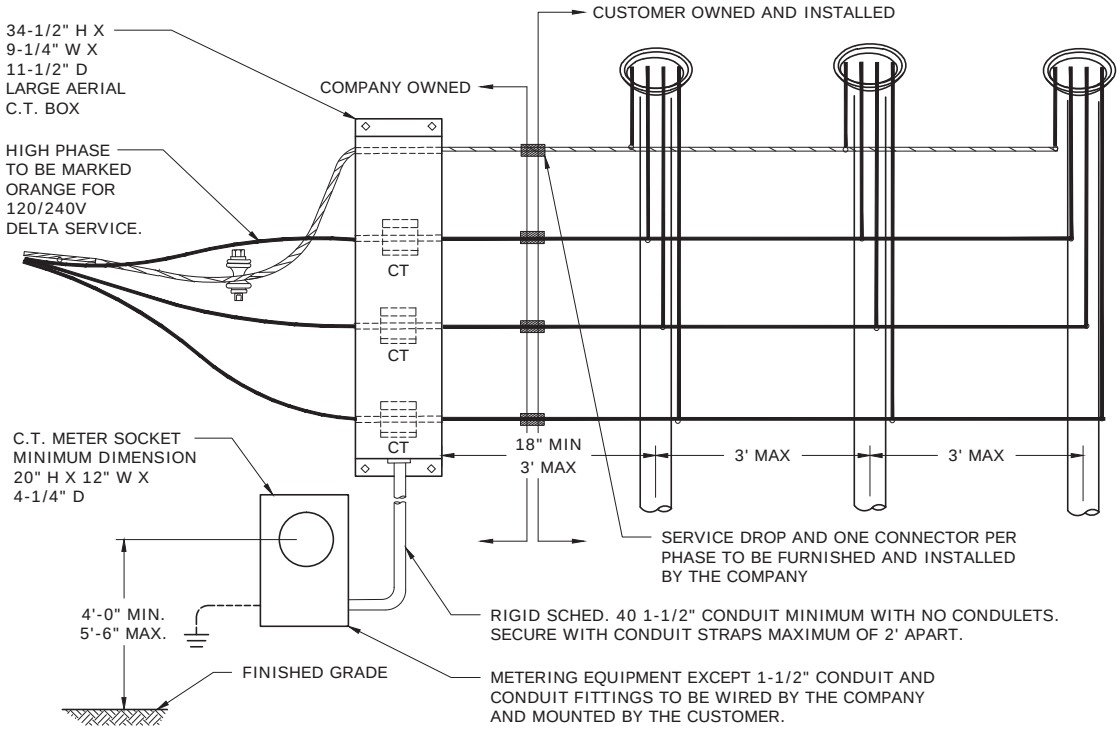
DUKE ENERGY.

FLA

DWG. 34.07-10



CUSTOMER SHALL CONNECT MULTIPLE RISERS BEHIND THE C.T.'S TO A SINGLE SET OF CONDUCTORS OR CONNECTION BLOCK FOR CONNECTION TO THE SERVICE DROP BY THE COMPANY. (REFER TO FIG. 47 OF THE METER BOOK FOR CONNECTION BLOCK DETAILS)



NOTES:

1. CUSTOMER MUST PROVIDE ADEQUATE GROUNDING OF FACILITIES IN ACCORDANCE WITH THE N.E.C. AND AUTHORITY HAVING JURISDICTION, AND THE COMPANY.

2. ALL METER CONTROL WIRE CONNECTIONS TO BE MADE INSIDE CURRENT TRANSFORMER ENCLOSURE.

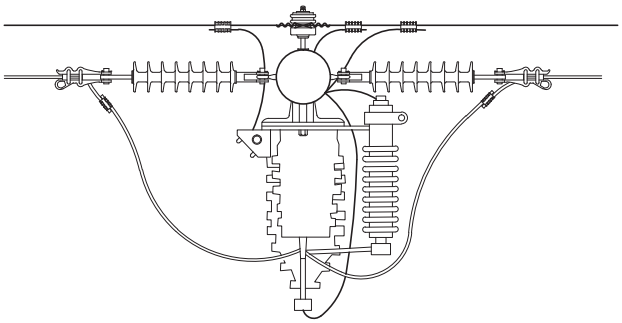
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

CT CABINET INSTALLATION ON THREE-PHASE, 4-WIRE WALL MOUNTED

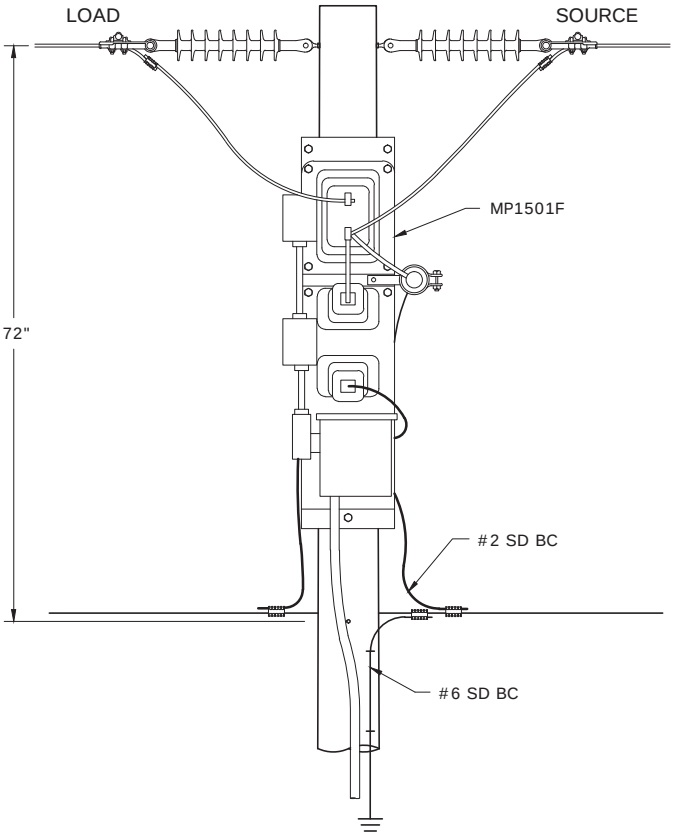
DUKE ENERGY.

FLA

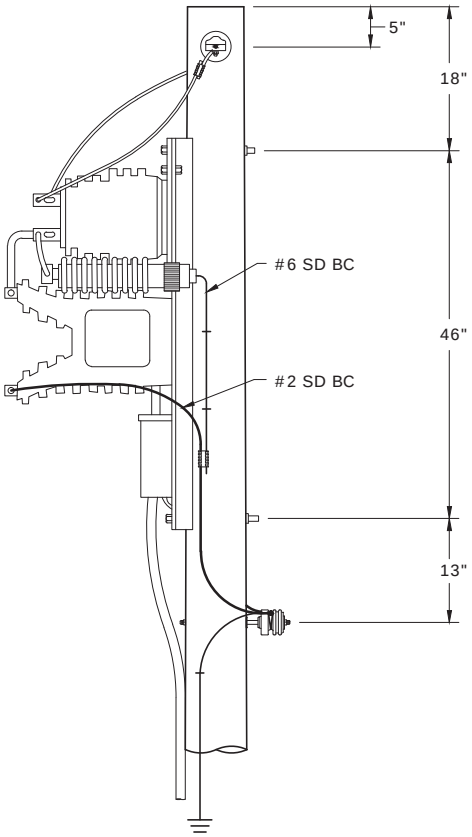
DWG. 34.07-12



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

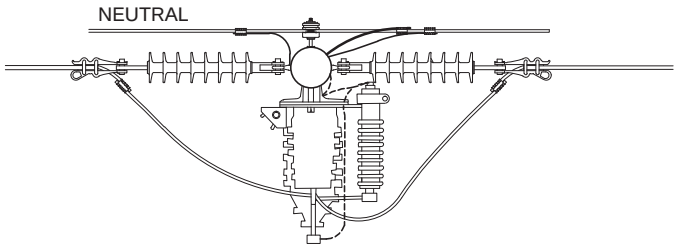
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

SINGLE-PHASE PRIMARY METERING INSTALLATION - 15 KV OVERHEAD CLUSTER

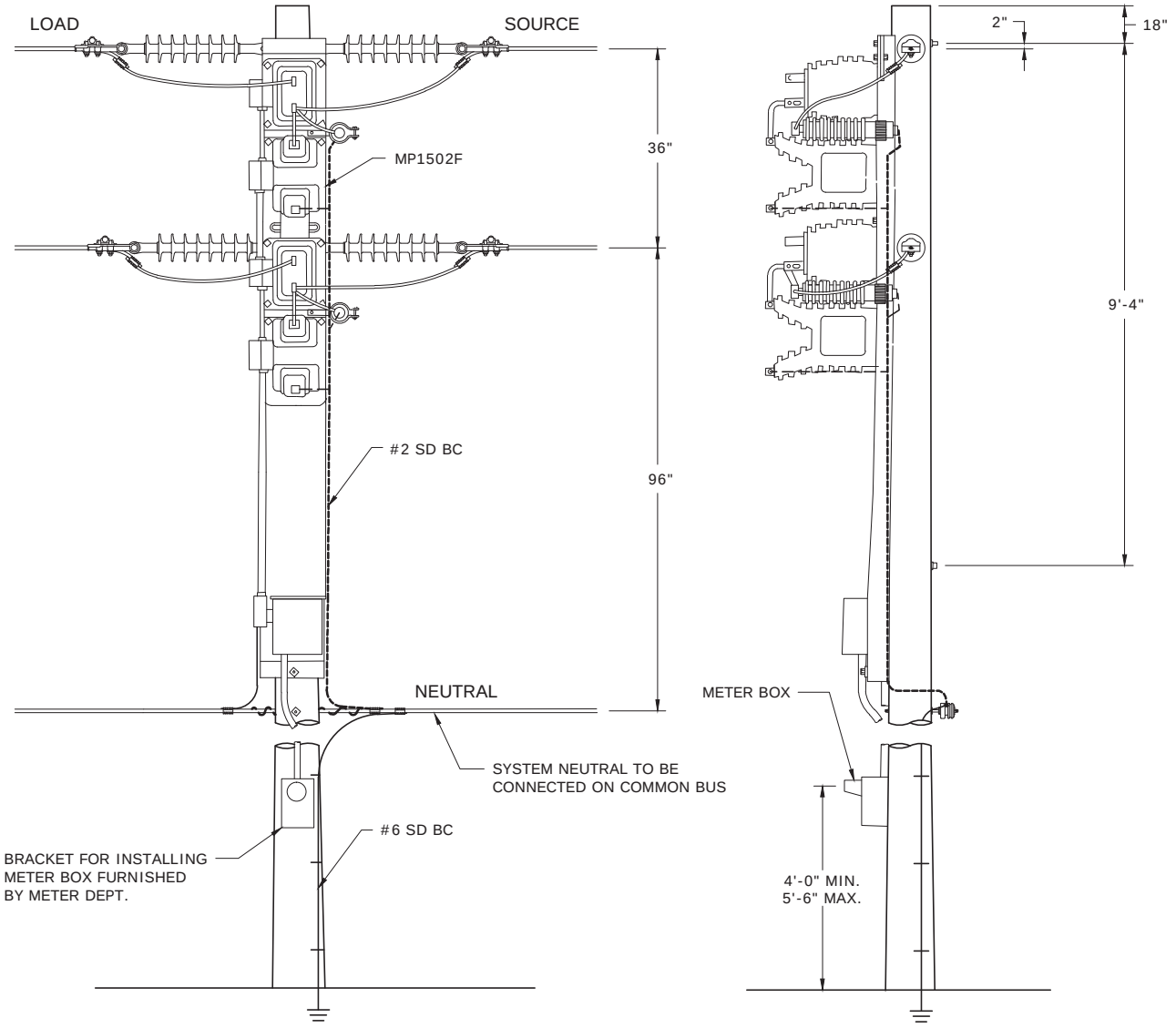
DUKE ENERGY.

FLA

DWG. 34.08-04



PLAN VIEW



FRONT VIEW

SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

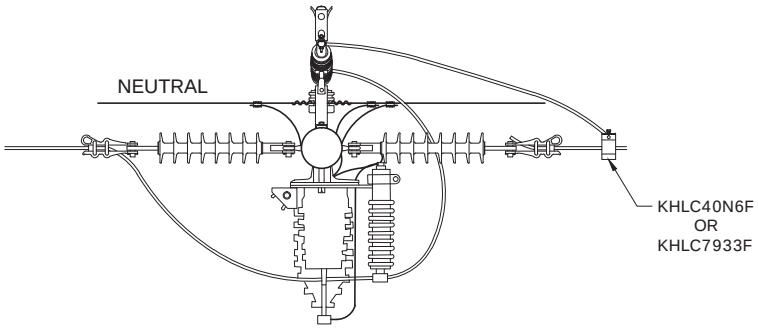
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

POLYPHASE PRIMARY METERING INSTALLATION - 15 KV, 2 ELEMENT, OVERHEAD VERTICAL CLUSTER

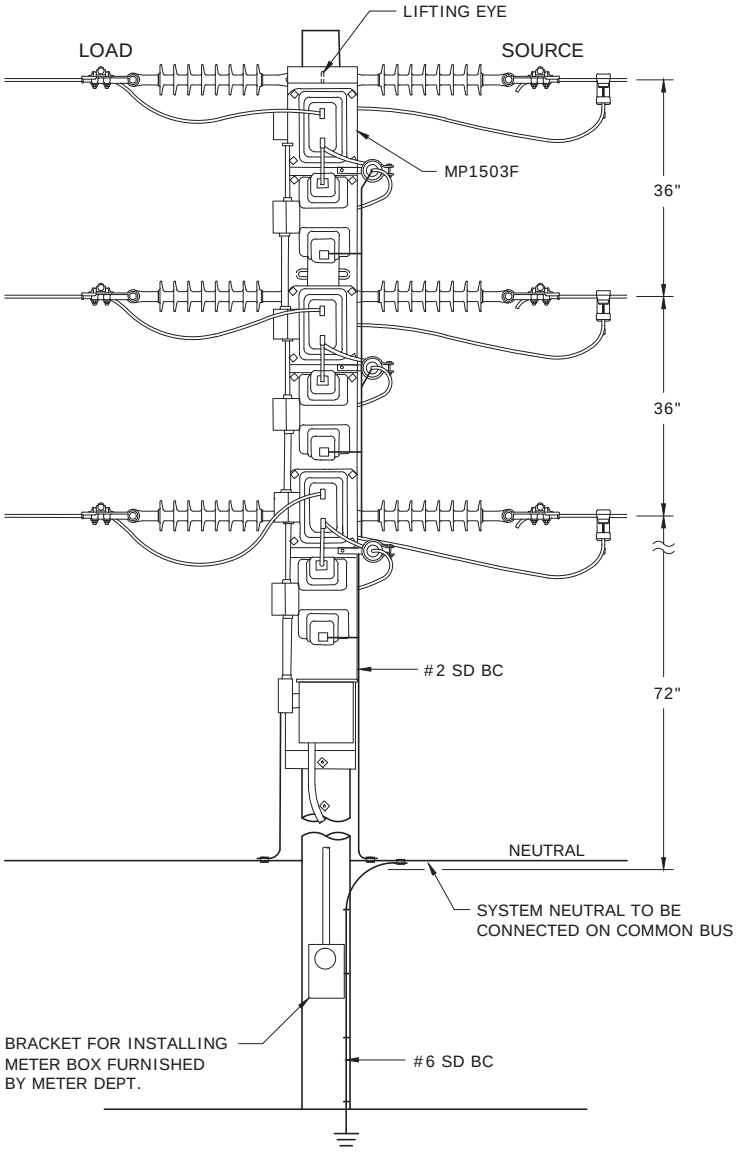
DUKE ENERGY.

FLA

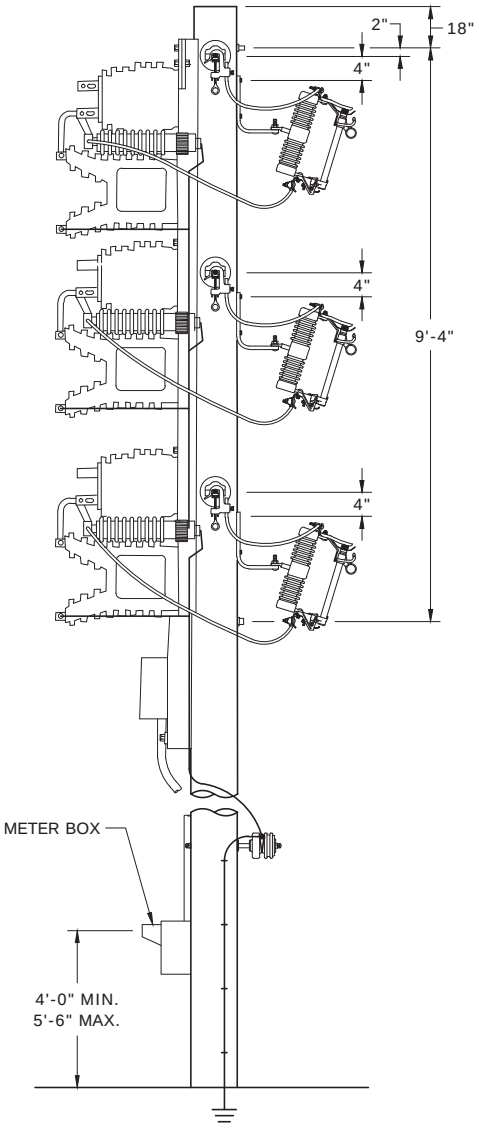
DWG. 34.09-06



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

2. LINE FUSES MAY BE PLACED ON POLE UPSTREAM OF METER CLUSTER IF CIRCUIT CONFIGURATION PERMITS AND APPROVED BY PLANNER.

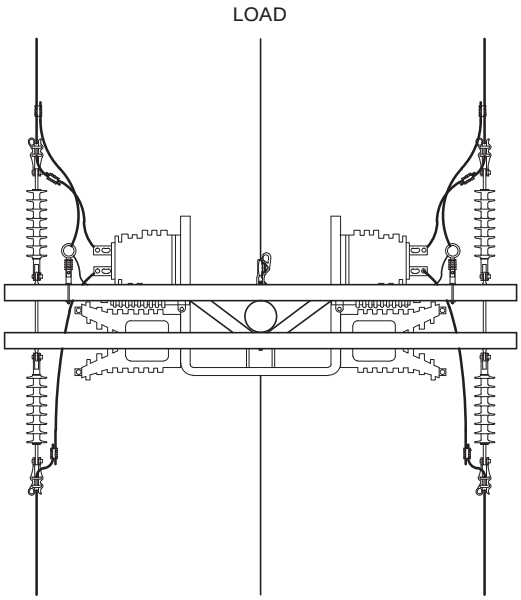
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 3 ELEMENT, OVERHEAD VERTICAL CLUSTER

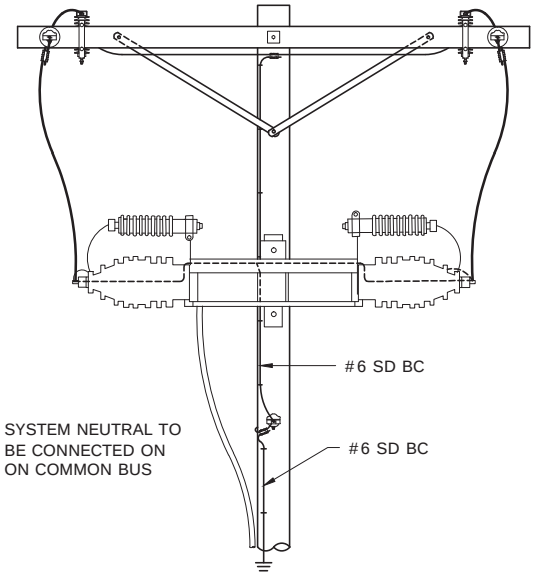
DUKE ENERGY.

FLA

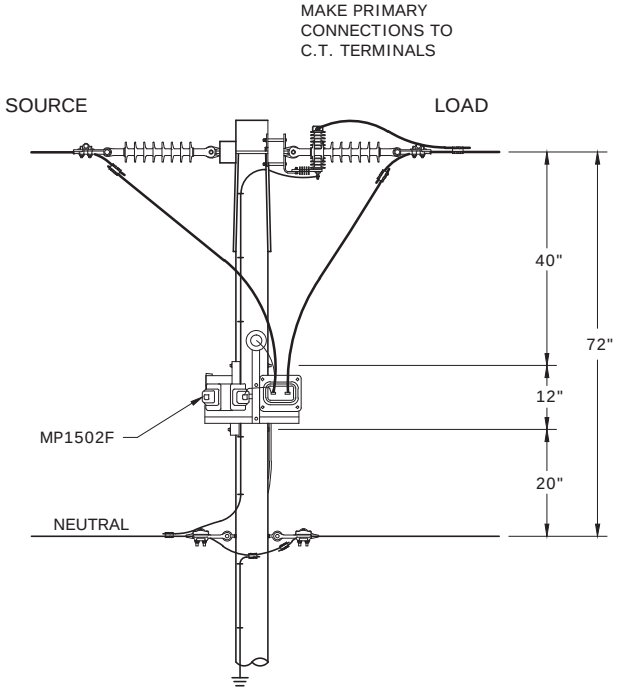
DWG. 34.09-10



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. METER DEPARTMENT TO SPECIFY LOCATION FOR USE OF THIRD POTENTIAL TRANSFORMER.
2. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

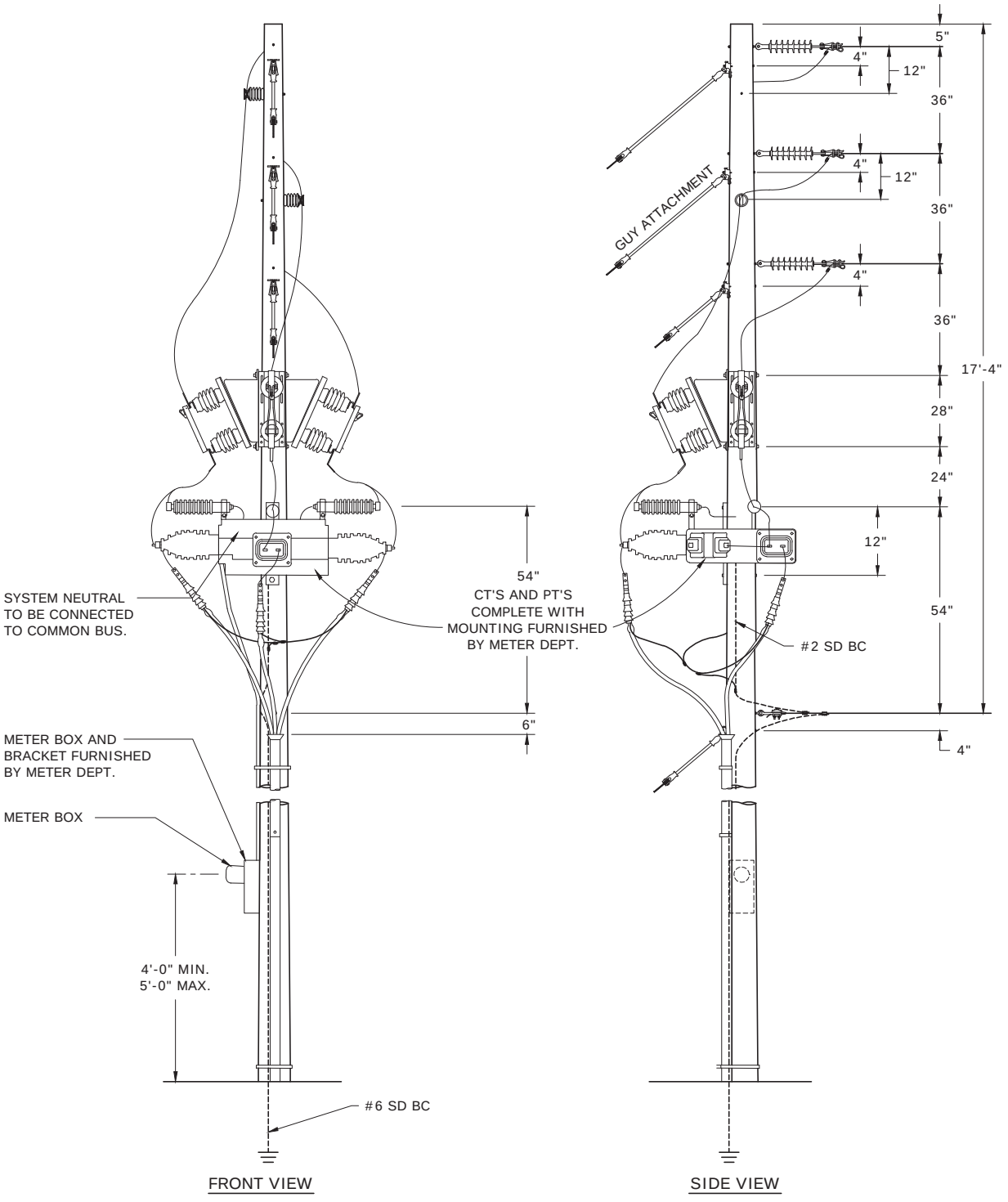
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION -
15 KV, 2 ELEMENT,
OVERHEAD HORIZONTAL CLUSTER

DUKE ENERGY.

FLA

DWG.
34.09-12



NOTES:

1. GUYS MUST BE BONDED TO POLE GROUND, NOT SHOWN HERE FOR CLARITY. REFER TO DWG. 02.04-04.

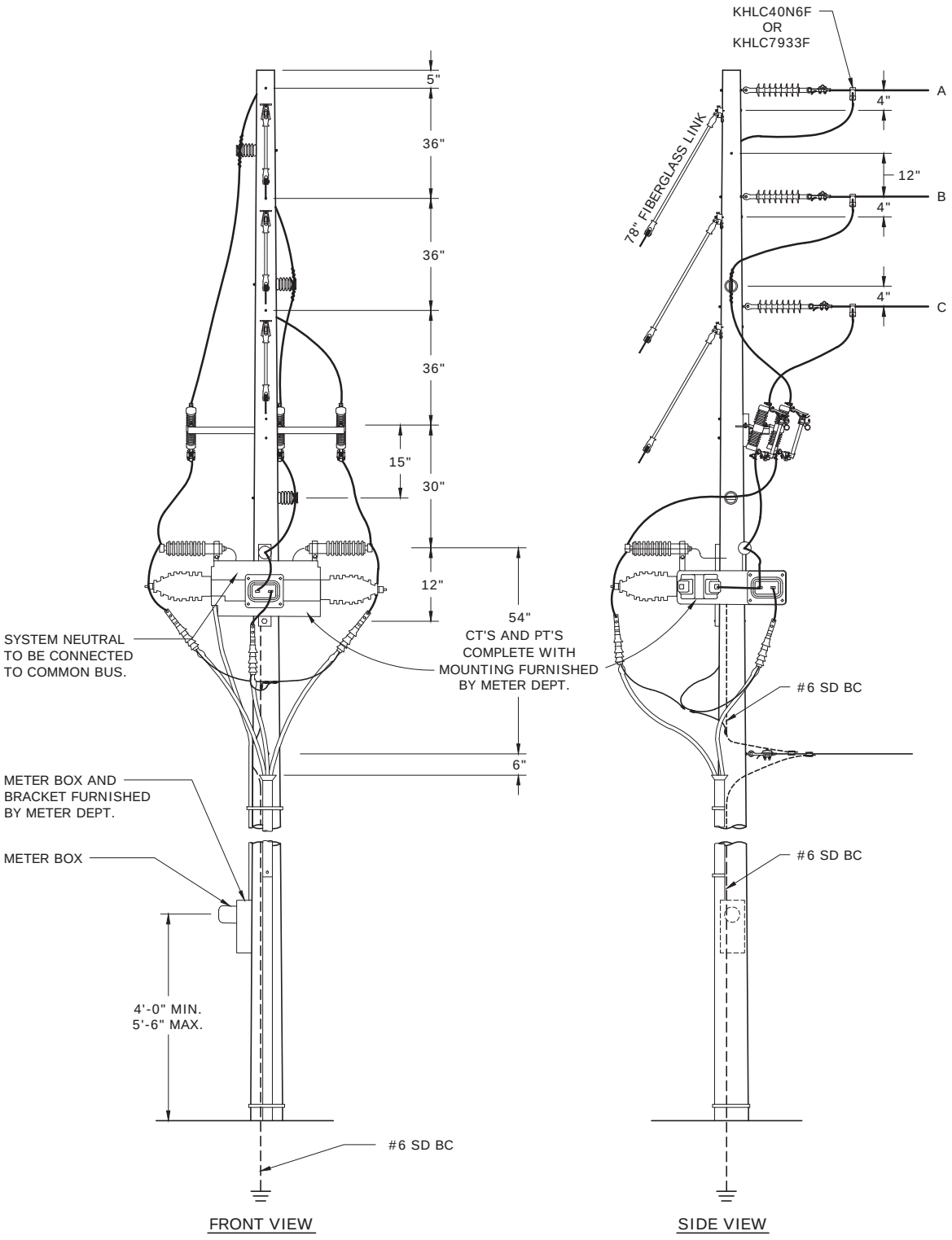
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 600 AMP, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

DUKE ENERGY.

FLA

DWG. 34.09-16



NOTES:

1. GUYS MUST BE BONDED TO POLE GROUND, NOT SHOWN HERE FOR CLARITY. REFER TO DWG. 02.04-04.

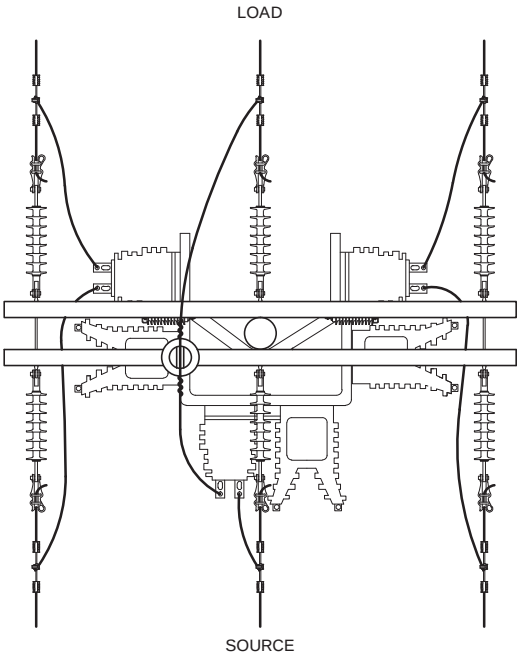
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 200 AMP, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER

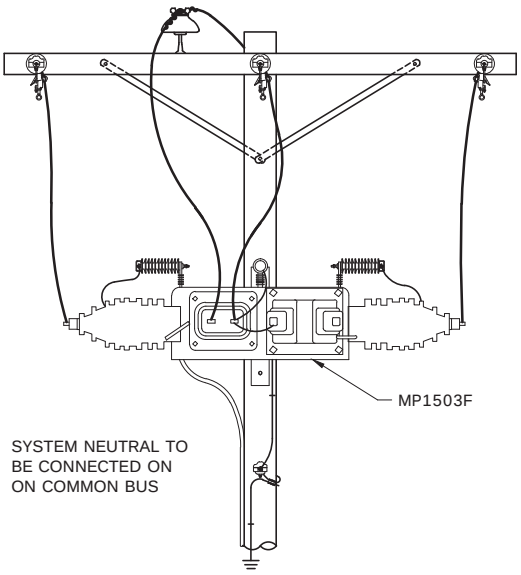
DUKE ENERGY.

FLA

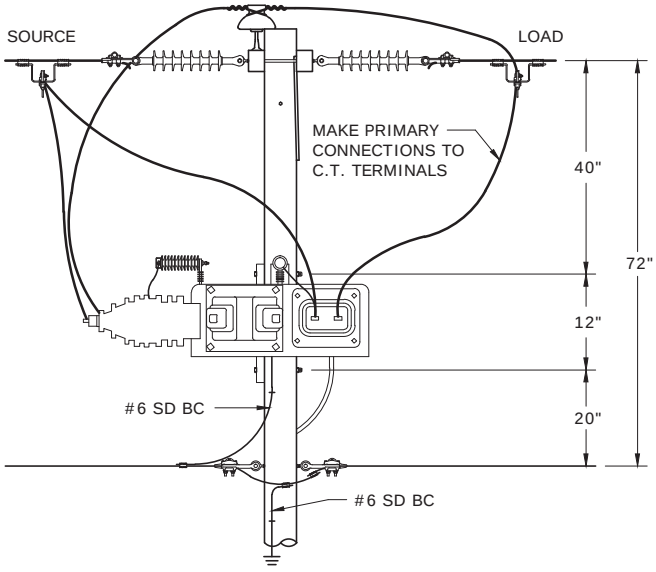
DWG. 34.09-18



PLAN VIEW



FRONT VIEW



SIDE VIEW

NOTES:

1. METER DEPARTMENT TO SPECIFY LOCATION FOR USE OF THIRD POTENTIAL TRANSFORMER.
2. CUTOUTS MAY BE INSTALLED ON ADJACENT SERVICE POLE IF SPECIFIED BY ENGINEER.
3. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

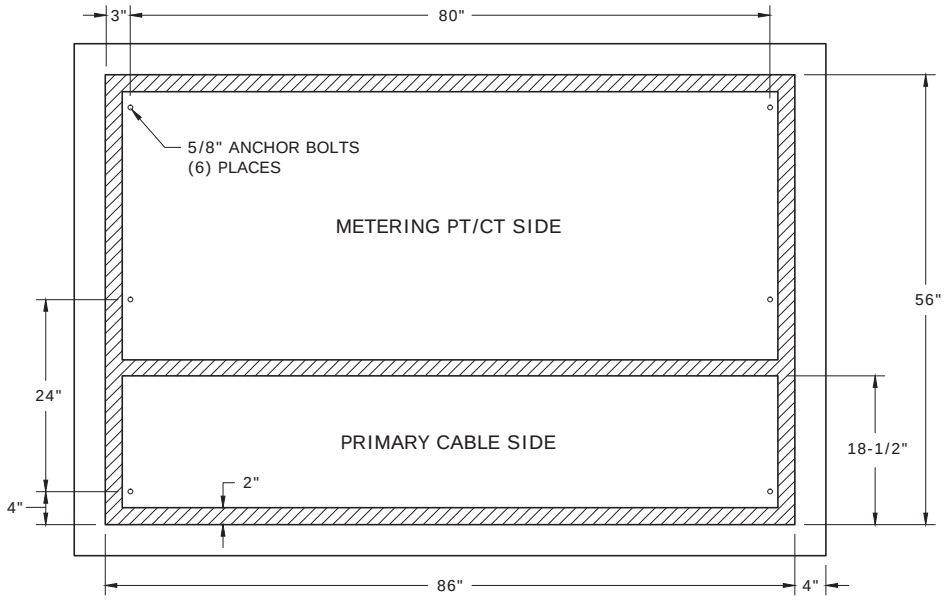
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION -
15 KV, 3 ELEMENT,
OVERHEAD HORIZONTAL CLUSTER

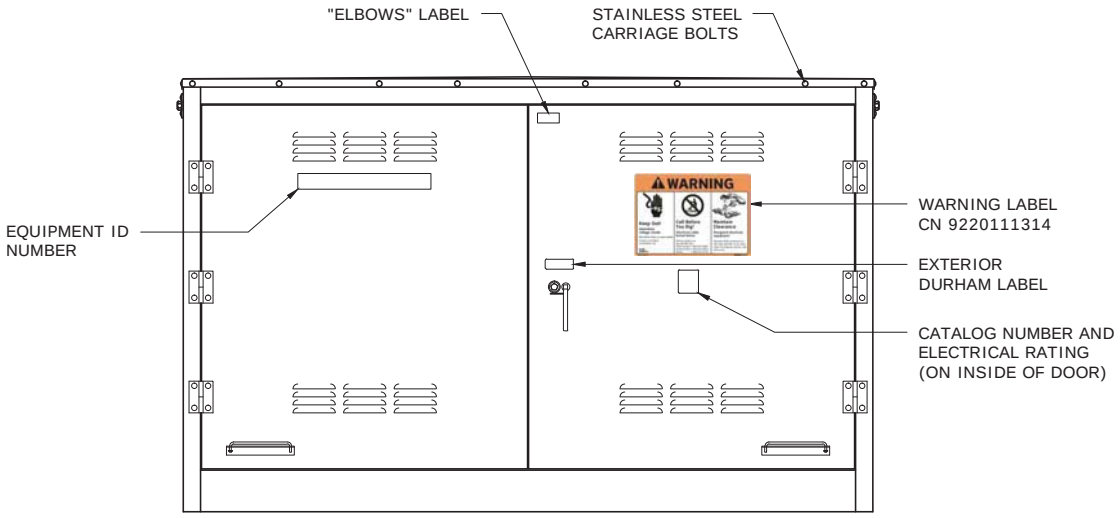
DUKE ENERGY.

FLA

DWG.
34.09-20



ENCLOSURE FOOTPRINT



FRONT VIEW

BILL OF MATERIALS						
MACRO UNIT	CU ITEM NO.	COMPATIBLE UNIT	QTY REQ'D	CATALOG NUMBER	QTY PER CU	DESCRIPTION
-	1	ENCMTRCTPTSF	1	001466	1	PAD-MOUNTED METER ENCLOSURE
	2	PAD3P82X87CF	1	327712	1	82" X 87" CONCRETE PAD
	3	-	1	9220111314	1	WARNING LABEL
	4	-	4	211298041	1	DANGER LABEL (SEE NOTE 2)

NOTES:

1. ISSUE GROUNDS SEPARATELY.
2. INSTALL DANGER LABEL ON INSIDE OF EACH DOOR: TOTAL (4) LABELS.
3. INSTALL 1 WARNING LABEL ON EACH SET OF DOORS (ONE PER SIDE).

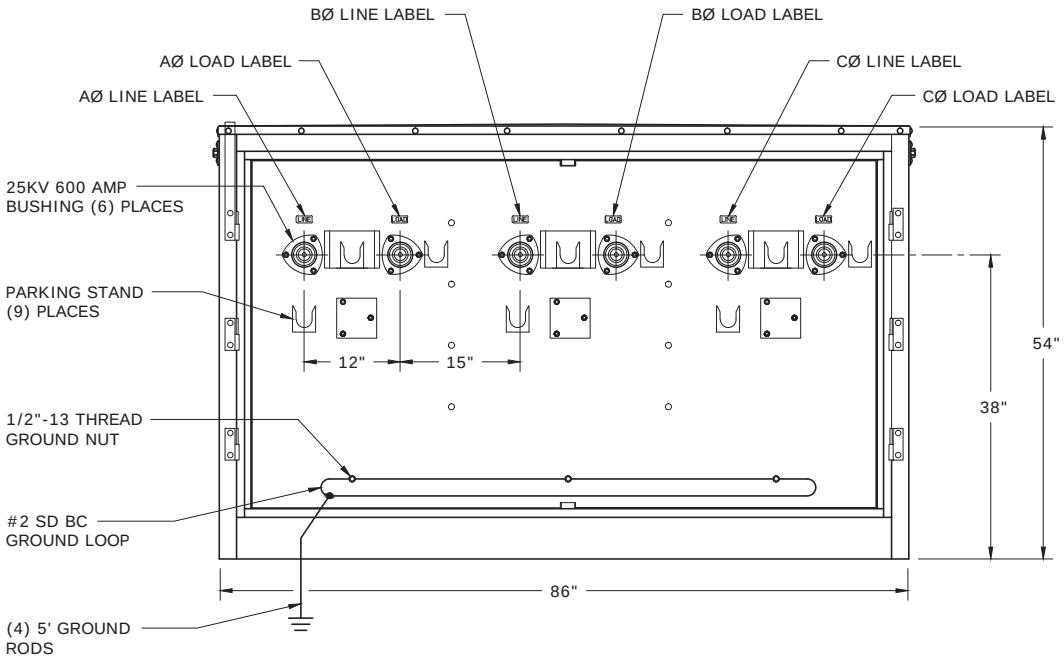
REVISED		BY	CK'D	APPR.
3				
2				
1	7/25/14	DANNA	DANNA	ADCOCK
0	11/5/13	GUINN	GUINN	ADCOCK

THREE-PHASE PRIMARY METERING ENCLOSURE
FRONT VIEW AND FOOTPRINT

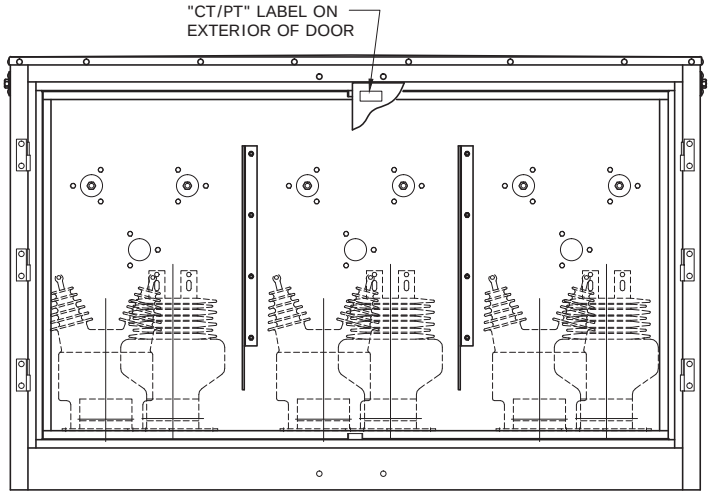
DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

34.11-01



FRONT VIEW (DOORS REMOVED)



BACK VIEW (DOORS REMOVED)

NOTES:

1. REAR SIDE ACCESS FOR METER DEPARTMENT ONLY.
2. CONTACT METERING WHEN THERE IS AN APPLICATION FOR THIS ENCLOSURE.
3. INSTALL ELBOW ARRESTERS ON BACK OF T-BODY.

3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING ENCLOSURE
BUSHING AND CT/PT LAYOUT

DUKE ENERGY.

FLA

DWG. 34.11-03

NOTES:

1. DEADFRONT CONSTRUCTION 600 AMP BOLTED ELBOW (T-BODY).

2. T-BODY IS NON-LOADBREAK (NO VOLTAGE AND CURRENT).

3. IT IS ACCEPTABLE TO CONNECT BOTH GROUND DRAIN LEADS TO THE GROUNDING BUSS USING SEPARATE CONNECTORS AS A METHOD OF CROSS BONDING.

4. CONNECT DRAIN WIRE FROM INSULATED CAP TO GROUND LOOP.

5. VERIFY LINE AND LOAD SIDE CABLES ARE CONNECTED PROPERLY (I.E. LINE TO LINE, LOAD TO LOAD, CORRECT PHASE).

   IMPROPER CONNECTION WILL RESULT IN INCORRECT METER READINGS!

6. SEE DWG. 22.06-10 FOR CABLE AND CONDUIT PLACEMENT.

7. MARK ALL CABLES USING WHITE PLASTIC CABLE IDENTIFICATION TAG. TAG MUST INCLUDE LINE OR LOAD DESIGNATION. SEE DWG. 27.00-03 FOR ADDITIONAL DETAIL.

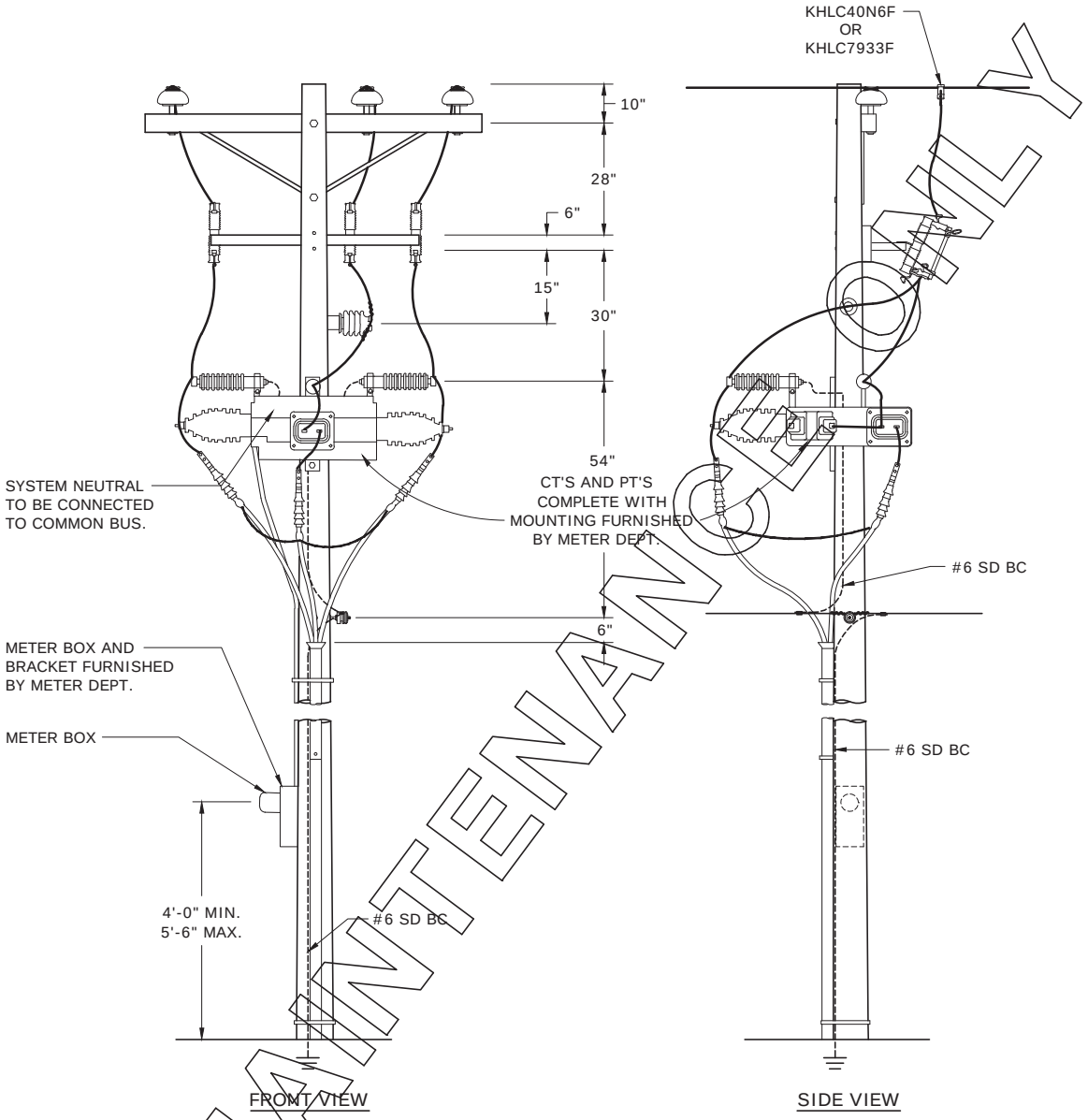
3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING ENCLOSURE

DUKE ENERGY.

FLA

DWG. 34.11-05



NOTES:

1. SEE SECTION 01 FOR ADDITIONAL GROUNDING DETAILS.

3				
2				
1				
0	11/5/13	GUINN	GUINN	ADCOCK
REVISED		BY	CK'D	APPR.

THREE-PHASE PRIMARY METERING INSTALLATION - 15 KV, 2-1/2 ELEMENT, OVERHEAD HORIZONTAL CLUSTER (FMO)

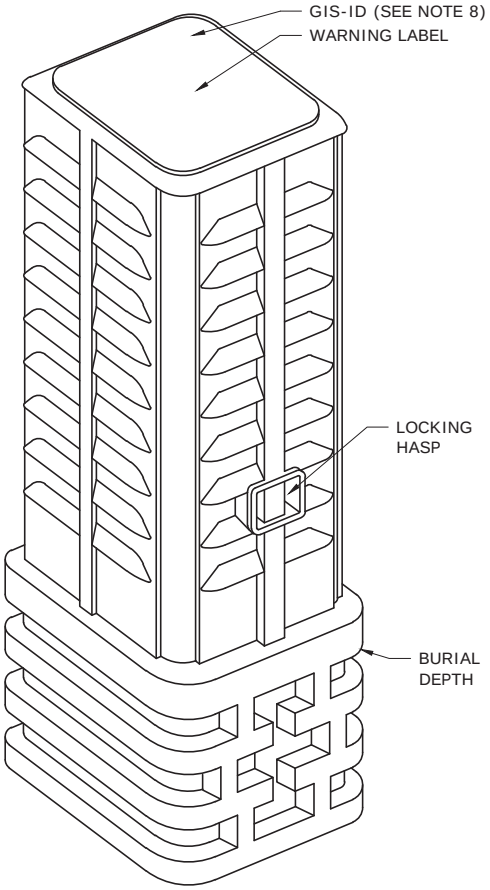
DUKE ENERGY.

FLA

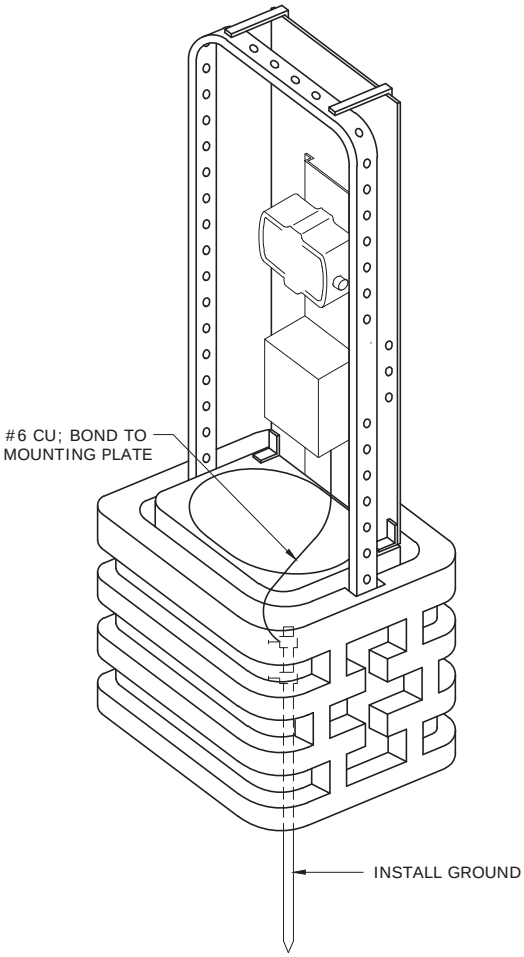
DWG. 34.09-14

35.02 NEIGHBORHOOD AREA NETWORKS

35.03 ATS COMMUNICATIONS AND CONTROLS



PEDESTAL



WARNING LABEL

NOTES:

1. SEE DWG. 35.02-102B FOR NOTES.

3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

PEDESTAL - NAN ANTENNA

DEC	DEM	DEP	DEF
		X	X

35.02-102A

BILL OF MATERIALS						
MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	PEDNAN12X18FGF	1	9220239984	1	PEDESTAL, MOUNTING, AMI ANTENNA, PEDESTAL (TYPE-03)
				9220253029	1	ANTENNA, OMNIDIRECTIONAL, TERRAWAVE OIL CAN, PED. MOUNT
				9220253031	1	KIT, MOUNTING, PEDESTAL, SSN RELAY OR ACCESS POINT
	2	GUAR2F	1	60136	1	COUPLING, ROD, 5/8 IN, COPPER PLATED STEEL, GRD
				9220192319	2	ROD, GROUND, 5/8 X 60 IN, COPPER CLAD
	3	-	1	434337	1	PADLOCK, KEYED, LOCK TO BE KEYED SAME AS CAT. NO.30170302
	4	-	1	9220118950	1	LABEL, WARNING, 3M YEL REF SHEETING #3271

NOTES:

1. TO KEEP COSTS AT A MINIMUM AND TO REDUCE RIGHT-OF-WAY ISSUES, NAN ANTENNA PEDESTALS SHOULD SHOULD BE INSTALLED WITHIN 2-4 FT. OF EXISTING TRANSFORMER OR POWER PEDESTAL. INSTALL NAN POWER CABLE IN A SHORT PIECE OF CONDUIT FROM THE TRANSFORMER/POWER PEDESTAL TO THE NAN PEDESTAL. WHERE THIS IS NOT POSSIBLE, SECONDARY CABLE MUST BE RAN FROM THE TRANSFORMER/POWER PEDESTAL TO THE NAN ANTENNA PEDESTAL.
2. SOIL UNDERNEATH THE PEDESTAL SHALL BE COMPACTED TO THE FIRMNESS OF UNDISTURBED EARTH AND SHALL BE FREE OF ROOTS AND OTHER ORGANIC MATERIALS.
3. SECONDARY SHALL ENTER APPROXIMATELY 4" INSIDE LEFT SIDE OF BASE.
4. PEDESTAL BASE SHALL HAVE A MINIMUM OF 12" OF BACKFILL.
5. DO NOT FILL INSIDE OF PEDESTAL WITH BACKFILL.
6. SECURE PEDESTAL WITH COMPANY PADLOCK.
7. INSTALL WARNING LABELS AS SHOWN.
8. INSTALL GIS-ID NUMBER AS SHOWN ON DWG. 25.02-02B.
9. WHEN PEDESTAL IS INSTALLED WITHIN 2-4 FT. OF TRANSFORMER, BOND ANTENNA PLATE TO TRANSFORMER GROUND WITH #6 CU. ELSE, INSTALL 10' GROUND AND BOND ANTENNA PLATE TO GROUND WITH #6 CU.

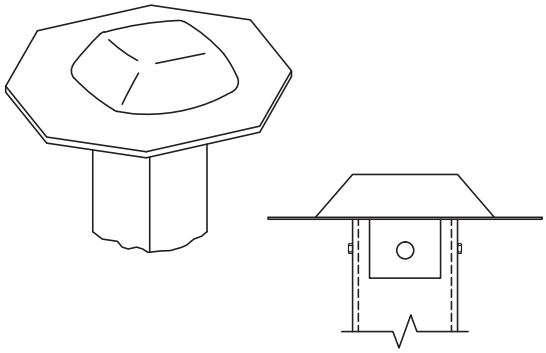
DUKE ENERGY.

3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

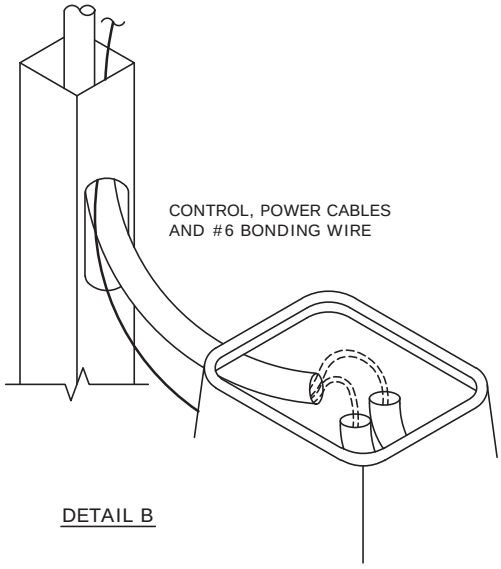
PEDESTAL - NAN ANTENNA

DEC	DEM	DEP	DEF
			X

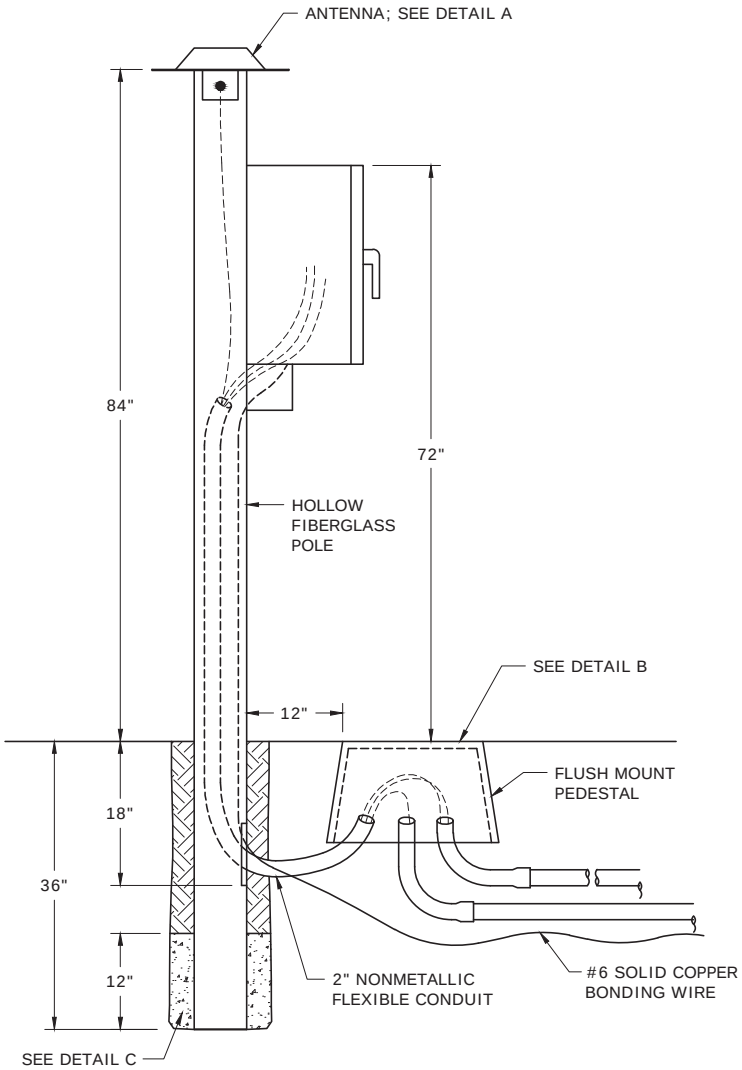
35.02-102B

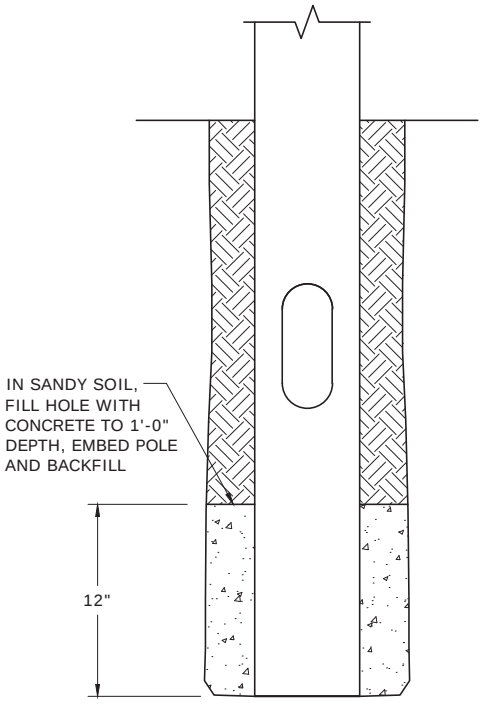


DETAIL A
GROUND PLANE AND ANTENNA
BOLTED TO TOP OF POLE



DETAIL B





DETAIL C

NOTES:

1. SEE DWG. 35.03-115B FOR ATS DETAILS.

2. SEE DWG. 35.03-115C FOR BILL OF MATERIALS.

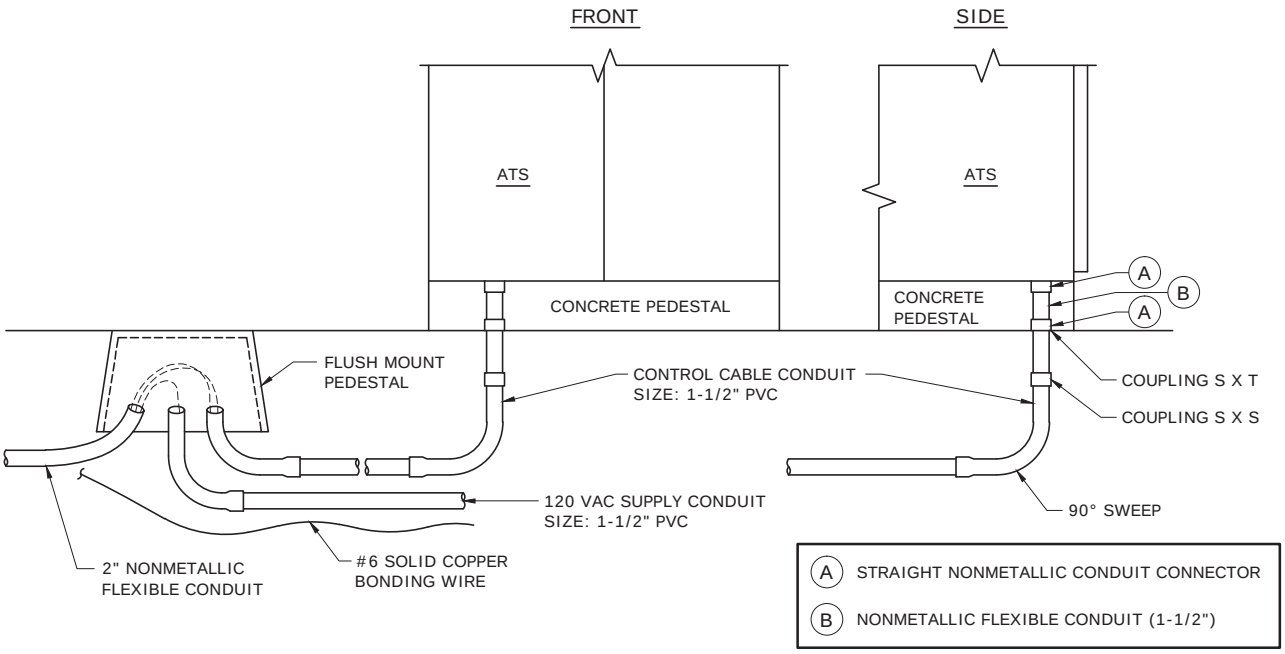
3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ATS COMMUNICATION CABINET INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

35.03-115A



NOTES:

1. THE LOCATION OF THE COMMUNICATION BOX AND POST WILL BE RELATIVE TO THE SWITCHGEAR. LOCATION SELECTED SHOULD NOT INTERFERE WITH ANY DOORS ON THE ATS, OR OTHER NEARBY SWITCHGEAR OR TRANSFORMER ACCESS. PLACE IN LOCATION FOR EASY ACCESS. GIVE CONSIDERATION TO OTHER ACTIVITY AT THE SITE SUCH AS MOWING.

2. 120 VOLT POWER TO COMMUNICATION BOX MAY COME FROM A VARIETY OF LOCATIONS INCLUDING NEARBY UNDERGROUND OR OVERHEAD SECONDARY, CT METERING CIRCUITS, NON-SWITCHED STREETLIGHT CIRCUITS, OR NEARBY 120 VOLT TRANSFORMER. IN SOME CASES, A SINGLE-PHASE TRANSFORMER WILL NEED TO BE ADDED TO THE 200 AMP LOOP OUT OF THE ATS. CONSIDERATION SHOULD BE GIVEN TO THE MOST ECONOMICALLY FEASIBLE OPTION. (SEE DWG. 35.03-115D FOR CT METERING CIRCUIT.)

3. CONTROL MUST BE BONDED TO SWITCHGEAR GROUND.

4. UP TO 3 ATS GEARS MAY BE CONTROLLED FROM ONE COMMUNICATION BOX.

5. SEE DWG. 35.03-115A FOR POLE, PEDESTAL AND FOUNDATION DETAILS.

6. SEE DWG. 35.03-115C FOR BILL OF MATERIALS.

3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ATS COMMUNICATION CABINET INSTALLATION

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

35.03-115B

BILL OF MATERIALS						
MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	SGCOMBOXATSF	1	9220269839	1	CONTROL, SWITCH, ATS, COM DSCADA, WITH SEL 2440, SEL-3622, UPS
	2	PFG10F	1	9220269951	1	POST 10'X4"X4", FOR ATS COM CONTROL, WITH HOLES FOR CONDUIT
	3	-	-	9220267798	1	CONTROLLER, AUTOMATION, DISCRETE, PROGRAMMABLE RELAY, SEL-2440
	4	-	-	9220267813	1	GATEWAY, SECURITY, RELAY, SEL-3622 W/ FIRMWARE VER. R142 OR R143
	5	PEDFM9X14PF	1	320173	1	PEDESTAL, STREET LIGHT, 9" X 14" X 12" D BOX-JUNCTION, FLUSH MOUNT
	6	-	-	9220272933	1	MODEM, CELLULAR, SIERRA GX440, W/DC POWER CABLE, RUGGEDIZED SIM
	7	-	-	9220272935	1	ANTENNA, MODEM, MOBILEMARK, LTM300, W/15' CABLE AND SMA CON.
	8	-	-	9220270934	*	BRACKET, MOUNTING, 12 GA., GLV STEEL, SWITCHGEAR PROXIMITY SENSOR
	9	-	-	9220274928	*	SWITCH, PROXIMITY, SENSOR, 12MM DIA, NON FLUSH MOUNT, SOURCE NO
	10	-	-	372104	*	CONDUIT, PVC, SCH 40, 1-1/2", W/CPLG, 20'
	11	-	-	9220211958	*	FLEXIBLE NONMETALLIC CONDUIT, 1-1/2 IN
	12	-	-	9220110469	*	FLEXIBLE NONMETALLIC CONDUIT, 2 IN
	13	-	-	21016308	*	FLEXIBLE NONMETALLIC CONDUIT CONNECTOR, 1-1/2 IN
	14	-	-	372154	*	FEMALE CONDUIT ADAPTER, PVC, SXT, 1-1/2"
	15	-	-	372704	*	COUPLING, PVC, SCH 40, 1-1/2N/ST
	16	-	-	372411	*	BEND, PVC, 90 DEG, SCH 40, 1-1/2 X 12", RADIUS
	17	-	-	9220274893	*	WIRE, CABLE, ELECTRICAL, CONTROL, 12 CONDUCTOR, TINNED
	18	-	-	9220274877	*	WIRE, CABLE, ELECTRICAL, CONTROL, 7 CONDUCTOR, TINNED CU, 600V, XLP
	19	-	-	9220125586	*	CABLE, #6 AWG, 600V, GROUNDING COPPER, GREEN - INSULATED TINNED
	20	-	-	327852	*	CONNECTOR, INSULATED SUBMERSIBLE, CONNECTOR, #12 - 1/0 STR.
	21	-	-	192107	*	WIRE, COPPER, #10, STREETLIGHT, ST LIGHT #10 CU
	22	-	-	9220276496	*	PT CABINET AND SECONDARY FUSE
	23	-	-	NON-STOCK	*	277 TO 120V TRANSFORMER (AVAILABLE AT METER SHOP)

* AMOUNT REQUIRED WILL VARY FROM LOCATION TO LOCATION DEPENDING ON NUMBER OF SWITCHGEAR AND THEIR ARRANGEMENT

BILL OF MATERIALS - PARTS ASSOCIATED WITH CONTROL						
MACRO UNIT	BUBBLE NUMBER	COMPATIBLE UNIT	CU QTY	ITEM NUMBER	ITEM QTY/ CU	DESCRIPTION
-	1	-	1	9220284648	*	UNINTERRUPTIBLE POWER SUPPLY, TRIO-UPS/1AC/24DC/5. WITH INTERGRATED POWER SUPPLY UNIT, 24 VDC/5 AMP OUTPUT.
	2	-	1	9220284650	*	CONVERTOR, MINI-PS-12-24DC/5-15DC/2, DC/DC. INPUT; 12-24 V DC, OUTPUT; 5-15 V DC/2 A
	3	-	-	9220284653	*	BATTERY, QUINT-BAT/24DC/3.4AH, POWER STORAGE DEVICE, 24 VDC,3.4 AH
	4	-	-	9220150062	*	RING, .., TERMINAL LUG RING, 12 - 10 1/2 STUD
	5	-	1	9220284649	*	PTV1-9 - VINYL PIN TERMINALS - 22-16AWG, RED
	6	-	-	9220284651	*	PTV2-9 - VINYL PIN TERMINALS - 16-14AWG

* USE AS NEEDED - PART LOCATED IN ST PETE METER STOREROOM 302

NOTES:

1. SEE DWG. 35.03-115A FOR POLE, PEDESTAL AND FOUNDATION DETAILS.

2. SEE DWG. 35.03-115B FOR ATS DETAILS.

DUKE ENERGY.

3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ATS COMMUNICATION CABINET INSTALLATION

DEC	DEM	DEP	DEF
			X

35.03-115C

THIS BOX IS TO BE USED TO SUPPLY 120V POWER TO THE ATS.

COMMUNICATIONS BOX FROM THE CT METERING CIRCUIT. USE WHEN THERE IS NO OTHER 120V SUPPLY AVAILABLE.

JUNCTION BOX TO HOUSE FUSE AND TRANSFORMER IF NECESSARY. MOUNT ON CT METER POST OR SECURE NEAR CT METER JUNCTION BOX.

ITEM # 9220276496

3				
2				
1				
0	6/30/16	EANES	BURLISON	ADCOCK
REVISED		BY	CK'D	APPR.

ALTERNATE POWER SUPPLY FOR ATS COMMUNICATION CABINET FROM CT METERING CABINET

DUKE ENERGY.

DEC	DEM	DEP	DEF
			X

35.03-115D

36.01 PAD-MOUNTED EQUIPMENT CLEARANCES

36.02 TRENCH CLEARANCES

36.03 JOINT TRENCH GUIDELINES

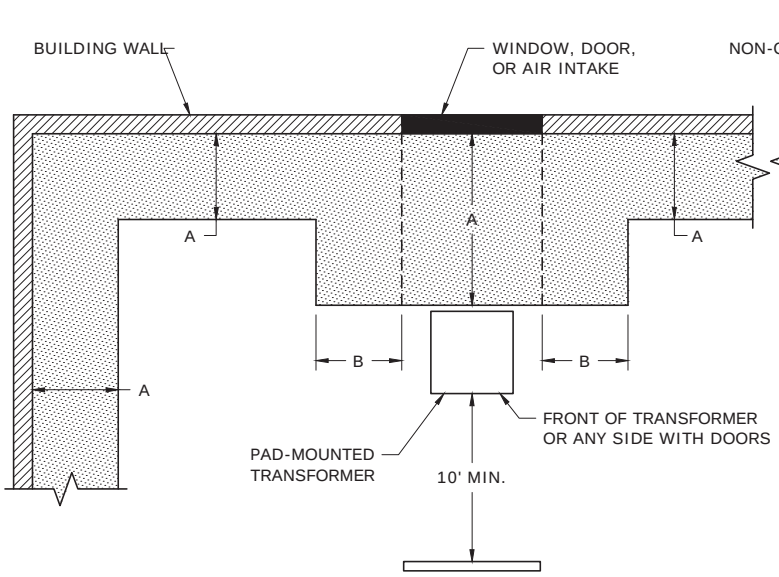


FIGURE 1
ALLOWABLE CLEARANCES

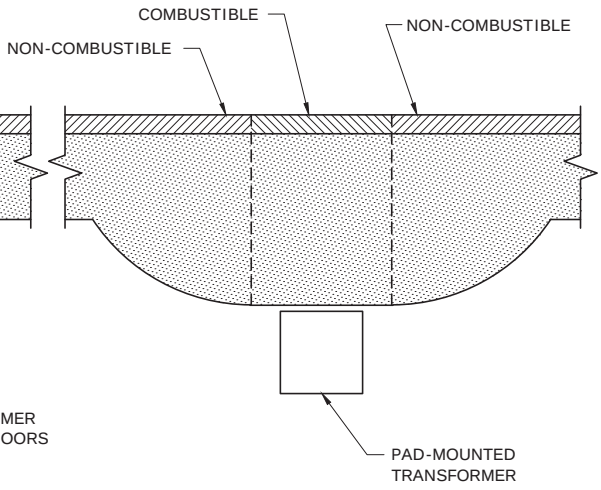


FIGURE 2
BUILDING CONSTRUCTION WITH
COMBUSTIBLE AND NON-COMBUSTIBLE
MATERIAL (SEE NOTE 5)

TYPE OF CONSTRUCTION	DIMENSION A: CLEARANCE EXTENDING OUT FROM BUILDING (FT)	DIMENSION B: SIDE CLEARANCE MEASURED FROM EDGE OF WINDOW, DOOR, ETC. (FT)
NON-COMBUSTIBLE WALLS	3	N/A
COMBUSTIBLE WALLS	10	N/A
DOORS	20	10
WINDOWS (FIRST STORY)	10	10
WINDOWS (SECOND STORY)	REFER TO WALL TYPE	REFER TO WALL TYPE
AIR INTAKES	10	10
FIRE ESCAPES	20	20

NOTES:

1. ADEQUATE PASSAGEWAYS TO ACCOMMODATE CRANES, LINE TRUCKS, OR OTHER NECESSARY LIFTING AND HAULING EQUIPMENT SHALL BE PROVIDED TO ALLOW FOR MAINTENANCE, OPERATION, OR REPLACEMENT.
2. DISTANCES ARE FROM THE PAD OR TRANSFORMER CASING, WHICHEVER IS CLOSER TO THE BUILDING OR OPENING.
3. IF THE BUILDING HAS AN OVERHANG, THE DISTANCE IS MEASURED FROM THE OUTSIDE EDGE OF THE OVERHANG.
4. OUTSIDE WALKWAYS OR STAIRS ATTACHED TO THE BUILDING SHALL BE CONSIDERED AS PART OF THE BUILDING.
5. IF A BUILDING IS CONSTRUCTED OF BOTH COMBUSTIBLE AND NON-COMBUSTIBLE MATERIALS, NO PART OF THE PAD-MOUNTED TRANSFORMER CAN BE WITHIN THE ALLOWABLE DISTANCE FOR THE COMBUSTIBLE MATERIALS IN ANY DIRECTION.
6. DISTANCES LESS THAN THOSE SPECIFIED MAY BE ALLOWED IF APPROVED BY THE APPROPRIATE CODE ENFORCEMENT AUTHORITY, BUT IN NO CASE SHALL DISTANCES TO A BUILDING BE LESS THAN 3 FT. THIS MAY REQUIRE ALTERNATE MEANS OF FIRE PROTECTION INCLUDING FIRE BARRIERS, FIRE RATED WALLS, OIL CONTAINMENT MEANS, OR OTHER APPROVED MEASURES.
7. FIRE-RATED WALLS AROUND TRANSFORMERS MUST BE A MINIMUM OF 1'-0" ABOVE THE ANTICIPATED HEIGHT OF THE INSTALLED TRANSFORMER. NO WALL, WHETHER FOR FIRE PROTECTION OR AESTHETIC PURPOSES, CAN BE HIGH ENOUGH TO PREVENT DUKE ENERGY'S INSTALLATON AND FUTURE MAINTENANCE OF THE TRANSFORMER WITH STANDARD EQUIPMENT AND LIFTING DEVICES AS DETERMINED BY DUKE ENERGY.
8. FINAL GRADE AT THE LOCATION OF THE PAD-MOUNTED TRANSFORMER SHALL PROVIDE FOR MINERAL OIL TO DRAIN FROM THE BUILDING. OTHERWISE, AN OIL CONTAINMENT MEANS IS REQUIRED.
9. CLEARANCES LISTED ARE DUKE ENERGY MINIMUM REQUIREMENTS. THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ) MAY HAVE REQUIREMENTS THAT ARE MORE STRINGENT. IT SHALL BE THE CUSTOMER'S RESPONSIBILITY TO CONFORM TO ALL LOCAL BUILDING CODES, INSURANCE REGULATIONS, OR ORDINANCES AFFECTING THE TRANSFORMER LOCATION.

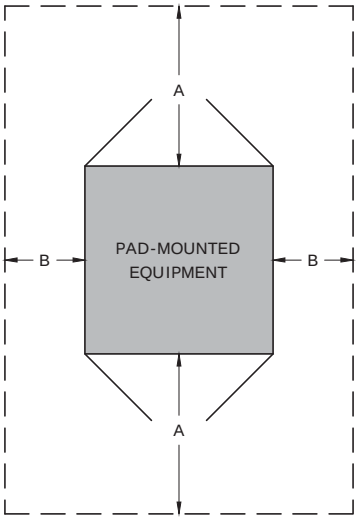
DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PAD-MOUNTED TRANSFORMER CLEARANCES
FROM BUILDINGS

DEC	DEM	DEP	DEF
X	X	X	X

36.01-101



MINIMUM CLEAR WORKING SPACE AROUND PAD-MOUNTED EQUIPMENT		
TYPE OF PAD-MOUNTED EQUIPMENT	DIMENSION A DOOR SIDES (FT)	DIMENSION B (FT)
TRANSFORMERS (SEE NOTE 4)	10	3
SWITCHGEAR (SEE NOTE 3)	10	5
RECLOSERS, PRIMARY METERS, ETC.	10	3

MISCELLANEOUS CLEARANCES	
TYPE OF EQUIPMENT	CLEARANCE IN ANY DIRECTION (FT)
FUEL OR GAS DISPENSERS	20
CONTAINERS STORING FLAMMABLE LIQUID OR GAS	10
CUSTOMER-OWNED GENERATORS OR TRANSFORMERS	10
FIRE HYDRANTS	SEE NOTE 8
NATURAL GAS METERS	3

NOTES:

1. ADEQUATE PASSAGEWAYS TO ACCOMMODATE CRANES, LINE TRUCKS, OR OTHER NECESSARY LIFTING AND HAULING EQUIPMENT SHALL BE PROVIDED TO ALLOW FOR MAINTENANCE, OPERATION, OR REPLACEMENT.
2. DISTANCES ARE FROM THE PAD OR SURFACE MOUNTED EQUIPMENT, WHICHEVER IS CLOSER TO THE OBJECT IN QUESTION.
3. A MINIMUM CLEAR WORKING SPACE OF 5 FT MUST BE MAINTAINED FROM EACH NON-DOOR SIDE OF THE EQUIPMENT (TO ACCOMMODATE CONTROL CABINETS, ETC.).
4. WHERE A METER IS MOUNTED TO A TRANSFORMER, A CLEAR SPACE AROUND THE METER OF AT LEAST 3 FT WIDE, 4 FT DEEP, AND 8 FT HIGH MUST BE PROVIDED AND ALWAYS AVAILABLE FOR READING, INSPECTING, TESTING, AND MAINTENANCE OPERATIONS.
5. DISTANCES LESS THAN THOSE SPECIFIED MAY BE ALLOWED IF APPROVED BY THE APPROPRIATE CODE ENFORCEMENT AUTHORITY. THIS MAY REQUIRE ALTERNATE MEANS OF FIRE PROTECTION INCLUDING FIRE BARRIERS, FIRE RATED WALLS, SPRINKLER SYSTEMS, OIL CONTAINMENT MEANS, OR OTHER APPROVED MEASURES.
6. IT SHALL BE THE CUSTOMER'S RESPONSIBILITY TO CONFORM TO ALL LOCAL BUILDING CODES, INSURANCE REGULATIONS, OR ORDINANCES AFFECTING THE EQUIPMENT LOCATION.
7. FOR INSTALLATIONS SUBJECT TO REGULAR VEHICLE TRAFFIC, SEE DWG. 36.01-105.
8. 7.5 FT. IN FLORIDA, 4 FT. ELSEWHERE. MAY BE REDUCED TO 3 FT BY AGREEMENT WITH LOCAL FIRE AUTHORITY.

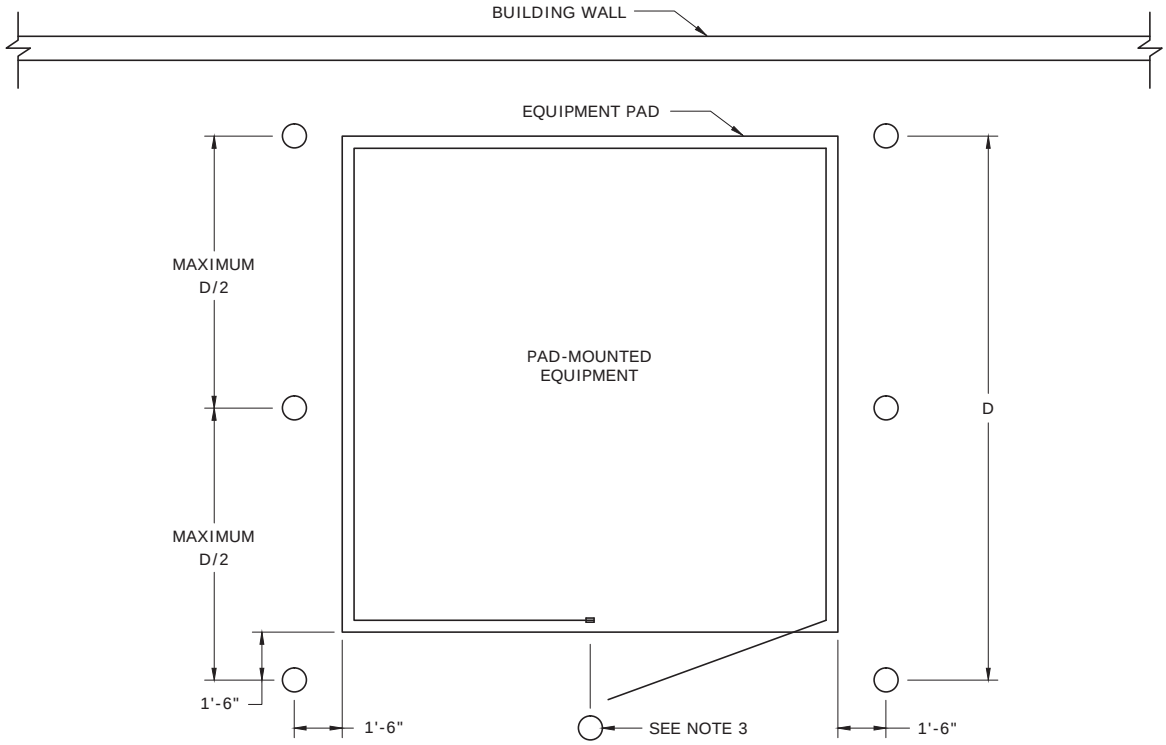
DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PAD-MOUNTED EQUIPMENT WORKING SPACE AND MISCELLANEOUS CLEARANCES

DEC	DEM	DEP	DEF
X	X	X	X

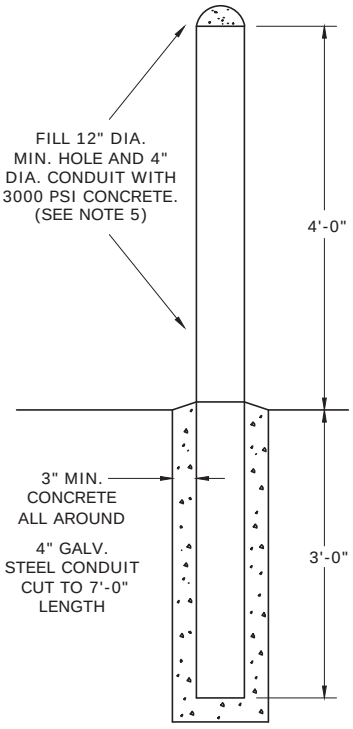
36.01-103



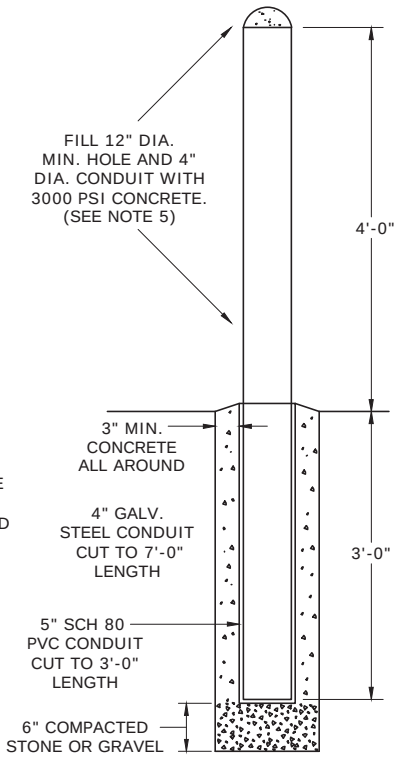
PLAN VIEW

NOTES:

1. PROTECTIVE POLES CAN BE INSTALLED ON ALL SIDES OF PAD-MOUNTED EQUIPMENT THAT ARE SUBJECT TO REGULAR VEHICLE TRAFFIC. THEIR USE IS AT THE DISCRETION OF LOCAL ENGINEERING AND WILL BE THE CUSTOMER'S RESPONSIBILITY TO PROVIDE AND INSTALL AFTER ALL REASONABLE EFFORTS TO LOCATE THE PAD-MOUNTED EQUIPMENT ELSEWHERE HAVE BEEN EXHAUSTED.
2. POLES SHOULD BE EVENLY SPACED ALONG THE SIDES OF THE PAD-MOUNTED EQUIPMENT, NO WIDER THAN HALF THE DIMENSION OF THE SIDE THEY ARE PROTECTING. EXCEPTIONS TO THIS ALONG SIDES WITH DOORS ARE ALLOWED IN ORDER TO ACCOMMODATE NOTE 3.
3. ON ANY SIDE OF PAD-MOUNTED EQUIPMENT WITH DOORS, THIS POLE SHOULD BE CENTRALLY LOCATED BETWEEN THE DOORS AND MUST ACCOMMODATE THE DOOR SWING OF THE EQUIPMENT. IT SHALL BE EITHER REMOVABLE BY HAND OR COLLAPSIBLE. REMOVABLE OR COLLAPSIBLE DESIGNS OTHER THAN WHAT ARE SHOWN MUST BE APPROVED BY LOCAL ENGINEERING.
4. POLES LOCATED ON ANY SIDE OF PAD-MOUNTED EQUIPMENT SHALL NOT INTERFERE WITH THE SAFE OPERATION AND EXPECTED MAINTENANCE OR REPLACEMENT OF THAT EQUIPMENT.
5. POLES SHALL BE PAINTED YELLOW OR OUTFITTED WITH A YELLOW BOLLARD COVER OR POST SLEEVE.
6. ALL POLES SHALL HAVE A 2" REFLECTIVE TAPE APPLIED EITHER AROUND THE TOP OF THE BOLLARD OR EXTENDING VERTICALLY DOWN THE LENGTH OF THE BOLLARD FOR 24". VERTICAL APPLICATIONS MUST BE ON THE SIDE FACING ANY ANTICIPATED TRAFFIC.



STANDARD POLE



REMOVABLE POLE

DUKE ENERGY.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

PROTECTIVE POLES FOR PAD-MOUNTED EQUIPMENT

DEC	DEM	DEP	DEF
X	X	X	X

36.01-105

PRIMARY OR SECONDARY CABLES - DIRECT BURIED OR IN CONDUIT					
PARALLELING	HORIZONTAL SEPARATION (IN)		CROSSING	VERTICAL SEPARATION (IN)	
	PREFERRED (SEE NOTE 2)	NESC MINIMUMS		PREFERRED (SEE NOTE 3)	NESC MINIMUMS
COMMUNICATION LINES	12	SEE NOTE 4	COMMUNICATION LINES	12	SEE NOTE 4
WATER LINES	36	SEE NOTE 2	WATER LINES	12	SEE NOTE 2
SEWER LINES	36	SEE NOTE 2	SEWER LINES	12	SEE NOTE 2
FUEL LINES	36	12 (SEE NOTE 5)	FUEL LINES	12	12 (SEE NOTE 5)
STEAM LINES	60	12 (SEE NOTE 5)	STEAM LINES	36	12 (SEE NOTE 5)
CUSTOMER OWNED CABLES	36	SEE NOTE 2	CUSTOMER OWNED CABLES	12	SEE NOTE 2

PRIMARY OR SECONDARY CABLES - IN A CONDUIT (DUCTBANK) SYSTEM					
PARALLELING	HORIZONTAL SEPARATION (IN)		CROSSING	VERTICAL SEPARATION (IN)	
	PREFERRED (SEE NOTE 2)	NESC MINIMUMS		PREFERRED (SEE NOTE 3)	NESC MINIMUMS
COMMUNICATION LINES	12	3 - CONCRETE 4 - MASONRY	COMMUNICATION LINES	12	3 - CONCRETE 4 - MASONRY
WATER LINES	36	SEE NOTE 2	WATER LINES	12	SEE NOTE 2
SEWER LINES	36	SEE NOTE 2	SEWER LINES	12	SEE NOTE 2
FUEL LINES	36	12 (SEE NOTE 5)	FUEL LINES	12	12 (SEE NOTE 5)
STEAM LINES	60	SEE NOTE 6	STEAM LINES	36	SEE NOTE 6
CUSTOMER OWNED CABLES	36	SEE NOTE 2	CUSTOMER OWNED CABLES	12	SEE NOTE 2

NOTES:

1. THE MINIMUM SEPARATIONS IN THIS DRAWING REFER ONLY TO SEPARATE TRENCH LINES AND DO NOT APPLY TO JOINT TRENCH INSTALLATIONS.

2. THE NESC DOES NOT SPECIFY ACTUAL DISTANCES FROM MOST UTILITIES, BUT INSTEAD STATES THAT THE RADIAL SEPARATION SHOULD BE ADEQUATE TO PERMIT ACCESS TO AND MAINTENANCE OF EITHER FACILITY TO LIMIT DAMAGE TO THE OTHER (RULE 320.B.1 AND RULE 353.A.2). THE DISTANCES SHOWN IN THE ABOVE TABLE HAVE BEEN FOUND TO MEET THESE CRITERIA. LESSER DISTANCES MAY BE ALLOWED WITH AGREEMENT BY ALL OF THE INVOLVED PARTIES.

3. VERTICAL SEPARATION MUST BE SUFFICIENT TO LIMIT THE LIKELIHOOD OF DETRIMENTAL LOAD BEING TRANSFERRED TO EITHER OF THE UTILITIES OR STRUCTURES INVOLVED. THE DISTANCES SHOWN IN THE ABOVE TABLE HAVE BEEN FOUND TO MEET THESE CRITERIA. LESSER DISTANCES MAY BE ALLOWED WITH AGREEMENT BY ALL OF THE INVOLVED PARTIES.

4. DIRECT BURIED APPLICATIONS WITH LESS THAN 12” OF RADIAL SEPARATION BETWEEN COMMUNICATION AND SUPPLY CONDUCTORS ARE CONSIDERED 'RANDOM LAY' AND REQUIRE AGREEMENT BETWEEN THE AFFECTED PARTIES. RANDOM LAY INSTALLATIONS MUST ALSO MEET MORE STRINGENT NESC GUIDELINES AND SHOULD BE AVOIDED UNLESS PART OF A JOINT TRENCH AGREEMENT.

5. DIRECT BURIED PRIMARY AND SECONDARY CABLES SHALL BE INSTALLED WITH A MINIMUM RADIAL SEPARATION OF NOT LESS THAN 12” FROM STEAM LINES, GAS, AND OTHER LINES THAT TRANSPORT FLAMMABLE MATERIAL.

6. ENCASED CONDUIT OR DUCTBANK SYSTEMS SHOULD BE INSTALLED SO AS TO LIMIT THE LIKELIHOOD OF DETRIMENTAL HEAT TRANSFER BETWEEN THE STEAM AND DUCTBANK SYSTEMS.

7. INSTALLATIONS UNDER RAILROAD TRACKS MUST BE A MINIMUM OF 60” BELOW THE TOP OF RAILS. THIS IS THE NESC MINIMUM ONLY. CONSULT WITH THE DUKE ENERGY PERMIT COORDINATOR FOR ACTUAL REQUIREMENTS DICTATED BY INDIVIDUAL RAILROADS.

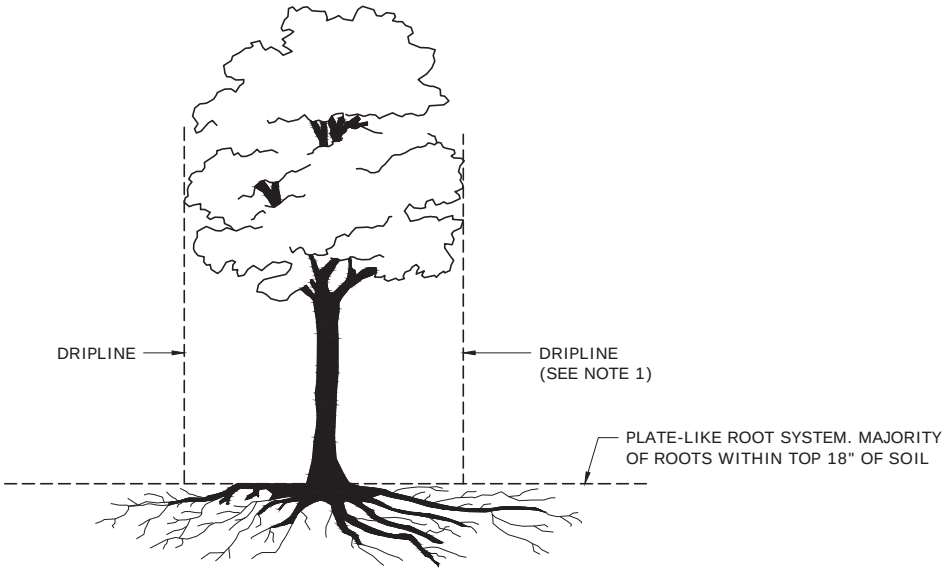
DUKE ENERGY.

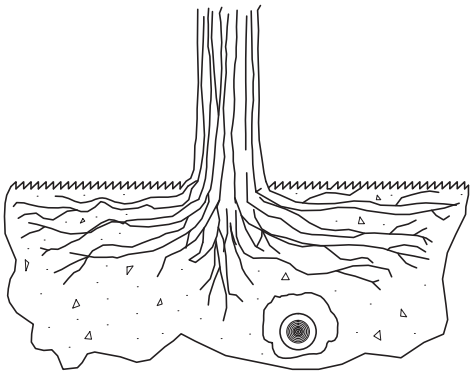
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

UNDERGROUND CLEARANCES FROM OTHER UTILITIES NOT IN A JOINT TRENCH CONFIGURATION

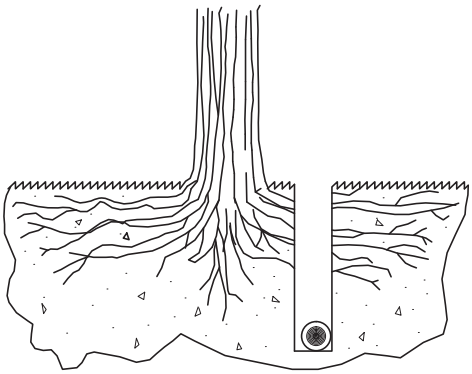
DEC	DEM	DEP	DEF
X	X	X	X

36.02-101





TUNNELING AT PROPER MINIMUM
DEPTH CAUSES MINIMAL ROOT KILL.



TRENCHING LOCATED TOO CLOSE TO
TREE CAN CAUSE SIGNIFICANT ROOT KILL,
POTENTIALLY KILLING THE ENTIRE TREE LATER.

TABLE 1	
TREE DIAMETER	MINIMUM DISTANCE FROM TRUNK
0" - 5"	BEYOND DRIPLINE
6" - 9"	5'
10" - 14"	10'
15" - 19"	12'
OVER 19"	15'

NOTES:

1. WHERE PRACTICAL, CONFINE ALL CABLE INSTALLATION ACTIVITIES TO AREAS OUTSIDE THE DRIPLINE OF DESIRABLE TREES OR THOSE IDENTIFIED AS NEEDING TO BE SAVED.

2. IF CABLE INSTALLATION IS WITHIN THE DRIPLINE, REFER TO TABLE 1 FOR MINIMUM DISTANCES. ANOTHER RULE OF THUMB IS TO TRENCH 1' AWAY FOR EVERY 1" OF TRUNK DIAMETER AT BREAST HEIGHT (DBH).

3. IF THE MINIMUM DISTANCES IN TABLE 1 CANNOT BE OBTAINED, BORING MAY BE CONSIDERED AS AN ALTERNATE MEANS OF INSTALLATION. BORING AT A DEPTH OF 2 TO 3 FT SHOULD AVOID THE MAJORITY OF THE ROOT SYSTEM. IF DONE SOLELY AS A RESULT OF THE CUSTOMER'S INABILITY TO PROVIDE AN ADEQUATE ROUTE FOR THE INSTALLATION, CHARGES MAY APPLY.

4. BORING PITS SHOULD NOT BE DUG WITHIN THE DISTANCES SPECIFIED IN TABLE 1.

DUKE ENERGY.

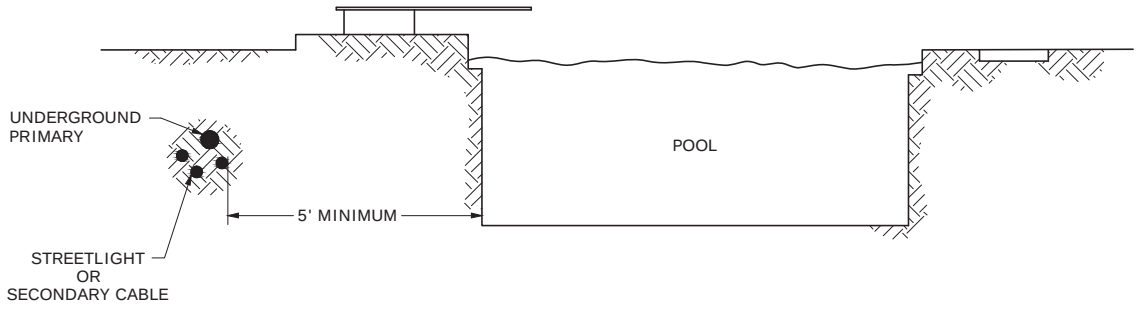
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

CABLE INSTALLATION NEAR TREES

DEC	DEM	DEP	DEF
X	X	X	X

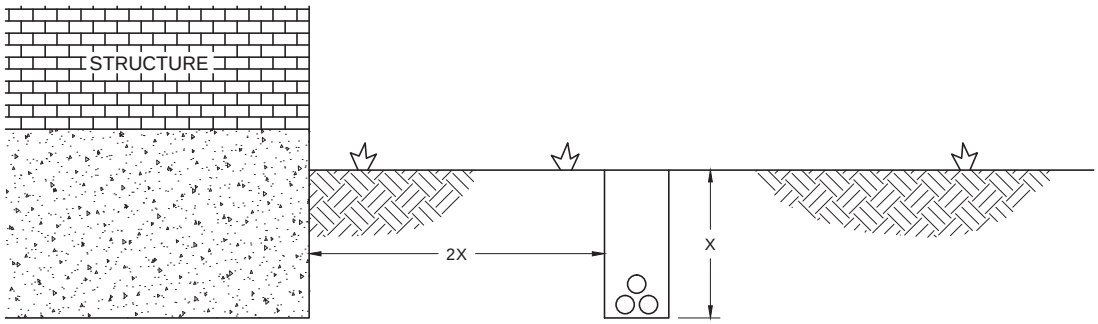
36.02-103

POOL AREAS



UNDERGROUND PRIMARY AND SECONDARY CABLE SHOULD MAINTAIN 5' MINIMUM SEPARATION FROM POOLS AND THEIR AUXILIARY EQUIPMENT. IF 5' IS NOT ATTAINABLE, LESSER DISTANCES ARE PERMITTED PER NESC RULE 351c. WITH CONSIDERATION FOR FUTURE OPERATIONAL NEEDS, THE DESIGNER SHOULD STILL MAINTAIN AS MUCH CLEARANCE AS POSSIBLE. ALL INSTALLATIONS WITHIN 5' MUST BE IN CONDUIT.

INSTALLING UG CABLE PARALLEL TO STRUCTURES



NOTES:

1. WHEN INSTALLING UNDERGROUND CABLE PARALLEL TO EXISTING STRUCTURES, OR THOSE THAT ARE UNDER CONSTRUCTION, IT IS NECESSARY TO MAINTAIN ADEQUATE CLEARANCE FROM THOSE STRUCTURES. THIS CLEARANCE IS NECESSARY TO MAINTAIN THE INTEGRITY OF THE SOIL, AND THE SUPPORT PROVIDED BY THE SOIL, UNDER THE FOUNDATION OF THE STRUCTURE.

2. UNDERGROUND FACILITIES INSTALLED PARALLEL TO A STRUCTURE SHOULD BE LOCATED AT LEAST TWICE AS FAR AWAY FROM THE STRUCTURE AS THE DEPTH OF THE TRENCH THAT IS DUG. FOR EXAMPLE, IF A TRENCH IS TO BE TWO (2) FEET DEEP, THEN THE TRENCH MUST BE LOCATED AT LEAST FOUR FEET AWAY FROM THE STRUCTURE.

3. THIS REQUIREMENT DOES NOT APPLY TO CABLE THAT IS NOT INSTALLED PARALLEL TO A STRUCTURE. IT ALSO DOES NOT APPLY TO CABLE THAT IS INSTALLED BY DIRECTIONAL BORING TECHNIQUES.

4. ON INSTALLATIONS WHERE THE CABLE CANNOT BE INSTALLED TWICE AS FAR FROM THE FOUNDATION AS THE CABLE IS DEEP, THE SOIL MUST BE COMPACTED THROUGHOUT THE ENTIRE TRENCH DEPTH TO 100% OF THE ORIGINAL SOIL DENSITY IN ALL AREAS WHERE ADEQUATE SEPARATION CANNOT BE OBTAINED FROM THE FOUNDATION.

DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK

CABLE INSTALLATION NEAR POOLS AND OTHER STRUCTURES

DEC	DEM	DEP	DEF
X	X	X	X

36.02-105

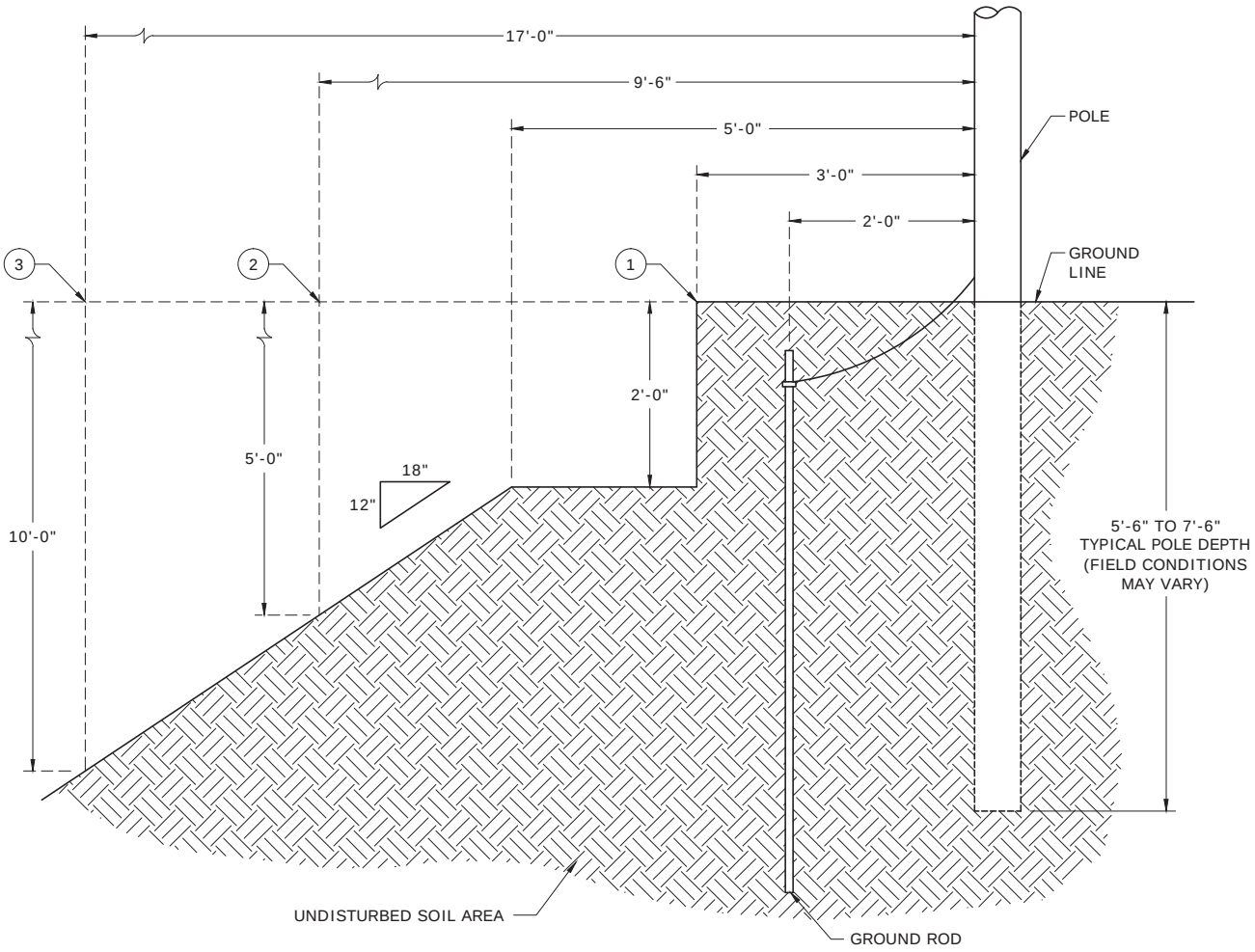


FIG. 1

TABLE 1

	DEPTH OF TRENCH	MINIMUM CLEARANCE FROM NEAR EDGE OF TRENCH TO POLE
1	2'-0" OR LESS	3'-0"
	3'-0"	6'-6"
	4'-0"	8'-0"
2	5'-0"	9'-6"
	6'-0"	11'-0"
	7'-0"	12'-6"
	8'-0"	14'-0"
	9'-0"	15'-6"
3	10'-0"	17'-0"

NOTES:

1. **THE SCOPE OF THIS GUIDELINE APPLIES ONLY TO DISTRIBUTION POWER POLES (VOLTAGES UP TO 35KV).** CONTACT DUKE ENERGY TO DETERMINE LINE VOLTAGE. IF TRANSMISSION VOLTAGES (> 35KV) ARE PRESENT ON THE POLE OR WITHIN THE WORK AREA, DUKE ENERGY TRANSMISSION DEPARTMENT WILL ADVISE REQUIREMENTS FOR EXCAVATION AND MINIMUM WORKING CLEARANCES.
2. CONTACT DUKE ENERGY TO EVALUATE POLE SUPPORT IF PLANNED EXCAVATION ENCROACHES THE 'UNDISTURBED SOIL AREA' SHOWN IN FIG. 1, AND/OR IF ANCHORS WITH DOWN GUYS OR PUSH BRACE POLES ARE PRESENT ON THE SIDE OF THE POLE THAT FACES THE PLANNED EXCAVATION.
3. MINIMUM CLEARANCES SHOWN ARE FOR 3RD PARTY EXCAVATIONS BESIDE DISTRIBUTION POWER POLES. CONSULT DUKE ENERGY IF TRENCHING FOR FACILITIES TO BE LOCATED ON POLE, I.E. CONDUIT.
4. EXCAVATION EQUIPMENT MUST MAINTAIN AT MINIMUM A 10 FT. CLEARANCE TO OVERHEAD DISTRIBUTION LINES.
5. EXCAVATOR IS RESPONSIBLE FOR HAVING UTILITY LOCATES COMPLETED.
6. IF UNEXPECTED FIELD CONDITIONS ARE ENCOUNTERED THAT COULD AFFECT THE STABILITY OF THE SOIL IN THE 'UNDISTURBED SOIL AREA' SHOWN IN FIG. 1, I.E. WATER, CAVITIES, ETC., STOP WORK AND CONTACT DUKE ENERGY IMMEDIATELY.
7. THE 'UNDISTURBED SOIL AREA' SHOWN IN FIG. 1 IS BASED ON TYPE 'C' SOIL AS DEFINED IN OSHA 1926, SUBPART P. THIS GUIDELINE DOES NOT PREVENT THE EXCAVATOR FROM HIRING A LICENSED PROFESSIONAL ENGINEER TO PREPARE AN EXCAVATION PLAN BASED ON ACTUAL FIELD SOIL CONDITIONS. IN SUCH CASES, THE ENGINEERED EXCAVATION PLAN MUST BE SUBMITTED TO DUKE ENERGY FOR REVIEW PRIOR TO ANY EXCAVATION WORK BEING PERFORMED.

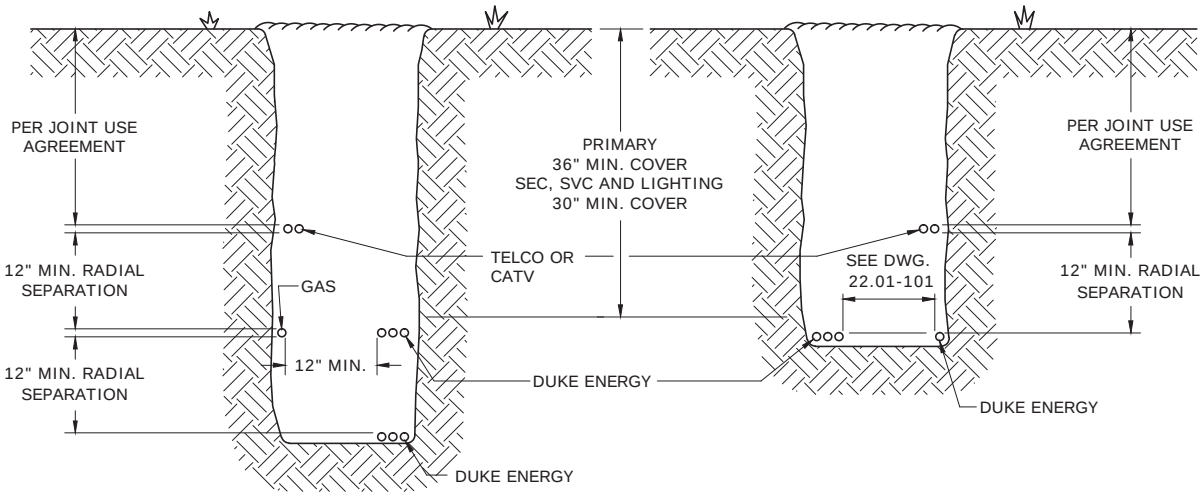
DUKE ENERGY.

REVISED		BY	CK'D	APPR.
3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK

GUIDELINES FOR THIRD PARTY EXCAVATION AND TRENCHING BESIDE DISTRIBUTION POWER POLES

DEC	DEM	DEP	DEF
X	X	X	X

36.02-107



NOTES:

1. THE CLEARANCES STATED IN THIS SPECIFICATION ARE GENERAL GUIDELINES THAT SHOULD BE FOLLOWED IN ANY JOINT TRENCH ARRANGEMENT. ACTUAL CLEARANCES AND THE UTILITIES INVOLVED ARE UNIQUE TO THE JOINT USE AGREEMENT IN PLACE FOR THAT INSTALLATION AND SHOULD BE APPLIED ONLY TO THE INSTALLATIONS THEY GOVERN.

2. THIS SPECIFICATION DOES NOT INCLUDE THE CURRENT JOINT TRENCH PRACTICES IN PLACE IN DUKE ENERGY MIDWEST.

3. SUPPLY LINES OF ANY VOLTAGE SHALL HAVE A RADIAL SEPARATION OF NOT LESS THAN 12" FROM GAS LINES OR OTHER LINES THAT TRANSPORT FLAMMABLE MATERIAL AND ALLOW FOR PROPER MAINTENANCE OF EITHER.

4. SUPPLY LINES OF ANY VOLTAGE SHOULD HAVE A RADIAL SEPARATION OF NOT LESS THAN 12" FROM COMMUNICATIONS OR CATV LINES AND ALLOW FOR PROPER MAINTENANCE OF EITHER.

5. COMMUNICATIONS AND CATV LINES ARE PERMITTED WITHIN 12" OF EACH OTHER WITH AGREEMENT OF THE PARTIES INVOLVED.

6. RADIAL SEPARATIONS ARE MEASURED FROM SURFACE TO SURFACE, NOT CENTER TO CENTER.

7. SEPARATIONS BETWEEN PRIMARY AND SECONDARY LINES SHOULD MAINTAIN THOSE CLEARANCES AND BURIAL DEPTHS SET FORTH IN DWG. 22.01-101.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

UNDERGROUND CLEARANCES FROM OTHER UTILITIES IN A JOINT TRENCH CONFIGURATION

DEC	DEM	DEP	DEF
X		X	X

36.03-101

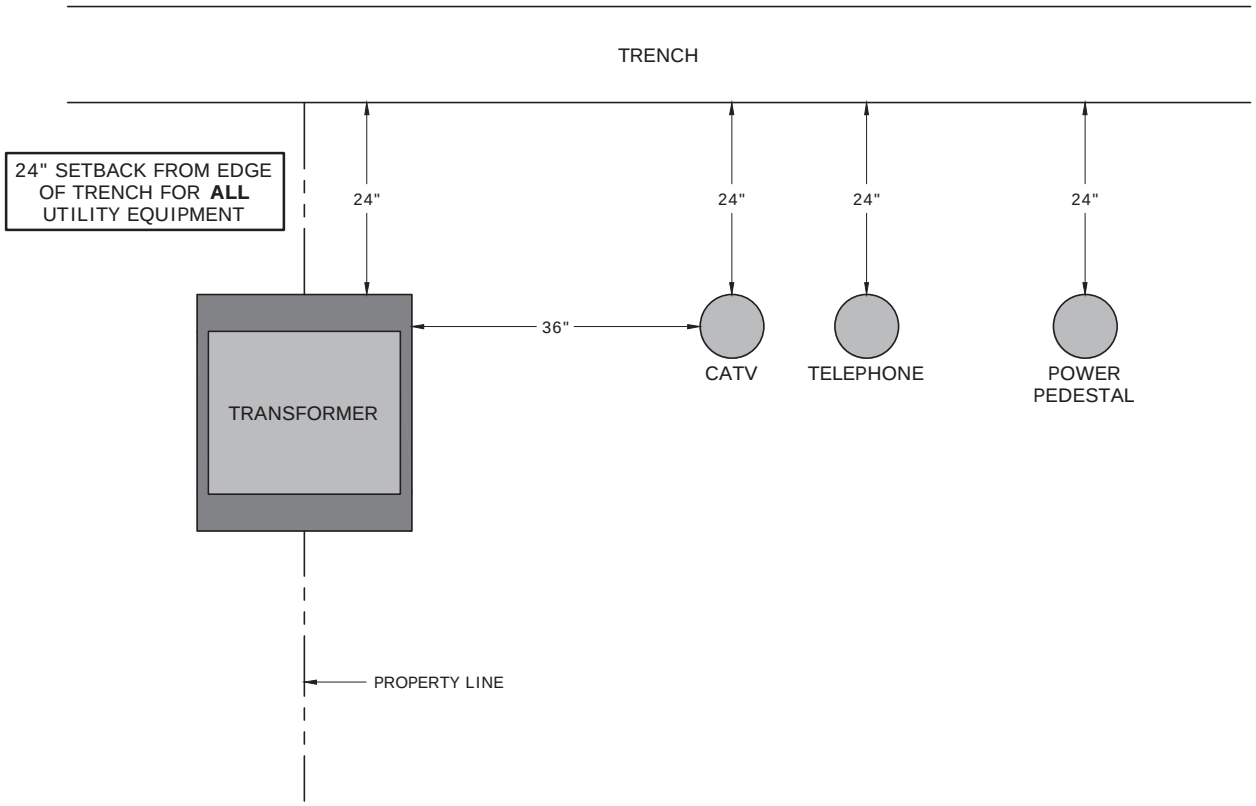


FIGURE 1

NOTES:

1. THIS SPECIFICATION DOES NOT INCLUDE THE CURRENT JOINT TRENCH PRACTICES IN PLACE IN DUKE ENERGY MIDWEST.

2. SEPARATIONS BETWEEN PRIMARY AND SECONDARY LINES SHOULD MAINTAIN THOSE CLEARANCES AND BURIAL DEPTHS SET FORTH IN SECTION 22. SEPARATIONS BETWEEN DUKE ENERGY LINES OF ANY VOLTAGE AND OTHER UTILITIES SHOULD FOLLOW THE GUIDELINES SET FORTH IN DWG. 36.03-101.

3. JOINT USE LINES OF OTHER UTILITIES SHALL NOT BE INSTALLED UNDER DUKE ENERGY SURFACE OR SUB-SURFACE EQUIPMENT.

4. PEDESTAL LOCATIONS MUST FOLLOW THE GUIDELINES SET FORTH IN FIGURE 1.

5. TRANSFORMERS, REGARDLESS OF ORIENTATION, MUST BE PLACED TO ALLOW FOR PROPER OPERATION AND MAINTENANCE AS SET FORTH IN DWG. 36.01-103.

6. TRANSFORMER ID'S MUST BE AFFIXED SO AS TO BE VISIBLE FROM THE ROAD.

7. ALL ABOVE-GROUND METALLIC POWER AND COMMUNICATION APPARATUS SEPARATED BY A DISTANCE OF 6' OR LESS SHALL BE BONDED TOGETHER, PER THE TERMS OF THE APPLICABLE JOINT USE AGREEMENT WITH THAT UTILITY.

8. FOR INSTALLATIONS IN CLOSE PROXIMITY TO DUKE ENERGY POLES, JOINT USE COMPANIES SHALL NOT BE ALLOWED TO BOND TO DUKE ENERGY'S POLE GROUND UNLESS IT IS EXPRESSLY ALLOWED BY THAT COMPANY'S INDIVIDUAL JOINT USE AGREEMENT. BONDING TO THE POLE GROUND CAN CREATE HAZARDOUS CONDITIONS AND SHOULD NOT BE CONFUSED WITH THE ABOVE REQUIREMENT OF BONDING METALLIC EQUIPMENT.

3				
2				
1				
0	12/31/15	EANES	FLETCHER	ADCOCK
REVISED		BY	CK'D	APPR.

LOCATION OF ABOVE GROUND FACILITIES
IN A JOINT TRENCH CONFIGURATION

DEC	DEM	DEP	DEF
X		X	X

36.03-117

Attachment A

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 Voltage Drop Examples

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

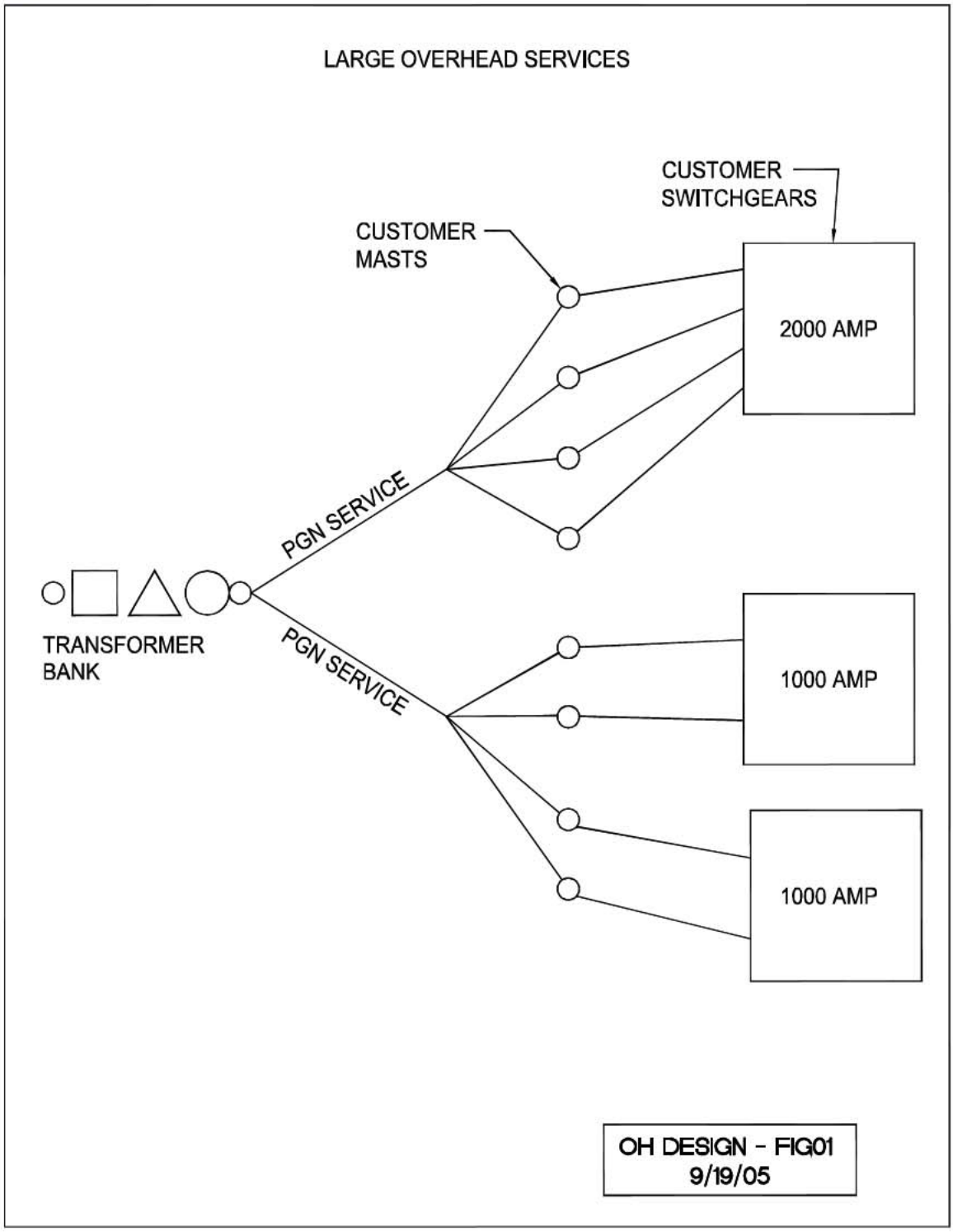
One situation encountered in overhead systems is an overhead service to a high amperage point of delivery. When the customer starts wiring out more than four or six conductors per phase and our service drops need to be several conductors per phase to handle the amperage, connecting up this many wires 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:

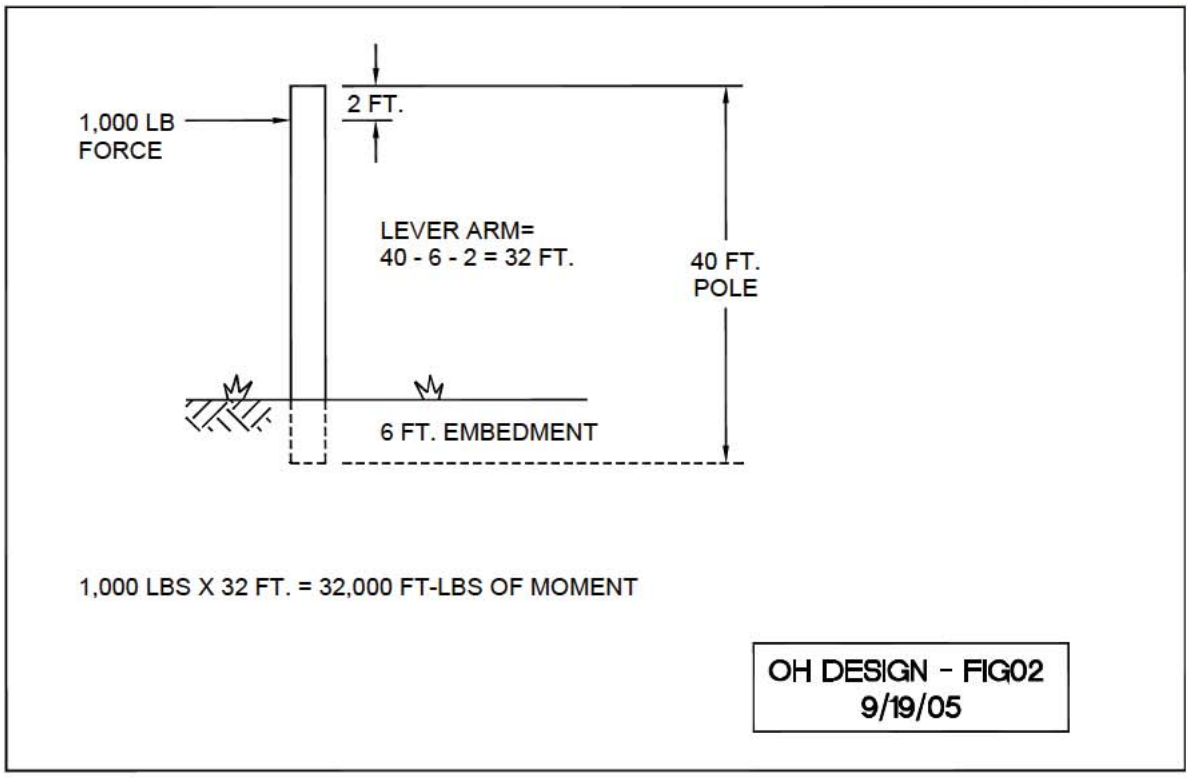
- The vertical, downward axial loading in the pole caused by the guy lead. (See Fig 05). This is usually the major force. The horizontal force of wind and tension on the conductors is offset by the horizontal force component of the guy wire. So only the vertical component would contribute to the pole, 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

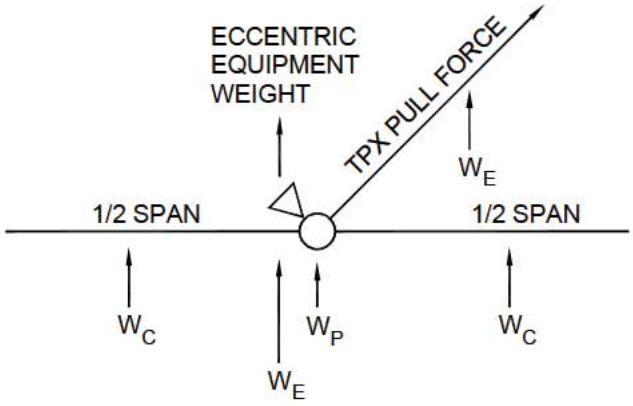
POLE BENDING MOMENTS - SOUTHERN YELLOW PINE						
POLE SIZE	CLASS	POLE DEPTH (FT)	CIR AT GROUND LINE (IN)	ANSI MAXIMUM MOMENT (FT-LBS)	WIND ON POLES	
					CAROLINAS	FLORIDA
30	4	5.0	29.85	56,173	739	1,787
30	6	5.0	25.33	34,234	656	1,475
35	3	5.5	34.19	84,410	1,234	2,777
35	4	5.5	31.68	67,151	1,134	2,551
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



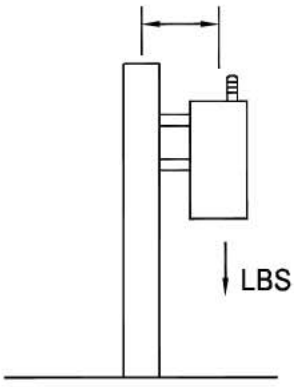
W_C = WIND FORCE ON CONDUCTORS = SPAN LENGTH X FORCE PER FOOT (W_F)

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 Pole-Sizing-Height – Non-Joint Use Poles

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:

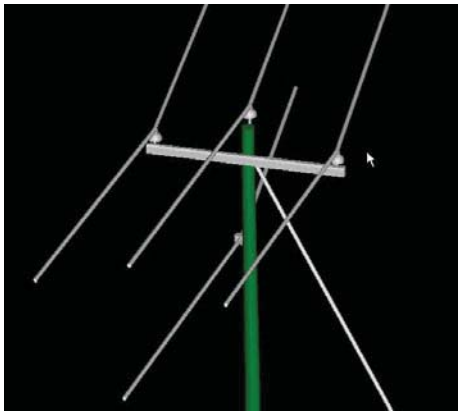
- 40 inches (3.33 feet) for the Communications Worker Safety Zone
- 32 inches (2.66 feet) for the additional sag-related clearances
- 12 inches (1 foot) for each additional joint use company

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.

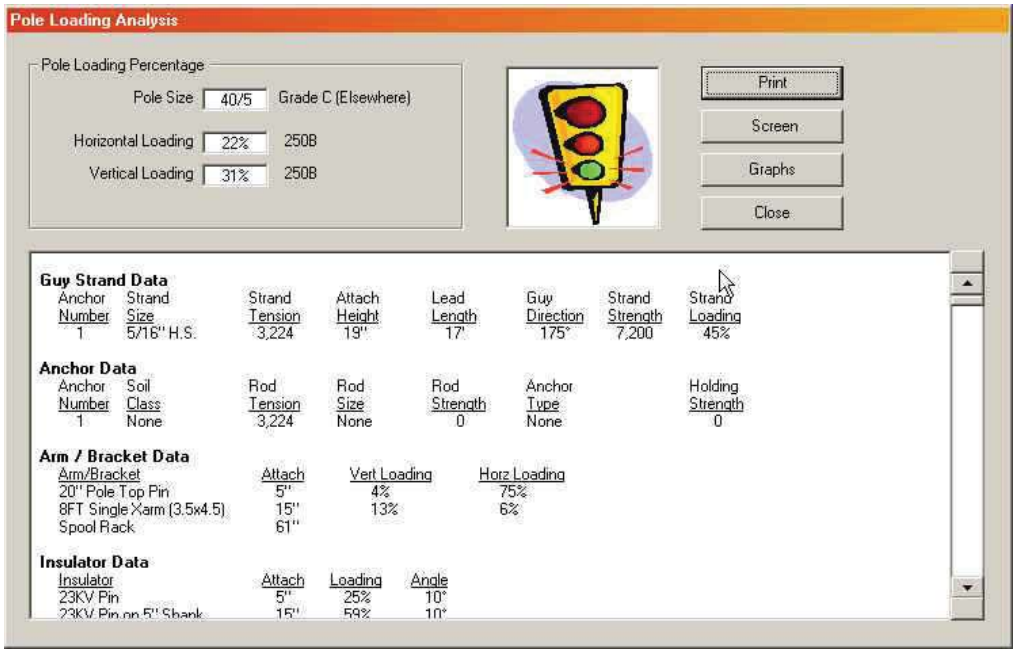
We can also check the math from the pole viewpoint if we desire. From the pole viewpoint, the required mounting height for the joint use cable attachment is 18-feet of ground clearance for the joint use cable plus two feet of joint use sag for a mounting height of 20 feet. To this we add the 72 inches (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.

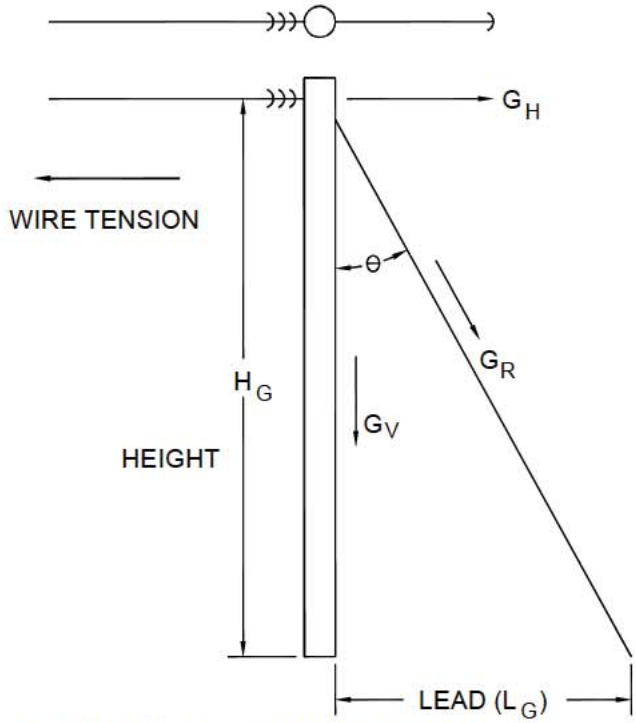
The maximum loading tensions with appropriate NESC overload factors must be used for the conductor tensions.

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

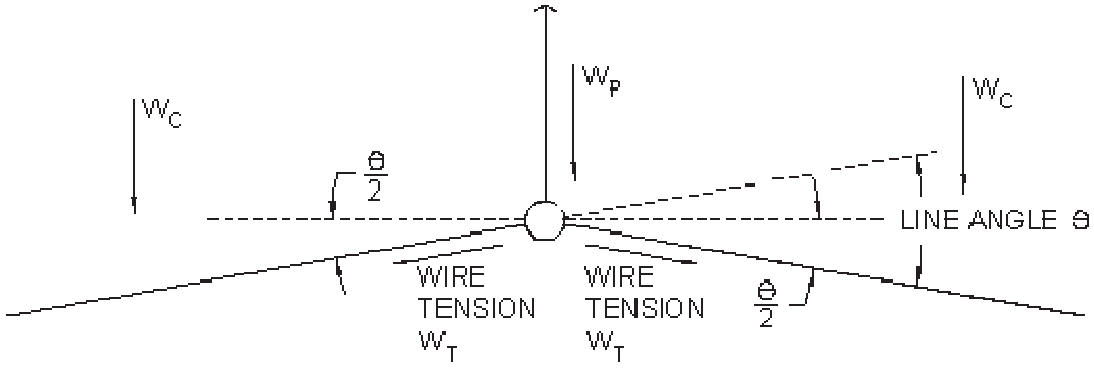
An angle or bisector guyed structure is treated differently by the NESC. A tangent pole has the transverse wind loading on the conductors and pole resisted by the bending moment of the pole. A guyed structure is required to use the pole acting as a column or strut only, and all the forces must be resisted 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 $\frac{\theta}{2}$

$$W_F = \text{WIND FORCE/COND FT} = \text{WIND FORCE (LB/FT)} \times \frac{\text{CONDUCTOR DIAMETER (IN)}}{12}$$

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 Voltage Drop Constants

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

$$\text{Voltage Drop Constant} = I[R\,\cos(\text{Ø}) + X\,\sin(\text{Ø})]$$

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 BREAK NG 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 - MERL N	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 BREAK NG 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 WALK NG	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 M LE	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. TR PLEX	.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 NCHES	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

Table of Contents **Page**

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

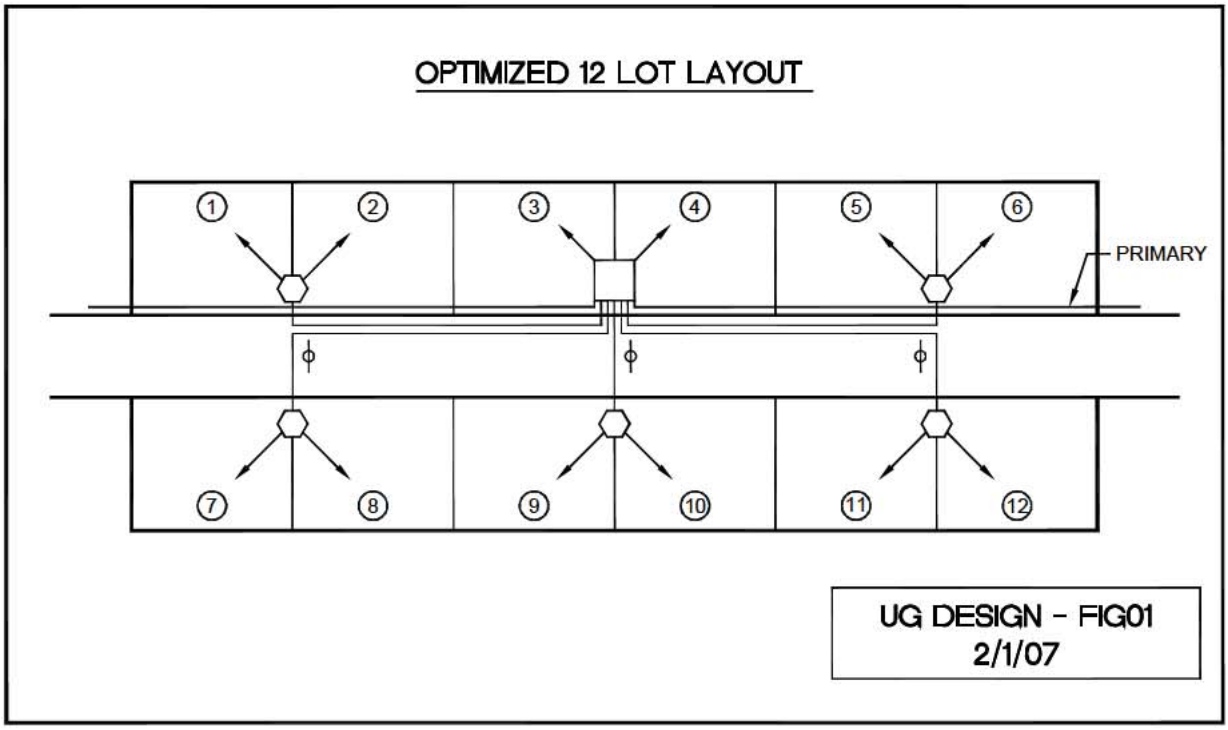
The maximum number of secondary connections to a padmount transformer is limited by the number of positions on the secondary spade connectors. Eight connections is the normal maximum due to eight-hole, secondary spade connectors. Only one conductor may be installed per position.

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 2nd or 3rd-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 2nd or 3rd 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

NEC Requirements:

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.

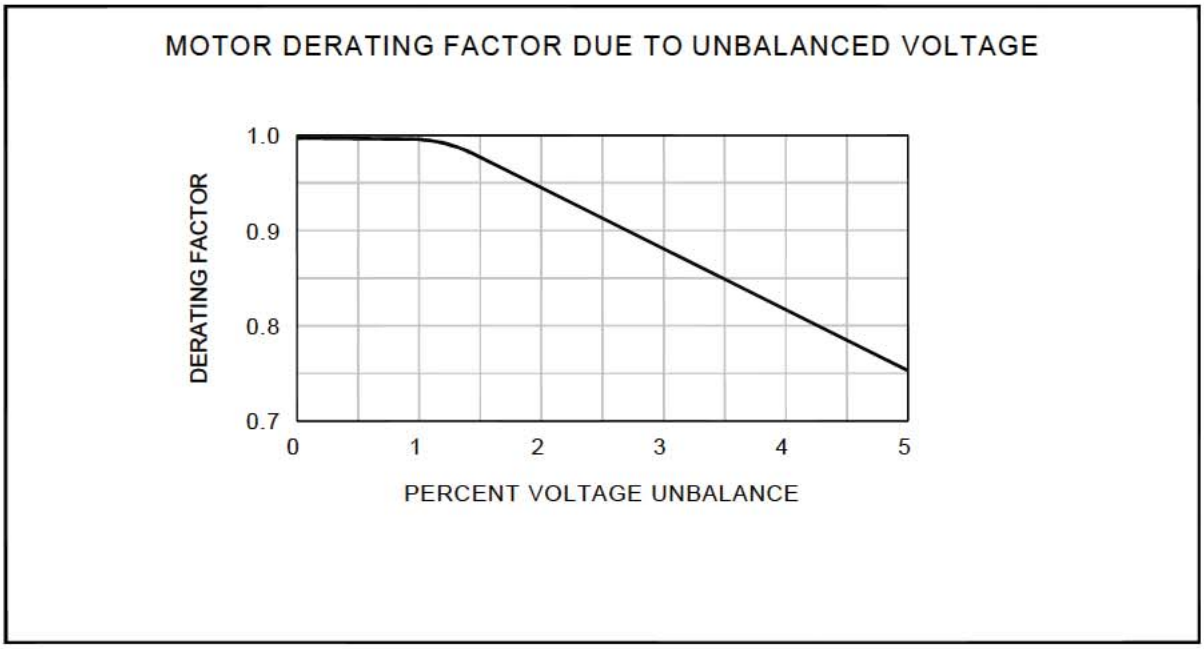
If the plans do not include the rating of the main breaker we should ask the developer to provide ratings, or provide the fault current information on the layout and get the developer to formerly acknowledge the layout and keep a record of this acknowledgement on file. We normally get the developer to 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.

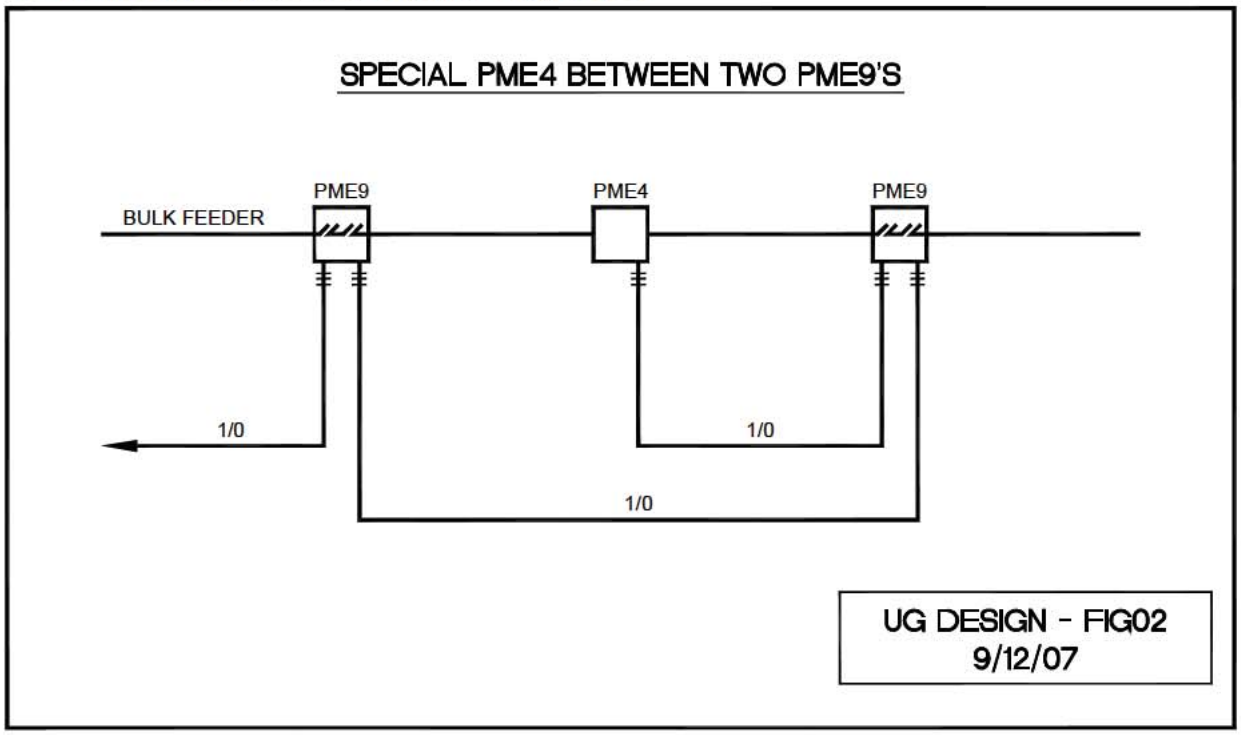
If we size the fuse to 75% of the fuse size and use a 100-amp maximum fuse then a 3-phase 1/0 loop is good for 3.2 MW at 12 kV and 5.9 MW at 23 kV. The layout of the subdivision may be such that multiple 1/0 loops can be used. Multiple 1/0 loops would be more economical than a feeder cable system with 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 **trans**former en**closures,** 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 Customer Responsibility – Outside-the-Building Vault

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.

Lighting - 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.

Metering - 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.

Point of Delivery and Customer Service Entrance Cables - 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. DO NOT fuse two transformers separately on the primary side and connect them together on the secondary side. 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 Customer Responsibility - Inside the Building Vaults). 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.

Attachment A

Transmission Extreme Winds Loading Design Criteria Guideline for Overhead Transmission Line Structures

Document title:	Document number:
SPS: Extreme Wind Loading Design Guideline for Overhead Transmission Line Structures – DEP, DEF	STDP-STD-TRM-00077
	Revision number: 000
Keywords: Wind Speeds, Loading Criteria, TEAM-SS; SPS-LINE-X-0004;	Applies to: Transmission – DEP, DEF

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 DEF and DEP. 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 600 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 DEF and DEP 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 DEF and DEP 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 Appendix A. Also attached with this document are extreme wind speed and pressure maps for both DEP and DEF identified as in the Appendices 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 600 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 Appendix 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:

$$\text{Load (psf)} = (0.00256) (V_{mi/h})^2 \cdot k_z \cdot G_{rf} \cdot C_d$$

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 (Appendix A) and used as input in Pls-Cadd is:

Load (psf) = $(0.00256) \cdot (V_{mi/h})^2$

with the wind speed, Vmi/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 (Appendix A) along with the extreme wind pressure maps (Appendix B or

Appendix 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, Appendix A and Extreme Wind Pressure Maps, Appendices B and C.

Example 1: Project Scope - DEF 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 (Appendix A) and Extreme Wind Pressure Map (Appendix 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 - DEP 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 DEF 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 DEP, 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 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.

6.0 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 Appendix C corrected; Change management plan implemented
000	11/15	Prasad Yenumula		SPS-LINE-X-0004 formatted to Fusion

Appendix A

DEP and DEF Transmission Department's Extreme Wind Pressure Design Criteria Guideline

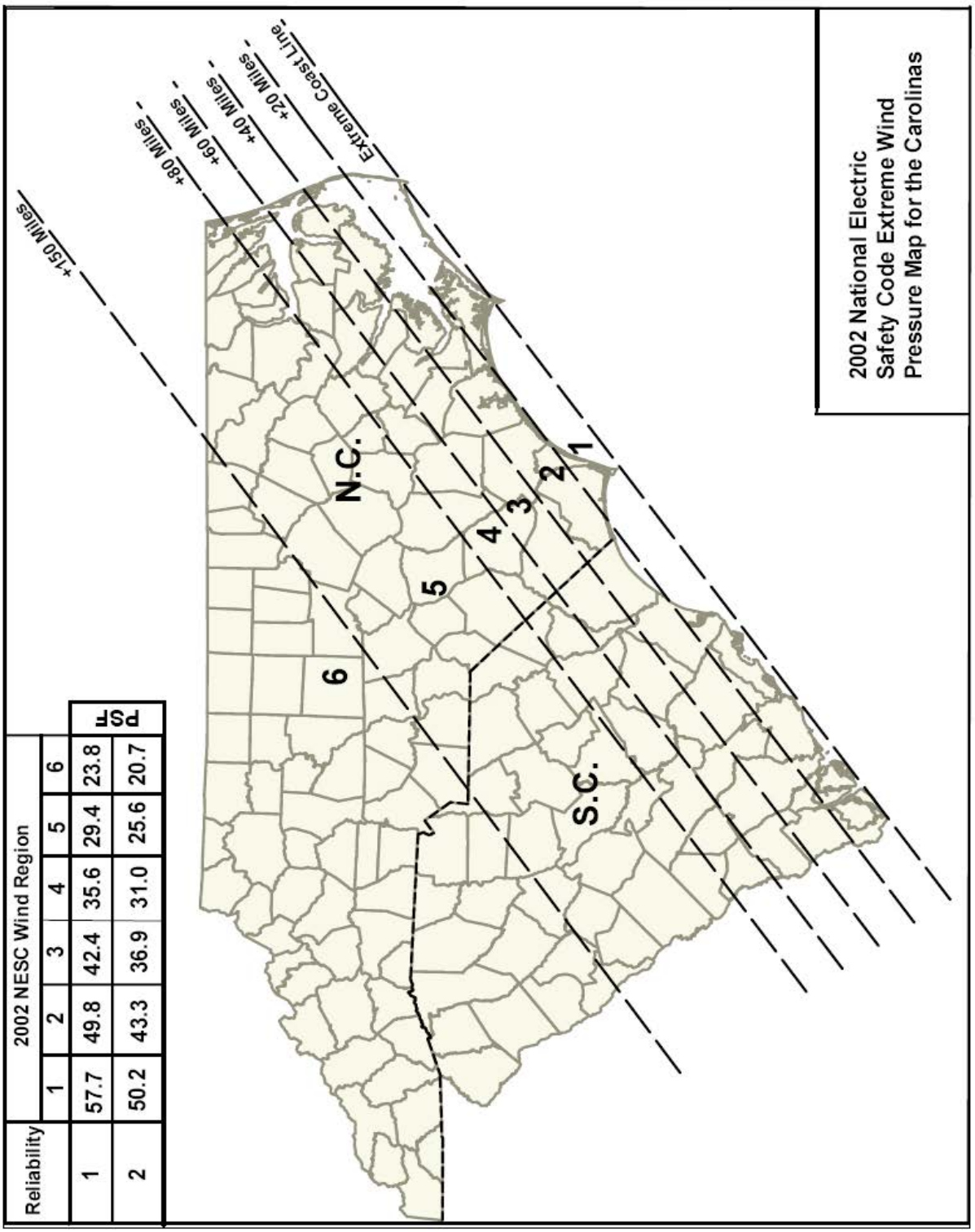
Extreme Wind Design Criteria and Line Reliability Classes							
Reliability Class	**Design Codes**	**Critical Source**	**Critical Load**	**Line Rating (MVA) [6]**			
1[2]	NESC 2002 & ASCE 74	Yes	Yes	> 475			
2[3]	NESC 2002 & ASCE 74	No	No	< 475			
DEP							
NESC Extreme Wind Regions & Corresponding 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	
DEP							
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	
DEF							
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			

DEF		
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.

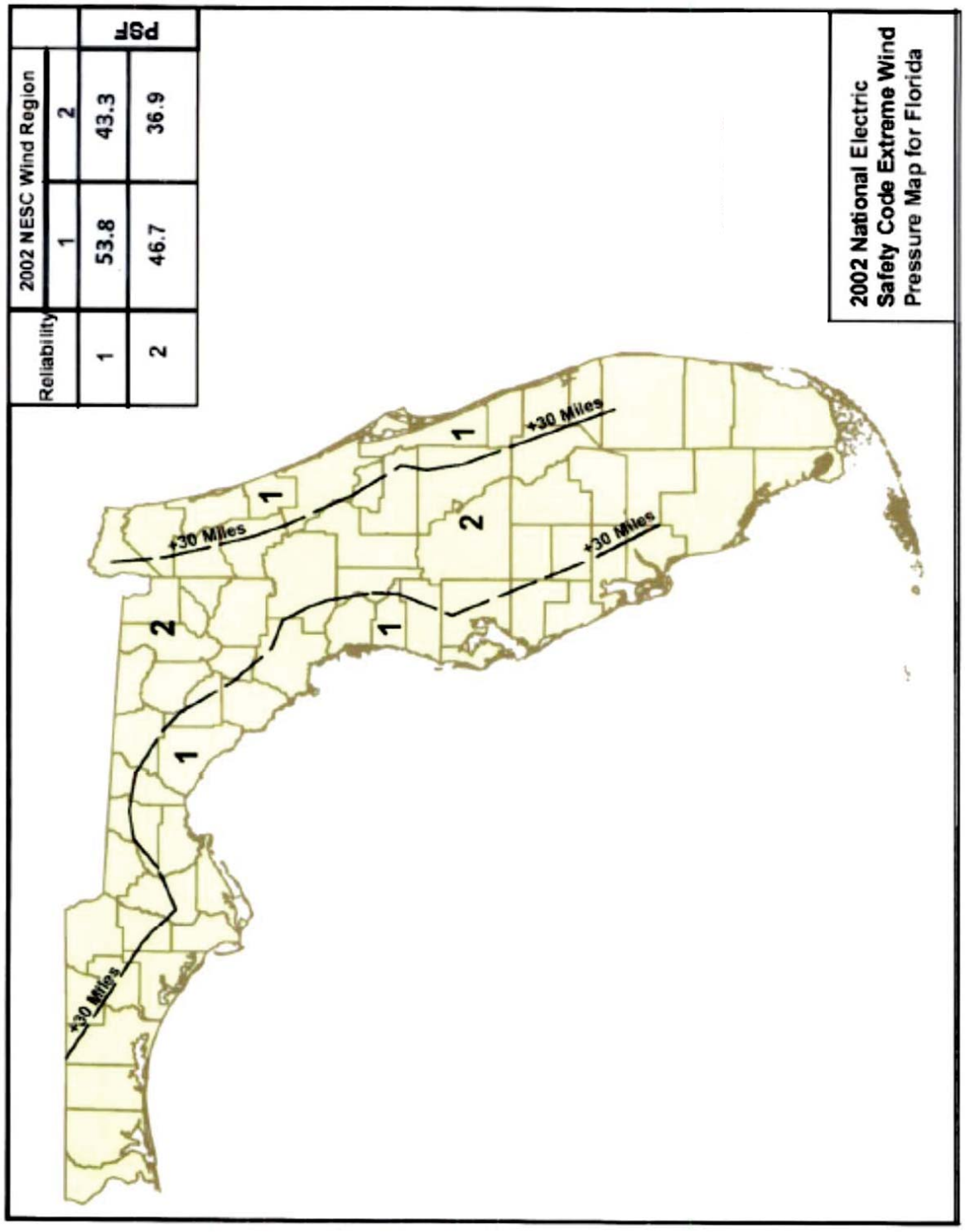
Appendix B

Extreme Wind Pressure Map for DEP



Appendix C

Safety Code Extreme Wind for DEF



Appendix D

Former DEF and DEP Design Practice & Industry Design Practice

DEF

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 600ºF under initial loading conditions. The inland region design 3-second gust wind speed is 120 mph at a design ambient temperature of 600ºF 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	135 mph 3-second gust wind, 60 Deg. Initial Conditions.	1.0 – 1.4 for ALL Loads -**See Importance Factor Matrix**
Inland - Beyond 30 miles from the coast.	120 mph 3-second gust wind, 60 Deg., Initial Conditions.	

DEF 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

DEP

DEP'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. DEP 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 600 F, no ice, final loading condition. DEP 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-90s, 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 psf - 30 psf (90mph-108mph) to a maximum exceeding 50 psf (140mph).

Document Approval Form

published 03/07/2016

Section A: Document identification and type of action

Document no.: STDP-STD-TRM-00077

Revision no.: 000

Document title: SPS: Extreme Wind Loading Design Guideline for Overhead Transmission Line Structures - DEP, DEF

Type of action:

- ☒ ~~xxxx~~ New
- ☐ Renumber
- ☒ ~~Revision~~
- ☐ Cancellation
- ☐ Ownership Change
- ☐ Periodic review completed, as required
- ☐ Suspension

For Corporate Document Center use only:

- ☐ Editorial Change
- ☐ Migration
- ☐ Control element revision _____ (does not require approval authority signature)

Applies to: (Select all that apply)

- ☐ Duke Energy
- ☐ Duke Energy Carolinas, LLC
- ☒ Duke Energy Progress, LLC
- ☒ Duke Energy Florida, LLC
- ☐ Duke Energy Indiana, Inc.
- ☐ Duke Energy Kentucky, Inc.
- ☐ Duke Energy Ohio, Inc.
- ☐ Group _____
- ☐ Department _____
- ☐ Other _____

Security Restrictions Required: ☐ Yes ☐ No

If yes, explain (see instructions on page 2) _____

Compliance Applicability: (required field)

☒ None ☐ State Codes/Standards ☐ HIPAA ☐ Sarbanes-Oxley ☐ OSHA _____

☐ NERC ☐ FERC Standards of Conduct ☐ Patriot Act ☐ Other _____

Applicable to forms only: (see instructions on page 2)

Does the form have a parent, governing or instructional procedure? ☐ No ☐ Yes (Procedure No:_____)

How is the form to be completed or used? ☐ Hard Copy Completion (by hand) ☐ Online Data Entry

☒ Communication plan established ☒ Impact Reviews completed

Description of document action or summary of changes:

Fusion updates, ownership change, company references and formatting updated.

Section B: Approval **Who should sign?** see instructions on page 2

Preparer(s)/Author(s)/Writer(s) (*signature not required*):

Prasad Yenumula; Jimmy Robinson

Approval recommended (*print name*):	*(signature)*	Date:
Approval recommended (*print name*):	*(signature)*	Date:
Approval recommended (*print name*):	*(signature)*	Date:
Final Approval (*print name*): Prasad Yenumula	Prasad Yenumula Digitally signed by Prasad Yenumula DN: cn=Prasad Yenumula, o=Systems Standards, ou, email=prasad.yenumula@duke-energy.com, c=US Date: 2015.11.04 12:39:12 -05'00' *(signature)*	Date:

RETURN SIGNED FORM AS SCANNED PDF VIA E-MAIL OR FAX TO (919) 235-3165

Keywords: procedures and forms; procedures program – general; daf; ADMP-PRO-ADS-00002; corporate document program

Applies to: Duke Energy

Attachment A

Transmission Line Engineering Design Philosophy

Duke Energy Florida
Transmission Department

Line Engineering
DESIGN PHILOSOPHY

Version 3

Table of Contents

Table of Contents

This Design Philosophy is an outline of practices currently in place in the Duke 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.

DE 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. DE typically uses concrete poles and / or galvanized steel poles for cross country designs. 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

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 DE's 230kV Standards. Concrete poles are the most cost efficient option where site specific conditions favor concrete pole installation. DE typically uses galvanized steel poles for 230kV designs when site specific conditions require steel. 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
-

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

DE 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 DE 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 Finite Element

DE requires that each transmission line segment be checked with Finite Element (FE) sag and tension calculations prior to the final design of the structures within PLS-CADD. This pertains only to clearances, not structural.

2.3 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.

2.4 Usage

Conductor selection is typically determined by collaboration between Transmission Planning and Line Engineering units using the tables below as a guideline for selection.

DE Line Engineering Standard Conductors to use for Projects (as of April 2015)

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
9220166391	Santee	2627.3 ACSS/TW/HS	230kV	New lines and rebuilds for 3000A capacity

2.5 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 str	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 or 2627 ACSS/TW/HS	115kV & 230kV

2.6 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 Finite Element

DE requires that each transmission line segment be checked with Finite Element (FE) sag and tension calculations prior to the final design of the structures within PLS-CADD. This pertains only to clearances, not structural.

3.3 OPGW wire controls

0.465" 24 / 36 / 48 CentraCore fiber at 16% Rated Breaking Strength at 30 degrees F, no wind, final condition

3.4 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

3.5 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 DE 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.

3.6 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 DE's grounding standards can be found in section 9 of the Standards manual.

3.7 Lightning Arresters

Lightning arresters are not normally used on DE 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 DE 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

DE'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 DE's soil boring policy. Foundations shall be designed based on soil boring information utilizing industry based foundation program or DE'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 with reinforcement can be used if shown to be more economical than direct embedment.

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 and above, 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.

5.4 Exploratory Excavations

Where it is suspected that underground facilities may exist at proposed transmission structure locations, Subsurface Utility Engineering (SUE) Level A exploratory excavations must be performed by the surveyor to verify the location, type, size and owner of the underground facility or facilities to insure full knowledge of these facilities so that a plan may be developed to mitigate any conflicts with them. Typical locations where exploratory excavations will be required are urban areas, within old road, major road and state highway right of ways, areas fronting substations, gas regulator stations and other industrial areas, and all locations where underground facilities are known to exist.

Typical size of the exploratory excavation is 5' x 5' x 4.5' deep with probes extending a minimum 10 feet below the bottom of the excavation are required. Larger foundations will require larger excavations. A list of structures and associated auger sizes should be sent with the SUE request. Other methods may be employed,

including SUE Level B ground penetrating radar and /or electronic devices where those methods are better suited for the location and type facility to be verified. There will be times where these underground facilities can be relocated to mitigate a conflict (usually at Duke Energy expense) due to the critical location of the transmission structure, but this can be very expensive and should only be done if alternate solutions are more costly.

The Engineer is cautioned that 811 Utility and survey markings may not be accurate and may completely overlook the existence of some underground facilities.

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 cannot be acquired for guys, self-supporting structures shall be used.

6.2 Capacity Ratings

Below are charts showing standard DE guys/anchors and their respective capacity ratings.

Guy Ratings

Guy Size	Rated Breaking Strength	NESC Grade B Light Loading & DE 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 DE extreme wind loading.

8.2 Load Cases

Load Case	Load Condition	Load 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

DEP and DEF 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

DEP

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

DEP

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

DEF

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

DEF

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.

8.4 Structural Percent Utilization

All NESC and internal DE 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 DE design criteria. Overly conservative design margins that exceed the NESC and DE minimums introduce costly designs and will require prior approval before implementing.

Design efforts shall obtain a maximum percent utilization of 95% for concrete pole design, and a maximum percent utilization of 99% for steel pole design, on the governing load case.

8.5 Wire Clearances

8.5.1 Philosophy

DE 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 ultimate structure loading as well as 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. It is imperative that the Engineer verify the placement of all transmission structures do not create any aerial encroachments onto property outside the easement.

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 Methodology

Reference DE 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 DE 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 DE 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 walkthroughs.

12.2.5 System Constraints

All designs must take system constraints into consideration. Close coordination with Construction and DE 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 As-built Design Check

13.1 Philosophy

Post construction as-built field surveys are required on all projects. The surveyor will provide the Design Engineer with the actual location of each structure, top of structure, attachment points and select span wire sag locations along each transmission line segment. The surveyor will provide the required weather data for the Design Engineer

to use in the IEEE Standard 738 Steady-State Conductor Temperature calculation. Adjustments on the PLS-CADD and plan and profile shall be updated. At a minimum, clearances shall be given a cursory review. Any discrepancies shall be identified if they violate the initial line design. All mitigation required shall be brought to the attention of the Line Engineering Manager and coordinated through the project team.

Revision History

Revision No.	Revision description
1	Add requirements for checking clearances using Finite Element (FE). As-built survey and design check requirements.
2	Removed weathering steel alternative, added Santee conductor, modified anchor bolt, structure percentage utalization, and structure deflection paragraphs.
3	Added Section 5.4 Exploratory Excavations

Attachment B

POLE INSPECTION PLAN

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 Duke Energy Florida ("DEF") 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. DEF'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, DEF 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 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). DEF conducts ground-line inspections of State 2 and 3 poles. State 3 poles are given priority for ground-line inspection scheduling. DEF replaces State 4 and 5 poles. DEF 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 who is certified as g 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 is contained in the Joint Use section of this Plan.

(iv). Records and Reporting

A pole inspection report will be filed with the Florida Public Service Commission 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

- DEF 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.

DEF 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 & Cost Estimate		
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, DEF'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 DEF 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 DEF'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 Florida Public Service Commission 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

DEF 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. DEF 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.

Annual Unit Estimate				
Years per Cycle	# of Wood Poles to be inspected per year	Replacements	Bracing	Treatments
8	96,000	7,000	368	25,600

Annual Cost Estimate							
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	$ 1,800,000	$ 200,000	$ 28,000,000	$ 422,000	$ 2,000,000	$ 28,422,000	$ 30,000,000

3) Joint Use Pole Inspection Plan

A. Introduction

DEF currently has approximately 774,000 joint use attachments on distribution poles and approximately 7,400 joint use attachments on transmission poles. On average, DEF receives approximately 3,000 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 DEF's attachment permitting process and how DEF 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 correct the overload. The remedy may include replacing 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.

(ii). Structural Analysis for a Transmission Pole New Joint Use Attachment

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, Stantec, to be modeled in PLS-CADD/LITE and PLS-POLE for structural analysis.
- Stantec 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 DEF 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 correct the overload. The remedy may include replacing 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.

(iii). Analysis of Existing Joint Use Attachments On Distribution Poles

There are approximately 774,000 joint use attachments on approximately 450,000 distribution poles in the DEF 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 correct the overload. The remedy may include replacing 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. 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 corrected. If the pole is changed out, the GIS database will be updated to reflect the date the new pole was installed.

(iv). Analysis of Existing Joint Use Attachments On Transmission Poles

There are approximately 7,400 joint use attachments on approximately 5,600 transmission poles in the DEF 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, Stantec, to be modeled in PLS-CADD/LITE and PLS-POLE for structural analysis. Stantec 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 **DEF 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 correct the overload. The remedy may include replacing 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.

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 corrected. If the transmission pole is changed out, the GIS database will be updated to reflect the date the new pole was installed.

(v). Records and Reporting

A pole inspection report will be filed with the Florida Public Service Commission 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 774,000 joint use attachments on approximately 450,000 distribution poles and approximately 7,400 joint use attachments on approximately 5,600 transmission poles. DEF 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, DEF 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.

Annual Unit & Cost Estimate

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)
450,000	56,000	5,600	56	5,600	700	210	21	$551,950	$585,000

Attachment B

2018 PSC RELIABILITY REPORT EXCERPTS;

Pages 39-42, 44-65

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*".

a. Describe each storm hardening activity undertaken in the field during 2017.

Distribution

In addition to the activities identified in DEF's Storm Hardening Plan (Attachment J), Wood Pole Inspection Plan (Attachment K), and other initiatives identified and discussed herein, Duke Energy Florida Distribution undertook the following specific activities that deliver a storm hardening benefit during 2018:

Existing Overhead to Underground Conversion:
See Attachment L - "Major Conversions Historical Data".

New Construction Cable footage installed underground:
In 2018, DEF installed 196 circuit miles of new underground cable. Overall, the DEF distribution system consists of 44.34% primary underground circuit miles (14,337 circuit miles).

Network Maintenance and Replacement:
2018 Actuals - $5.6m

Switchgear Replacement
2018 Actuals - $2.4m

Midfeeder Electronic Sectionalizing (Reclosers):
2018 Actuals - $617k

Wood Pole Inspection and Treatment:
2018 Actuals - $4.0m

Wood Pole Replacement and Reinforcement:
2018 Actuals - $21.3m

Padmount Transformer Replacement:
2018 Actuals - $6.6m

Storm Hardening Projects
2018 Actuals - $8.1m

Transmission

In addition to the activities identified in DEF's Storm Hardening Plan (Attachment J), Wood Pole Inspection Plan and TECP-MIM-TRM-00118 (Attachment K), and other initiatives identified and discussed herein, Duke Energy Florida Transmission undertook the following specific Storm Hardening Activities during 2018:

Maintenance Change outs:
Duke Energy Florida Transmission is installing either steel or concrete poles when replacing existing wood poles. This activity resulted in the replacement of 796 wood poles with steel or concrete during 2018.

DOT/Customer Relocations and Line Upgrades and Additions:
Duke 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 the installation of approximately 372 poles with steel or concrete poles during 2018.

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 x - DEF's Storm Hardening Plan.
Transmission

Maintenance Change outs
Poles that require change out are identified by Procedure TECP-MIM-TRM-00026, "Ground Patrols" (Attachment M).
DOT/Customer Relocations
Poles that are changed out and upgraded are identified by requests from DOT or customers.

Line Upgrades and Additions
Duke Energy Florida Transmission Planning will determine where and when lines need to be upgraded.

For additional information, please see Attachment J - DEF's Storm Hardening Plan.

c. Provide the costs incurred and any quantified expected benefits.

Distribution

See Subsection (a) above.

Transmission

Line Maintenance Change outs
Duke Energy Florida Transmission invested approximately $37.1 million in Capital Improvements during 2018. Capital Improvements include 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 Duke Energy Florida's Transmission system should reduce from approximately 50% today to 25%.

DOT/Customer Relocations and Line Upgrades and Additions
Duke Energy Florida Transmission invested approximately $148.5 million for DOT/Customer Relocations and Line Upgrades and Additions in 2018.

Quantified benefits will be a stronger and more consistent material supporting Transmission Circuits. Over the next 10 years, the percentage of wood poles on Duke Energy's Transmission system should reduce from approximately 50% today to 25%.

d. Discuss any 2019 projected activities and budget levels.

Distribution

Duke Energy Florida Distribution's storm hardening strategy and activities can be found in its Storm Hardening Plan filed in Docket No. 20180146-EI. In addition, DEF 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 15 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:
2019 Budgets - $1.7m

Switchgear Replacement

2019 Budgets - $800k

Wood Pole Inspection and Treatment:
2019 Budgets - $4.1m

Wood Pole Reinforcements & Replacement:
2019 Budgets - $42.9m

Padmount Transformer Replacement:
2019 Budgets - $5.7m

Storm Hardening Projects
2019 Budgets - $8.6m

Grid Investment Projects
2019 Budgets - $115.6m

The Grid Investment Projects include the Self-Optimizing Grid, Deteriorated Conductor, Live Front Switchgear Replacement Transformer Retrofit and Targeted Underground programs.

Transmission

Duke Energy Florida Transmission's storm hardening strategy and activities can be found in its Storm Hardening Plan filed in Docket No. 20180146-EI. In addition, DEF Transmission projects as follows:

Line Maintenance Change outs
Duke Energy Florida Transmission is projecting replacement of approximately 595 poles in 2019. Capital Budget for Line Maintenance is $46.9 million for 2019 which includes pole change outs, insulator replacements and any overhead ground wire (OHGW) replacements.

DOT/Customer Relocations and Line Upgrades and Additions
Duke Energy Florida Transmission is projecting replacement of approximately 413 poles in 2019. Current identified DOT/Customer Relocation Projects and Line Upgrades and Additions have a capital budget of $113.3 million.

IV. WOOD POLE INSPECTION PROGRAM

a. Provide a detailed description of the Company's wood pole inspection program.

Duke Energy Florida's wood pole inspection program's 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.

Duke Energy is utilizing the expertise of Osmose Utilities Services, Inc. for distribution and Quanta Utility Engineering Services (QUES) for transmission to perform the inspections on an eight-year cycle. Inspections include 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 and poles that cannot be excavated due to obstructions. For CCA poles less than 16 years of age, inspections include visual and sound, as well as, selective boring to determine the pole condition. In addition, inspections are providing remediation of decayed poles through external and internal treatments. In distribution if the pole is below NESC standards and has the minimum remaining wood above ground line, reinforcement of the pole with steel C-trusses is often performed to bring the pole back to original strength.

For additional information, please see Attachment K - "Wood Pole Inspection Plan".

b. 2018 accomplishments

Distribution

Duke Energy Florida inspected 101,607 wood distribution poles during 2018. This completes 4 years and 8 months of the second 8-year 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.

The distribution wood pole inspection program is planned to complete approximately 1/8 of the distribution pole fleet per year. In cycle 1, the route of the inspections was performed to inspect the coastal poles first, moving inland as the program proceeded. Cycle 2 is being conducted in a manner that provides a more even distribution of work to Duke Energy Florida's engineering and line resources.

Transmission

In 2018 DEF's Transmission ground patrol inspected 15,531 wood pole structures. This represents approximately 77.2% of the wood pole structures on the DEF Transmission system.

c. Projected accomplishments for 2019

Distribution

DEF's goal for 2019 is to continue cycle two inspections of the system. DEF will continue to utilize the same inspection procedures in 2019 that were used in the past. Projected cost for the 2019 distribution pole inspection program is $4m.

Transmission

Plans for 2019 are to perform a visual and sounding inspection on 1/4 of the wood pole system. A sound and bore inspection will be performed on at least 1/8 of the wood pole system. Both inspections will be performed by outside contractors. DEF is inspecting at least 1/6 of our non-wood system. The entire system will also be flown aerially twice via helicopter in 2019.

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 – 2018 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2019.

For a description of the methods used for structural analysis and pole inspection – please refer to Attachment K - "Wood Pole Inspection Plan", pages 6 - 8.

For the summary report of the inspection data - See Attachment P – a CD containing Excel file - "2018 DEF Distribution Pole Inspection Data".

Transmission

Please see Attachment O - 2018 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2019.

For a description of the methods used for structural analysis and pole inspection – please refer to Attachment K - "Wood Pole Inspection Plan", pages 1 -6.

For the summary report of the inspection data – See Attachment Q – CD containing Excel files - "2018 Pole Data,""2018 Pole Visual Data", and "2018 Structure Data".
Note: Due to changes from Cascade to Maximo asset management software the data provided is in a different format.

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."*

2018 CCA Pole Sampling Results

Please see Attachment O – Duke Energy's 2018 Annual Wood Pole Inspection Report filed with the FPSC on March 1, 2019. The "CCA Sampling Results for 2018" is included in DEF'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 2018 and 2019 in terms of both activity and costs.

- *See Attachment R - "Internal Policy & Guidelines".*
- *For activities and costs - See information herein on pages 49-55.*

b. Describe tree clearing practices in utility easements and authorized rights-of-ways.

See Attachment R - "Internal Policy & Guidelines".

c. Identify relevant portions of utility tariffs pertaining to utility vegetation management activities within easements and authorized rights-of-ways.

DEF'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 R - "Internal Policy & Guidelines".

e. Describe tree clearing practices outside of utility easements and authorized rights-of-ways.

See Attachment R - "Internal Policy & Guidelines".

f. Identify relevant portions of utility tariffs pertaining to utility vegetation management activities outside of easements and authorized rights-of-ways.

DEF'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 R - "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 DEF's tariffs that pertain to customer vegetation management obligations as a term or condition of electric service. However, in Section 4 of DEF's tariff book, Sheet 4.032, reference is made to a customer's responsibility for providing DEF with a cleared route for line extensions, upgrades or service drops. Implied in the obligation to provide a clear route to obtain service is the obligation to maintain the route sufficiently clear to not interfere with DEF's facilities.

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 Duke Energy Florida field resource will submit a ticket using the work management system. For the remaining process, please see Attachment S - "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, DEF cannot elaborate as to how these factors may apply in each factual circumstance.

k. Discuss any 2019 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 *	186	N/A *	N/A *	8,334	N/A *
(B) Customer Interruptions	N/A *	175,960	N/A *	N/A *	279,756	N/A *
(C) Miles Cleared	N/A *	662	N/A *	N/A *	2,626	N/A *
(D) Remaining Miles	N/A *	(22)	N/A *	N/A *	(179)	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.29	N/A *	N/A *	3.40	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	274.97	N/A *	N/A *	114.29	N/A *
(G) Number of Hotspot trims	N/A *	4,867	N/A *	N/A *	18,464	N/A *
(H) All Vegetation Management Costs	N/A *	$ 6,747,914	N/A *	N/A *	$ 30,751,127	N/A *
(I) Customer Minutes of Interruption	N/A *	12,198,734	N/A *	N/A *	36,628,467	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2018	N/A *	$ 6,734,928	N/A *	N/A *	$ 29,302,218	N/A *
(L) Vegetation Goal (current year) - 2018	N/A *	684	N/A *	N/A *	2,805	N/A *
(M) Vegetation Management Budget (next year) – 2019	N/A *	$ 21,304,963	N/A *	N/A *	$ 28,877,319	N/A *
(N) Vegetation Management Goal (next year) – 2019	N/A *	2,267	N/A *	N/A *	2,983	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

Note: Total miles cleared in 2018 was 3,288. Annual variations from target are expected as DEF manages resource and unit cost factors associated with its integrated vegetation management plan. Full workplan could not be completed due to deployment to multiple storms in 2018. Based on the 3-year system weighted average feeder / 5-year system weighted average lateral tree trimming cycle. DEF is at 12% of total 3-year cycle feeder miles and 52% of total 5-year cycle lateral miles since the beginning of the current respective cycles. The vegetation management lateral line miles are defined in column AA of Attachment G.

As noted in the 2017 PSC Annual Service Reliability Report the DEF vegetation management program trim frequency became based on segments of conductor being identified as either "feeder" or "lateral" in 2018 and Vegetation Management aligned trimming activities with other business processes' definition of "feeder." DEF defines "Feeder" as a portion of the 3phase circuit typically within a substation breaker's zone of protection; however, it does not require a specific size of conductor or "big wire." This change in "feeder" definition is observed predominantly in the North Coastal and South Central rural service areas due to wire size and system configuration. This definition change increased the overall "feeder" designation by 1,224 miles. Having just

completed the feeder anniversary in 2017, this seemed like the optimal time to make this transition and align with our other business processes.

* There is no unadjusted data on tree caused storm events that would be relevant to DEF'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 DEF'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 all 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. DEF conducts forensic analysis of distribution poles and structures as outlined in the Storm Preparedness Plan. During a storm event, outage tracking migrates from Outage Management System event to a Damage Assessment event. ** This data was scheduled in 2017 and completed in 2018.

***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 ZONE (NORTH CENTRAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	46	N/A *	N/A *	1,842	N/A *
(B) Customer Interruptions	N/A *	46,979	N/A *	N/A *	57,819	N/A *
(C) Miles Cleared	N/A *	108	N/A *	N/A *	578	N/A *
(D) Remaining Miles	N/A *	(24)	N/A *	N/A *	(34)	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.55	N/A *	N/A *	3.38	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	562.29	N/A *	N/A *	106.21	N/A *
(G) Number of Hotspot trims	N/A *	966	N/A *	N/A *	5,195	N/A *
(H) All Vegetation Management Costs	N/A *	$ 1,118,885	N/A *	N/A *	$ 6,016,765	N/A *
(I) Customer Minutes of Interruption	N/A *	3,915,328	N/A *	N/A *	6,882,936	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2018	N/A *	$ 1,445,576	N/A *	N/A *	$ 7,773,534	N/A *
(L) Vegetation Goal (current year) - 2018	N/A *	132	N/A *	N/A *	612	N/A *
(M) Vegetation Management Budget (next year) – 2019	N/A *	$ 5,447,162	N/A *	N/A *	$ 6,668,531	N/A *
(N) Vegetation Management Goal (next year) – 2019	N/A *	554	N/A *	N/A *	678	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT ZONE (SOUTH CENTRAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	27	N/A *	N/A *	1,119	N/A *
(B) Customer Interruptions	N/A *	31,564	N/A *	N/A *	37,664	N/A *
(C) Miles Cleared	N/A *	85	N/A *	N/A *	191	N/A *
(D) Remaining Miles	N/A *	(1)	N/A *	N/A *	(31)	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.32	N/A *	N/A *	7.00	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	373.85	N/A *	N/A *	235.56	N/A *
(G) Number of Hotspot trims	N/A *	2,274	N/A *	N/A *	5,075	N/A *
(H) All Vegetation Management Costs	N/A *	$ 1,212,828	N/A *	N/A *	$ 2,706,698	N/A *
(I) Customer Minutes of Interruption	N/A *	1,566,167	N/A *	N/A *	4,594,128	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2018	N/A *	$ 1,268,492	N/A *	N/A *	$ 2,830,925	N/A *
(L) Vegetation Goal (current year) - 2018	N/A *	86	N/A *	N/A *	221	N/A *
(M) Vegetation Management Budget (next year) – 2019	N/A *	$ 4,748,048	N/A *	N/A *	$ 3,242,808	N/A *
(N) Vegetation Management Goal (next year) – 2019	N/A *	607	N/A *	N/A *	414	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT ZONE (NORTH COASTAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	81	N/A *	N/A *	3,002	N/A *
(B) Customer Interruptions	N/A *	49,794	N/A *	N/A *	101,021	N/A *
(C) Miles Cleared	N/A *	407	N/A *	N/A *	1,107	N/A *
(D) Remaining Miles	N/A *	4	N/A *	N/A *	(69)	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.20	N/A *	N/A *	2.89	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	121.17	N/A *	N/A *	97.39	N/A *
(G) Number of Hotspot trims	N/A *	1,228	N/A *	N/A *	3,337	N/A *
(H) All Vegetation Management Costs	N/A *	$ 3,356,110	N/A *	N/A *	$ 9,117,639	N/A *
(I) Customer Minutes of Interruption	N/A *	4,160,230	N/A *	N/A *	13,126,346	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2018	N/A *	$ 3,199,196	N/A *	N/A *	$ 8,691,346	N/A *
(L) Vegetation Goal (current year) - 2018	N/A *	404	N/A *	N/A *	1,176	N/A *
(M) Vegetation Management Budget (next year) – 2019	N/A *	$ 5,163,393	N/A *	N/A *	$ 8,865,148	N/A *
(N) Vegetation Management Goal (next year) – 2019	N/A *	652	N/A *	N/A *	1,120	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

MANAGEMENT ZONE (SOUTH COASTAL) VEGETATION MANAGEMENT PERFORMANCE METRICS

	Feeders			Laterals		
	Unadjusted*	Adjusted	Diff.	Unadjusted*	Adjusted	Diff.
(A) Number of Outages	N/A *	32	N/A *	N/A *	2,371	N/A *
(B) Customer Interruptions	N/A *	47,623	N/A *	N/A *	83,252	N/A *
(C) Miles Cleared	N/A *	62	N/A *	N/A *	751	N/A *
(D) Remaining Miles	N/A *	(1)	N/A *	N/A *	(45)	N/A *
(E) Outages per Mile [A ÷ (C + D)]	N/A *	0.52	N/A *	N/A *	3.36	N/A *
(F) Vegetation CI per Mile [B ÷ (C + D)]	N/A *	780.83	N/A *	N/A *	117.88	N/A *
(G) Number of Hotspot trims	N/A *	399	N/A *	N/A *	4,857	N/A *
(H) All Vegetation Management Costs	N/A *	$ 1,060,090	N/A *	N/A *	$ 12,910,024	N/A *
(I) Customer Minutes of Interruption	N/A *	2,557,009	N/A *	N/A *	12,025,057	N/A *
(J) Outage restoration costs	N/A *	***	N/A *	N/A *	***	N/A *
(K) Vegetation Management Budget (current year) – 2018	N/A *	$ 821,664	N/A *	N/A *	$ 10,006,414	N/A *
(L) Vegetation Goal (current year) - 2018	N/A *	62	N/A *	N/A *	796	N/A *
(M) Vegetation Management Budget (next year) – 2019	N/A *	$ 5,979,885	N/A *	N/A *	$ 10,141,874	N/A *
(N) Vegetation Management Goal (next year) – 2019	N/A *	454.80	N/A *	N/A *	771.34	N/A *
(O) Trim-Back Distance	N/A *	***	N/A *	N/A *	***	N/A *

Local Community Participation: A discussion was held 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 73-81.

Priority Trees

a. Number of priority trees removed? **9,031**
b. Expenditures on priority tree removal? **$ 1,142,688.06**
   -includes tree removal, removal trims, overhang & vines
c. Number of request for removals that were denied? ***4***
   -These trees were on private property. The owners refused a request for removal. DEF instead trimmed the trees as much as possible within its legal rights 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 DEF to guess and speculate on conditions for which it has neither reliable nor supporting data. DEF therefore cannot provide data for these fields.

JOINT-USE POLE ATTACHMENT AUDITS FOR THE YEAR 2018 (*Initiative 2*)

a. **Percent of system audited.** *Feeders and Laterals: 100%*
b. **Date audit conducted?** *A Joint-Use Pole Loading Analysis is conducted every eight (8) years per FPSC requirements. In 2018, one-eighth (1/8) of the joint attachments were audited to fulfill the 8-year requirement.*
c. **Date of previous audit?** *2017 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.*

2018 Joint-Use Structural Audits – Distribution Poles (all pole types)

(A) Number of company owned distribution poles.	1,014,830
(B) Number of company distribution poles leased.	495,222
(C) Number of owned distribution pole attachments (cable & phone attachments on DEF poles)	803,011
(D) Number of leased distribution pole attachments. (DEF attachments on phone poles)	16,604
(E) Number of authorized attachments. (7,423 new attachments approved in 2017)	802,918
(F) Number of unauthorized attachments.	0
(G) Number of distribution poles strength tested. (complete loading analysis needed)	56,929
(H) Number of distribution poles passing strength test. (complete loading analysis needed) *	56,882
(I) Number of distribution poles failing strength test (overloaded).	47
(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)	5
(L) Number of distribution poles corrected (other reasons).	0
(M) Number of distribution poles to be replaced. (Overloaded poles entered into the FMDR database)	42
(N) Number of apparent NESC violations involving electric infrastructure.	None
(O) Number of apparent NESC violations involving 3rd party facilities.	None

** 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 worse-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.*

2018 Joint-Use Attachment Audits – Transmission Poles (all pole types)

(A) Number of company owned transmission poles.	58,762
(B) Number of company transmission poles leased.	5,761
(C) Number of owned transmission pole attachments (cable & phone attachments on DEF poles)	5,978
(D) Number of leased transmission pole attachments. (DEF attachments on phone poles)	0
(E) Number of authorized attachments. (112 new attachments approved in 2017)	5,978
(F) Number of unauthorized attachments.	0
(G) Number of transmission poles strength tested.	779
(H) Number of transmission poles passing strength test.	737
(I) Number of transmission poles failing strength test (overloaded).	42
(J) Number of transmission poles failing strength tests (other reasons).	0
(K) Number of transmission poles corrected (data provided to transmission for replacement)	42
(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

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". DEF conducts partial audits of its pole attachments throughout the year. A full Joint-Use Pole Loading Analysis is conducted every eight years. When DEF discovers unauthorized attachments on DEF poles, DEF follows-up with the attacher who owns the unauthorized attachments and DEF 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.

Duke Energy Florida's Transmission Department follows Procedure TECP-MIM-TRM-00026 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 DEF's Storm Hardening Plan.

Transmission Circuit, Substation and Other Equipment Inspections

	2018 Activity		2018 Current Budget		Next Year (2019)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A)Total transmission circuits	N/A	682	$2,230,904	$1,826,054	N/A	$1,249,441
(B) Planned transmission circuit inspections	261	N/A	N/A	N/A	170	N/A
(C) Completed transmission circuit inspections.	N/A	280	N/A	N/A	N/A	N/A
(D) Percent of transmission circuit inspections completed.	N/A	41%	N/A	N/A	24.9%	N/A
(E) Planned transmission substation	N/A	489	$4,648,181	$6,084,176	489	$7,000,311
(F) Completed transmission	N/A	489	N/A	N/A	N/A	N/A
(G) Percent transmission	N/A	100%	N/A	N/A	N/A	N/A
(H) Planned transmission	N/A	N/A	N/A	N/A	N/A	N/A
(I) Completed transmission	N/A	N/A	N/A	N/A	N/A	N/A
(J) Percent of transmission	N/A	N/A	N/A	N/A	N/A	N/A

Note: For most entries of "N/A" in the chart above, DEF 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

	2018 Activity		2018 - Current Budget		Next Year (2019)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total transmission tower structures.	N/A	3435	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	994	N/A	N/A	N/A	N/A
(D) Percent of transmission tower structure inspections completed.	N/A	28.9%	N/A	N/A	N/A	N/A

Note 1: Please see the previous budget and actuals on page 58 for line inspections. All inspections for wood poles, towers, steel and concrete structures are included in the O&M budget. Duke 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 6-year cycle. Inspections are planned and completed based upon the 6-year cycle.

Transmission Pole Inspections

	2018 Activity		Current Budget (2018)		Next Year (2019)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of transmission pole structures.	N/A	48,984	$2,230,904 See Note 1	$1, 826,054 See Note 1	N/A	$1,249,441 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*	N/A	A: 779 B:	N/A	N/A	N/A	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*	N/A	A: 737 B:	N/A	N/A	N/A	N/A
(D) Number of transmission poles failing strength test (overloaded). (*See Note 4)*	N/A	42	N/A	N/A	N/A	N/A
(E) Number of transmission poles failing for other reasons – *Ground Inspection (See Note 2)*	N/A	3,114		N/A	N/A	N/A
(F) Number of transmission poles corrected (strength failure).	N/A			N/A	N/A	N/A
(G) Number of transmission poles corrected for other reasons - *Ground Inspection (See Note 2)*	N/A	0	N/A	N/A	N/A	N/A
(H) Total transmission poles replaced.	N/A	796	N/A	N/A	N/A	N/A

Note 1: DEF 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: DEF 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 DEF is in the process of working through corrections based on those prioritizations.

Note 3: Transmission circuits are inspected on a 4 or 6-year cycle depending on structural material.

Note 4: Duke Energy Florida Transmission rejected the request for Joint Use on these structures, therefore the structures deemed not overloaded without the new Joint Use connection.

Please also see Attachment O – "Wood Pole Inspection Report" filed on March 1, 2019 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

	2018 Activity		Current Budget (2018)		Next Year (2019)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Transmission structures scheduled for hardening.	1002	N/A	$118.7M	N/A	1,008	$160.2M
(B) Transmission structures hardening completed.	N/A	1168	N/A	$185.6M	N/A	N/A
(C) Percent transmission structures hardening completed.	N/A	116.6%	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. DEF does not break out the cost of the structures separately and is reporting the entire construction costs for the Transmission Line Projects.

Storm Hardening Activity and Remaining Population

Report Year	Maintenance Change outs	DOT/Relocation, Upgrades and Rebuilds	**Total**
2018	796	372	**1168**
2017	530	455	**985**
2016	698	469	**1167**
2015	1,738	559	**2,297**
2014	2,028	1,440	**3,468**
2013	1,384	857	**2,241**
2012	1,080	857	**1,937**
2011	635	915	**1,550**
Report Year	Wood Pole Beginning Balance	Current Balance	**Poles changed**
2018	21,285	20,117	**1,168**
2017	23,567	21,285	**2282**
2016	24,265	23,567	**698**
2015	25,370	24,265	**1,105**
2014	28,000	25,370	**2,630**

Note: The 2018 current balance variance includes updated replacements from previous years found during data reconciliation in the asset management software.

GEOGRAPHIC INFORMATION SYSTEM (GIS) (*Initiative 5*)

In 2017, Duke Energy rolled out a new Geographical Information System (GIS), Work Management system, and Asset Management system for the entire enterprise. As a result, in November 2017, DEF transitioned to those new systems. The new Smallworld GIS system is a Duke Energy enterprise-wide solution for GIS which is an asset and location based GIS system that is consistent with Commission Order No. PSC-06-0351-PAA-EI. These systems allow DEF to facilitate the tracking, maintenance, planning, and risk management of the major Distribution and Transmission assets.

In addition, Duke Energy has dedicated local GIS departments in each region across the enterprise to ensure the accuracy and quality of the data within the GIS and the Outage Management System (OMS) with a focus on business processes. These GIS departments continue to focus on key performance indicators that are used to measure and monitor the quality of the 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 DEF field crews.

Distribution OH Data Input						
	Activity		Current Budget		Next Year	
	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	1,295,915	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

DEF cannot necessarily report data in the form of items (A)-(F) above given that such items are not entirely consistent and in line with the status of PEF's current GIS system and DEF's ongoing efforts to upgrade that system.

Distribution UG Data Input						
	Activity		Current Budget		Next Year	
	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	187,781	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

DEF cannot necessarily report data in the form of items (A)-(F) above given that such items are not entirely consistent and in line with the status of PEF's current GIS system and DEF's ongoing efforts to upgrade that system.

Transmission OH Data Input

	Activity (2018)		Current Budget (2018)		Next Year (2019)	
	Goal	Actual	Budget	Actual	Goal	Budget
(A) Total number of system wide OH transmission assets for input.	N/A	49,027	N/A	N/A	N/A	N/A
(B) Number of OH transmission assets currently on system.	N/A	48,896	N/A	N/A	N/A	N/A
(C) Percent of OH transmission assets already on	N/A	99.7%	N/A	N/A	N/A	N/A
(D) Annual OH transmission assets targeted for	N/A	N/A	N/A	N/A	N/A	N/A
(E) Annual OH transmission assets input to	N/A	N/A	N/A	N/A	N/A	N/A
c(F) Annual percent of OH transmission assets	N/A	100%	N/A	N/A	N/A	N/A

DEF cannot necessarily report data in the form of items (A)-(F) above given that such items are not entirely consistent and in line with the status of DEF's current GIS system and DEF's ongoing efforts to upgrade that system.

Transmission UG Data Input

	Activity (2018)		Current Budget (2018)		Next Year (2019)	
	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	N/A	100%	N/A	N/A	N/A	N/A
(D) Annual UG transmission assets targeted for	N/A	N/A	N/A	N/A	N/A	N/A
(E) Annual UG transmission assets input to	N/A	N/A	N/A	N/A	N/A	N/A
(F) Annual percent of UG transmission assets	N/A	100%	N/A	N/A	N/A	N/A

Attachment C

JOINT USE POLE GUIDELINES

DUKE ENERGY®

JOINT USE

POLE ATTACHMENT

GUIDELINES

Revised August 11, 2015

DUKE ENERGY®

GENERAL

Anyone desiring to 1) attach to Duke Energy (DE) poles or 2) overlash to existing facilities whether owned by proposing attacher or another attacher on DE poles must first have a contractual agreement in place with DE. After the contractual agreement is finalized, the proposed attacher must make application to DE via the approved request format based on DE's operational area (see below). These requirements shall apply to anyone wanting to attach to or occupy DE facilities, including all cable operators, telecommunications carriers, WiFi and DAS attachers and any affiliates of DE. Throughout this document, all types of attachers and their facilities other than DE will be referred to as attachers, third party attachers, communication facilities or attacher's facilities.

Pole utilization requiring an attachment request or notification includes: 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 service poles. Service drops may be sent in monthly on one "after the fact" request.

An Exhibit A 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 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.

DUKE ENERGY OPERATIONAL AREAS

DEC – Duke Energy Carolinas – the area in North Carolina and South Carolina that was part of Duke Energy prior to the merger between Duke Energy and Progress Energy.
DEF – Duke Energy Florida
DEI – Duke Energy Indiana
DEK – Duke Energy Kentucky
DEO – Duke Energy Ohio
DEP – Duke Energy Progress – the area in North Carolina and South Carolina that was part of Progress Energy prior to the merger between Duke Energy and Progress Energy.

POLE ATTACHMENT AND OVERLASH APPLICATION PROCEDURES

A pole attachment and/or overlash application shall include:

1. A maximum of 40 DE poles identified for proposed attachment and/or overlash per application. No more than 300 poles shall be submitted in any calendar month.

2. One set of marked facility maps depicting the street level route of the proposed attachments to DE 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 Exhibit A: company name, representative's name, telephone number and e-mail address, county name, project reference number, DE 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, Distribution Construction Specifications, or DOT requirements, whichever is greater. Existing installations which were in compliance with the NESC at the time of their original construction need not be modified.

5. Overlash applications may be submitted 10 days in advance of construction. A post-inspection will be completed on all poles in addition to a loading analysis. The overlashing company will be responsible for any make-ready to resolve existing violations and to support the additional load.

6. Attachments to transmission poles with distribution underbuild may be accepted for application in DEC, DEF, DEI, DEK, and DEO only. Requests for attachments to transmission poles in DEP must be submitted directly to DEP's transmission department. Contact the joint use representative in your area for further details.

Exhibit A Pole Attachment Requests are to be submitted electronically to the following addresses.

DEC: JURequest@duke-energy.com
DEP: JUAttachRequestCarolinaEast@duke-energy.com
DEF: JUAttachRequest@duke-energy.com
DEI: JURequestIndiana@duke-energy.com
DEO, DEK: JURequestOh/Ky@duke-energy.com

Contact the joint use representative in your area for clarification and examples of any of the above items.

Third party attachers on DE poles are required to utilize the applicable joint use notification system for transfers. When poles are replaced, DE will use the applicable system to provide 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, DE 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 full structural loading analysis will be performed on a minimum 10% of the total permitted poles, or a minimum of one (1) pole per lead (branch). A new lead will be considered when the line angle of the pole is greater than 15 degrees. The worst case pole in each lead, the pole that has the most visible loading, greatest line angle, and/or the longest or most uneven span lengths, will be chosen for analysis. If the pole fails loading, the process will continue until an analyzed pole in the lead passes. All costs associated with loading analysis will be paid by the requesting company. Payment for the resulting correctional work will be determined on an individual pole basis.

Once the clearance analysis is completed, the attacher will receive a response within 45 days (30 days in Ohio and Kentucky) of DE's acceptance of the Exhibit A attachment request 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 30 days will serve as DE's authorization to perform the make-ready construction. Failure to provide payment within the 30 days may result in denial of the affected poles. Following receipt of make-ready payment, DE shall sign and issue approval authorizing attachment.

The attacher shall have 120 days from the date of approval in which to complete the attachment installation and any other requirements stated in this standard. If attacher fails to do so, the approval shall expire and the attacher will be required to resubmit to DE a new Exhibit A application for attachment with all current data required as support of its application. Attacher must promptly notify DE Joint Use upon completion of construction for each application and arrange scheduling of post-inspection. If notification is not received, a post-inspection will still be scheduled by DE. If the attacher has not constructed its facilities on all or a portion of the Exhibit A, the approval for these poles will be voided due to non-construction. A 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 DE clerical, engineering and crew costs will be paid by the proposing attacher.

All Exhibit As are subject to a post inspection after 120 days of the Exhibit A's approval to verify the attacher's construction is in compliance with DE and NESC standards. If any pole on the Exhibit A fails inspection, the attacher will be given 60 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 Exhibit A requests 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 DE 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, DE may deem the attacher in violation of DE Standards and the Pole Attachment Agreement. If identifying tags are not installed at the time of new construction, the Exhibit A will fail post inspection.

If attacher's facilities are acquired by another entity, the acquiring entity must notify DE of said change, provide maps and/or plats of acquired assets, and sign a new Pole Attachment Agreement with DE or obtain DE's consent to assignment of the Pole Attachment Agreement, as applicable. 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, DE may deem the attacher in violation of DE Standards.

CLEARANCES

All poles on an Exhibit A request for new attachment 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 DE 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. Attachments are not allowed between the brackets of the street light. 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 proposed 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 DE's neutral or secondary facilities. The cable shall follow Duke Energy's route so as not to compromise the structural integrity of Duke Energy poles. During construction or deconstruction, third party attachers shall not directly or indirectly influence the sag and tension of DE 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 or secondary riser pole using a bracket that wraps around the outside of or under the riser. If the u-guard or conduit is in the way of a standard dead-end attachment with eyebolt, then make-ready will be required at the cost of the communication company to relocate the riser if such make-ready is feasible, or dead-end must occur on some other pole.

Poles shall not be boxed in (communication cables installed on both sides of a pole). Communication cable must be installed on the same side as the secondary or neutral, unless all the existing communication attachments are on the opposite side from the neutral, in which case the new cable shall be installed with the existing communication cables on the same side of the pole. 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 DE. Any work performed by DE 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 DE of the clearance violations and make all reasonable efforts to immediately bring its facilities into compliance. Attacher shall notify DE following its correction of the clearance violations. Attacher shall notify DE 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. DE shall also inform the attacher if DE becomes aware that the attacher's facilities are not in compliance with applicable clearance requirements. In all instances, the attacher will have sixty (60) days to bring its facilities within compliance or DE may deem the attacher in violation of DE Standards.

GUYS AND ANCHORS

Attachers are responsible for installation of their own down guys and anchors when needed. The need for attacher's guys and anchors for additional attachments shall be determined based on a pole loading analysis to be conducted by Duke Energy. Attachers are not permitted to utilize DE anchors. All guys shall have guy guards installed.

Communication company anchors are to be located in the same line lead and line angle as the DE anchor. They are to be located 4' from existing DE anchor(s), or if not possible, anchors shall be located as far as possible from existing DE anchors.

OTHER

No permanent climbing aids are allowed on DE 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 DE specification drawings. Ground blocks, pedestals and power supplies may not be attached to the pole.

New air dryers, nitrogen bottles, cabinets, load coils, etc. shall not be attached to DE poles. Existing equipment on existing poles may remain in place until such time as the pole is replaced or the equipment is upgraded.

All vertical runs (pole risers) installed by attacher shall be placed in u-guard or conduit and attached to the pole using appropriate hardware. Where applicable, each communication company shall be allowed no more than one riser per pole to facilitate all pole-to-ground attachments. Vertical runs must be on a 45° angle from the communication company's attachment and never on the face of the pole. See appropriate DE specification drawing.

Horizontal attachments to DE poles must be made by use of a three-bolt suspension clamp with a center through bolt installed flush to the pole. The nut side of the bolt shall not extend more than two inches (2") from the pole unless a riser prohibits mounting a three-bolt suspension clamp. In such cases, the bolt may extend up to four inches (4") from the pole with the appropriate suspension clamp. A four-inch minimum vertical spacing must be maintained between any new 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 DE Engineering department. Line-mounted amplifiers and terminals shall be a minimum of 24" from the closest surface of the pole.

Communication facilities will **not** be allowed on temporary DE 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 DE 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 DE includes: pole number (where applicable), 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 DE.

WiFi standards exist for wood and static cast concrete streetlight poles. Please reference appropriate DE specification drawings.

DAS standards exist. Please reference appropriate DE specification drawings.

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”
PC4	Separation from primary at pole	(40 + 0.4 per kV in excess of 8.7kV)”
MC1	Secondary conductor separation at midspan	30”
MC2	Neutral separation at midspan	30”
MC3	Primary separation at midspan	30”
SL1	Streetlight separation from SL bracket	12”
SL2	Streetlight separation from SL drip loop	12”
V1	Cable is crossing under DE neutral from different structure	24”
R1	Clearance from top of DE 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	15’6”
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”
C5	Cable parallel to DOT maintained roadway that is inside the DOT ROW (applies to NC and FL)	16’
C6	Cable parallel to roadway that is located in an area accessible to pedestrians only	9’6”
DM3	Telecom service drop separation from DE service drop at midspan and attachment to building	12”
M4	Wires on different supporting structures crossing at midspan; communications only under DE	24”
G1	Guy or anchor needed	
G2	Guy or anchor is slack or damaged	
G3	Guy attached to DE anchor	
G4	Guy marker needed	
GR	Ground; messenger cable must be bonded to DE ground wire	
L	Cable tagging; missing or unreadable	
B1	Boxed Pole	
AC1	Floating cable; need to properly attach	
TC1	Transfer cable to new pole	
CS1	Communication separation does not meet NESC or DE specifications at the pole	12”
CS2	Communication separation does not meet NESC or DE specifications at midspan	12”
MD	Failure to follow make-ready directives	
NC	Not constructed; original attachment approval voided	
RA	Remove unauthorized attachments	

Contact Information

DEC

Theresia Elliott
EC10Q
526 South Church St
Charlotte, NC 28202
704-382-6384
Theresia.Elliott@duke-energy.com

DEP

Debbie Perry
NC4
411 Fayetteville St
Raleigh, NC 27601-1849
919-546-3297
Debbie.Perry@duke-energy.com

DEF

Bret Gordon
NP4B
3300 Exchange Place
Lake Mary, FL 32746
407-942-9673
Bret.Gordon@duke-energy.com

DEI

Jeremy Gibson
EX467
139 East Fourth St
Cincinnati, OH 45202
513-287-3274
Jeremy.Gibson@duke-energy.com

DEK, DEO

Van Bryan
EX467
139 East Fourth St
Cincinnati, OH 45202
513-287-2882
Van.Bryan@duke-energy.com

DUKE ENERGY®

☐ **EXHIBIT A Attachment Request**
- ◉ New
- ○ Rebuild
- ○ Service Drop
- ○ Overlash 3rd Party
- ○ Overlash Self

☐ **EXHIBIT B Removal Request**

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 Duke 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 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, Duke Energy 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.

Duke Energy Pole Number	✓ for Transmission	House and Street Address *and / or* Comments

Duke Energy Pole Number	✓ 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: _____

10.00 GENERAL INFORMATION

10.01 CLEARANCE OF SUPPORTING STRUCTURES FROM OTHER OBJECTS

10.02 VERTICAL CLEARANCES ABOVE GROUND, ROADWAY, RAIL OR WATER SURFACES

10.03 CLEARANCES BETWEEN WIRES AND CONDUCTORS CARRIED ON DIFFERENT SUPPORTING STRUCTURES

10.04 CLEARANCE OF WIRES AND CONDUCTORS FROM BUILDINGS, BRIDGES, POOLS AND OTHER INSTALLATIONS

10.05 CLEARANCE OF WIRES AND CONDUCTORS CARRIED ON THE SAME SUPPORTING STRUCTURE

10.06 MISCELLANEOUS APPLICATIONS

DUKE ENERGY.

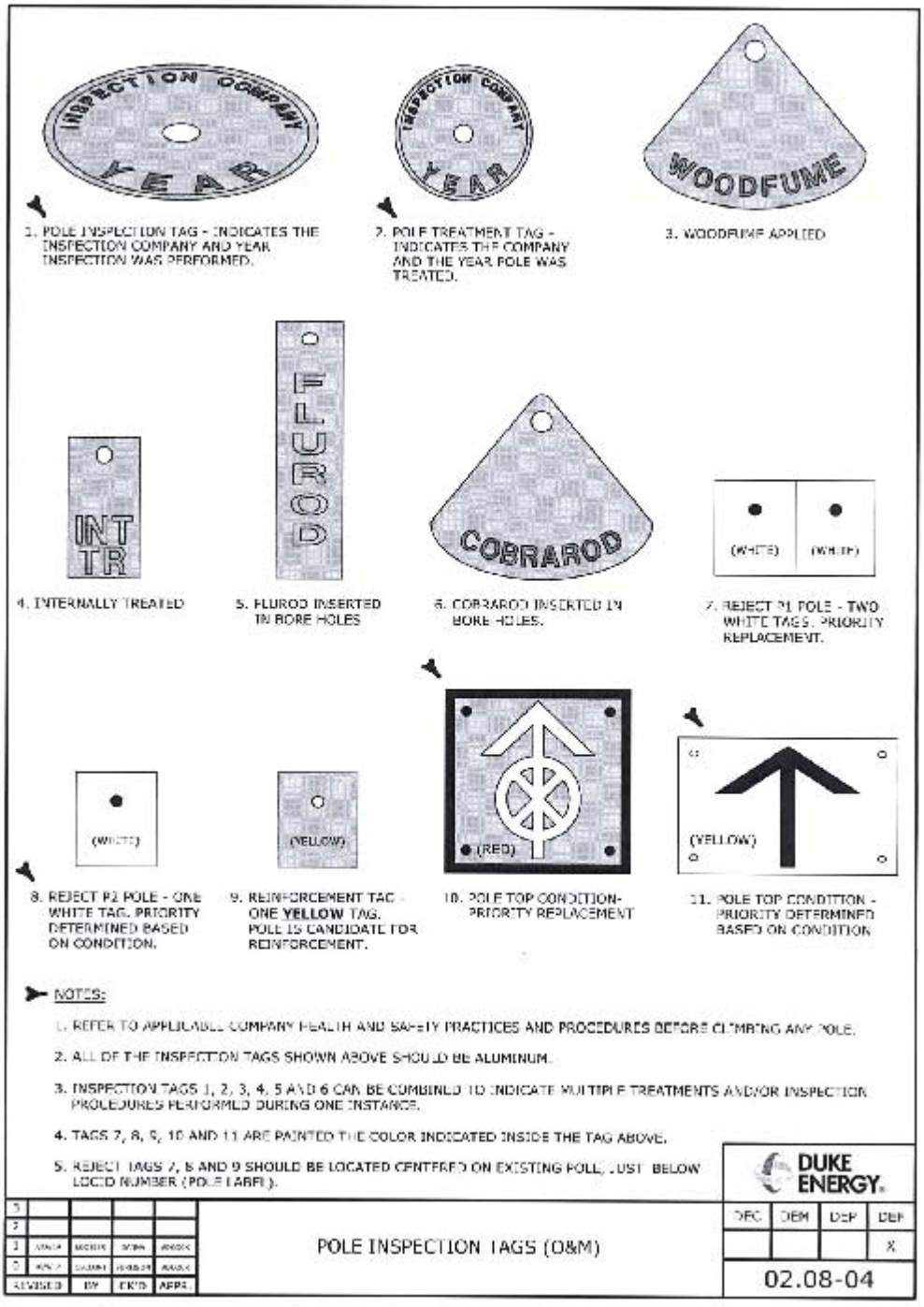
REVISED	BY	CK'D	APPR.
3			
2			
1			
0			

SECTION 10 - CLEARANCES AND JOINT USE

TABLE OF CONTENTS

DEC	DEM	DEP	DEF
X	X	X	X

10.00-00A



1. POLE INSPECTION TAG - INDICATES THE INSPECTION COMPANY AND YEAR INSPECTION WAS PERFORMED.
2. POLE TREATMENT TAG - INDICATES THE COMPANY AND THE YEAR POLE WAS 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. PRIORITY DETERMINED BASED ON CONDITION.
9. REINFORCEMENT TAG - ONE **YELLOW** TAG. POLE IS CANDIDATE FOR REINFORCEMENT.
10. POLE TOP CONDITION- PRIORITY REPLACEMENT
11. POLE TOP CONDITION - PRIORITY DETERMINED BASED ON CONDITION

NOTES:

1. REFER TO APPLICABLE COMPANY HEALTH AND SAFETY PRACTICES AND PROCEDURES BEFORE CLIMBING ANY POLE.
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, 9, 10 AND 11 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).

DUKE ENERGY.

5				
4				
3	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]
REVISED	BY	CK'D	APP'D	

POLE INSPECTION TAGS (O&M)

DEC	DBM	DEP	DEP
			X

02.08-04

Attachment D

DEF STORM HARDENING PROJECTS 2007-2018

Distribution Storm Hardening Projects Planned and Completed, 2007 through 2018

Operations 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	

St Petersburg	Shore Acres Bridge Reconductor (NE area improvement)	Feeder Tie	
St Petersburg	21st/22nd Alley Reconductor (NE area improvement)	Feeder Tie	
Ocala	Feeder Tie Addition between A38 and A204	Feeder Tie	
St Petersburg	Cordova Blvd. NE to Snell Isle NE Reconductor	Feeder Tie	
Inverness	Feeder Tie Addition between A68 and A49	Feeder Tie	
St Petersburg	62nd Street Reconductor (NE area improvement)	Feeder Tie	
Apopka	Reconductor Wekiva Pines Blvd., Sorrento	Back lot to Front lot conversion	
St Petersburg	34th Ave NE/Monterey Blvd / Almedo / Rivera Dr Reconductor	Feeder Tie	
Ocala	Martin A38 - CR 316 E of CR 200A	Small Reconductor	
Monticello	Madison N2, N3 Feeder Tie	Feeder Tie	
St Petersburg	15th Ave S Reconductor	Feeder Tie	
St Petersburg	1st St. N Reconductor	Feeder Tie	
St Petersburg	Denver St. NE/Venetian Blvd.	Feeder Tie	
St Petersburg	9th St. South Reconductor	Feeder Tie	
Monticello	Alligator Point Extreme Wind Extreme Wind Phase 1 of 4 Upgrades	Feeder Tie	
Inverness	Lebanon Sub feeder Reconductor	Small Reconductor	
Lake Wales	Feeder tie K1521 and K1526	Feeder Tie	
Deland	Monastery 14 Oh-Ug conversion	OH to UG	
Monticello	St George Island -East Side UG	Submersible UG	
South East Orlando	Reconductor US-192 Holopaw Phase 1 & 2 of 3	Small Reconductor	
Inverness	Brooksville - SR SO E of Cortez	Small Reconductor	
Inverness	Holder A48 -Arrowhead	Small Reconductor	
Monticello	Madison N1- Fdr to Lee	Small Reconductor	
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 Helen 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	Cancelled - elected not to rebuild line in back-lot area that is inaccessible
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	
St Petersburg	15 Ave S Feeder Tie between 37th st S and 49th St S	Feeder Tie	Completed in 2019
Highlands	Lakeview Dr.Reconductor	Feeder Tie	Completed in 2018
Buena Vista	K4426 on Bay Hill K74	Feeder Tie	Completed in 2019
Highlands	Airport Rd 2/3	Feeder Tie	Completed in 2017
Highlands	Airport Rd 3/3	Feeder Tie	Completed in 2018
Lake Wales	K55 Reconductor	Feeder Tie	Completed in 2019
Clermont	Suburban Terrace Small Wire Reconductor	Small Wire	Completed in 2019
Winter Garden	Tilden to Stoneybrook Feeder Tie	Feeder Tie	Completed in 2019
Winter Garden	Ingram Road Reconductor	Feeder Tie	Completed in 2018
Longwood	Lake Maitland Terrace Reliability- UG Conversion	OH-to-UG Conversion	Completed in 2018
Jamestown	Cleburne Rd	Small Wire	Completed in 2017
Apopka	Feeder tie Lockhart M408-M412 to Eatonville M1137	Feeder Tie	Completed in 2017
Deland	Feeder tie Deltona east W0124 to W0123	Feeder Tie	Completed in 2017
Apopka	Feeder tie Zellwood M31-M32	Feeder Tie	Completed in 2018
Monticello	Indian Pass N556 Reconductor - Phase 1	Feeder Tie	Planned 2019 Completion
Monticello	Indian Pass N556 Reconductor - Phase 2 Extreme Wind	Alternative NESC Construction Standards (Extreme Wind)	Planned 2019 Completion
Ocala	Reddick A35 - Phase 1	Feeder Tie	Completed in 2018
Ocala	Reddick A35 - Phase 2	Feeder Tie	Planned 2019 Completion
Ocala	Reddick A35 - Phase 3 Extreme Wind	Alternative NESC Construction Standards (Extreme Wind)	Planned 2019 Completion
Ocala	Micanopy - Recond #4 along SE 199th Ave	Small Wire	Completed in 2017
Ocala	NW 63rd St., Kendric reconductor #4 to 1/0 AAAC	Small Wire	Planned 2019 Completion
Ocala	Oklawaha - CR 464C Reconductor	Small Wire	Completed in 2019
Ocala	Martin - Reconduc #6 cu on NW 100th st.	Small Wire	Completed in 2019
Ocala	Weirsdale - Recond SE 175th St	Small Wire	Planned 2019 Completion
Lake Wales	6358879 off TS Wilson Road	Small Wire	Completed in 2017
Monticello	Apalachicola N58 - Feeder Upgrade	Feeder Tie	Planned 2019 Completion
Inverness	Floral City Reconductor	Feeder Tie	Part 1, completed early 2019 Part 2, to be completed in 2019
Clearwater	C4 Clearwater Beach Reconductor	Small Wire	Planned 2019 Completion
Clearwater	Belleair C1005 Brookhill Terrace Subdivision	Small Wire	Planned 2019 Completion
Clearwater	City of St Pete Beach - Pass a Grille - Phase 1	Submersible UG	Completed in 2016

The 2016, 2017 and 2018 storm seasons were extremely active both in and out of Florida. Duke Energy responded to Hurricanes Hermine, Matthew, Irma and Michael within its service territory. Additionally, Duke Energy provided resources for restoration efforts outside of its Florida territory for Hurricanes Harvey, Maria and Florence as well as winter storms in 2017 and 2018. These exceptional